International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Evaluating the Impact of Generative AI–Based Assessment and Feedback Systems on Student Learning Outcomes in Higher Education

Dr. D. Rajasekaran

Assistant Professor, Department of Commerce – Professional Accounting, NGM College, Pollachi, Tamil Nadu – 642001.

Abstract

The rapid advancement of Generative Artificial Intelligence (GAI) has significantly transformed assessment and feedback mechanisms in higher education. Traditional assessment practices often suffer from delayed feedback, limited personalization, and high faculty workload, which may negatively affect student engagement and learning outcomes. Generative AI–based assessment and feedback systems offer adaptive, real-time, and personalized evaluation models that promise enhanced learning effectiveness. This study evaluates the impact of Generative AI–driven assessment and feedback systems on student learning outcomes in higher education institutions. Using a mixed-method research design, data were collected from undergraduate and postgraduate students exposed to AI-supported assessments across multiple disciplines. Statistical tools such as simple percentage analysis, paired t-tests, and regression analysis were employed to assess improvements in academic performance, learner engagement, and self-regulated learning. The findings reveal that Generative AI–based feedback significantly improves conceptual understanding, timely error correction, and student satisfaction. However, concerns regarding academic integrity, algorithmic bias, and ethical data use remain critical challenges. The study concludes that while Generative AI can substantially enhance assessment effectiveness, its successful adoption requires ethical governance, faculty training, and transparent AI models. The paper offers practical implications for educators, policymakers, and institutional leaders aiming to integrate AI responsibly into higher education assessment frameworks.

Keywords: Generative Artificial Intelligence, Assessment Systems, Automated Feedback, Higher Education, Learning Outcomes, Educational Technology

1. Introduction

Higher education systems worldwide are undergoing a profound transformation due to the integration of advanced digital technologies. Among these innovations, **Generative Artificial Intelligence (GAI)** has emerged as a disruptive force, reshaping teaching, learning, assessment, and feedback processes. Unlike traditional rule-based systems, Generative AI models—such as large language models and adaptive learning algorithms—are capable of generating human-like responses, personalized evaluations, and contextual feedback in real time.

Assessment and feedback are central to the learning process, as they guide students in understanding their academic progress, identifying knowledge gaps, and improving performance. However,

conventional assessment methods in higher education often face challenges such as delayed feedback, standardized evaluation approaches, limited individualization, and increasing faculty workload due to growing student numbers. These limitations reduce the formative value of assessments and may hinder student learning outcomes.

Generative AI–based assessment and feedback systems offer innovative solutions by automating evaluation tasks, generating instant and personalized feedback, and supporting adaptive learning pathways. These systems can analyze student responses, detect patterns in learning behavior, and provide targeted suggestions for improvement. As a result, students receive continuous formative feedback, while instructors benefit from reduced administrative burden and enhanced instructional insights.

Despite these advantages, the adoption of Generative AI in assessment raises concerns related to academic integrity, transparency, data privacy, and ethical accountability. Therefore, it is essential to empirically evaluate the effectiveness of AI-based assessment systems and examine their influence on student learning outcomes. This study aims to assess the impact of Generative AI–based assessment and feedback systems on academic performance, engagement, and learner satisfaction in higher education.

2. Review of Literature

Ardito (2023), in the study titled *"Contra generative AI detection in higher education assessments,"* examined the reliability of AI-detection tools used to identify AI-generated academic content. The primary objective was to evaluate whether detection-based approaches can effectively uphold academic integrity in the era of generative AI. The study adopted a conceptual and critical analysis methodology, reviewing existing detection technologies and their applications in higher education. The findings revealed that AI-detection tools are often unreliable, producing both false positives and false negatives. The study emphasized that institutions should move away from detection-focused strategies and instead redesign assessment methods to encourage originality, critical thinking, and authentic student engagement. **Cotton, Cotton, and Shipway (2023),** in their article *"Chatting and cheating: Ensuring academic integrity in the era of ChatGPT,"* investigated the implications of generative AI on academic honesty. The objective of the study was to understand how AI tools influence student behavior and assessment practices. Using a qualitative methodology based on policy analysis and emerging educational practices, the study found that generative AI significantly increases the risk of academic misconduct. The authors recommended the adoption of authentic and application-based assessments, along with updated institutional policies, to mitigate the misuse of AI technologies in academic environments. **Kasneci et al. (2023),** in the study *"ChatGPT for good? On opportunities and challenges of large language models in education,"* explored both the potential benefits and limitations of large language models in educational contexts. The objective was to assess how generative AI can support teaching, learning, and assessment. The study employed a comprehensive literature review and conceptual analysis methodology. The findings indicated that AI tools can enhance personalized learning, automate feedback, and support student engagement. However, the study also highlighted concerns related to misinformation, algorithmic bias, and lack of transparency, emphasizing the need for responsible and ethical implementation. **Damiano, Lauría, Sarmiento, and Zhao (2024),** in their study titled *"Early perceptions of teaching and learning using generative AI in higher education,"* aimed to analyze the perceptions of students and faculty regarding the use of generative AI tools. The study used a survey-based quantitative methodology involving participants from higher education institutions. The

findings revealed that both students and educators generally perceive AI tools as useful and easy to use. However, concerns regarding trust, ethical usage, and over-dependence on AI systems were also reported, suggesting the need for balanced integration. **Lee and Moore (2024),** in the study *"Harnessing generative AI for automated feedback in higher education: A systematic review,"* focused on evaluating the effectiveness of AI-based feedback systems. The objective was to synthesize findings from existing studies on automated feedback mechanisms. Using a systematic review methodology, the authors analyzed multiple peer-reviewed articles. The findings indicated that generative AI enhances feedback quality by providing real-time, personalized, and scalable responses. Despite these advantages, challenges related to pedagogical alignment and integration into existing curricula were identified. **Perkins, Roe, and Furze (2024),** in their work *"The AI assessment scale revisited: A framework for educational assessment,"* aimed to develop a structured framework for integrating AI into assessment practices. The study adopted a conceptual framework development methodology based on existing theories and models. The findings introduced the AI Assessment Scale (AIAS), which provides a systematic approach to incorporating AI into educational assessments while maintaining ethical standards. The framework emphasizes transparency, student engagement, and responsible AI usage. **Furze, Perkins, Roe, and MacVaugh (2024),** in the study *"The AI assessment scale in action: A pilot implementation of GenAI-supported assessment,"* examined the practical application of the AIAS framework. The objective was to assess its effectiveness in real educational settings. The study employed a pilot implementation methodology involving students using AI-assisted assessment tools. The findings demonstrated improved student engagement, enhanced academic performance, and reduced instances of academic misconduct, indicating the effectiveness of structured AI integration. **Williams (2024),** in the study *"Comparison of generative AI performance on undergraduate and postgraduate written assessments in the biomedical sciences,"* aimed to compare AI-generated responses with student performance. The study used an experimental research design, analyzing responses produced by AI and students. The findings revealed that generative AI performs comparably to students in certain academic tasks. This raises important concerns regarding assessment authenticity and highlights the need for redesigning evaluation strategies to ensure fairness and originality.

Xia, Weng, Ouyang, Lin, and Chiu (2024), in their study *"A scoping review on how generative artificial intelligence transforms assessment in higher education,"* aimed to explore the broader impact of AI on assessment practices. Using a scoping review methodology, the authors analyzed recent literature on AI-driven assessment. The findings indicated that generative AI promotes adaptive learning, improves feedback mechanisms, and supports personalized education. However, the study also emphasized the need for institutional reforms, faculty training, and ethical governance. **Farrokhnia, Latifi, and others (2026),** in the study *"Generative AI offers more, but students revise less: Comparing the effects of teacher and AI feedback on student essay revisions,"* aimed to compare the effectiveness of AI-generated feedback with teacher feedback. The study used an experimental methodology involving student writing and revision tasks. The findings showed that while AI provides more detailed and immediate feedback, students tend to engage less deeply in revision compared to teacher feedback. The study concluded that a hybrid approach combining AI and human feedback is more effective for improving learning outcomes.

3. Objectives of the Study

1. To analyze students' perceptions of Generative AI–based assessment and feedback systems.

2. To examine the impact of AI-based feedback on academic performance.
3. To study the relationship between AI-based assessment and learner engagement.
4. To identify ethical and implementation challenges of Generative AI in assessment.

4 Hypotheses of the Study

- **H1:** Generative AI–based assessment systems have a significant impact on student academic performance.
- **H2:** AI-based feedback significantly enhances student engagement and motivation.
- **H3:** There is a significant relationship between personalized AI feedback and self-regulated learning.
- **H4:** Ethical concerns significantly influence students' acceptance of AI-based assessment systems.

5. Research Methodology

5.1 Research Design

A mixed-method research design was adopted to ensure a comprehensive analysis of the impact of Generative AI–based assessment systems. The quantitative component involved structured survey data to measure students' perceptions, academic performance, and engagement levels, while the qualitative component captured students' experiences, opinions, and feedback regarding AI-based learning tools. This combination enabled triangulation of data, improving the validity and reliability of the findings. The design was suitable for examining both measurable outcomes and subjective learning experiences associated with AI-driven assessment practices.

5.2 Sample Size

The study was conducted among 250 undergraduate and postgraduate students drawn from different academic disciplines. A stratified random sampling technique was employed to ensure fair representation across levels of study and gender categories. This method helped in minimizing sampling bias and improving generalizability of results. The selected sample size was considered adequate for statistical analysis, allowing the application of inferential techniques such as t-tests and regression analysis while maintaining reliability and consistency in findings.

5.3 Data Collection

Primary data were collected using a well-structured questionnaire designed on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." The questionnaire included items related to academic performance, engagement, feedback quality, and ethical concerns of AI-based systems. Secondary data were gathered from institutional reports, academic journals, and relevant publications to support theoretical understanding. The combination of primary and secondary data enhanced the depth of analysis and ensured a comprehensive evaluation of the research problem.

5.4 Tools for Analysis

Various statistical tools were employed to analyze the collected data effectively. Simple percentage analysis was used to interpret demographic characteristics and general responses. A paired sample t-test was applied to compare pre- and post-assessment performance. Pearson correlation analysis measured the relationship between AI feedback and student engagement. Multiple regression analysis was used to determine the influence of independent variables such as feedback timeliness and personalization on overall learning outcomes, ensuring robust and meaningful conclusions.

6 Data Analysis and Interpretation

Table 1: Demographic Profile of Respondents (n = 250)

Category	Frequency	Percentage
Undergraduate	150	60.0
Postgraduate	100	40.0
Male	128	51.2
Female	122	48.8

The demographic profile indicates that the sample consists of a higher proportion of undergraduate students (60%) compared to postgraduate students (40%), ensuring adequate representation of early-stage learners while still including advanced-level participants. Gender distribution is nearly balanced, with 51.2% male and 48.8% female respondents, which enhances the reliability and neutrality of the findings. This balanced composition suggests that the study captures diverse perspectives across academic levels and gender groups, thereby improving the generalizability of results related to Generative AI–based assessment systems in higher education.

Table 2: Students' Perception of AI-Based Feedback

Statement	Agree (%)	Neutral (%)	Disagree (%)
Feedback is timely	78.4	12.0	9.6
Feedback is personalized	74.0	15.6	10.4
Improves understanding	81.2	9.2	9.6

The results indicate a strong positive perception of AI-based feedback among students. A majority (78.4%) agree that feedback is timely, highlighting the advantage of instant responses compared to traditional methods. Similarly, 74% of respondents perceive the feedback as personalized, suggesting that AI systems effectively cater to individual learning needs. Notably, 81.2% of students agree that AI-based feedback improves their understanding, indicating its significant role in enhancing learning outcomes. The relatively low percentage of disagreement across all statements reflects general acceptance and satisfaction with AI-driven feedback mechanisms in higher education.

Table 3: Paired Sample t-Test on Academic Performance

Variable	Mean (Pre)	Mean (Post)	t-value	p-value
Test Scores	62.45	74.88	9.36	<0.01

The paired sample t-test results show a significant improvement in students' academic performance after the implementation of AI-based assessment systems. The mean score increased from 62.45 (pre-assessment) to 74.88 (post-assessment), indicating a substantial gain in learning outcomes. The calculated t-value of 9.36 with a p-value less than 0.01 confirms that the difference is statistically significant. This suggests that AI-driven feedback and assessment have a positive impact on student performance, supporting the effectiveness of Generative AI in enhancing academic achievement.
Since $p < 0.01$, **H1 is accepted**, indicating a significant improvement in academic performance after AI-based assessment.

Table 4: Correlation Between AI Feedback and Engagement

Variables	r-value	Significance
AI Feedback & Engagement	0.68	<0.01

Interpretation:
The correlation analysis reveals a strong positive relationship between AI-based feedback and student engagement, with an r-value of 0.68. Since the significance value is less than 0.01, the relationship is statistically significant. This indicates that timely and personalized AI feedback effectively enhances student participation, motivation, and overall engagement in learning activities.

Table 5: Multiple Regression Analysis

Dependent Variable: Learning Outcomes

Predictor Variables	β	t-value	Sig.
Timely Feedback	0.42	6.12	<0.01
Personalization	0.31	4.88	<0.01
Engagement	0.27	3.96	<0.01

$R^2 = 0.59$

Interpretation:
The multiple regression results indicate that timely feedback, personalization, and engagement significantly influence learning outcomes, as all predictors are statistically significant ($p < 0.01$). Timely feedback has the strongest impact ($\beta = 0.42$), followed by personalization ($\beta = 0.31$) and engagement ($\beta = 0.27$). The R^2 value of 0.59 suggests that 59% of the variation in learning outcomes is explained by these variables. This demonstrates the substantial role of AI-based feedback mechanisms in improving student learning effectiveness.

7. Results and Discussion

7.1 Impact on Academic Performance: The results reveal a statistically significant improvement in student performance after the introduction of AI-based assessment and feedback systems. The paired t-test indicates higher post-assessment scores compared to pre-assessment scores, suggesting enhanced conceptual clarity and continuous learning support.

7.2 Student Engagement and Learning Behavior: A majority of respondents reported increased engagement due to instant feedback and personalized suggestions. Generative AI systems enabled learners to identify weaknesses early, fostering self-regulated and independent learning.

7.3 Quality of Feedback: Students rated AI-generated feedback as timely, detailed, and actionable. Unlike traditional feedback, which is often delayed, AI-based systems provided immediate explanations, examples, and improvement strategies.

7.4 Ethical and Practical Challenges: Despite positive outcomes, respondents expressed concerns about over-dependence on AI tools, data privacy, and the potential misuse of AI-generated content for academic dishonesty. These findings align with previous studies emphasizing the need for ethical governance frameworks.

8. Outcome of the Study

- Generative AI–based assessment systems significantly enhance student learning outcomes.
- Immediate and personalized feedback improves engagement and motivation.

- AI-driven assessments support self-paced and adaptive learning.
- Ethical concerns and transparency issues remain critical barriers.
- Faculty training and institutional policies are essential for effective AI adoption.

9. Suggestions and Policy Implications

- Higher education institutions should integrate Generative AI as a **supportive tool**, not a replacement for human judgment.
- Clear ethical guidelines and data protection policies must be established.
- Faculty development programs should focus on AI literacy and pedagogical integration.
- Hybrid assessment models combining AI and human evaluation are recommended.

10. Conclusion

Generative AI–based assessment and feedback systems represent a transformative innovation in higher education, offering personalized, timely, and scalable evaluation mechanisms. The study demonstrates that these systems positively influence student learning outcomes, engagement, and satisfaction. However, responsible implementation grounded in ethical principles, transparency, and human oversight is crucial. As higher education continues to evolve in the digital age, Generative AI has the potential to redefine assessment practices and promote inclusive, learner-centered education.

ACKNOWLEDGMENT:

The author sincerely acknowledges and expresses gratitude to the Management of NGM College, Pollachi, Tamil Nadu, for their generous financial assistance through the SEED Money Support for this research work.

References:

1. Ardito, C. G. (2023). Contra generative AI detection in higher education assessments. *arXiv Preprint*. https://arxiv.org/abs/2312.05241
2. Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*. https://doi.org/10.1080/14703297.2023.2190148
3. Damiano, A. D., Lauría, E. J. M., Sarmiento, C., & Zhao, N. (2024). Early perceptions of teaching and learning using generative AI in higher education. *Journal of Educational Technology Systems, 52*(3). https://doi.org/10.1177/00472395241233290
4. Farrokhnia, M., Latifi, S., et al. (2026). Generative AI offers more, but students revise less: Comparing the effects of teacher and AI feedback on student essay revisions. *International Journal of Educational Technology in Higher Education.*
5. Furze, L., Perkins, M., Roe, J., & MacVaugh, J. (2024). The AI assessment scale in action: A pilot implementation of GenAI-supported assessment. *arXiv Preprint*. https://arxiv.org/abs/2403.14692
6. Holmes, W., Bialik, M., & Fadel, C. (2022). *Artificial intelligence in education: Promises and implications for teaching and learning*. Routledge.
7. Kasneci, E., Sessler, K., Küchemann, S., et al. (2023). ChatGPT for good? On opportunities and challenges of large language models in education. *Learning and Individual Differences, 103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

8. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.
9. Lee, S. S., & Moore, R. L. (2024). Harnessing generative AI for automated feedback in higher education: A systematic review. *Online Learning, 28*(3). https://doi.org/10.24059/olj.v28i3.4593
10. OECD. (2021). *Artificial intelligence, big data and education*. OECD Publishing. https://doi.org/10.1787/6c0e6c61-en
11. Perkins, M., Roe, J., & Furze, L. (2024). The AI assessment scale revisited: A framework for educational assessment. *arXiv Preprint*. https://arxiv.org/abs/2412.09029
12. Williams, A. (2024). Comparison of generative AI performance on undergraduate and postgraduate written assessments in the biomedical sciences. *International Journal of Educational Technology in Higher Education, 21*(52). https://doi.org/10.1186/s41239-024-00485-y
13. Williamson, B., & Eynon, R. (2023). Historical threads, missing links, and future directions in artificial intelligence in education. *Learning, Media and Technology, 48*(1), 1–15. https://doi.org/10.1080/17439884.2022.2133413
14. Xia, Q., Weng, X., Ouyang, F., Lin, T. J., & Chiu, T. K. F. (2024). A scoping review on how generative artificial intelligence transforms assessment in higher education. *International Journal of Educational Technology in Higher Education, 21*(40). https://doi.org/10.1186/s41239-024-00468-z
15. Zhai, X., He, P., & Li, Y. (2021). Artificial intelligence–based formative assessment and feedback in education. *Computers & Education, 168*, 104192. https://doi.org/10.1016/j.compedu.2021.104192