Pedagogical Research
2025, 10(3), em0243
e-ISSN: 2468-4929
https://www.pedagogicalresearch.com

MODESTUM

Review Article

OPEN ACCESS

Utilizing artificial intelligence for assessment in higher education

Daniel Lupiya Mpolomoka [1*]

[1] Unicaf University Zambia, ZAMBIA
*__Corresponding Author:__ mpolomokadl@gmail.com

Citation: Mpolomoka, D. L. (2025). Utilizing artificial intelligence for assessment in higher education. *Pedagogical Research, 10*(3), em0243. https://doi.org/10.29333/pr/16677

ARTICLE INFO

Received: 30 Aug 2024

Accepted: 24 Jun 2025

ABSTRACT

Overview: This systematic review explores the utilization of artificial intelligence (AI) for assessment, grading, and feedback in higher education. The review aims to establish how AI technologies enhance efficiency, scalability, and personalized learning experiences in educational settings, while addressing associated challenges that arise due to AI use.

Methods: In this article, a comprehensive search of 6 different academic databases including PubMed, Google Scholar, IEEE Xplore, ERIC, and Scopus were conducted. The focus was on the published studies ranging between 2010 and 2023. Also, inclusion criteria required studies to be peer-reviewed, centered on AI applications in higher education. Studies were to provide empirical evidence or theoretical discussions relevant to assessment processes. Thus, twenty studies meeting these criteria were selected, scrutinized and analyzed.

Results: Pertaining to the findings, they indicate that AI-driven systems significantly streamline grading processes, reduce turnaround times, and provide timely, personalized feedback. These systems also offer data-driven insights that inform instructional practices. However, challenges such as algorithmic bias, validity concerns in subjective assessments, and ethical issues related to data privacy persist. Effective AI integration necessitates alignment with pedagogical goals, ongoing professional development for educators, and transparent policies to ensure fairness and equity.

Conclusion: AI technologies hold transformative potential for enhancing assessment practices in higher education. Therefore, addressing technical, ethical, and pedagogical challenges through interdisciplinary collaboration and evidence-based approaches is essential to fully realizing AI's benefits. Future research should focus on validating AI-driven assessment methods and exploring their long-term impact on educational outcomes.

Keywords: AI, higher education, assessment, feedback, pedagogical strategies

INTRODUCTION

The advent of artificial intelligence (AI) has profoundly impacted various sectors, with higher education being no exception. In recent years, AI's role in assessment, grading, and feedback has garnered significant attention, catalyzing a paradigm shift in educational methodologies. The integration of AI in these areas promises enhanced efficiency, consistency, and personalized learning experiences, aligning with the evolving demands of the modern educational landscape. This systematic review aims to explore the multifaceted applications of AI in higher education, particularly focusing on its efficacy and challenges in assessment, grading and feedback mechanisms (Aldreabi et al., 2025; Iyenghar, 2025; Rane et al., 2023). According to Phillips and Barker (2021), “A systematic review, as its name suggests, is a systematic way of collecting, evaluating, integrating and presenting findings from several studies on a specific question or topic.”

Assessment, grading and feedback are critical components of the educational process, serving as the cornerstone for evaluating student performance, providing necessary guidance and fostering an environment conducive to continuous learning. Traditional methods, while effective, often suffer from inherent biases, inconsistencies, and scalability issues (Crompton & Burke, 2023; Rutherford et al., 2025). The advent of AI technologies, such as machine learning algorithms and natural language processing, offers potential solutions to these longstanding problems by automating and standardizing various aspects of the educational assessment process (Aldreabi et al., 2025; Azoulay et al., 2025; Pang & Wei, 2025; Pérez et al., 2025; Ramesh & Sanampudi, 2022). AI-driven tools can analyze vast amounts of data rapidly, providing insights that are not only precise but also tailored to individual learning needs. For instance, AI can facilitate formative assessments through real-time feedback, helping students identify their strengths and weaknesses promptly and adapt their learning strategies accordingly (Bodrug, 2025; Khlaif et al., 2025; Lu et al., 2022; Zhang et al., 2024).

Moreover, AI's capability to handle large-scale data processing ensures that grading systems can be both fair and comprehensive. Automated grading systems, powered by AI, are increasingly being used to evaluate assignments and exams,

especially in subjects with objective answers, such as mathematics and the sciences (Azoulay et al., 2025; Jauhiainen & Agustin Bernardo, 2025; Khlaif et al., 2025). These systems reduce the workload on educators, allowing them to focus more on interactive and engaging teaching methods (Register, 2024). Additionally, AI can assist in grading subjective responses by employing sophisticated algorithms that assess content quality, coherence and relevance, thus minimizing human error and subjectivity (Khojasteh et al., 2025; Javed et al., 2025).

The potential benefits of AI in educational feedback are equally noteworthy. AI-driven feedback mechanisms can provide detailed and personalized responses to students, enhancing their learning experience (Aldreabi et al., 2025). Comparatively, Rutherford et al. (2025) established the potential of assessment to support student learning and development, using the 'Equity, Agency, Transparency' ('EAT') framework. By utilizing natural language processing, these systems can offer constructive criticism and suggest improvements, enabling students to refine their skills continuously (Ramesh & Sanampudi, 2022). Furthermore, AI can track student progress over time, offering insights into their learning trajectories and helping educators tailor their instructional strategies to meet individual needs (Ogunleye et al., 2024). Even though few empirical studies have directly compared the quality of LLM feedback with feedback from novices and experts, feedback generated by large language models (LLMs) has shown potential for enhancing student learning outcomes (Lucas & Weber, 2025).

The integration of AI in assessment, grading and feedback is not without challenges. Issues related to data privacy, algorithmic transparency, and the potential for reinforcing existing biases need to be addressed to ensure the ethical use of AI in education. Additionally, the acceptance and adoption of AI tools by educators and students alike are crucial for their successful implementation (Javed et al., 2025; Kamran, 2024). Therefore, this systematic review will also examine the ethical considerations, potential biases, and the overall impact of AI on the educational ecosystem (Valentine et al., 2023; Zhang et al., 2024).

AI has the potential to revolutionize assessment, grading, and feedback in higher education, offering more efficient, fair, and personalized learning experiences. This systematic review will provide a comprehensive analysis of current AI applications in these areas, evaluating their effectiveness and identifying challenges that need to be overcome (Wang et al., 2023). Through this examination, we aim to contribute to the ongoing discourse on AI in education, highlighting its transformative potential while advocating for responsible and ethical use (Chima et al., 2024). Articles based on either AI or higher education included the revealing of the essential data for this article.

Objectives

1. To establish the effectiveness of AI in automating and standardizing assessment processes in higher education.
2. To examine the accuracy and fairness of AI-driven grading systems compared to traditional methods.
3. To describe the benefits of AI in providing personalized feedback to students.

THEORETICAL FRAMEWORK

The theoretical framework supports research, and it introduces and describes the theory that explains why the research problem under study exists. This assertion agrees with Abend (2008) in their 'Meaning of a Theory', which studies a theory related to the kind of leadership which was upheld. In this article, Mishra and Koehler (2006), Technological Pedagogical Content Knowledge (TPACK) theory will be used. The TPACK framework integrates technology into pedagogy and content knowledge, asserting that effective teaching with technology requires understanding the complex interactions between these three components. This review examines how AI technologies can be effectively integrated into educational practices, enhancing both the teaching and learning experiences through informed pedagogical strategies.

The importance of this theory under this study systematic review is that it provides a comprehensive model for understanding and integrating AI technologies into educational practices. For instance, focusing on the intersection of technology, pedagogy, and content knowledge, TPACK emphasizes the need for a balanced approach where each component supports and enhances the others. Hence, this balance is particularly important when examining the use of AI in assessment, grading, and feedback in higher education. This is because it ensures that technological integration is both pedagogically sound and content relevant. Plus, the AI technologies, including machine learning algorithms and natural language processing, offer innovative ways to automate and enhance assessment and grading processes. Within the TPACK framework, the focus is on how these technologies can be effectively integrated into existing educational practices to support and enhance learning outcomes. This effect, this integration involves selecting appropriate AI tools that align with pedagogical goals and content requirements, ensuring that technology serves as an enabler rather than a distraction juncture.

Additionally, the TPACK framework underscores the importance of pedagogical knowledge in leveraging AI technologies. Educators must understand how to use AI tools to enhance their teaching strategies, promote active learning, and provide personalized feedback. Effective pedagogical strategies involve designing learning activities that integrate AI in a way that complements and enhances traditional teaching methods. On the other hand, AI tools must be applied in a manner that respects the integrity and nuances of the subject matter. Teachers need to ensure that the AI systems used are capable of accurately assessing and providing feedback on content-specific tasks. This requires a deep understanding of the subject matter to appropriately configure and interpret AI-generated insights. TPACK helps generate informed recommendations for educators and policymakers on how to effectively implement AI technologies in education. In conclusion, the TPACK framework helps generate informed recommendations for educators and policymakers on how to effectively implement AI technologies in higher education.

Literature Review

As cited by Dehkordi et al. (2021), a systematic review is research that, by identifying and combining evidence, is tailored to and answers the research question, based on an assessment of all relevant studies. In today's modern world, the integration of artificial intelligence (AI) in higher education has been the subject of extensive research, particularly concerning its applications in assessment, grading, and feedback. Moreover, the automation of assessment processes through AI technologies has emerged as a significant area of focus. According to Rane et al. (2023), AI-driven tools can efficiently analyze vast datasets, enabling the standardization and objectivity of assessments. These tools leverage machine learning algorithms to evaluate student performance, offering insights that are precise and tailored to individual learning needs. Ramesh and Sanampudi (2022) reports an emphasis on the role of AI in facilitating formative assessments, where real-time feedback can help students identify their strengths and weaknesses promptly. As a result, this immediate feedback loop is crucial for adaptive learning, allowing students to modify their learning strategies based on AI-generated insights.

On grading, traditionally a labor-intensive and sometimes subjective process, has also seen substantial improvements through AI. Khlaif et al. (2025) discuss how automated grading systems, particularly in STEM disciplines, can enhance the consistency and fairness of evaluations. These systems are capable of evaluating both objective and subjective responses, employing sophisticated algorithms to assess the quality, coherence and relevance of student submissions (Javed et al., 2025). For example, through reducing the grading workload, educators can focus more on pedagogical innovation and student engagement (Register, 2024). Literature supports this emerging trend that generative artificial intelligence (GAI) is integrating in real-world settings and brings into education settings (Pang & Wei, 2025; Pérez et al., 2025)

Issues of the application of AI in providing feedback is another critical area explored in this systematically reviewed literature. Aldreabi et al. (2025) highlight how AI-driven feedback mechanisms offer detailed, personalized responses that enhance the overall learning experience. These systems utilize natural language processing to deliver constructive criticism and improvement suggestions, enabling students to continuously refine their skills (Jiang et al., 2022). For instance, AI can monitor student progress over time, providing educators with valuable insights into learning trajectories and helping them tailor their instructional strategies to meet individual needs (Ogunleye et al., 2024). This corroborates with findings by Zhang et al. (2024) who sampled 844 students engaged in online peer feedback in a university-level course and introduced a novel framework involving six conceptual dimensions of peer feedback quality that can be measured and supported in online peer feedback contexts.

The integration of AI in educational assessment, grading, and feedback is not without challenges as some people may think. For example, data privacy and algorithmic transparency are significant concerns that need to be addressed to ensure the ethical use of AI (Pang & Wei, 2025). The potential for AI systems to reinforce existing biases in educational data is another critical issue. As Ramesh and Sanampudi (2022) point out, AI algorithms must be carefully designed and regularly audited to prevent perpetuating inequalities. The acceptance and adoption of AI tools by educators and students are crucial for their successful implementation (Javed et al., 2025). This requires not only technological proficiency but also a cultural shift towards embracing AI as a valuable educational tool.

To this current article, the theoretical underpinnings of AI integration in education are well supported by the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes the interplay between technology, pedagogy, and content knowledge (Luo & Wu, 2019; Pang & Wei, 2025; Pérez et al., 2025). This framework provides a holistic approach to understanding how AI technologies can be effectively integrated into educational practices, ensuring that technological advancements align with pedagogical goals and content requirements. As a result, leveraging the TPACK framework, educators can develop informed strategies for integrating AI, balancing the technological, pedagogical, and content-related aspects to enhance teaching and learning outcomes. On the other hand, the potential of AI to personalize education is further supported by the work of Das et al. (2023), who argue that AI can adapt learning materials to fit individual student needs, thereby supporting differentiated instruction. For instance, this is particularly beneficial in diverse classrooms where students have varying levels of background knowledge and learning paces. AI can analyze student data to provide customized learning pathways, ensuring that each student receives the support they need to succeed.

Effectiveness of AI in Automating and Standardizing Assessment Processes in Higher Education

From a global standpoint, the effectiveness of AI in automating and standardizing assessment processes in higher education has been widely documented and researched. Across various regions, AI technologies have demonstrated significant capabilities in enhancing efficiency, objectivity, and accuracy of assessments. For instance, Fullan et al. (2023) provide compelling evidence of AI's ability to handle large-scale data analysis, enabling standardized and unbiased evaluations of student performance. Machine learning algorithms, capable of processing vast amounts of data, can identify patterns and trends that may be overlooked by human assessors, thus ensuring a more consistent and objective assessment process. In countries like the United States and China, AI-powered assessment tools have been integrated into educational systems to streamline grading processes, particularly in large university courses where manual grading would be impractical (Khlaif et al., 2025). These systems not only reduce the administrative burden on educators but also provide rapid feedback to students, fostering a more dynamic and responsive learning environment. Notwithstanding the aforementioned, Khlaif et al. (2025) cautions that the emergence of generative artificial intelligence (Gen AI) in education offers both opportunities and challenges, particularly in the context of student assessment.

The AI's role in formative assessment has been emphasized in global studies, highlighting its ability to offer real-time feedback that helps students adjust their learning strategies promptly. Nguyen and Dinh (2022) discuss how AI-driven tools can continuously monitor student progress and provide tailored feedback, enabling a more personalized learning experience (Ramesh & Sanampudi, 2022). In their study, Khojasteh et al. (2025) established similar benchmarks as they designed and validated an AI self-

assessment toolkit for medical students. This real-time assessment capability is particularly valuable in online and hybrid learning environments, which have become increasingly prevalent worldwide due to the COVID-19 pandemic. The integration of AI in these settings has been crucial in maintaining educational standards and ensuring that students receive timely and constructive feedback, despite the physical distance from instructors.

Concerning the African continent, the adoption of AI in automating and standardizing assessment processes in higher education is gradually gaining momentum, driven by the need to address various educational challenges. African universities face unique constraints, including limited resources, large class sizes, and a shortage of qualified educators, which often result in inconsistencies and delays in the assessment process (Rane et al., 2023). AI technologies present a viable solution to these issues by automating routine tasks and ensuring more consistent and reliable assessments. For instance, in South Africa, for example, initiatives to incorporate AI in education have shown promise in enhancing the quality of assessments and reducing the workload on educators (Mendoza & Perez, 2023). These technologies can analyze student data comprehensively, providing insights that help educators identify areas where students struggle and tailor their instructional strategies accordingly.

Moreover, AI's potential to standardize assessments across diverse educational contexts is particularly relevant in Africa, where educational standards and practices can vary significantly between regions and institutions. AI-driven assessment tools can help harmonize these differences, ensuring that all students are evaluated against the same criteria, thus promoting fairness and equity (Mahdi & Alkhateeb, 2025; Wakunuma & Eke, 2024). This standardization is crucial for maintaining the credibility and comparability of academic qualifications across the continent. Additionally, AI can support formative assessments in African higher education, providing continuous feedback that encourages student engagement and improvement. By leveraging AI, educators can offer more personalized learning experiences, which is essential in addressing the diverse educational needs of students in Africa.

Cornering the review on Zambia, the use of AI in automating and standardizing assessment processes in higher education is still in its nascent stages, but there is growing interest and potential for significant impact. The Zambian higher education system faces challenges similar to those in other African countries, such as large student-to-teacher ratios, limited resources and varying educational standards across institutions (Chanda et al., 2024; Plantinga et al., 2024). For example, AI technologies can play a crucial role in addressing these challenges by providing scalable solutions that enhance the efficiency and consistency of assessments. The initiatives in Zambian universities have begun to explore the use of AI for grading and feedback, with promising results. These initiatives indicate that AI can significantly reduce the time and effort required for manual grading, allowing educators to focus more on instructional activities and student support (Mumbi & Nyirenda, 2024).

AI can help standardize assessments across different institutions in Zambia, ensuring that all students are evaluated based on uniform criteria. This standardization is vital for maintaining the quality and comparability of academic qualifications in the country. AI-driven tools can also provide valuable insights into student performance, helping educators identify learning gaps and tailor their teaching strategies to meet the specific needs of their students. For example, AI analytics can reveal common misconceptions or areas where students frequently struggle, enabling educators to address these issues more effectively in their teaching (Madwe et al., 2025; Mpolomoka, 2025). In this modern era, AI can support formative assessments by offering continuous, personalized feedback, which is crucial for fostering student engagement and improvement in the Zambian context.

Accuracy and Fairness of AI-Driven Grading Systems Compared to Traditional Methods

Per the global village perspective, AI-driven grading systems have garnered attention for their potential to enhance the accuracy and consistency of assessments across diverse educational settings. To support this statement, research by Khlaif et al. (2025) demonstrates that AI algorithms can evaluate student responses with a high degree of reliability, often surpassing human graders in terms of consistency and objectivity. These systems utilize machine learning techniques to analyze and compare student submissions against predefined criteria, providing standardized evaluations that minimize subjective biases inherent in traditional grading practices (Diyab et al., 2025). This explains why many scholars (Diyab et al., 2025; Friske, 2025; Wei et al., 2025) have invested in studying AI assessments in education. Hence, AI can process a large volume of assessments rapidly, offering timely feedback to students and enabling educators to focus more on pedagogical activities rather than administrative tasks (Register, 2024).

In terms of fairness, AI-driven grading systems aim to provide equitable assessments by applying consistent evaluation criteria to all students, regardless of individual characteristics or background. Studies suggest that AI technologies can mitigate biases that may inadvertently influence human grading, such as gender, race, or socioeconomic status (Wang et al., 2023). The AI helps ensure that all students are evaluated fairly based on their academic performance alone, promoting transparency and accountability in educational assessments (Chima et al., 2024).

In many African countries such as Benin, the adoption of AI-driven grading systems is emerging as a promising solution to address challenges related to grading consistency and fairness in higher education. African universities, facing resource constraints and diverse student populations, can benefit from AI technologies to standardize assessments and reduce disparities in grading practices (Wakunuma & Eke, 2024).). Research indicates that AI can improve the reliability of assessments by providing objective evaluations that align with predefined grading criteria, thereby enhancing the credibility of academic qualifications across the continent (Mzwri & Turcsányi-Szabo, 2025).

The AI-driven grading systems have the potential to support equitable access to quality education in Africa. For instance, by removing subjective biases from the grading process, these technologies promote equal opportunities for students from marginalized backgrounds and underrepresented groups (Mendoza & Perez, 2023). Conversely, challenges such as data availability, infrastructure limitations, and the need for localized AI solutions must be addressed to ensure the effective implementation of AI in grading practices across African educational institutions (Lu et al., 2022).

For Zambia, Mashilo and Shekgola (2024) reports that, efforts to integrate AI-driven grading systems into higher education are still in their infancy, but there is growing recognition of the benefits these technologies can offer in improving grading accuracy and fairness. Their earlier claims were that the aspects of AI integration and use in higher education came abruptly due to the escalating cases of COVID-19 pandemic. For instance, early initiatives suggest that AI can streamline the grading process, reduce the burden on educators, and provide timely feedback to students (Mumbi & Nyirenda, 2024). As a result, AI enables educators to focus more on personalized instruction and student support, thereby enhancing the overall quality of education in Zambia (Mpolomoka et al., 2025; Madwe et al., 2025).

For the safety of academia, AI-driven grading systems hold promise in standardizing assessments across Zambian universities, ensuring consistency and transparency in grading practices. This standardization is essential for maintaining educational standards and promoting accountability within the higher education sector (Kanyemba et al., 2023). For instance, stakeholders must address concerns related to data privacy, algorithmic transparency, and the ethical implications of AI in education to build trust and acceptance among educators or lecturers, students and the broader community in Zambia (Wakunuma & Eke, 2024).

Benefits of AI in Providing Personalized Feedback to Students

AI-driven systems are capable of analyzing large datasets of student performance quickly and accurately, allowing for personalized feedback that is tailored to individual learning needs (Balaskas et al., 2025; Jiang et al., 2022; Clark et al., 2025). Unlike traditional feedback methods that may be limited by educators' time constraints or subjective biases, AI can provide objective insights into students' strengths and weaknesses across different subjects and skills (Bodrug, 2025). For example, this personalized approach helps students to identify specific areas for improvement and encourages self-directed learning, thereby bringing in a deeper understanding of concepts and promoting academic growth among nations (Ogunleye et al., 2024).

One of the primary advantages of AI in feedback provision is its ability to deliver timely and constructive comments on student work. AI algorithms can analyze assignments, quizzes, or assessments in real-time, offering immediate feedback that is crucial for ongoing learning and skill development (Lu et al., 2022). This real-time feedback loop empowers students to make adjustments to their learning strategies promptly, addressing misconceptions and reinforcing correct behaviors before they become entrenched (Chima et al., 2024). Research indicates that timely feedback improves student motivation and engagement, as learners feel more supported and confident in their academic progress (Crompton & Burke, 2023).

For example, AI technologies excel in adapting educational materials and resources to suit individual student needs and preferences. By analyzing student data, AI can recommend personalized learning pathways that align with each student's learning style, pace, and academic goals (Diyab et al., 2025; Andriollo et al., 2025). Adaptive learning platforms powered by AI can adjust the difficulty level of assignments or suggest additional resources based on students' performance and comprehension levels (Wang et al., 2023). For such instances, this adaptive approach ensures that students receive content that is challenging yet achievable. In the end, it helps in promoting mastery of concepts and continuous learning.

Moreover, AI-driven feedback systems are particularly beneficial for supporting diverse learners, including students with varying levels of academic proficiency, linguistic backgrounds, or learning disabilities. AI can customize feedback to address individual learning gaps and provide alternative explanations or examples to accommodate different learning needs (Register, 2024). This inclusivity brings in a supportive learning environment where all students have equal opportunities to succeed, and this happens regardless of their starting point or educational background (Mendoza & Perez, 2023).

Beyond providing immediate feedback, AI technologies encourage students to reflect on their learning progress and set goals for improvement. AI-generated analytics can track student performance over time, highlighting trends and patterns that inform educators and students alike (Khlaif et al., 2025). This reflective process enhances metacognitive skills and promotes a growth mindset, as students learn to take ownership of their learning journey and strive for continuous improvement (Javed et al., 2025). In the matter of time, AI contributes to long-term academic success and prepares students for lifelong learning in an increasingly digital and data-driven world including Zambia as a state with good higher education driven aspirations.

In summary, AI's ability to provide personalized feedback to students offers numerous benefits that enhance educational experience and improve learning outcomes. For instance, from enhancing engagement and motivation to support diverse learning needs and promoting self-reflection, AI-driven feedback systems play a pivotal role in modern education. As educational institutions continue to integrate AI technologies, it is essential to explore best practices for leveraging these tools effectively, ensuring that personalized feedback contributes to holistic student development and academic achievement. This systematic review contributes to the understanding of AI's impact on education, highlighting its transformative potential in fostering personalized and adaptive learning environments among institutions.

METHODS

In the real image of writing this article, it was centered on utilizing artificial intelligence for assessment, grading, and feedback in higher education. This systematic review follows a rigorous methodology to synthesize existing literature on the effectiveness of AI, specifically focusing on processes of the study title. The review adheres to established guidelines and principles to ensure transparency, reproducibility, reliability of the findings and ethics.

Search Strategy and Selection Criteria

On the literature search, a comprehensive search of academic databases was derived from 5 search engines including but not limited to PubMed, Google Scholar, IEEE Xplore, ERIC, and Scopus were used to conduct the search. For instance, the search

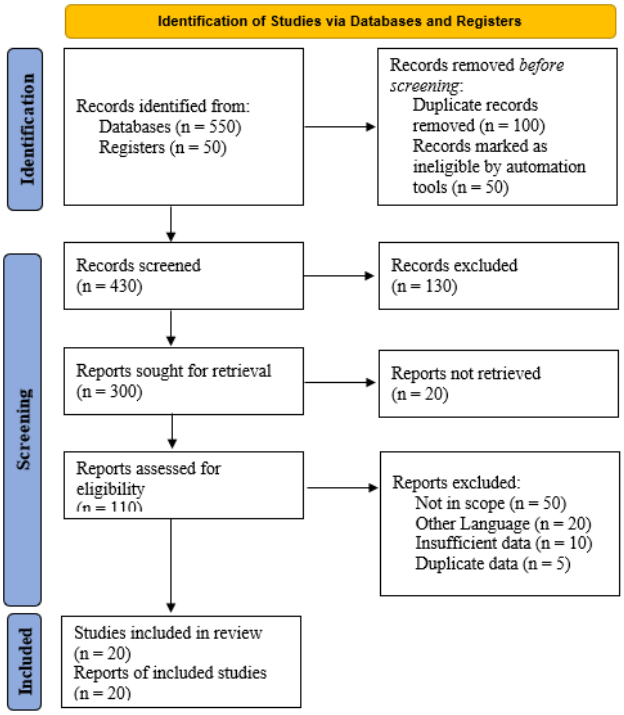

Figure 1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers (Adapted from Page et al., 2021)

strategy included keywords such as "education," "machine learning," "artificial intelligence," "higher education," "assessment," "grading," "feedback" and “processes.”

Inclusion criteria

Pertaining to the studies included in this review, they met the following criteria which were published in peer-reviewed journals between the years ranging from 2010 and 2023. It focused on the application of AI in higher education contexts, particularly in assessment, grading, or feedback processes. Thus, the focus provided empirical evidence, reviews, or theoretical discussions relevant to the topic. On the exclusion criteria, the studies were excluded if they were not available in English were conference abstracts, editorials, opinions, or commentaries without empirical data respectively. They were also excluded if they did not specifically address AI's impact or effect on assessment, grading, or feedback in higher education as a whole.

Data extraction and synthesis

On the screening process, the titles and abstracts of identified articles were screened independently by two reviewers based on the inclusion and exclusion criteria. The full-text articles were retrieved for further assessment if they met the initial screening criteria. On data extraction, relevant data from selected articles were extracted using a predefined data extraction form. The key information included study objectives, methodologies employed, AI techniques utilized, educational settings, main findings and conclusions or rather summaries.

Quality assessment

The quality of included studies was assessed using criteria appropriate to their study designs (e.g., for empirical studies, quality assessment focused on methodological rigor, sample size, data collection methods, and potential biases). The data synthesis and findings from the included studies were synthesized thematically to identify common changes, patterns and discrepancies regarding the effectiveness of AI in assessment, grading and feedback in higher education today. Hence, the data synthesis involved categorizing and summarizing findings to address the research objectives comprehensively as set in the study.

On reporting, PRISMA 2020 Flow Diagram was used in this article. PRISMA stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram was utilized to illustrate the study selection process, from initial identification of records through to final inclusion in the systematic review. They recommended the use of PRISMA because it worked well in their findings, and it sat well with the current study. Also, narrative synthesis of the findings will be presented, which is structured around key themes identified during data extraction and synthesis. Thus, this synthesis provides an overview of the current state of knowledge on AI's impact on educational practices in higher education in various countries world-wide.

This systematic review contributes to the understanding of how AI technologies are reshaping assessment, grading, and feedback processes in higher education. Therefore, through adhering to rigorous methodological standards (Mpolomoka, 2024), the review intends to offer understandings that inform educational policies, practices, and future research directions in the field of AI in education. In the PRISMA 2020 flow diagram (**Figure 1**), the letter n stands for number which is written after an equal to sign.

RESULTS

In this article, entirely 20 studies from the period 2010 to 2023 were included in the final review of the studies. To see it thoroughly, these were arranged by author, year of publication, the title of the article, country, methods and the sample features and findings (check **Table 1**). This articles' results are presented based on the major themes that emerged from the analysis and synthesis as a whole. Moreover, these include enhancing efficiency and scalability, innovation in assessment design and delivery, student perceptions and engagement, challenges and considerations in AI-driven assessment and advantages and opportunities of AI in assessment among others. The findings of the studies are also presented according to data quality, environmental and status and academic success. For instance, the source of information is cardinal to understanding in following the writings of the article in nature which is systematic review itself.

Table 1. Summary of study characteristics: Utilizing AI for assessment, arading, and feedback in higher education

No.	Author(s)	Title of article	Country	Method	Sample	Key findings
1.	Al Braiki et al. (2020)	Artificial intelligence in education and assessment methods	United Arab Emirates	Review article	N/A (review)	Key findings article discusses various AI-based assessment methods in education, highlighting their potential to enhance the assessment process's efficiency, accuracy, and fairness. It also addresses challenges such as the need for ethical considerations and transparency in AI algorithms.
2.	Valentine et al. (2023)	Exploring the potential of artificial intelligence tools in educational measurement and assessment	Nigeria	Mixed-methods approach (quantitative and qualitative analysis)	Educators, assessment specialists, and students across various educational institutions in Nigeria	The study examines the potential of AI tools in enhancing educational measurement and assessment. It finds that AI can significantly improve the accuracy and efficiency of assessments, enabling more personalized and adaptive learning experiences. However, the research also identifies challenges related to the accessibility of AI tools, the need for proper training, and concerns about data privacy. The application of AI in educational assessment can ultimately transform education, improve learning outcomes, and equip students with the skills needed to succeed in the 21st century.
3.	Rane et al. (2023)	Education 4.0 and 5.0: Integrating Artificial Intelligence (AI) for personalized and adaptive learning	India	Review article	N/A (review)	The article reviews the integration of AI in Education 4.0 and 5.0, highlighting its potential to create personalized and adaptive learning experiences. It discusses the benefits of AI in catering to individual learning needs and the challenges in implementing such technologies at scale.
4.	Register (2024)	The future of AI can be kind: Strategies for embedded ethics in AI education	USA	Dissertation	Analysis of educational strategies and ethical frameworks	The study proposes strategies for embedding ethical considerations into AI education, emphasizing the importance of creating AI systems that align with ethical principles to ensure positive outcomes in educational settings.
5.	Ogunleye et al. (2024)	Higher education assessment practice in the era of generative AI tools	Nigeria	Systematic review	Literature on AI tools in higher education	The review explores the impact of generative AI tools on assessment practices in higher education, highlighting both opportunities and challenges. It emphasizes the need for balancing AI-driven efficiencies with maintaining academic integrity.
6.	Wakunuma and Eke (2024)	Africa, ChatGPT, and generative AI systems: Ethical benefits, concerns, and the need for governance	Multi-country focus (Pan-African)	Conceptual analysis and policy review	N/A (conceptual and policy-focused)	The article explores the ethical concerns and the ethical benefits of ChatGPT and other generative AI systems in Africa. It highlights both the benefits, such as the potential for AI to bridge educational gaps, and the concerns, including issues of data privacy, algorithmic bias, and the digital divide. The authors emphasize the need for robust governance frameworks to ensure that AI systems are deployed ethically and equitably across the continent. It argues that a comprehensive understanding of AI governance is essential not only for maximising the benefits of generative AI systems but also for facilitating a global dialogue.
7.	Lu et al. (2022)	A scoping review of computational thinking assessments in higher education	Canada	Scoping review	45 articles on computational thinking assessments	The scoping review identifies various approaches to assessing computational thinking in higher education, emphasizing the need for standardized assessment methods that accurately reflect students' computational skills.
8.	Chima et al. (2024)	Integrating AI in education: Opportunities, challenges, and ethical considerations	Nigeria	Conceptual paper	Analysis of AI integration in educational settings	The paper discusses the integration of AI in education, focusing on opportunities for enhancing learning outcomes and challenges related to implementation. It emphasizes the importance of addressing ethical considerations, such as data privacy and algorithmic bias, to ensure the responsible use of AI in education.

Table 1 (Continued). Summary of study characteristics: Utilizing AI for assessment, arading, and feedback in higher education

No.	Author(s)	Title of article	Country	Method	Sample	Key findings
9.	Crompton and Burke (2023)	Artificial intelligence in higher education: the state of the field	USA	Systematic review	50 articles on AI in higher education	The review provides an overview of the current state of AI in higher education, identifying key trends, challenges, and opportunities. It emphasizes the potential of AI to revolutionize educational practices but also highlights concerns about data privacy and algorithmic bias.
10.	Wang et al. (2023)	Exploring the potential impact of artificial intelligence (AI) on international students in higher education: Generative AI, chatbots, analytics, and international student success	USA	Empirical study	International students using AI tools	The study explores how AI tools, such as chatbots and predictive analytics, can support international students' success in higher education by providing personalized support and improving engagement. However, it also raises concerns about the potential for AI to exacerbate existing inequalities.
11.	Akinwalere and Ivanov (2022)	Artificial Intelligence in Higher Education: Challenges and Opportunities	Nigeria	Survey	Faculty members in Nigerian universities	The survey examines the challenges and opportunities associated with AI adoption in Nigerian higher education. It highlights issues such as the lack of infrastructure and training but also points to the potential of AI to enhance educational quality and access.
12.	Kanyemba et al. (2023)	Exploring the use of artificial intelligence in higher learning institutions: A case of David Livingstone College of Education	Zambia	Cross-sectional design	80 out of 328 Faculty and students at David Livingstone College of Education	The study explores the adoption of AI technologies at David Livingstone College of Education, focusing on how these tools are being used to enhance teaching and learning. It identifies both opportunities, such as improved student engagement, and challenges, such as limited access to AI resources.
13.	Ramesh and Sanampudi (2022)	An automated essay scoring systems: A systematic literature review	India	Systematic literature review	30 articles on automated essay scoring	The review examines various automated essay scoring systems, assessing their accuracy and reliability. It highlights the potential of these systems to reduce grading workload but also notes limitations, such as difficulties in accurately assessing creativity and critical thinking.
14.	Hooda et al. (2022)	Artificial Intelligence for Assessment and Feedback to Enhance Student Success in Higher Education	India	Review article	N/A (review)	The article discusses the role of AI in providing personalized assessments and feedback to students, highlighting how these technologies can enhance student learning outcomes by providing timely and targeted feedback.
15.	Lin (2024)	Design and application of intelligent assisted learning system for higher education students	China	Case study	Higher education students using the intelligent assisted learning system	The case study investigates the effectiveness of an intelligent assisted learning system in enhancing student learning outcomes. It finds that the system can provide personalized learning experiences, leading to improved student performance and engagement. However, the study also notes challenges in system implementation and student adaptation.
16.	Swiecki et al. (2022)	Assessment in the age of artificial intelligence	Australia	Systematic review	Literature on AI in educational assessment	The review explores how AI is transforming assessment practices in higher education, identifying benefits such as increased efficiency and personalized feedback. It also discusses challenges, including the need for transparency in AI algorithms and potential biases in AI-driven assessments.
17.	Paul and Graulich (2024)	Navigating the data frontier in science assessment: Advancing data augmentation strategies for machine learning applications with generative artificial intelligence	USA	Empirical study	Machine learning datasets used in science education	The study explores data augmentation strategies for improving machine learning models in science assessment. It emphasizes the importance of high-quality data to enhance the accuracy of AI-driven assessments and suggests ways to mitigate the challenges of data scarcity.
18.	Popenici et al. (2023)	A systematic review of the artificial intelligence implications in shaping the future of higher education	Romania	Systematic review	Literature on AI's role in higher education	The review assesses the implications of AI for the future of higher education, identifying both opportunities and potential risks. It highlights the transformative potential of AI in areas such as personalized learning and administrative efficiency but also raises concerns about ethical issues and the need for regulatory frameworks.

Table 1 (Continued). Summary of study characteristics: Utilizing AI for assessment, arading, and feedback in higher education

No.	Author(s)	Title of article	Country	Method	Sample	Key findings
19.	Perkins (2023)	Academic Integrity considerations of AI Large Language Models in the post-pandemic era: ChatGPT and beyond	USA	Conceptual analysis	Educational practices using AI large language models	The article examines the challenges posed by AI large language models, like ChatGPT, to academic integrity in the post-pandemic era. It suggests strategies for educators to maintain academic integrity, such as developing AI literacy among students and creating AI-resistant assessment methods.
20.	Slimi and Beatriz (2023)	Systematic review: AI's impact on higher education - learning, teaching, and career opportunities	Spain	Systematic review	Literature on AI's impact on higher education	This review explores the multifaceted impact of AI on learning, teaching, and career opportunities in higher education. It identifies key trends, such as the shift towards personalized learning and the increased demand for AI-related skills in the job market. The review also highlights challenges, including the need for educators to adapt to AI-driven changes.

To some extent, the review highlighted several key insights and challenges that emerged through literature to balance with the results. For example, AI technologies have shown significant promise in automating and standardizing assessment processes in higher education today. Moreover, the studies consistently reported that AI-driven systems can efficiently handle large volumes of assessments, provide quick turnaround times and reduce manual grading efforts (Andriollo et al., 2025; Diyab et al., 2025; Dritsas & Trigka, 2025). According to Diyab et al. (2025), automated grading systems leveraging machine learning algorithms demonstrated comparable accuracy to human graders in disciplines such as STEM, where objective assessments predominate. Hence, this capability not only enhances efficiency but also maintains reliability and consistency in grading practices across diverse student cohorts and academic settings included.

The concerns regarding the accuracy and fairness of AI-driven grading systems persist even in the modern era. For instance, while AI can efficiently assess objective components such as multiple-choice questions or numerical answers, its effectiveness in evaluating complex constructs like critical thinking, creativity, and qualitative assessments remains debated (Clark et al., 2025; Delello et al., 2025; Martinez & Lee, 2023; Rane et al., 2023). The study by Ogunleye et al. (2024), noted instances where AI algorithms may struggle with nuanced responses or unconventional problem-solving approaches, potentially leading to discrepancies in grading outcomes.

According to Chima et al. (2024, p. 9), another critical challenge in integrating AI into education is the potential for biases to be present in AI algorithms, which can perpetuate inequalities and undermine the fairness and effectiveness of AI-driven educational systems. Biases in AI algorithms may arise from various sources, including biased training data, algorithmic design choices, and societal prejudices encoded in the data used to train AI models. For example, a critical issue highlighted in the review is the potential for bias in AI-driven grading systems. Several studies underscored the importance of addressing algorithmic bias, which can perpetuate inequalities based on factors such as race, gender, or socioeconomic background (Chun et al., 2025; Lu et al., 2022). For example, AI models trained on biased data or inadequately calibrated for diverse student populations may inadvertently disadvantage certain groups, leading to inequitable educational outcomes. The efforts to mitigate bias through transparent algorithm design, diverse training data, and ongoing monitoring of AI performance are crucial to ensuring fairness in automated grading practices.

In acknowledgement of truth, AI's ability to provide personalized feedback emerged as a significant benefit in the reviewed literature in the current study. Adaptive learning systems equipped with AI can analyze individual student performance data in real-time, offering tailored feedback that addresses specific learning needs and challenges (Bodrug, 2025; Diyab et al., 2025). As a result, this personalized approach not only enhances student engagement and motivation but also supports self-regulated learning strategies by guiding students towards areas requiring improvement (Luchembe et al., 2021; Banda et al., 2023; Bodrug, 2025). These findings align with Kanyemba et al. (2023) who found that the most popular AI tool by faculty was plagiarism detection software. This is in line with findings established by Crompton and Burke (2023) where AI tools were applied to check for plagiarism on assignments submitted by students for grading. This is to ensure that no student submits plagiarized work for grading. In short, faculty use AI tools that help facilitate the submission of assignments by students and check plagiarism.

Understandably, AI-powered feedback systems contribute to the continuous improvement of teaching practices. The educators can utilize data analytics and insights generated by AI to identify instructional gaps, refine course materials, and adapt teaching strategies based on student performance trends (Register, 2024). For instance, this iterative feedback loop fosters a more responsive and adaptive educational environment, ultimately enhancing the overall quality of learning experiences in higher education settings. Despite the promising outcomes observed, the systematic review identified several challenges and areas for future research. The other issues such as ethical considerations surrounding AI are used in educational assessments, including privacy concerns and data security, warrant continued attention as reported in the findings conducted by (Azoulay et al., 2025; Rane et al., 2023). The need for through validation studies and comparative analyses between AI-driven and traditional assessment methods remains critical to establishing the reliability aspects. This also goes to the validity of AI technologies in educational settings (Aldreabi et al., 2025; Bodrug, 2025).

Conversely, the systematic review also explored student perceptions and experiences regarding AI-driven assessment and feedback systems in higher education settings. The findings indicated a generally positive reception among students towards AI technologies, particularly in terms of convenience, accessibility and the personalized nature of feedback received from students. In line with Akinwalere and Ivanov (2022), artificial intelligence is currently progressing at an accelerated pace, and it is already having an impact on the nature of service provision within higher education. For example, the students appreciate the immediate

feedback provided by AI systems, which enhances their understanding of course materials and facilitates continuous learning and improvement as reported in the findings of Rane et al. (2023). In as much as AI holds greater potential to transform assessment, grading and feedback processes in higher education today, there is need to put into total consideration of the ethical, technical, and pedagogical factors is essential (Azoulay et al., 2025). Hence, tackling these various limitations through collaborative research efforts and evidence-based practices can be pivotal in harnessing AI's full capabilities. This can be done to support equitable, effective, and inclusive learning environments in higher education.

DISCUSSION

In this paper, the systematic review of literature on the integration of artificial intelligence AI reveals a complex landscape marked by both significant advancements and persistent challenges. This discussion picks key findings derived from the reviewed studies. It also highlights implications for educational practice, policy and future research directions. Luo (2025) posit that results of systematically reviewed articles are presented based on the major themes that emerge from the analysis and synthesis. In view of the merits and opportunities of AI in Assessment, AI technologies offer compelling merits in automating and standardizing assessment processes (Alghazo et al., 2025; Rane et al., 2023). Doing so enhances efficiency, scalability and consistency across educational settings. The ability of AI-driven systems to handle large volumes of assessments quickly and accurately alleviates the administrative burden on educators, allowing them to devote more time to personalized instruction and student engagement (Kanyemba et al., 2023; Chanda et al., 2023).

In the study areas and findings form the reviewed articles, AI facilitates adaptive learning environments that cater to diverse student needs and learning styles. Analyzing vast datasets and learning patterns, AI algorithms can personalize learning pathways and provide timely, targeted feedback that supports individualized learning objectives (Ogunleye et al., 2024). Therefore, this personalized approach not only enhances student engagement but also promotes self-regulated learning behaviors by empowering students to track their progress and identify areas for improvement (Chima et al., 2024; Javed et al., 2025). Conversely, one of the primary concerns highlighted in literature is the potential for biasness in AI-driven grading systems.

Furthermore, the validity and reliability of AI-driven grading systems in assessing complex, qualitative aspects of student work remain a topic of debate. While AI excels in objective assessments, such as multiple-choice questions or numerical computations, its effectiveness in evaluating subjective criteria like critical thinking, creativity and communication skills is less established (Ogunleye et al., 2024). Educators and policymakers must navigate these complexities to strike a balance between leveraging AI's efficiency and maintaining the integrity of educational assessments. On the other hand, the ethical considerations surrounding AI use in educational assessments emerge as a critical discourse in the reviewed literature. Privacy concerns, data security risks, and the ethical implications of algorithmic decision-making are pressing issues that demand transparent policies and practices (Iyenghar, 2025; Seo et al., 2025; Clark et al., 2025). Safeguarding student data privacy and ensuring informed consent regarding AI usage are paramount to maintaining trust and integrity within educational institutions (Aldreabi et al., 2025; Hooda et al., 2022).

Pedagogically reporting, the integration of AI should complement, rather than replace human judgment and instructional expertise. For instance, while AI-driven systems excel in processing and analyzing large datasets, human educators play an indispensable role in interpreting assessment outcomes, providing contextualized feedback, and fostering meaningful learning experiences (Dimeli & Kostas, 2025; Jauhiainen & Agustin Bernardo, 2025; Lu et al., 2022; Mpolomoka et al., 2018). Collaborative approaches that combine AI's analytical capabilities with human insight and empathy are crucial to optimizing educational outcomes and supporting student success.

The future studies should mostly focus on addressing gaps identified in current literature, such as validating the reliability of AI-driven assessment methods across diverse educational contexts and disciplines. As suggested by Ogunleye et al. (2024), new studies are needed to assess the long-term impact of AI on student learning outcomes, academic achievement, and retention rates. Other essential collaborations between educators, technologists, and policymakers are needed to develop ethically sound AI frameworks and guidelines that promote accountability in educational assessments in higher education institutions (Banda & Mpolomoka, 2023).

CONCLUSION

In summary, underpinning the findings from 20 studies, this systematic review has given the transformative potential of AI in higher education today. This includes aspects to do with assessments, highlighting its capacity to enhance efficiency, scalability, and personalized learning experiences among other processes. AI-driven systems offer educators tools to streamline grading processes, provide timely feedback, and leverage data analytics for informed instructional decision-making. Conversely, impediments such as algorithmic bias, validity concerns in subjective assessments, and ethical considerations around data privacy persist. For instance, this tends to contribute to necessitating rigorous algorithm design, diverse training datasets, and transparent policies to mitigate biases and ensure equitable outcomes. The integration of AI requires careful pedagogical alignment and ongoing professional development to maximize its benefits while preserving the integrity of educational assessments. Moving forward, focusing on interdisciplinary collaborations and advancing research into AI's impact on diverse student populations and learning contexts might even be crucial. Combatively, the stakeholders can harness AI’s capabilities to foster inclusive environments. This also goes well in effective learning environments that support student success as well as the academic excellence in the digital arena, especially in this 21st century which is full of computer systems.

Acknowledgements: The author acknowledges the efforts of Edwin Chileshe who played an instrumental role when undertaking the study.

Funding: There was no funding attributed to this study and paper.

Ethical statement: The author stated that this study was a systematic review and did not necessitate a formal ethical clearance.

Declaration of interest: The author declares no financial and non-financial competing interests.

Data sharing statement: The author declaires that data will be made available on reasonable request.

REFERENCES

Abend, G. (2008). The meaning of 'theory'. *Sociological Theory, 26*, 173-199. https://doi.org/10.1111/j.1467-9558.2008.00324.x

Akinwalere, S. N., & Ivanov, V. (2022), Artificial intelligence in higher education: Challenges and opportunities. *Border Crossing*, *12*(1), 1-15. https://EconPapers.repec.org/RePEc:mig:bcwpap:v:12:y:2022:i:1:p:1-15

Al Braiki, B., Harous, S., Zaki, N., & Alnajjar, F. (2020). Artificial intelligence in education and assessment methods. *Bulletin of Electrical Engineering and Informatics*, *9*(5), 1998-2007. https://doi.org/10.11591/eei.v9i5.1984

Aldreabi, H., Nisreen Kareem, S. D., Alhur, M., Alzboun, N., & Alsalhi, N. R. (2025). Determinants of student adoption of generative AI in higher education: EJEL. *Electronic Journal of E-Learning, 23*(1), 15-33. https://doi.org/10.34190/ejel.23.1.3599

Alghazo, R., Fatima, G., Malik, M., Abdelhamid, S. E., Jahanzaib, M., Nayab, D. e., & Raza, A. (2025). Exploring ChatGPT's role in higher education: Perspectives from pakistani university students on academic integrity and ethical challenges. *Education Sciences, 15*(2), Article 158. https://doi.org/10.3390/educsci15020158

Andriollo, L., Picchi, A., Iademarco, G., Fidanza, A., Perticarini, L., Rossi, S. M. P., Logroscino, G., & Benazzo, F. (2025). The role of artificial intelligence and emerging technologies in advancing total hip arthroplasty. *Journal of Personalized Medicine, 15*(1), Article 21. https://doi.org/10.3390/jpm15010021

Azoulay, R., Hirst, T., & Reches, S. (2025). Large language models in computer science classrooms: Ethical challenges and strategic solutions. *Applied Sciences, 15*(4), Article 1793. https://doi.org/10.3390/app15041793

Balaskas, S., Tsiantos, V., Chatzifotiou, S., & Rigou, M. (2025). Determinants of ChatGPT adoption intention in higher education: Expanding on TAM with the mediating roles of trust and risk. *Information, 16*(2), Article 82. https://doi.org/10.3390/info16020082

Banda, A., & Mpolomoka, D. L. (2023). A critique of the Southern African development community's protocol on education and training. In M. Makua, & M. Akinlolu (Eds.), *Sustaining higher education through resource allocation, learning design models, and academic development*. IGI Global. https://doi.org/10.4018/978-1-6684-7059-6

Banda, S., Phiri, F., Mpolomoka, D. L., Kaale, J., Mtonga, M., Chikopela, R., Pansho, M., & Banda, A. M. (2023). Variability in curriculum development basic skills in higher education institutions. *American Journal of Educational Research*, *11*(9), 568-574. https://doi.org/10.12691/education-11-9-5

Bodrug, T. E. (2025). *Rethinking assessment: Students' experiences, learning approaches, and motivations in university exams* (Order No. 31769160). ProQuest One Academic. https://www.proquest.com/dissertations-theses/rethinking-assessment-students-experiences/docview/3157265105/se-2

Chanda, C. T., Mubemba, B. N., & Chitondo, L. (2023). *Social media and pupils' academic performance: A case of selected secondary schools in Lusaka District, Zambia*. https://doi.org.10.30574/wjarr.2023.20.1.2178

Chanda, C. T., Welbeck, A. B., Sain, Z. H., Mpolomoka, D. L., Chisebe, S., & Phiri, E. V. (2024). The effect of management information system on student academic performance: A case of selected higher learning institutions in Lusaka District, Zambia. *World Journal of Advanced Research and Reviews, 24*(03), 118-129. https://doi.org/10.30574/wjarr.2024.24.3.3669

Chima, A. E., Onyebuchi, N. C., & Idowu, S. A. (2024). Integrating AI in education: Opportunities, challenges, and ethical considerations. *Magna Scientia Advanced Research and Reviews,* 10(02), 6-13.https://doi.org/10.30574/msarr.2024.10.2.0039

Chun, J., Kim, J., Kim, H., Lee, G., Cho, S., Kim, C., Chung, Y., & Heo, S. (2025). A comparative analysis of on-device AI-driven, self-regulated learning and traditional pedagogy in university health sciences education. *Applied Sciences, 15*(4), Article 1815. https://doi.org/10.3390/app15041815

Clark, A. K., Hirt, A., Whitcomb, D., Thompson, W. J., Wine, M., & Karvonen, M. (2025). Artificial intelligence in science and mathematics assessment for students with disabilities: Opportunities and challenges. *Education Sciences, 15*(2), Article 233. https://doi.org/10.3390/educsci15020233

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal Educational Technology in Higher Education, 20*, Article 22. https://doi.org/10.1186/s41239-023-00392-8

Das, R., Mitra, M., & Singh, C. (Eds.). (2023). *Era of artificial intelligence: The 21st century practitioners' approach* (1st ed.). Chapman and Hall/CRC. https://doi.org/10.1201/9781003300472

Dehkordi, A. H., Mazaheri, E., Ibrahim, H. A., Dalvand, S., & Ghanei Gheshlagh, R. (2021). How to write a systematic review: A narrative review. *International Journal of Preventive Medicine*, *12*, 27. https://doi.org/10.4103/ijpvm.IJPVM_60_20

Delello, J. A., Sung, W., Mokhtari, K., Hebert, J., Bronson, A., & De Giuseppe, T. (2025). AI in the classroom: Insights from educators on usage, challenges, and mental health. *Education Sciences, 15*(2), Article 113. https://doi.org/10.3390/educsci15020113

Dimeli, M., & Kostas, A. (2025). The role of ChatGPT in education: Applications, challenges: Insights from a systematic review. *Journal of Information Technology Education.Research, 24*, Article 2. https://doi.org/10.28945/5422

Diyab, A., Russell, M. F., Fedoruk, B. D., & Diyab, A. (2025). Engineered prompts in ChatGPT for educational assessment in software engineering and computer science. *Education Sciences, 15*(2), Article 156. https://doi.org/10.3390/educsci15020156

Dritsas, E., & Trigka, M. (2025). Methodological and technological advancements in E-learning. *Information, 16*(1), Article 56. https://doi.org/10.3390/info16010056

Friske, Z. M. (2025). *AP® STEM student assessment of ChatGPT prompt responses* [Master thesis, Harvard University]. https://www.proquest.com/docview/3160740562

Fullan, M., Azorín, C., Harris, A., & Jones, M. (2023). Artificial intelligence and school leadership: challenges, opportunities and implications. *School Leadership & Management*, *44*(4), 339–346. https://doi.org/10.1080/13632434.2023.2246856

Hooda, M., Rana, C., Dahiya, O., Rizwan, A., & Hossain, M. S. (2022). Artificial Intelligence for assessment and feedback to enhance student success in higher education. *Mathematical Problems in Engineering, 2022*(1). https://doi.org/10.1155/2022/5215722

Iyenghar, P. (2025). Clever hans in the loop? A critical examination of ChatGPT in a human-in-the-loop framework for machinery functional safety risk analysis. *Eng, 6*(2), Article31. https://doi.org/10.3390/eng6020031

Jauhiainen, J. S., & Agustin Bernardo, G. G. (2025). Educational evaluation with large language models (LLMs): ChatGPT-4 in recalling and evaluating students' written responses. *Journal of Information Technology Education: Innovations in Practice, 24*, Article 2. https://doi.org/10.28945/5433

Javed, M. S., Aslam, M., & Syed, K. K. (2025). An intelligent model for parametric cognitive assessment of E-learning-based students. *Information, 16*(2), Article 93. https://doi.org/10.3390/info16020093

Jiang, C. C., Lin, L. S., Long, S., Ke, X. Y., Fukunaga, K., Lu, Y. M., & Han, F. (2022). Signalling pathways in autism spectrum disorder: Mechanisms and therapeutic implications. *Signal Transduction and Targeted Therapy*, *7*(1), 229. https://doi.org/10.1038/s41392-022-01081-0

Kamran, F. (2024). *Relevance of formative assessment and feedback practices of language and science teachers for students' motivation and self-regulation at public higher education institutions in pakistan* [Doctoral dissertation, Friedrich-Alexander-Universität Erlangen-Nürnberg]. https://www.proquest.com/dissertations-theses/relevance-formative-assessment-feedback-practices/docview/3122642942/se-2

Kanyemba, K., Phiri, F., Munsanje, M., Velenasi, & Mwaanga, O. (2023). Exploring the use of artificial intelligence in higher learning institutions: A case of David Livingstone College of Education. *Mulungushi University Multidisciplinary Journal, 4*(2), 60-68.

Khlaif, Z. N., Wejdan, A. A., Salama, N., & Belal, A. E. (2025). Redesigning assessments for AI-enhanced learning: A framework for educators in the generative AI era. *Education Sciences, 15*(2), Article 174. https://doi.org/10.3390/educsci15020174

Khojasteh, L., Kafipour, R., Pakdel, F., & Mukundan, J. (2025). Empowering medical students with AI writing co-pilots: Design and validation of AI self-assessment toolkit. *BMC Medical Education, 25,* Article 159. https://doi.org/10.1186/s12909-025-06753-3

Lin, Y. (2024). Design and application of intelligent assisted learning system for higher education students. *Journal of Electrical Systems, 20*(6), 1992-2001. https://doi.org/10.52783/jes.3114

Lu, C., Macdonald, R., Odell, B., Kokhan, V., Demmans Epp, C., & Cutumisu, M. (2022). A scoping review of computational thinking assessments in higher education. *Journal of Computing in Higher Education, 34*(2), 416-461. https://doi.org/10.1007/s12528-021-09305-y

Lucas, J. J., & Weber, K. E. (2025). The promises and pitfalls of large language models as feedback providers: A study of prompt engineering and the quality of AI-driven feedback. *AI, 6*(2), Article 35. https://doi.org/10.3390/ai6020035

Luchembe, M., Sampa, P. C., & Mpolomoka, D. L. (2021). Distance education students' experiences of informal study groups in higher education. *Journal of Adult Education*, *2*(2), 16-31.

Luo, Y., & Wu, D. (2019). Adaptive learning and AI: Personalizing the learning experience in higher education. *Educational Technology & Society*, *22*(2), 38-51.

Luo, Y. (2025). Designing with AI: A systematic literature review on the use, development, and perception of AI-enabled UX design tools. *Advances in Human - Computer Interaction, 2025*, Article 3869207. https://doi.org/10.1155/ahci/3869207

Madwe, M., Chonco, C., & Zungu, A. (2025). Artificial intelligence in higher education assessment: Opportunities, challenges and pedagogical considerations. *International Journal of Applied Research in Business and Management, 6*(2). https://doi.org/10.51137/wrp.ijarbm.2025.mmaa.45846

Mahdi, H., & Alkhateeb, A. (2025). Revolutionising essay evaluation: A cutting-edge rubric for AI-assisted writing. *International Journal of Computer - Assisted Language Learning and Teaching, 15*(1). https://doi.org/10.4018/IJCALLT.368226

Martinez, J., & Lee, C. (2023). AI-driven grading systems: Benefits and biases. *International Journal of Educational Technology, 59*(2), 110-126.

Mendoza, R., & Perez, M. (2023). AI and machine learning in formative assessments: A systematic review. *International Journal of Learning Analytics and Artificial Intelligence for Education, 5*(1), 78-94.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*, 1017-1054. http://dx.doi.org/10.1111/j.1467-9620.2006.00684.x

Mpolomoka, D. L. (2024). Research ethics in post-graduate education: A meta-analysis. *Journal of Education and Practice*, *15*(13), 26-33 https://doi.org/10.7176/JEP/15-13-02

Mpolomoka, D. L. (2025). Impact of academic capitalism on quality higher education: A utilitarian view. In M. Kayyali (Ed.), *Navigating quality assurance and accreditation in global higher education* (pp. 393-406). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-6915-9.ch016

Mpolomoka, D. L., Banda, S., Dube, M. V., Muyangana, A., Kanduza, E., & Kaleba, M. N. (2018). The role of private higher education provision in Zambia: Changing the higher education landscape in Africa. *International Journal of Humanities and Social Science. 8*(6), 97-104. https://doi.org/10.30845/ijhss.v8n6a11

Mpolomoka, D. L., Beirat, M. A., Mushibwe, C., Chikopela, R., & Phiri, P. S. (2025). Universal design for learning (UDL) in higher education institutions (HEIs): Enablers and disablers. *Journal of Education and Practice, 16*(3), 290-304. http://doi.org/10.7176/JEP/16-3-21

Mumbi, M., & Nyirenda, M. (2024) Towards automated assessment of learning management systems in higher education institutions in Zambia. *Open Journal of Applied Sciences, 14*, 1279-1294. https://doi.org/10.4236/ojapps.2024.145083

Mzwri, K., & Turcsányi-Szabo, M. (2025). The impact of prompt engineering and a generative AI-driven tool on autonomous learning: A case study. *Education Sciences, 15*(2), Article 199. https://doi.org/10.3390/educsci15020199

Ogunleye, B., Kudirat, I. Z., Ajao, O., Olayinka, O., & Sharma, H. (2024). Higher education assessment practice in the era of generative AI tools. *Journal of Applied Learning & Teaching (JALT), 7*(1). https://doi.org/10.37074/jalt.2024.7.1.28

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021) The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *PLoS Medicine, 18*(3), Article e1003583. https://doi.org/10.1371/journal.pmed.1003583

Pang, W., & Wei, Z. (2025). Shaping the future of higher education: A technology usage study on generative AI innovations. *Information, 16*(2), Article 95. https://doi.org/10.3390/info16020095

Paul, P. M., & Graulich, N. (2024). Navigating the data frontier in science assessment: Advancing data augmentation strategies for machine learning applications with generative artificial intelligence. *Computers and Education: Artificial Intelligence*, *7*, Article 100265. https://doi.org/10.1016/j.caeai.2024.100265

Pérez, A., McClain, S. K., Alana, F. R., Rosado-Mendinueta, N., Trigos-Carrillo, L., Robles, H., & Campo, O. (2025). Artificial intelligence applications in college academic writing and composition: A systematic review. *Íkala, 30*(1). https://doi.org/10.17533/udea.ikala.355878

Perkins, M. (2023). Academic integrity considerations of AI large language models in the post-pandemic era: ChatGPT and beyond. *Journal of University Teaching & Learning Practice*, *20*(2). https://doi.org/10.53761/1.20.02.07

Phillips, V., & Barker, E. (2021). Systematic reviews: Structure, form and content. *Journal of Perioperative Practice*, *31*(9), 349-353. https://doi.org/10.1177/1750458921994693

Plantinga, P., Shilongo, K., Mudongo, O., Umubyeyi, A., Gastrow, M., & Razzano, G. (2024). Responsible artificial intelligence in Africa: Towards policy learning. *Data & Policy, 6*. https://doi.org/10.1017/dap.2024.60

Popenici, S., Catalano, H., Mestic, G., & Ani-Rus, A. (2023). A systematic review of the artificial intelligence implications in shaping the future of higher education. *Educatia,* (26), 92-107. https://doi.org/10.24193/ed21.2023.26.11

Ramesh, D., & Sanampudi, S. K. (2022). An automated essay scoring systems: A systematic literature review. *Artificial Intelligence Review, 55*, 2495-2527. https://doi.org/10.1007/s10462-021-10068-2

Rane, N., Choudhary, S., & Rane, J. (2023). Education 4.0 and 5.0: Integrating Artificial Intelligence (AI) for personalized and adaptive learning. *Journal of Artificial Intelligence and Robotics, 1*(1), 29-43. https://doi.org/10.2139/ssrn.4638365

Register, Y. (2024). *The future of AI can be kind: Strategies for embedded ethics in AI education* [Doctoral Disertation, University of Washington]. https://www.proquest.com/dissertations-theses/future-ai-can-be-kind-strategies-embedded-ethics/docview/3081478187/se-2

Rutherford, S., Pritchard, C., & Francis, N. (2025). Assessment IS learning: Developing a student-centred approach for assessment in higher education. *FEBS Open Bio, 15*(1), 21-34. https://doi.org/10.1002/2211-5463.13921

Seo, H., Hwang, T., Jung, J., Kang, H., Namgoong, H., Lee, Y., & Jung, S. (2025). Large language models as evaluators in education: Verification of feedback consistency and accuracy. *Applied Sciences, 15*(2), Article 671. https://doi.org/10.3390/app15020671

Slimi, Z., & Beatriz, V. C. (2023). Systematic review: AI's impact on higher education - learning, teaching, and career opportunities. *TEM Journal, 12*(3), 1627-1637. https://doi.org/10.18421/TEM123-44

Swiecki, Z., Khosravi, H., Chen, G., Martinez-Maldanado, R., Lodge, J. M., Milligan, S., Selwyn, N., & Gašević, D. (2022). Assessment in the age of artificial intelligence. *Computers and Education: Artificial Intelligence*, *3*, Article 100075.

Valentine, J. O., Kinsgley, B. A., Idika, D. O., Eugene, O. E., & Bassey, B. A. (2023). Exploring the potential of artificial intelligence tools in educational measurement and assessment. *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(8), Article em2307. https://doi.org/10.29333/ejmste/13428

Wakunuma, K., & Eke, D. (2024). Africa, ChatGPT, and generative AI systems: Ethical benefits, concerns, and the need for governance. *Philosophies, 9*(3), Article 80. https://doi.org/10.3390/philosophies9030080

Wang, T., Lund, B. D., Marengo, A., Pagano, A., Nishith, R. M., Teel, Z. A., & Pange, J. (2023). Exploring the potential impact of artificial intelligence (AI) on international students in higher education: Generative AI, chatbots, analytics, and international student success. *Applied Sciences*, *13*(11), Article 6716. https://doi.org/10.3390/app13116716

Wei, Y., Zhang, R., Zhang, J., Qi, D., & Cui, W. (2025). Research on intelligent grading of physics problems based on large language models. *Education Sciences, 15*(2), Article 116. https://doi.org/10.3390/educsci15020116

Zhang, Y., Schunn, C. D., & Wu, Y. (2024). What does it mean to be good at peer reviewing? A multidimensional scaling and cluster analysis study of behavioral indicators of peer feedback literacy. *International Journal of Educational Technology in Higher Education, 21*(1), Article 26. https://doi.org/10.1186/s41239-024-00458-1