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RESEARCH

Redefining student assessment in AI-infused learning environments: a systematic review of challenges and strategies for academic integrity

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Abstract
Integrating Artificial Intelligence (AI) tools, particularly generative AI (GenAI), in higher education is reshaping assessment practices, presenting both challenges and opportunities. While these tools enhance learning, they also raise concerns about academic integrity and the authenticity of student work. Traditional assessments, such as essays and take-home assignments, are increasingly susceptible to AI-assisted plagiarism, necessitating a re-evaluation of assessment strategies. This systematic review, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, examines educators' challenges in assessing student learning in AI-infused environments. Using Scopus, IEEE Xplore, and ScienceDirect, we identified relevant literature highlighting concerns about originality, critical thinking evaluation, and the quality of student work. Findings underscore the need for AI-resistant, process-based assessments, such as oral exams and multi-stage evaluations, to uphold academic integrity. The study advocates for institutional AI policies and digital literacy programs to promote ethical AI use and mitigate academic misconduct. Additionally, it emphasises a balanced human-AI collaboration in assessments, ensuring that AI enhances rather than replaces student effort. Addressing these challenges can reduce academic misconduct cases, allowing educators to focus on fostering meaningful learning experiences and sustainable educational outcomes.

Keywords Student assessment · AI-infused environment · Artificial intelligence · Academic integrity · Education

1 Introduction and background

With technological advances, the adoption of applications like artificial intelligence (AI) is increasing across various sectors such as healthcare, finance, defence, education, transportation, and many others. This trend presents both transformative opportunities and significant challenges. In the field of education, AI's impact has been particularly pronounced in areas such as personalised learning [1], accessibility and inclusion, administrative efficiency [2], and efficient grading [3, 4]. Personalised learning platforms, content generation tools, and automated grading systems are enhancing the learning experience [1, 5] by providing tailored instruction and delivering faster feedback [3]. These innovations suggest that AI can enhance student engagement [6] and efficiency in assessments [7], yet the rapid integration of such technologies also raises concerns about academic integrity and the potential for misuse [8, 9].

While AI in education presents a promising opportunity for enhancing learning, concerns continue to rise [8, 10]. A key aspect challenging the education sector is conducting assessments in an AI-infused environment [7, 11]. With the tremendous boom in AI technology, universities are overwhelmed by the level of unregulated AI use. Students have access to this technology and use it for almost everything, to the extent that they might be handing over aspects of their autonomy and the ability to self-create to AI. In spite of the shortcomings of traditional assessment methods [12], today's educational landscape characterised by artificial intelligence, is experiencing greater criticism.

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Educational practitioners are struggling to keep pace with the rapid, unprecedented rate of technological advancements, leaving them uncertain about how to respond and adapt effectively. Even more striking, though, is that these technologies are being used everywhere, even in the most concealed spaces, by everyone, including both educators and students. Studies by [13] highlighted teachers' and students' growing use of AI, though with differing usage patterns and motivations. Teachers, in particular, have raised concerns about academic misconduct, especially regarding AI-assisted assignments submitted for skill, knowledge, and competence assessments. This indicates a critical issue in maintaining academic integrity amidst the increasing reliance on AI in education. As a result, the way we approach student assessment in an AI-infused learning environment needs to change if we are to prioritise academic integrity. Despite these challenges, AI in education presents a promising opportunity for enhancing learning [3, 4, 14], provided proper safeguards and strategies are implemented to address its potential risks. In this regard, this paper outlines strategies to be used in redefining assessment in an AI-infused environment. In drawing parallels to the past, we would like to bring attention to the 1966 teachers' strike in the USA, which was sparked by opposition to using calculators in schools. Given the rapid advancement of AI technology, it is inevitable that we may experience similar incidents in the future as educators grapple with the implications of AI in student assessment and the broader educational landscape.

To provide context for our study, we will outline how assessments are carried out and where the problem arises with the current setup. A study in [15] defined assessments as "a process by which information is obtained relative to some known objective or goal." Along the same lines, it is crucial to understand how evaluation, measurement, and assessment are connected, which are often conflated. Measurement provides the data, assessment interprets it, and evaluation uses the insights to improve teaching and learning practices, creating a continuous improvement cycle. Understanding these aspects greatly assists decision-making, evaluating educational outcomes, and continual improvements [16]. Assessments can be conducted through measurement and non-measurement processes to inform evaluative judgments. Conducting assessments through measurement processes tends to be problematic since non-measurement processes include methods such as observation. Study [15] has identified dichotomous poles when discussing types of assessments, and these are:

> Formative and summative assessments: Formative assessments help a learner prepare for the final assessment, which is summative and used for grading [17].
> Informal and formal assessments: Informal assessments support formal ones, often used in formative assessment. Unscheduled and flexible, they are common in apprenticeships and promote progressive learning [18].
> Continuous and final assessments: Continuous assessment occurs throughout learning, often using portfolios, as seen in coding boot camps [19]. Final assessments, an older method, happen at the end and rely on measurement-based tests.
> Process and product assessment: Process assessment focuses on steps taken, while product assessment evaluates the final outcome. Capstone projects exemplify product assessment, reflecting cumulative learning over a course, while simulations can be used in process assessments [20].
> Divergent and convergent assessments: Divergent assessments allow multiple answers, while convergent assessments have a single correct answer. Typically found in technical reports or essays, divergent assessments support problem-based learning, fostering critical thinking and lifelong learning [21].
> Self vs peer assessments: Self-assessments let students evaluate themselves, while peer assessments allow them to assess each other using a rubric. [22] argues that traditional teacher assessments limit students' ability to develop negotiation and discrimination skills.

Educators must devise strong mechanisms to protect the authenticity of academic assessments because AI's ability to generate text, solve problems, and offer recommendations blurs the line between legitimate assistance and academic misconduct. Since various types of assessments are vulnerable to AI influence, ensuring academic integrity is a pressing concern. Without adequate safeguards, students may misuse AI tools, undermining the validity of their assessments. Therefore, establishing clear boundaries and implementing robust protective measures is essential to maintaining the credibility of academic evaluations. This paper explores the potential of redefining student assessment in AI-infused learning environments. We also examine potential strategies to uphold academic integrity and the credibility of assessments for academic evaluations. The key research question is:

> *How can student assessment be effectively redefined in AI-infused learning environments to maintain academic integrity?*

To address the above question, a guiding sub-question to be answered is:

What strategies help educators balance AI-assisted learning with ethical assessments?

The rest of the paper is organised as follows: Sect. 2 discusses the relevant literature on AI and its integration into education, Sect. 3 discusses the methodology adopted, Sect. 4 presents the findings and discusses the study, and Sect. 5 concludes the paper.

2 Literature review

2.1 AI integration into education

Integrating artificial intelligence (AI) into education has significantly transformed teaching, learning, and assessment practices [23, 24]. While AI-driven tools such as ChatGPT and automated grading systems enhance learning experiences, they also challenge academic integrity and the validity of traditional assessment methods [25]. The rise of AI-generated content necessitates a shift towards authentic assessment strategies emphasising higher-order thinking, creativity, and ethical responsibility [26]. Authentic assessment is defined as an evaluation that challenges students to tackle tasks that directly relate to the workplace, allowing them to engage with their fields as if they were actual employees while still at university, thereby mastering their profession [27]. This assessment will aid the drive toward academic integrity and job preparedness.

2.2 Academic integrity in the AI era

Academic integrity, defined as adherence to ethical principles in scholarship, faces new threats in the AI era. Studies highlight that AI-generated content challenges conventional plagiarism detection systems, making it difficult to distinguish between student-authored work and AI-generated responses [25]. A study by [28] identified three principal concerns associated with the use of artificial intelligence, particularly large language models. These concerns include the potential for plagiarism, the generation of fabricated or inaccurate information, and the prevalence of incorrect or misleading referencing practices. Furthermore, contract cheating, facilitated by AI writing tools, blurs the line between legitimate assistance and academic misconduct [29]. Concerns over AI-generated misinformation and its potential misuse in assessments underscore the need for updated academic policies and enhanced detection mechanisms [30–32]. A failure to adapt could lead to increased academic dishonesty, which undermines the validity of assessment results. Institutions must rethink integrity policies and equip educators with AI literacy, a comprehensive understanding of AI, and its potential for assessment misuse to uphold ethical standards [31]. AI's disruptive nature has made ensuring academic integrity extremely daunting as generative AI continues to develop, making it difficult to determine whether the work submitted by a student is theirs. To mitigate this, an assessment revolution needs to be implemented.

2.3 Rethinking assessment: from traditional to authentic approaches

Student assessment in higher education is crucial for measuring learning outcomes, tracking student progress, and maintaining academic standards. Traditional assessment methods, such as multiple-choice exams, standardised essays, practical assignments, and presentations, are increasingly inadequate in evaluating student learning in AI-infused environments [32, 33]. Research suggests that assessments should prioritise critical thinking, problem-solving, and creativity over rote memorisation [26, 34]. Authentic assessment, which includes competency-based evaluations, project-based learning, and experiential learning, is gaining traction as a robust alternative [35]. These approaches encourage students to apply knowledge in real-world contexts, reducing opportunities for AI-assisted dishonesty. This evolution is driven by the need for student-centred learning, which aims to make students active participants in their own education. Additionally, there has been a shift towards authentic assessment methods, which have become increasingly crucial as employability is prioritised in today's job market [27]. Governments and industries worldwide seek graduates from higher education institutions who are well-prepared for the workforce by the time they leave university. Consequently, there is a growing demand from government and industry leaders for higher education institutions to produce job-ready graduates [36]. While AI presents risks to integrity, it also offers opportunities for enhanced assessment, security, and personalised feedback [37]. A balanced approach leveraging AI while upholding ethical standards will ensure meaningful and credible assessments in the AI era [30, 38].

2.4 AI as a tool for enhancing academic integrity

While AI poses risks to academic integrity, it also offers solutions to mitigate these risks. AI-powered plagiarism detection tools, such as Turnitin and GPTZero, are increasingly effective in identifying AI-generated content [39]. Proctoring software utilising facial recognition and keystroke analysis aims to deter cheating in online assessments, though ethical concerns regarding privacy and surveillance remain [40, 41]. Additionally, AI can provide personalised

feedback, guiding students towards ethical writing practices and self-regulated learning [37]. Leveraging AI for integrity-enhancing measures requires balancing technological oversight and respect for student privacy [26].

2.5 Designing AI-resilient authentic assessments

To maintain academic integrity, educators must design assessments resistant to AI manipulation by incorporating elements that require critical thinking, creativity, and personal reflection. A study by [42] suggests using AI tools to detect AI-generated content. Studies recommend open-ended assignments, oral defences, and collaborative projects as effective strategies to minimise AI [34]. Process-based assessments, which emphasise the development and documentation of learning over time, help ensure originality and deeper engagement [43]. Reflective writing assignments and real-world problem-solving tasks encourage students to demonstrate unique insights and personal engagement, making AI-generated responses less viable. A study by [34] found that generative AI tools, such as ChatGPT-4, ChatGPT-3.5, Google Bard, and Microsoft Bing, perform well at the lower levels of Bloom's taxonomy (e.g., remembering and understanding). Therefore, if educators can design assessments that touch on the higher levels of Bloom's taxonomy, particularly in the "create" category, where students are required to use their lifelong learning skills, namely critical thinking, creativity, communication, and collaboration, then the assessments tend to be difficult for generative AI to complete [44]. It is pertinent to mention that there is a dire need to enhance educators' capabilities in designing assessments that align with the strengths and weaknesses of generative AI tools. This support is crucial for effectively integrating AI into educational practices.

2.6 Ethical and pedagogical considerations in AI-driven assessments

Implementing AI in assessments must address ethical concerns such as bias, data privacy, and the role of human judgment. If not carefully designed, AI grading systems risk perpetuating biases present in training datasets [45, 46]. Furthermore, reliance on AI-driven proctoring tools raises concerns about student privacy and consent [40]. To navigate these challenges, institutions should adopt a hybrid assessment model that integrates AI while preserving human oversight, ensuring fair and context-sensitive evaluations. As AI reshapes the educational landscape, maintaining academic integrity requires a proactive shift toward authentic and ethically responsible assessment methods.

2.7 Theoretical framework

This study is grounded in constructivist learning theory, which asserts that learners construct knowledge through engagement with real-world experiences. The theory, advocated by pragmatists like John Dewey, Lev Vygotsky, Charles Sanders Peirce, and William James, emphasises problem-solving [47, 48]. While AI tools offer the potential for improved outcomes, they also present risks to the authenticity of assessments, potentially undermining academic integrity. Our key principle is that authentic assessments can enhance critical thinking and preserve academic integrity when paired with the ethical use of AI tools and clear policies [49]. From a pragmatic perspective, our study asserts that constructivist learning theory holds significant potential in redefining assessments within an AI-infused learning environment.

3 Methodology

3.1 Research design

Guided by the interpretive paradigm, this study employs a qualitative approach to redefine student assessment in AI-infused learning environments. We aimed to explore the different ways in which assessments can be planned, executed, and evaluated in a manner that is credible to students, educators, industry, and other stakeholders. The various stakeholders may perceive AI-based assessments differently. An interpretive paradigm, therefore, helps to examine and intersect these differing realities within AI-infused environments and to understand how they can be negotiated [50, 51]. Through the adopted methodology, the study examined emerging strategies to uphold academic integrity and ensure the credibility of assessments in academic evaluations. The study employed a qualitative approach as it enables an in-depth exploration of the challenges and strategies in AI-infused student assessment. The qualitative approach provides rich contextual insights that cannot be captured quantitatively. A systematic review was used to systematically map the existing literature on student assessment in AI-infused learning, identifying key challenges and strategies for maintaining academic integrity. This approach allows the researchers to comprehensively explore diverse assessment methods and emerging best practices without being limited to a narrow research focus. A systematic review can synthesise existing literature to understand the topic comprehensively.

3.2 Search strategy

The literature search was conducted across Scopus, IEEE Xplore, and ScienceDirect, focusing on article titles, abstracts, and keywords. This approach ensured that relevant studies were captured even if the search terms did not appear in the full text of the articles, while maintaining specificity to the research topic. These databases were chosen for this systematic review because they extensively cover high-quality, peer-reviewed literature in education, technology, and AI. Scopus offers a broad interdisciplinary scope, ensuring the inclusion of diverse perspectives relevant to student assessment and academic integrity. IEEE Xplore is a leading source for cutting-edge research in AI and technological innovations, while ScienceDirect provides extensive access to applied research and theoretical studies in education and technology. Collectively, these databases maximise the likelihood of retrieving relevant, credible, and up-to-date studies to address the objectives of this study. The following search string was used for the three databases:

(“student assessment" OR "academic assessment" OR "student evaluation”) AND (“AI environment" OR "Artificial Intelligence" OR "AI-based learning" OR "AI in education") AND ("learning" OR "Education") AND "Academic Integrity".

The screening of the retrieved studies was guided by the inclusion and exclusion criteria.

3.3 Inclusion and exclusion criteria

The study was guided by the inclusion and exclusion criteria presented in Table 1.

Table 1 Inclusion and exclusion criteria

Category	Inclusion criteria	Exclusion criteria
Study focus	Studies focusing on student assessments in higher education	Studies not focusing on student assessments in higher education
	Studies focusing on the use of AI in higher Education	Studies not focusing on the use of AI in higher education
	Studies focusing on academic integrity	Studies not focusing on academic integrity
	Studies involving students, lecturers, or academic institutions engaging with AI-infused learning/assessment	Studies not involving students, lecturers, or academic institutions engaging with AI-infused learning/assessment
Type of evidence	Empirical studies	Non-empirical studies
Publication date	Studies published between 2015 and 2025	Studies published before 2015
Language	Studies written in English	Studies not written in English
Article type	Full publication	Not a full publication

3.4 Screening and selection process

Figure 1 illustrates the screening and selection process of the studies. The initial search across three databases, Scopus (20), IEEE Xplore (300), and ScienceDirect (65), yielded a total of 385 records. After removing 3 duplicates, 382 studies remained. An initial screening of abstracts and titles led to the exclusion of 264 studies based on the predefined criteria. The remaining 118 studies underwent full-text analysis, resulting in the exclusion of 62: 13 were non-empirical, 32 did not focus on student assessments, and 17 were not situated within an AI context. Ultimately, 56 studies satisfied all inclusion criteria and were retained for detailed analysis.

3.5 Data analysis

Thematic analysis was conducted using an inductive approach, where codes were derived directly from a careful reading of the included studies. This approach ensured that the analysis remained grounded in the content of the reviewed literature. Thematic analysis allowed us to uncover and make sense of the subjective meanings and diverse experiences of the various stakeholders reported in the different articles. Microsoft Excel was used for analysis purposes to create codes and themes following the six (6) by Clarke and Braun. The following steps were followed: familiarisation, coding, generating themes, reviewing themes, defining and naming themes, and writing up [52]. The familiarisation stage involved reading and rereading the articles included in the study to gain a deep understanding of the content and identify potential patterns and meanings. The coding stage was conducted by assigning labels to the relevant features of the data in a systematic manner to help organize the data in a meaningful way. The theme generation stage allowed the researchers to group related codes together to form themes that captured significant concepts within the data. The theme review stage enabled the authors to review the generated themes to ensure that they accurately reflected the data. The defining and naming stage enabled the authors to clearly describe the theme's scope and focus to ensure consistency and clarity. The generated codes were synthesized and organised into six overarching themes: (1) AI-enabled academic dishonesty and integrity challenges, (2) over-reliance on AI, (3) reliability and fairness concerns of AI-generated work, (4) AI-resistant and process-based assessment approaches, (5) institutional AI policies and digital literacy, and (6) human-AI collaboration for fostering ethical learning. Initial coding was performed by one author, while the remaining authors reviewed the codes and themes. Any discrepancies were discussed and resolved until a consensus was reached. Finally, the write-up stage enabled the authors

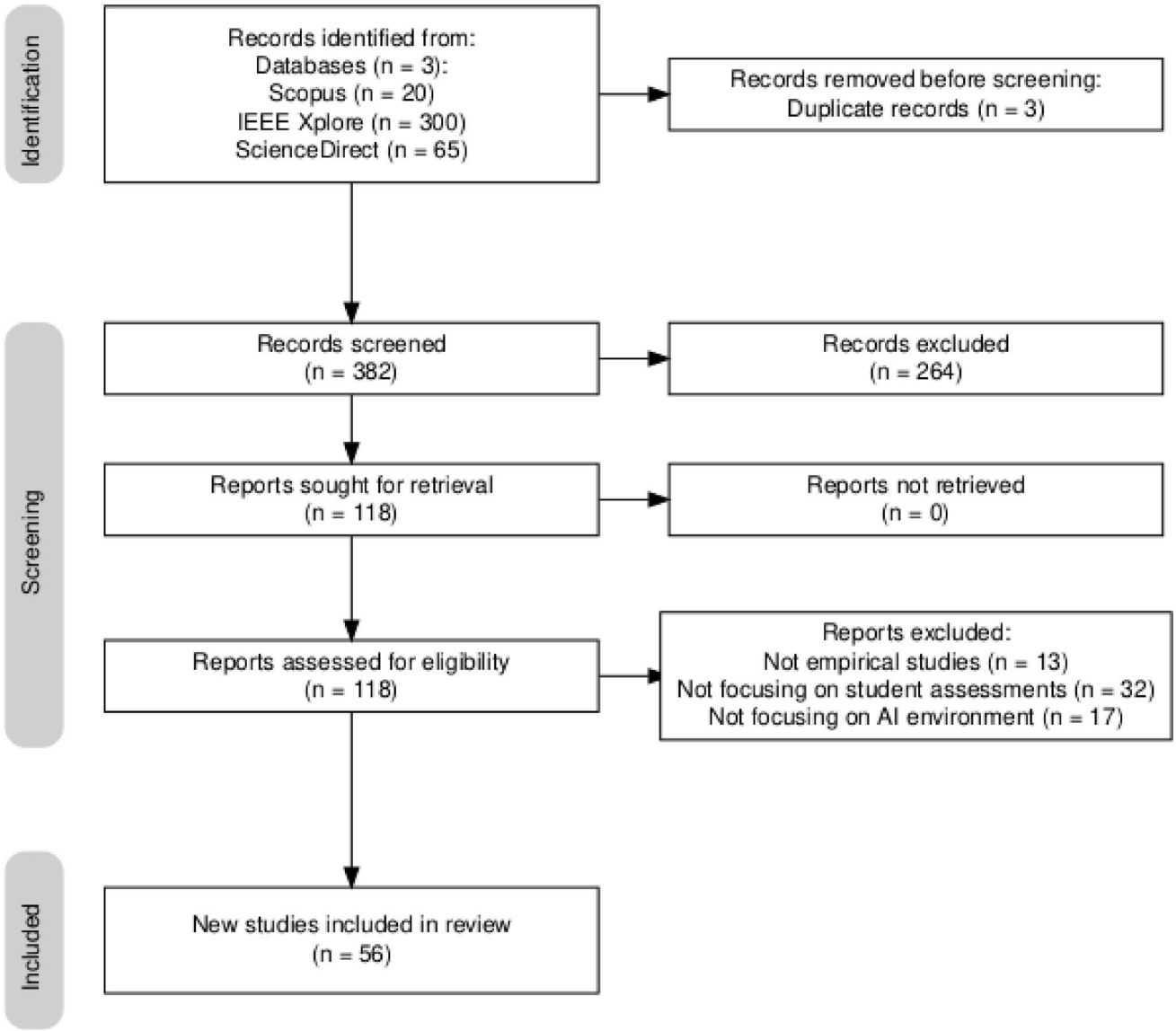

Fig. 1 Screening process

to present a coherent and compelling narrative that reflected the data to address the research objective.

4 Findings and discussion

The constructivist learning theory was used as the lens to understand the problem under investigation. Table 2 presents a summary of the 56 studies that were included in the study.

The study identified six themes, which were synthesized and presented under two overarching categories: (1) Challenges to academic integrity in unsupervised assessments, shown in Table 3, and (2) Strategies to uphold academic integrity in AI-infused environments, which are shown in Table 4. The study followed the six (6) steps of thematic analysis by Braun and Clarke (2006). In discussing the themes, we aim to answer our two key questions for this study:

How can student assessment be effectively redefined in AI-infused learning environments to maintain academic integrity?
What strategies help educators balance AI-assisted learning with ethical assessments?

Table 2 Mapping themes and codes of the included studies

Theme	Grouped codes and concepts	Sample studies
1. AI-enabled academic dishonesty and integrity challenges	AI-generated content & submission of non-original work Plagiarism, cheating, & authenticity concerns Difficulties in detecting AI-generated work & ineffectiveness of detection tools Challenges to assessment credibility	[31, 53–56]
2. Over-reliance on AI and diminished critical thinking	Over-reliance / dependence on AI tools Suppression of critical thinking, creativity, and problem-solving skills Superficial learning & reduced student engagement Decline in memory, high-order thinking, and cognitive erosion	[57–60]
3. Reliability and fairness concerns of AI-generated work	Factually incorrect AI responses, hallucinations, and unreliable output Biases and the accuracy of information concerns Unfairness and reinforced socioeconomic/technological disparities Challenges in AI-based grading and limitations of traditional assessments	[58, 61–65]
4. AI-resistant and process-based assessments	Alternative, multimodal, and multi-stage assessment strategies Focus on the learning process, continuous feedback, and the learning journey rather than the final product Assessments promoting critical thinking, personal reflections, and real-world applications Development of reliable AI content detection systems	[66–71]
5. Institutional AI policies and digital literacy	Call for and implementation of AI disclosure policies, guidelines, and training Need for AI literacy, digital literacy, and information literacy training for students and educators Educating about ethical use, critical engagement with AI, and balancing human-AI contributions Addressing confusion among educators and promoting responsible implementation	[31, 54, 62, 72–75]

Table 4 Strategies to uphold academic integrity in AI-infused environments

Theme	Codes
AI-resistant and process-based assessments	AI-resistant assessment methods, multi-stage assessment strategies, multimodal assessment approaches, enhancing AI detection tools, real-world, and practical applications
Institutional AI policies and digital literacy	AI disclosure policies, training, guidelines, and support systems
Human-AI collaboration for ethical learning	Encouraging critical engagement with AI, an AI-assisted feedback mechanism, and balancing human and AI contributions

Table 3 Challenges to academic integrity in unsupervised assessments

Theme	Codes
AI-enabled academic dishonesty and integrity challenges	AI-generated content, superficial learning, authenticity concerns, outsourcing to AI, submission of non-original work, the ineffectiveness of detection tools, assessment credibility, and factually incorrect AI responses
Over-reliance on AI and diminished critical thinking	Loss of critical thinking skills, reduced student engagement
Reliability and fairness concerns in AI-generated work	Challenges in AI-based grading, technological disparities, reinforced socioeconomic inequalities, limitations of traditional assessments, the need for new approaches, a lack of AI policies, and confusion among educators

4.1 Challenges to academic integrity in unsupervised assessments

This category looks at the challenges of academic integrity in unsupervised assessments. The category discusses the following themes: AI-enabled academic dishonesty and integrity challenges, over-reliance on AI, and reliability and fairness concerns of AI-generated work.

4.1.1 AI-enabled academic dishonesty and integrity challenges

The integration of AI tools like ChatGPT and other generative models has significantly impacted academic integrity, making it difficult for educators to differentiate between authentic student work and AI-generated content [53, 54, 57, 76–78]. These tools allow students to automatically generate essays, reports, and coding solutions, increasing the risk of plagiarism and contract cheating [55, 56, 79–81]. Moreover, in some contexts, there is a prevailing cultural perception that the use of AI tools constitutes a form of academic dishonesty [82, 83]. Conversely, other students view AI as legitimate support tools that are accessible for anyone to use [84].

Moreover, relying on AI for assignments leads to superficial learning, where students produce well-structured responses without demonstrating deep understanding or critical engagement [66, 67]. The ability to generate polished AI-driven responses has also contributed to the increasing submission of work that students do not create, thus undermining the authenticity of assessments [68, 72, 85, 86].

Universities struggle to enforce academic integrity policies due to the lack of robust AI-detection tools [87, 88]. Studies have revealed that traditional plagiarism detection tools, such as Turnitin, are ineffective in identifying AI-generated content, often yielding false positives or negatives

[31, 60, 85, 89, 90]. Furthermore, AI-generated responses can include factually incorrect but compelling content, compromising assessment reliability [91].

Irresponsible use of AI tools in assessment undermines academic integrity and threatens the reputation of educational institutions [58]. However, findings remain inconclusive, as AI assistance does not necessarily diminish learning outcomes, raising concerns about the long-term effects on student success and assessment credibility [76].

4.1.2 Over-reliance on AI and diminished critical thinking skills

The study found that students are actively using AI for personal and academic purposes [92, 93]. Excessive dependence on AI tools weakens students' ability to think critically, write independently, and solve problems effectively [57–59, 86, 89, 90, 94–96]. The reliance on AI for tasks requiring cognitive engagement results in declining independent reasoning, writing abilities, critical thinking, and analytical skills, making students less prepared for real-world problem-solving scenarios [60, 72, 93, 97, 98]. There is a fear of superficial learning as students rely too much on AI [88]. Notably, students who depend heavily on AI struggle to construct sentences with the use of AI support, suggesting that these tools risk displacing the development of essential academic skills [84].

4.1.3 Reliability and fairness concerns in AI-generated work

The increasing role of AI in grading and assessment has sparked concerns about fairness, reliability, and ethical grading practices in AI-infused learning environments. While AI-based evaluation promises efficiency and scalability, it presents significant limitations that affect assessment integrity [61].

One of the primary issues is that AI struggles to assess creativity, critical thinking, and ethical reasoning, favouring structured and standardised responses over original and interpretative work [63]. This can lead to grading inconsistencies, where AI misjudges student work due to its inability to evaluate complex reasoning and contextual depth. In addition, concerns have been raised about the authenticity and reliability of AI-generated context, as tools like ChatGPT can produce information that is factually inaccurate, biased, or otherwise inappropriate [56, 65, 88, 92, 94, 99].

Additionally, AI-assisted assessments may create an unfair academic playing field by benefiting students with better access to AI tools and technology while disadvantaging those from underprivileged backgrounds [62, 64, 97]. The digital divide further widens inequalities in education, reinforcing socioeconomic disparities that affect student performance and opportunities, especially in rural and marginalised communities [100].

Furthermore, unsupervised traditional assessments in AI-infused environments face challenges in accurately measuring student competencies, leading to concerns about the validity of current assessment models [100]. Without changes in assessment methods, institutions risk compromising the credibility of student evaluations, making it difficult to determine whether students have mastered key competencies.

A significant concern is that many institutions lack clear guidelines on AI use in assessments, forcing educators to navigate AI-related challenges without structured policies [100]. This lack of regulation leads to inconsistent assessment practices, confusion among faculty, and varying interpretations of ethical AI use in student work. Without structured policies, AI continues to be misused, leading to concerns about the quality of higher education in AI-driven learning environments.

4.2 Strategies to uphold academic integrity in AI-infused environments

This category discusses the following themes: AI-resistant and process-based assessments, institutional AI policies and digital literacy, and human-AI collaboration for ethical learning.

4.2.1 AI-resistant and process-based assessments

Ensuring academic integrity in AI-infused learning environments requires the development of AI-resistant and process-based assessments. These assessment strategies are designed to engage students in higher-order thinking, creativity, and problem-solving areas that AI tools currently struggle to replicate [100]. To achieve this, institutions have shifted toward alternative assessment methods, such as oral exams (viva voce), real-world reflective tasks, scaffolded assignments, reflective journals, use of Bloom's Taxonomy higher-order thinking questions, and interactive problem-solving tasks, which require direct student engagement and cannot be easily outsourced to AI [56, 65, 67, 70, 73, 79, 89, 94, 97–99, 101, 102]. Personalised reflections and assessments that involve human interaction are also being implemented to minimise AI-driven dishonesty and encourage authentic learning experiences [87].

A structured approach to assessment redesign has led to multi-stage assignments, where students submit drafts before finalising their work [70]. This method allows educators to track students' learning progress and interaction with AI throughout the assessment process, making it more difficult

to misuse AI tools [68, 69, 82]. Assignments that integrate real-world applications, such as case studies, oral defences, and practical problem-solving tasks, further ensure that students engage deeply with the content rather than relying on AI-generated responses [68]. The use of multimodal assessment techniques, including project-based assessments, live problem-solving activities, and peer evaluations, has also been identified as an effective strategy for fostering student accountability and reducing AI misuse [85, 103]. In addition, scholars propose designing assessments in ways that make the final outputs less susceptible to direct substitution by AI tools, thereby preserving the integrity and authenticity of student work [80]. The emphasis is on assessments that evaluate the learning process rather than solely focusing on the final product, and continuous feedback [60, 71, 77, 83, 90, 96, 104, 105].

To maintain academic integrity in an AI-infused environment, there is a growing need to redesign assessment practices in ways that emphasise critical thinking and creativity [54, 57, 66, 91]. One approach involves improving AI detection tools to accurately identify AI-generated content while reducing false positives and negatives that may affect academic integrity enforcement [31, 54, 57, 66, 91, 106]. The "Against, Avoid, Adopt, and Explore" (AAAE) framework proposed by [100] designing assessments that AI cannot easily complete, such as reflective writing and oral evaluations. In addition, [68] recommend integrating AI into the assessment process while maintaining academic integrity by ensuring that assignments focus on analytical thinking rather than simple information retrieval.

4.2.2 Institutional AI policies and digital literacy

The absence of formalised AI usage policies in many institutions has resulted in inconsistencies in enforcing academic integrity standards. To address this challenge, some universities have introduced mandatory AI disclosure policies, requiring students to declare their use of AI in assignments to promote transparency and accountability [56, 69]. These policies establish clear governance structures that define acceptable AI use, ensuring that AI tools support learning rather than facilitate misconduct [54, 57]. Without such policies, institutions risk ethical violations, academic dishonesty, and a lack of uniformity in AI integration within education [31]. Moreover, scholars emphasise the urgent need for policies and regulations that not only regulate the use of AI but also address critical concerns such as data privacy and security [64, 72, 77, 81, 107].

To further enhance ethical AI integration, universities have begun implementing AI literacy programs for students and educators [108]. Faculty training programs have been developed to help educators recognise AI-generated content, redesign assessment methods, and integrate AI responsibly into teaching and evaluation processes [62, 67]. Simultaneously, student AI and information literacy initiatives have been introduced to promote responsible AI use, ethical decision-making, and awareness of academic integrity principles [58, 74, 100]. These programs are essential in ensuring that students engage with AI tools in ways that enhance their learning experience rather than undermine it. Furthermore, some scholars have called for the expansion of AI literacy training as a means of addressing the challenges posed by inappropriate or uninformed AI use [73, 75, 86, 95, 101].

The findings are consistent with the literature on the best models for handling academic integrity breaches. The two dominantly recognised approaches are the more punitive ("punitive", "ethical", etc.) models and the educative models ("educative", "pedagogical", "proactive", etc.) [109], where punitive models seek to "deter students from committing breaches through the threat of penalties," and the educative approach aims to "reduce the likelihood of students committing breaches by providing them with relevant skills and knowledge" [110]. Therefore, it is incumbent for institutions to adopt models that promote the holistic development of students and enable them to value academic integrity over the fear of being caught cheating.

4.2.3 Human-AI collaboration for ethical learning

Rather than banning AI outright, institutions are encouraged to promote critical engagement with AI-generated content. This approach fosters an educational environment where AI functions as a learning partner rather than a replacement for human cognition [58, 100]. Educators adapt their teaching strategies to encourage students to analyse, critique, and refine AI-generated outputs, leading to deeper cognitive engagement and independent reasoning.

AI can enhance formative assessments by providing instant feedback and personalised learning pathways. However, to maintain academic integrity, AI-assisted feedback mechanisms must be designed to support rather than replace instructor-led evaluations [66, 91]. The challenge lies in ensuring that students do not become over-reliant on AI-generated responses but instead develop the ability to engage critically with AI suggestions and apply their own knowledge to refine their work.

In summary, the findings highlighted that while AI-infused assessments offer numerous benefits, such as personalised learning and efficiency, they also present significant challenges to academic integrity. One of the key solutions will be the implementation of policy frameworks that consider AI integration and ways to maintain academic integrity. Educational institutions should also educate the

students on the ethics to be observed during the assessment and its impact. Of course, upholding ethics requires a mind shift for the students and society. Industries could also conduct robust testing to validate qualifications. To ensure fairness and integrity in AI-infused assessments, it is crucial that society, industry, and all educational stakeholders work in unison to uphold ethical standards. Collaboration between policymakers, educators, and technology developers can lead to the creation of robust frameworks that balance AI's advantages with academic integrity. It is also crucial for institutions to frame questions that are resilient to GenAI-generated solutions. As suggested, it might also be time to go back to basics and do time-constrained assessments or standardised assessments conducted under supervision [111], though critics label them as oppressive and distant from real-world problems, advocating performance assessment.

Overall, from our findings, it became evident that the intersection between AI, assessment, and academic integrity is a critical area warranting deeper exploration. The articles reviewed highlighted concerns and varying interpretations around fairness, transparency, and trust in AI-driven assessments. These insights suggest a need for more integrated discussions on how assessments should be planned, executed, and conducted in AI-infused environments and how this technology reshapes traditional notions of integrity, which we propose as a key direction for future research.

4.2.4 Key takeaways

Our study revealed that whether we like it or not, AI is here to stay and accordingly will influence teaching and learning. Situational learning informs us that we cannot separate learning and assessment from the situation in which the process is taking place. Doing so will make the learning process less effective and less meaningful. Assessment and learning must be integrated into the context in which they occur, as this ensures that learners can apply their knowledge in real-world situations. Educational practitioners should aim for application-based assessments that foster problem-solving, critical thinking [13] and practical application of skills. Another interesting aspect that can be adopted is administering process-oriented assessments where learners are assessed throughout the learning process rather than only at the end of the process. This approach allows educators to monitor progress, identify challenges early, and provide timely support, ensuring a more comprehensive understanding of the material. Studies on authentic assessment [12, 35] are evidence of the current situation and can be applied to improve active engagement and continuous improvement. From an ethical perspective, practitioners can incorporate sections where students declare how they used AI in relation to the rubrics in an effort to encourage ethical use. The traditional pen and paper exams might not be the best for the current situation. We propose more oral exams, known as vivas, rather than using them to verify authenticity during alleged misconduct. Our study has also highlighted low literacy levels among practitioners, which makes it difficult for them to design assessments with a balance of AI and integrity at the same time. We propose that practitioners must continuously engage in professional development courses in AI and assessments.

5 Conclusion

This study examined challenges and strategies for redefining assessment in AI-infused learning environments while maintaining academic integrity. Through constructivist learning theory, the study advocated for authentic or performance-based assessments that foster critical thinking. The results underscore the need for educational institutions to adapt assessment strategies to balance AI integration with academic integrity. This may include rethinking traditional assessment models and introducing more robust AI detection tools. As technological advances continue, redefining assessment must be a pragmatic process that is continuous and adaptive to whatever works at the time.

Redefining assessment in an AI-infused environment necessitates a shift from standardised evaluations toward adaptive models that emphasise continuous learning. In line with redefining assessments in AI-infused environments, integrity refers to the transparent and ethical use of AI. Our key takeaways suggest designing assessments that encourage learners to declare the use of artificial intelligence and also assess them throughout the process to promote a culture of avoiding shortcuts. Practices such as oral viva help to ascertain validity with real-life problem-solving projects. For instance, in software development, students can be asked to design and develop an IoT-based system to detect fire and send an alert to emergency teams. Such projects are authentic and valid as they help to measure critical thinking and problem-solving. In line with the constructivist approach, such vivas will allow students to interpret the assessments clearly and reflect as they get individual feedback. As we suggested, having a clear rubric on assessment and usage of AI will mean that no student is penalised randomly. Currently, it is the educator's discretion, which, in most cases, is not fair. Educators can add another layer by specifying the AI platforms to be used, which they know all learners have access to; doing so will ensure equality. This resonates with the constructivist approach, where AI takes the role of scaffolding. Equally important is making sure that feedback is customised to meet personal needs. While

AI can generate generic feedback, educators must ensure that they customise each feedback based on each student's ability. Implementing these principles of integrity, fairness, validity, and personalised feedback ensures that assessments in AI-infused environments remain ethically grounded and aligned with constructivist learning theory, while fostering new collaborative frameworks where educators and learners co-construct knowledge and responsibly engage with emerging technologies.

This transformation carries significant policy implications, demanding new frameworks from policymakers for the purposes of credibility and integrity of assessments. Educators and learners need to be aware of the changing roles they play in decision-making in AI-infused environments.

A key limitation of the study has been over-reliance on literature, most of which has voices from educators at the forefront of challenges encountered in AI-infused teaching environments. Nevertheless, we hope this paper has made a practical contribution by outlining challenges and potential strategies that stakeholders operating in AI-infused environments can adopt.

Future studies could investigate students' perspectives on assessment methods in AI-infused learning environments.

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Declarations

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