

Strategies for e-Assessments in the Era of Generative Artificial Intelligence

Tapiwa Gundu

Nelson Mandela University, South Africa

tapgun@gmail.com

<https://doi.org/10.34190/ejel.22.7.3477>

An open access article under [CC Attribution 4.0](#)

Abstract: The rapid advancement of generative artificial intelligence (AI), particularly tools like ChatGPT, is reshaping educational landscapes by enabling students to generate responses that closely mimic human-written answers. This development presents both opportunities and challenges for e-assessments, especially concerning academic integrity and the authenticity of student learning outcomes. Traditional assessment methods, which often emphasize memorization and standardized testing, are proving insufficient in this new context, as they may not effectively measure higher-order skills like critical thinking, creativity, and problem-solving. This study employs a systematic literature review (SLR) to investigate adaptive e-assessment strategies in higher education that address the integrity challenges posed by generative AI while supporting meaningful learning. Through an in-depth analysis of recent literature on e-assessment practices and AI integration, this study identifies key adaptive strategies such as randomized questioning, project-based assessments, open-book exams, and AI-enhanced plagiarism detection. The findings reveal that while generative AI complicates the assessment process, it also provides an impetus for rethinking assessment design in ways that promote application-based knowledge and discourage cheating. By advocating for a shift towards assessments that evaluate critical skills rather than rote knowledge, this study proposes a framework that can support educators in creating robust, integrity-focused e-assessments. This research contributes to the evolving discourse on educational assessment, offering practical recommendations for institutions aiming to balance the benefits of AI-enhanced learning with the need for fair and accurate assessments.

Keywords: ChatGPT, Generative AI, e-Learning, e-Assessments, Higher education, Academic integrity

1. Introduction

There has been a remarkable transformation in the field of education, primarily driven by the rapid advancement of technology (Ebner et al., 2020). As digital technologies have revolutionized the way knowledge is acquired, disseminated, and accessed, e-learning has emerged as a prominent mode of education delivery, offering unprecedented flexibility and accessibility to learners worldwide (Ebner et al., 2020). However, despite the remarkable progress in e-learning methodologies, the assessment practices employed in this digital era often lag, relying on traditional methods that have roots dating back to ancient times. This paper delves into the critical issue of assessment practices in 21st-century e-learning environments and examines the extent to which these practices align with the dynamic and evolving educational landscape. Specifically, we explore the idea that contemporary e-learning, coupled with transformative language models like ChatGPT, has unveiled the shortcomings of traditional assessment methods, which are reminiscent of practices from as early as the 7th century.

In recent years, the integration of artificial intelligence (AI) and natural language processing (NLP) technologies into e-learning has provided new avenues for personalized and adaptive learning experiences (Baidoo-Anu and Owusu Ansah, 2023). Among these AI-powered innovations, ChatGPT, an advanced language model developed by OpenAI, has significantly reshaped the landscape of human-computer interaction and information processing. ChatGPT's ability to generate coherent, contextually relevant responses and its capacity to simulate human-like conversation have sparked a need for reevaluation of traditional educational practices, including assessments (Gundu, 2023a).

The 7th-century assessment methods, characterized by written examinations, oral recitations, and tests which were all memorization-based evaluations (Monroe, 1905), have become questionable. These have served as the primary means of evaluating knowledge and understanding for centuries. While these methods may have been suitable for the educational needs of their time, they fail to accommodate the multifaceted demands of modern e-learning environments (Bryan and Clegg, 2019). The dynamic nature of digital education requires assessments that can assess critical thinking, problem-solving, creativity, collaboration, and adaptability skills that are pivotal in a rapidly changing world (Cahapay, 2020).

The transformative potential of ChatGPT and similar AI technologies in e-learning has highlighted the need for a paradigm shift in assessment practices as students can use these technologies to generate answers for assessments. This has shown a need to shift from static, standardized assessments to dynamic and adaptive evaluations for lecturers to have a deeper understanding of the students' progress (Cotton, Cotton and Shipway, 2023).

Literature highlights the challenges with the current assessment methods and this paper discusses strategies for redesigning assessment practices for e-learning in the 21st century, with an emphasis on fostering a learner-centric approach that nurtures creativity, critical thinking, and a growth mindset.

Ultimately, this paper aims to shed light on the transformative potential of e-learning assessment practices, prompting educators, policymakers, and stakeholders to reconsider the traditional methods inherited from the past by exploring alternative assessment methods, such as project-based evaluations, portfolios, and performance assessments can better assess students' critical thinking, creativity, and problem-solving skills vs assessing knowledge retainment. These innovative assessment approaches seem to align better with the evolving needs of learners and the ever-changing knowledge economy.

The rest of the paper is structured as follows, next, the background and problem statement of the study will be discussed followed by the purpose and objectives of the study. A literature review and methods applied will then be discussed, these would then be followed by findings and discussion of the findings. The paper will round up with a conclusion that will discuss the recommendations and possibilities for future studies.

1.1 Background

In the ever-evolving landscape of education, the integration of technology has led to significant advancements in both e-Learning and e-Assessments. This comprehensive exploration aims to elucidate the interconnected dynamics of e-Learning and e-Assessments, underscoring the symbiotic relationship between these two components in the era of generative artificial intelligence. The surfacing of ChatGPT in November 2022 has led to a rise in the use of artificial intelligence to enhance the learning process (Baidoo-Anu and Owusu Ansah, 2023).

The role of technology as an enabler in eLearning is paramount. This subsection explores the technological tools and platforms that facilitate eLearning experiences, from Learning Management Systems (LMS) to interactive multimedia content, setting the stage for effective e-Assessments by providing a robust digital learning infrastructure.

1.2 Problem Statement

The integration of generative artificial intelligence (AI), such as ChatGPT, in education has created unprecedented opportunities for enhanced learning but also significant challenges for academic integrity and assessment authenticity. Traditional assessment methods, which often rely on memorization and standardized testing, are increasingly inadequate in an environment where students can leverage AI to generate answers that mimic human responses. This raises critical concerns about the reliability and fairness of e-assessments and challenges educators to ensure that assessments accurately reflect student learning and capabilities. Without adapting assessment strategies to address these issues, institutions risk compromising the validity of their assessments and undermining educational outcomes. This study seeks to address this urgent problem by exploring adaptive e-assessment strategies that maintain academic integrity and promote meaningful learning in the AI-enhanced educational landscape.

1.3 Purpose of the Study

The purpose of this study is to address this urgent problem by exploring adaptive e-assessment strategies that maintain academic integrity and promote meaningful learning in the AI-enhanced educational landscape, particularly focusing on the potential for students to use AI to generate answers.

1.4 Objective of the Study

The objective of this study is to recommend practical, AI-Resistant Strategies for educators and institutions to proactively address the potential misuse of generative AI in e-assessments. This includes designing assessments that are resistant to automation and promoting higher-order thinking skills that are challenging for AI to replicate.

2. Related Literature

The evolution of artificial intelligence (AI) and natural language processing has given rise to language models, for example ChatGPT, fundamentally altering the landscape of human-computer interaction. This paradigm shift has ignited scholarly discourse on the implications of such advancements for educational practices. This literature review undertakes a critical examination of the role of traditionally ascribed assessment methods within the contemporary context shaped by ChatGPT and similar AI technologies.

2.1 Generative AI

Generative Artificial Intelligence (AI) refers to a class of AI systems that have the capability to generate new and original content, such as text, images, or even audio, resembling human-created content (Gundu and Chibaya, 2024). Unlike traditional AI systems that rely on rule-based programming or predefined responses, generative AI models are trained on large datasets and learn patterns and features to generate content autonomously.

Models like GPT-4o (Generative Pre-trained Transformer 4o), developed by OpenAI, are examples of sophisticated generative AI language models. These models are pretrained on diverse datasets and can then be fine-tuned for specific tasks or applications. Generative AI operates on the principles of machine learning, particularly deep learning, where neural networks with multiple layers are employed to process and generate complex patterns (Gundu, 2023b). The generative process involves the model predicting the next element in a sequence based on the patterns it has learned from the training data.

2.2 The Evolution of Assessment Methods

As technology advances, so should the nature of assessments. This section delves into how assessments have evolved beyond traditional formats, incorporating adaptive learning algorithms, real-time feedback mechanisms, and the integration of artificial intelligence to provide a more nuanced and responsive evaluation of student performance.

The history of written exams spans across various epochs, reflecting the evolving nature of educational assessment. In ancient civilizations like China and Mesopotamia, the roots of written exams can be traced, with civil service exams in China during the Han Dynasty focusing on Confucian classics and administrative prowess, and Mesopotamian scribes being evaluated for their proficiency in writing and interpreting cuneiform script. Transitioning to the medieval period, monasteries and cathedral schools in Europe utilized written exams to gauge students' comprehension of religious texts, arithmetic, and grammar. The Renaissance marked a shift towards humanism, broadening the scope of education to include literature, history, and philosophy, leading to a more widespread adoption of written exams in universities. The 19th century witnessed the establishment of standardized examination systems like the British "General Certificate of Education" (GCE) and the French "baccalauréat." In the modern era, the digital revolution has prompted a shift from traditional paper-based exams to computer-based formats, offering efficiency in grading and enabling remote testing. As the trajectory of written exams unfolds in the digital era, there is a growing exploration of alternative assessment forms, such as project-based evaluations, aimed at assessing a broader spectrum of skills beyond mere rote memorization (Brooks, 1993; Eskelson, 2020; Herckis, 2018; Li and Hayhoe, 2012; Mounier-Kuhn, 2020)

e-Assessments, encompassing a variety of digital assessment formats, have become more prevalent in the recent years. These assessments are not limited to multiple-choice questions; they can include simulations, interactive elements, and adaptive testing (Woldeab and Brothen, 2019). e-Assessments have become increasingly popular due to the benefits they offer in terms of efficiency, flexibility, and the ability to leverage technology for various types of evaluations.

2.3 e-Assessments

In the advent of Generative AI, the significance of e-Assessment serves multifaceted purposes that significantly contribute to the overall e-learning experience and student development (Bryan and Clegg, 2019). The pivotal role of these assessments lies in their capacity to assess student progress, foster effective learning, and ensure the achievement of educational objectives in the context of e-learning environments (Gamage et al., 2020). The primary aim is to measure and evaluate the extent to which students have successfully attained the specified learning outcomes. Through diverse e-assessment methods, educators can discern the levels of knowledge, skills, and competencies acquired by students, thereby providing valuable feedback to both learners and instructors.

Moreover, e-assessments serve the purpose of offering students constructive feedback for improvement and fostering active learning in digital landscapes (Winstone and Boud, 2022). Through various e-assessment formats such as quizzes, projects, and discussions, e-learning actively engages students with the course content. Interactive assessments encourage critical thinking, problem-solving, and the application of knowledge, fostering deeper understanding and the development of higher-order cognitive skills.

This study advocates for a shift towards assessing the ability to apply knowledge and skills rather than focusing solely on the retention of information which Generative AI can be used to cheat. Consequently, there is a compelling need to reimagine assessments in order to optimize the educational experience for students, promote continuous improvement, and adequately equip them for the evolving demands of a global workforce.

2.4 Impact of Generative AI on e-Assessments

Students may exploit Generative AI during online exams or quizzes to seek answers in real-time, bypassing the intended evaluation process. This form of cheating can compromise the fairness and accuracy of assessments. Studies suggest that Generative AI is here to stay and that being so, there is a great need for an e-Assessment mindset shift, from focusing on memorisation to application, encouraging critical thinking and problem-solving skills that AI algorithms cannot emulate (Baidoo-Anu and Owusu Ansah, 2023).

3. Methodology

This study is grounded in a pragmatic philosophy. Pragmatism is suitable for this study because it focuses on generating practical and actionable insights into e-assessment strategies within higher education. This approach allows the research to emphasize both real-world applications and the implications of emerging technologies (like generative AI) on current assessment practices, prioritizing solutions that enhance academic integrity and effective e-assessment design.

3.1 Research Approach

A deductive approach is applied, as the study begins with established theories and frameworks on assessment practices and academic integrity. It seeks to validate these theories within the specific context of generative AI, testing their applicability and identifying any necessary adaptations. This approach aligns well with the systematic literature review (SLR) design, as it allows the research to analyze existing studies, derive conclusions, and propose recommendations based on the current evidence.

3.2 Methodological Choice

The research adopts a qualitative approach, using a systematic literature review (SLR) to consolidate and synthesize findings from previous research. This approach allows for an in-depth exploration of themes and patterns in e-assessment literature, drawing on qualitative insights to understand the effectiveness, challenges, and innovations within e-assessment practices in the context of generative AI.

3.3 Research Strategy

A systematic literature review is selected as the primary research strategy. The SLR is appropriate because it enables the study to rigorously examine and synthesize a wide range of peer-reviewed literature and conference proceedings, providing a comprehensive overview of global best practices in e-assessment. This strategy also facilitates the identification of gaps in existing research, which informs the development of new assessment frameworks that address the unique challenges posed by generative AI. The research strategy is structured in a way that aligns with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure rigor and reproducibility.

3.4 Techniques and Procedures

3.4.1 Data collection techniques

A comprehensive search of peer-reviewed articles, conference papers, and relevant academic databases was conducted. Keywords such as "e-learning," "artificial intelligence," "Generative Artificial Intelligence," "assessment practices," and "redesign" were used in various combinations to ensure the inclusiveness of the search.

A 'who', 'what', 'how' and 'where' (WWHW) structured approach was used to assist in the creation of the key search terms and ultimately the research string. The WWWH table, Table 1 is presented below.

Table 1: WWHW Table

	WHO	WHAT	HOW	WHERE	OTHER ISSUES
What are the Best Practices for e-Assessments in the advent of Generative AI	Lecturers/ students	Assessment Methods	Assessment Plan	University/ College	E-Learning/ Remote Learning

The development of the search string was an iterative process. The resultant research string was:

("Assessment Method" OR "Assessment Plan") AND ("e-learning" OR "remote learning") AND ("higher education" OR "tertiary education" OR "university" OR "College")

3.5 Inclusion Criteria

This study made use of several bibliographic databases, including EBSCOhost Research database, Emerald Insight, Science Direct, and Google Scholar. The same search string was applied consistently across all the selected databases. The research process involved both initial and secondary screening of the search results. To manage the systematic reviews efficiently, the researchers employed Rayyan, a web-based application designed to assist researchers in creating and organizing their reviews. The inclusion and exclusion criteria are shown in Table 2.

Table 2: Inclusion and exclusion criteria

INCLUSION CRITERION	EXCLUSION CRITERION
- assessment methods - Higher education; university; college; tertiary education - Learning technologies; digital technologies; e-learning; e-Assessments; remote learning	- Not applicable - Not relevant (outdated) - No abstract - Full-text unavailable - No translation for foreign language

3.6 Data Synthesis

The selected studies were subjected to data extraction, including information on research design, methodology, key findings, and implications. Thematic analysis was employed to identify common themes, patterns, and contradictions across literature.

The aim of data synthesis is to combine multiple sources of information into a single, integrated, and comprehensive representation. This process involved collecting and integrating data from various sources discussed in section 3.5, and then using meta-analysis, and modelling techniques to create a synthesized dataset that provided a more complete and accurate picture of the subject matter. The goal of data synthesis is to improve understanding and decision-making by combining the strengths of individual sources and reducing the limitations and biases inherent in any one source.

4. Findings

A total of 248 articles were identified and retrieved for the research. The study focused on publications from 2014 up to the present, except for referenced articles specifically related to the learning style models mentioned in numerous citations. Refer to Table 3 for further details.

Table 3: Results of searches

Search String	("Assessment Method" OR "Assessment Plan") AND ("e-learning" OR "e-assessment") AND ("higher education" OR "tertiary education" OR "university" OR "College")		
Database	Number of Hits	Database	Number of Hits
Google Scholar	103	Science Direct	78
EBSCOhost	14	Emerald Insight	53

After implementing the research string and obtaining the outcomes as described in Table 3, a PRISMA diagram was created. The PRISMA diagram serves as a visual representation of the information flow through the

various phases of the systematic review, and it was utilized to report the findings from the conducted searches. Refer to Figure 1 for the diagram.

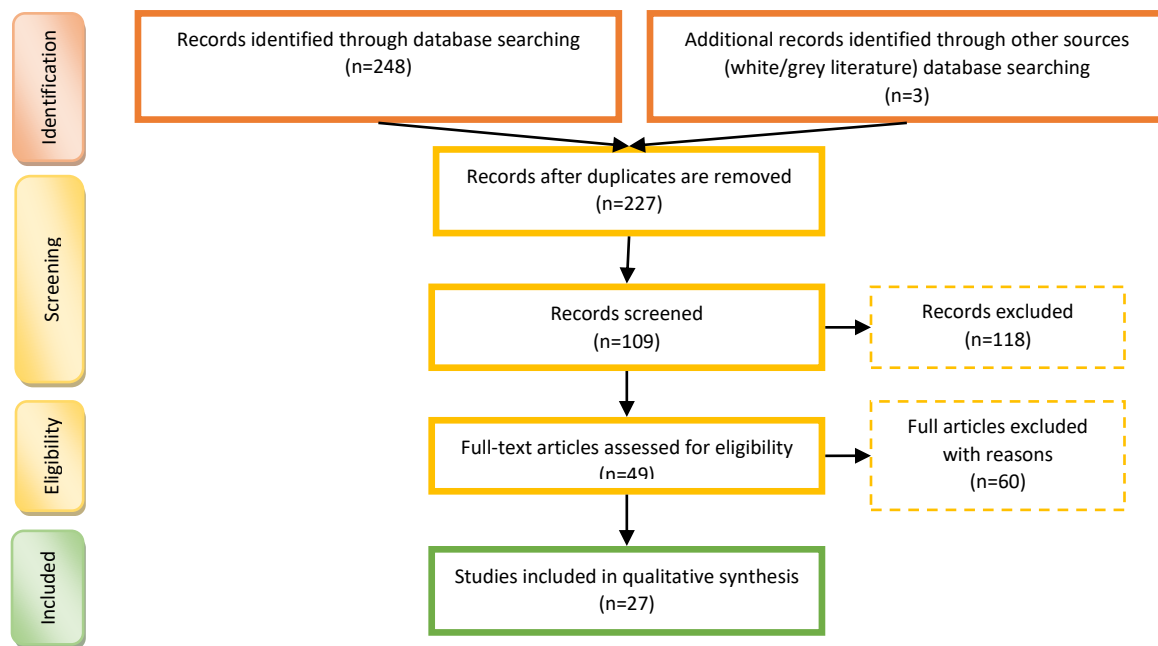


Figure 1: Systematic review flow

A total of twenty-seven (27) articles that met the eligibility criteria underwent a quality assessment. Out of these, twenty-one (21) papers were deemed suitable for inclusion in this systematic review.

To present the relevant and significant findings from these selected papers, data extraction tables were utilized. These tables contained valuable information and insights related to the research. Due to conciseness, the six (6) pages of data extraction tables have been summarized in Table 4.

Table 4: Summary of data extraction table

	Major assessment methods			Learning Style			
Subcategories	Projects	Tests/Exams	Assignments	F2F	Online	Blended	Other
Citing	4	21	11	0	19	5	3

As may be seen in Table 4, most papers reviewed were based on e-learning (19) and are largely reliant on tests and exams (21).

5. Discussion

Traditional assessment methods, such as written examinations and standardized tests, were designed for a different era and often fall short in assessing the diverse skills and competencies required in the modern workforce. This section discusses recommendations based on what was found in literature review. It was revealed that the 21st century education systems demand a more holistic approach to assessments that goes beyond testing memorization and instead evaluates critical thinking, problem-solving, creativity, collaboration, and digital literacy (Bryan and Clegg, 2019). E-learning provides a unique opportunity to rethink assessment practices and align them with the needs of the skills and knowledge economy.

This section will critically discuss recommended strategies based on the findings from literature.

5.1 Recommended Strategies for Implementing e-Assessments in the era of AI

5.1.1 Implementation of varied assessment formats

To foster a robust and authentic assessment environment within e-learning, a diversified mix of assessment formats is recommended, including open-ended questions, case studies, and projects, to diminish the dependence on easily searchable content and create challenges for potential cheating (Şenel and Şenel, 2021). Open-ended questions, characterised by their demand for thoughtful and analytical responses, propel

students beyond surface-level understanding and discourage reliance on readily available answers (Winstone and Boud, 2022). Case studies, by immersing students in real-world scenarios, evaluate not only comprehension but also the application of theoretical knowledge to practical situations, making it less likely for students to find pre-existing solutions online (Gamage et al., 2020). Lastly, project-based assessments, requiring in-depth exploration of a specific topic, produce tangible outcomes that uniquely showcase individual efforts (Gundu, 2023b). These diversified approaches encourage critical thinking, analytical skills, and practical application, collectively contributing to a comprehensive evaluation that deters cheating by emphasising originality and individualised understanding of the subject matter.

5.1.2 Randomisation of questions and answer choices

By randomizing the order of questions, each student faces a unique sequence, preventing the sharing of question order and reducing the effectiveness of collaborative cheating (Ranger, Schmidt and Wolgast, 2020). This method disrupts the predictability of assessments, challenging students attempting to coordinate responses systematically in real-time (Whisenhunt et al., 2022). Furthermore, randomizing the order of answer choices within multiple-choice questions adds an additional layer of complexity. This dynamic approach ensures that answer choices are presented in a different order for each student, significantly diminishing the effectiveness of collaborative efforts. Even if students share information, the corresponding answers may not align across different versions of the assessment. Collectively, these randomization techniques fortify the authenticity of assessments, promoting individual engagement and understanding while minimizing opportunities for collaborative cheating (Manoharan, 2019).

5.1.3 Use of time limits strategically

Tailoring time constraints to match the cognitive demands of each question ensures an equitable opportunity for students to demonstrate their understanding while simultaneously discouraging external assistance or prolonged searches for answers (Stadler, Kolb, Sailer, 2021). Recognizing that different questions necessitate varied degrees of critical thinking and problem-solving, this approach aims to strike a balance that challenges students appropriately without creating undue barriers (Ryznar, 2022). Moreover, beyond serving as a deterrent to seeking external help, strategic time limits play a crucial role in cultivating essential time management skills among students. The constraints prompt learners to prioritize effectively and make efficient decisions (Ellis, 2021), reinforcing the significance of time management as a crucial aspect of their overall academic development during assessments.

5.1.4 Leveraging AI for plagiarism detection

The integration of AI-powered plagiarism detection tools represents a pivotal strategy in upholding academic integrity within the realm of e-assessment practices. By employing advanced algorithms and machine learning, these tools play a crucial role in identifying instances of academic dishonesty (Khalil and Er, 2023), ensuring that student submissions are authentic and reflective of their individual understanding and work.

AI-powered plagiarism detection tools employ sophisticated algorithms to analyse written content comprehensively (Ibrahim, 2023). These algorithms can detect similarities, even in paraphrased or rephrased text, and identify instances that may indicate potential plagiarism (Santra and Majhi, 2023).

5.1.5 Enabling secure online proctoring

Secure online proctoring, fortified by advanced AI technologies, emerges as a robust solution to uphold academic honesty and ensure the credibility of assessments. Through the implementation of online proctoring tools, educators gain the capability to monitor students during assessments, utilising sophisticated algorithms to track eye movements, identify suspicious behaviour, and verify the test-taker's identity in real-time (Gribbins and Bonk, 2023).

This approach introduces key features integral to the effectiveness of secure online proctoring with AI. Firstly, the use of facial recognition technology aids in identity verification, ensuring that the individual taking the assessment is indeed the registered student, thereby enhancing the overall security of the evaluation process. Advanced AI algorithms contribute to behavioural monitoring, analysing eye movements, facial expressions, and body language to identify signs of potential cheating or irregular behaviour (Aurelia et al., 2023). Real-time alerts generated by online proctoring tools with AI capabilities enable educators to swiftly intervene when suspicious behaviour is detected, maintaining the integrity of the ongoing assessment. AI algorithms also conduct an environment analysis through webcam feeds, ensuring that the testing environment is conducive

to fair and honest assessments, free from external aids or distractions. Additionally, the incorporation of secure browser technology in some online proctoring solutions prevents students from accessing external websites or resources during the assessment, adding an extra layer of security and mitigating the risk of cheating through online searches (Selwyn et al., 2023).

5.1.6 *Promoting academic integrity policies*

Establishing and maintaining a culture of academic integrity begins with transparent guidelines that clearly define acceptable conduct (Möller, 2023). These guidelines, including details on plagiarism, unauthorised collaboration, and cheating during assessments, should be communicated extensively to students. Making these policies easily accessible through course materials, syllabi, and online platforms ensures that students can readily refer to them. Furthermore, articulating expectations regarding acceptable academic conduct and specifying permitted types of collaboration versus inappropriate ones provides the necessary clarity for students to navigate ethical boundaries effectively. To enhance understanding, offering concrete examples and scenarios illustrates acceptable and unacceptable behaviour, providing practical insights into how academic integrity policies apply in diverse contexts (Sullivan, Kelly and McLaughlan, 2023). In this way, a comprehensive approach to communicating and reinforcing academic integrity guidelines contributes to a community where ethical behaviour is prioritised and upheld (Perkins, 2023).

5.1.7 *Consideration of open-book assessments*

In the evolving landscape of education, the consideration of open-book assessments represents a progressive shift in pedagogical approaches. By intentionally designing assessments that allow students to refer to external resources, educators aim to foster a learning environment that emphasises the application of knowledge over rote memorisation (Rehman et al., 2022). Open-book assessments acknowledge the reality of the information age, where access to a vast array of resources is readily available. This approach encourages students to develop critical thinking skills, problem-solving abilities, and the capacity to synthesise information (Radha, 2023). Unlike traditional assessments that prioritise memorisation, open-book assessments challenge students to navigate and interpret a variety of sources, promoting a deeper understanding of the subject matter. Importantly, this shift in assessment strategy also serves as a deterrent to cheating, as the focus transitions from recalling facts to demonstrating a comprehensive grasp of concepts and the practical application of acquired knowledge. Embracing open-book assessments reflects a commitment to preparing students for real-world scenarios where the ability to access and apply information is often more valuable than memorising it (Masengu et al., 2023).

5.1.8 *Facilitating real-time interaction*

By designing assessments that require students to engage with course material in a real-time, interactive setting, educators introduce a layer of complexity that makes it challenging for students to depend on external sources or collaborators. This approach shifts the focus from rote memorization to the immediate application of knowledge in dynamic situations, fostering a deeper understanding of the subject matter (Nilimaa, 2023).

Real-time interactive assessments often emulate real-world scenarios, demanding quick thinking, problem-solving, and on-the-spot decision-making. This not only aligns assessments with practical, professional situations but also mitigates the opportunity for students to seek external help or collaborate during the assessment period. The dynamic nature of these assessments ensures that students draw upon their individual understanding and skills, discouraging reliance on external aids.

Moreover, the real-time element introduces an element of unpredictability, making it difficult for students to anticipate specific questions or scenarios (Gök, 2012). This not only enhances the authenticity of the assessment experience but also minimizes the potential for cheating through pre-prepared answers or coordinated efforts with peers.

5.1.9 *Monitoring communication channels*

Vigilant monitoring of communication channels serves as a proactive strategy to maintain the integrity of the evaluation process. Regular oversight of the channels used by students during assessments, such as chat platforms or discussion forums, is essential in preventing and detecting instances of academic dishonesty (Ngqondi, Maoneke, and Mauwa, 2021). By staying attuned to these channels, educators can swiftly identify potential collaboration or unauthorized communication among students. Creating an environment that encourages the reporting of suspicious behavior is crucial, emphasizing the collective responsibility of the

learning community to uphold academic honesty. Clear communication about a zero-tolerance policy for cheating reinforces the seriousness of maintaining integrity within the educational setting (Alguacil et al., 2023). This vigilant monitoring not only acts as a deterrent to dishonest practices but also ensures that assessments accurately reflect the individual understanding and effort of each student, contributing to a fair and trustworthy assessment process (Sabbah, 2017).

5.1.10 Educating students on ethical use of technology and encouraging academic honesty pledges

In navigating the digital age, where AI permeates every facet of education, it becomes imperative to integrate discussions on the ethical use of AI technologies directly into the curriculum. By doing so, educators can address the nuanced challenges posed by digital tools and platforms, fostering a heightened awareness among students about the consequences of cheating in this technologically advanced era (Mata, 2021). These discussions go beyond establishing what is deemed acceptable behavior; they delve into the broader implications of dishonest practices on the individual's educational journey and the broader academic community. Emphasizing the value of genuine learning and academic honesty becomes pivotal in this context, urging students to view their educational pursuits not merely as a means to an end but as a transformative process that shapes their intellectual growth.

Moreover, requesting students to actively participate in and sign academic honesty pledges prior to assessments adds a tangible layer of commitment to maintaining high ethical standards (Peer and Feldman, 2021). This formalized agreement creates a sense of responsibility, prompting students to reflect on the significance of their academic integrity. By publicly affirming their commitment to ethical conduct, students are not only reinforcing their personal dedication to honest academic practices but are also contributing to the creation of a culture that values and prioritizes integrity. The act of pledging serves as a visible reminder of the shared responsibility to uphold the principles of academic honesty, ultimately acting as a deterrent against cheating by fostering a community committed to ethical educational practices (Bates et al., 2016).

6. Conclusion

This study presents a contribution to the field of e-assessment by addressing the unique challenges posed by generative AI in higher education. In light of tools like ChatGPT, traditional assessments are increasingly inadequate, as they often fail to capture the depth of students' critical thinking and problem-solving abilities. Through a systematic literature review, this research identifies and evaluates adaptive e-assessment strategies that promote academic integrity while fostering meaningful learning. By focusing on application-based methods such as randomized questioning, project-based assessments, and open-book formats the study proposes a framework that enables educators to create AI-resistant assessments that prioritize skill application over rote memorization.

The contributions of this research are significant in advancing the discourse on e-assessment in the era of AI. This study not only offers practical recommendations for assessment design but also encourages a shift toward a learner-centered approach that emphasizes critical skills essential in modern education. These insights are valuable for educators and policymakers as they seek to uphold academic standards while embracing the potential of AI-enhanced learning.

Despite its contributions, the study has certain limitations. The reliance on existing literature restricts the ability to validate proposed strategies through empirical data, and the rapidly evolving nature of AI technologies means that new assessment challenges may soon emerge. Additionally, the study does not address the practical implementation barriers, such as institutional readiness or resource constraints, that educators may face when adopting these adaptive strategies.

Future research could focus on empirical studies to test the effectiveness of the recommended strategies across diverse educational settings. Longitudinal studies could also explore how AI influences student learning outcomes and integrity over time. Expanding research to include the perspectives of students, faculty, and administrators would provide a more comprehensive understanding of the practicalities involved in integrating AI-resistant e-assessments in higher education.

References

- Alguacil, M., Herranz-Zarzoso, N., Pernías, J.C., Sabater-Grande, G., 2023. Academic dishonesty and monitoring in online exams: a randomized field experiment. *J Comput High Educ.* <https://doi.org/10.1007/s12528-023-09378-x>
- Aurelia, S., Thanuja, R., Chowdhury, S., Hu, Y.-C., 2023. AI-based online proctoring: a review of the state-of-the-art techniques and open challenges. *Multimed Tools Appl.* <https://doi.org/10.1007/s11042-023-16714-x>

- Baidoo-Anu, D., Owusu Ansah, L., 2023. Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning. <https://doi.org/10.2139/ssrn.4337484>
- Bates, B., Neely, R., Donovan, J., Robinson, A., 2016. Academic Integrity: Effects of the University Pledge on Cheating and Plagiarism. Posters-at-the-Capitol.
- Brooks, V., 1993. The resurgence of external examining in Britain: A historical review. *British Journal of Educational Studies* 41, 59–72. <https://doi.org/10.1080/00071005.1993.9973949>
- Bryan, C., Clegg, K., 2019. *Innovative Assessment in Higher Education: A Handbook for Academic Practitioners*. Routledge.
- Cahapay, M.B., 2020. Rethinking Education in the New Normal Post-COVID-19 Era: A Curriculum Studies Perspective.
- Cotton, D.R.E., Cotton, P.A., Shipway, J.R., 2023. Chatting and Cheating. Ensuring academic integrity in the era of ChatGPT. <https://doi.org/10.35542/osf.io/mrz8h>
- Ebner, Martin, Schön, S., Braun, C., Ebner, Markus, Grigoriadis, Y., Haas, M., Leitner, P., Taraghi, B., 2020. COVID-19 Epidemic as E-Learning Boost? Chronological Development and Effects at an Austrian University against the Background of the Concept of “E-Learning Readiness.” *Future Internet* 12, 94. <https://doi.org/10.3390/fi12060094>
- Ellis, J.L., 2021. A Simple Model to Determine the Efficient Duration of Exams. *Educational and Psychological Measurement* 81, 549–568. <https://doi.org/10.1177/0013164420963163>
- Eskelson, T.C., 2020. How and Why Formal Education Originated in the Emergence of Civilization. *Journal of Education and Learning* 9, 29–47.
- Gamage, K.A.A., Silva, E.K. de, Gunawardhana, N., 2020. Online Delivery and Assessment during COVID-19: Safeguarding Academic Integrity. *Education Sciences* 10, 301. <https://doi.org/10.3390/educsci10110301>
- Gök, T., 2012. REAL-TIME ASSESSMENT OF PROBLEM-SOLVING OF PHYSICS STUDENTS USING COMPUTER-BASED TECHNOLOGY.
- Gribbins, M., Bonk, C.J., 2023. An exploration of instructors’ perceptions about online proctoring and its value in ensuring academic integrity. *British Journal of Educational Technology* 54, 1693–1714. <https://doi.org/10.1111/bjet.13389>
- Gundu, T., 2023a. Chatbots: A Framework for Improving Information Security Behaviours using ChatGPT, in: Furnell, S., Clarke, N. (Eds.), *Human Aspects of Information Security and Assurance*, IFIP Advances in Information and Communication Technology. Springer Nature Switzerland, Cham, pp. 418–431. https://doi.org/10.1007/978-3-031-38530-8_33
- Gundu, T., 2023b. ChatGPT-Proofing: Redesigning Assessment Practices for E-Learning, in: 22nd European Conference on E-Learning: ECEL 2023. Presented at the ECEL, Academic Conferences and publishing limited, Pretoria, pp. 121–130.
- Gundu, T., Chibaya, C., 2024. Demystifying the Impact of ChatGPT on Teaching and Learning, in: Van Rensburg, H.E., Snyman, D.P., Drevin, L., Drevin, G.R. (Eds.), *ICT Education*. Springer Nature Switzerland, Cham, pp. 93–104.
- Herckis, L., 2018. Passing the Baton: Digital Literacy and Sustained Implementation of eLearning Technologies. *Current Issues in Emerging eLearning* 5.
- Ibrahim, K., 2023. Using AI-based detectors to control AI-assisted plagiarism in ESL writing: “The Terminator Versus the Machines.” *Lang Test Asia* 13, 46. <https://doi.org/10.1186/s40468-023-00260-2>
- Khalil, M., Er, E., 2023. Will ChatGPT get you caught? Rethinking of Plagiarism Detection. <https://doi.org/10.48550/arXiv.2302.04335>
- Li, J., Hayhoe, R., 2012. Confucianism and higher education.
- Manoharan, S., 2019. Cheat-resistant multiple-choice examinations using personalization. *Computers & Education* 130, 139–151. <https://doi.org/10.1016/j.compedu.2018.11.007>
- Masengu, R., Dube, M., Mandongwe, L., Tshuma, S., 2023. Assessment: higher education institutions’ innovative online assessment methods beyond the era of the COVID-19 pandemic. p. 121. <https://doi.org/10.1016/B978-0-323-95500-3.00010-9>
- Mata, J.R., 2021. How to Teach Online? Recommendations for the assessment of online exams with University students in the USA in times of pandemic. *IJERI: International Journal of Educational Research and Innovation* 188–202. <https://doi.org/10.46661/ijeri.5003>
- Möller, A., 2023. An analysis of university academic integrity policies in New Zealand. *Journal of Further and Higher Education* 47, 338–350. <https://doi.org/10.1080/0309877X.2022.2130195>
- Monroe, P., 1905. *A Text-book in the History of Education*: By Paul Monroe. Macmillan.
- Mounier-Kuhn, P., 2020. Forms of Higher Education in Ancient Civilizations and beyond Europe. *Images des Mathématiques*.
- Ngqondi, T., Maoneke, P.B., Mauwa, H., 2021. A secure online exams conceptual framework for South African universities. *Social Sciences & Humanities Open* 3, 100132. <https://doi.org/10.1016/j.ssaho.2021.100132>
- Nilimaa, J., 2023. New Examination Approach for Real-World Creativity and Problem-Solving Skills in Mathematics. *Trends in Higher Education* 2, 477–495. <https://doi.org/10.3390/higheredu2030028>
- Peer, E., Feldman, Y., 2021. Honesty pledges for the behaviorally-based regulation of dishonesty. *Journal of European Public Policy* 28, 761–781. <https://doi.org/10.1080/13501763.2021.1912149>
- 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. <https://doi.org/10.53761/1.20.02.07>
- Radha, M., 2023. *Measurement, Evaluation And Assessment In Education*, Second Edition. PHI Learning Pvt. Ltd.
- Ranger, J., Schmidt, N., Wolgast, A., 2020. The Detection of Cheating on E-Exams in Higher Education—The Performance of Several Old and Some New Indicators. *Frontiers in Psychology* 11.

- Rehman, J., Ali, R., Afzal, A., Shakil, S., Sultan, A.S., Idrees, R., Fatima, S.S., 2022. Assessment during Covid-19: quality assurance of an online open book formative examination for undergraduate medical students. *BMC Med Educ* 22, 792. <https://doi.org/10.1186/s12909-022-03849-y>
- Ryznar, M., 2022. Exams in the Time of ChatGPT Developments. *Wash. & Lee L. Rev. Online* 80, 305–322.
- Sabbah, Y.W., 2017. Security of Online Examinations, in: Palomares Carrascosa, I., Kalutarage, H.K., Huang, Y. (Eds.), *Data Analytics and Decision Support for Cybersecurity: Trends, Methodologies and Applications*, Data Analytics. Springer International Publishing, Cham, pp. 157–200. https://doi.org/10.1007/978-3-319-59439-2_6
- Santra, P.P., Majhi, D., 2023. Scholarly Communication and Machine-Generated Text: Is it Finally AI vs AI in Plagiarism Detection? *Journal of Information and Knowledge* 175–183. <https://doi.org/10.17821/srels/2023/v60i3/171028>
- Selwyn, N., O'Neill, C., Smith, G., Andrejevic, M., Gu, X., 2023. A necessary evil? The rise of online exam proctoring in Australian universities. *Media International Australia* 186, 149–164. <https://doi.org/10.1177/1329878X211005862>
- Şenel, S., Şenel, H.C., 2021. Remote Assessment in Higher Education during COVID-19 Pandemic. *Int. J. Assess. Tools Educ.* 8, 181–199. <https://doi.org/10.21449/ijate.820140>
- Stadler, M., Kolb, N., Sailer, M., 2021. The right amount of pressure: Implementing time pressure in online exams. *Distance Education* 42, 219–230. <https://doi.org/10.1080/01587919.2021.1911629>
- Sullivan, M., Kelly, A., McLaughlan, P., 2023. ChatGPT in higher education: Considerations for academic integrity and student learning. *Journal of Applied Learning & Teaching*. <https://doi.org/10.37074/jalt.2023.6.1.17>
- Whisenhunt, B.L., Cathey, C.L., Hudson, D.L., Needy, L.M., 2022. Maximizing learning while minimizing cheating: New evidence and advice for online multiple-choice exams. *Scholarship of Teaching and Learning in Psychology* 8, 140–153. <https://doi.org/10.1037/stl0000242>
- Winstone, N.E., Boud, D., 2022. The need to disentangle assessment and feedback in higher education. *Studies in Higher Education* 47, 656–667. <https://doi.org/10.1080/03075079.2020.1779687>
- Woldeab, D., Brothen, T., 2019. 21st Century assessment: Online proctoring, test anxiety, and student performance | *International Journal of E-Learning & Distance Education / Revue internationale du e-learning et la formation à distance*.