

REIMAGINING RESPONSIBLE GENERATIVE AI ASSESSMENT
IN INFORMATICS EDUCATION: INTEGRATING HUMAN AI
COLLABORATION LEARNING ANALYTICS AND ISLAMIC
ETHICAL INTELLIGENCE

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Keywords:	Abstract
Generative Artificial Intelligence, Human Ai Collaboration, Learning Analytics, Informatics Education, Islamic Ethical Intelligence	The rapid adoption of Generative Artificial Intelligence (GenAI) is transforming assessment practices in informatics education, creating new opportunities for personalized learning, automated feedback, and data-driven decision making. However, current assessment models often prioritize technological efficiency while overlooking human collaboration, ethical responsibility, and the moral dimensions of AI use. This conceptual study aims to develop a Responsible Generative AI Assessment Framework by integrating Human AI Collaboration, Learning Analytics, and Islamic Ethical Intelligence for informatics education in Islamic higher education. Using a qualitative library research approach, the study synthesizes contemporary literature on generative AI, responsible AI, learning analytics, educational assessment, informatics education, and Islamic educational philosophy. The proposed framework consists of five interconnected dimensions: responsible GenAI utilization, human AI collaborative assessment, learning analytics, informatics competency assessment, and Islamic ethical intelligence. These dimensions promote transparent, accountable, and human-centered assessment while fostering digital competence, critical thinking, academic integrity, and ethical decision making. The framework contributes to contemporary educational assessment by aligning technological innovation with Islamic ethical values and sustainable human-centered learning in the era of Generative AI.

INTRODUCTION

The emergence of Generative Artificial Intelligence (GenAI) has fundamentally reshaped teaching, learning, and assessment in higher education, particularly in informatics education where digital technologies constitute both the content and medium of learning. Tools powered by large language models, code generation, multimodal AI, and intelligent tutoring systems enable students to solve problems, generate programming solutions, analyze datasets, and receive immediate feedback. These innovations have shifted educational assessment from measuring final learning outcomes toward evaluating the learning process, creativity, collaboration, and higher-order thinking. Consequently, universities are increasingly challenged to redesign assessment systems that not only accommodate AI-supported learning but also ensure academic integrity,

transparency, and meaningful student engagement in an era where human and artificial intelligence coexist (Sofa, 2026).

The rapid integration of GenAI into higher education has also introduced complex pedagogical and ethical challenges. Conventional assessment models are becoming less effective in distinguishing students' independent competencies from AI-assisted outputs. At the same time, concerns regarding algorithmic bias, misinformation, data privacy, explainability, intellectual ownership, and excessive dependence on AI continue to grow. These issues are particularly significant in informatics education, where students are expected to master computational thinking, programming, artificial intelligence literacy, data literacy, cybersecurity awareness, and digital problem-solving while demonstrating responsible and ethical use of emerging technologies. Therefore, assessment can no longer focus exclusively on cognitive performance; it must also evaluate students' ability to collaborate responsibly with AI systems and exercise critical judgment in technology-enhanced learning environments (Sa'diya et al., 2026).

Within the context of Islamic higher education, assessment is expected to embody a holistic educational philosophy that integrates intellectual development with ethical conduct, spiritual maturity, and social responsibility. Islamic educational thought emphasizes values such as *amanah* (trustworthiness), *'adl* (justice), *ihsan* (excellence), *ṣidq* (honesty), and *maslahah* (public benefit), which are highly relevant to the responsible use of artificial intelligence. Simultaneously, learning analytics has emerged as a powerful tool for collecting and interpreting educational data to support personalized feedback, adaptive instruction, and evidence-based decision-making. However, the application of learning analytics should be guided by ethical principles that protect learner privacy, ensure fairness, and preserve the central role of educators. Integrating Islamic Ethical Intelligence with Human AI Collaboration and learning analytics therefore offers a more balanced approach in which technological innovation strengthens rather than diminishes human values in education (Khair et al., 2026).

Although previous studies have investigated Generative AI, learning analytics, AI literacy, and digital assessment independently, relatively limited research has proposed an integrated assessment framework that combines Responsible Generative AI, Human AI Collaboration, Learning Analytics, and Islamic Ethical Intelligence within informatics education. Existing models generally emphasize technological efficiency or assessment automation without sufficiently addressing ethical reasoning, spiritual values, and collaborative intelligence between humans and AI. Accordingly, this study aims to develop a Responsible Generative AI Assessment Framework that reimagines assessment in informatics education by integrating technological innovation with human-centered learning and Islamic ethical principles (Mh et al., 2026). The proposed framework is expected to contribute to the theoretical development of AI-supported assessment while providing practical guidance for designing transparent, accountable, competency-based, and ethically grounded assessment systems in Islamic higher education.

LITERATURE REVIEW

The rapid development of Generative Artificial Intelligence (GenAI) has significantly transformed the landscape of higher education, particularly in informatics education where AI technologies have become integral to teaching, learning, and assessment. Unlike conventional artificial intelligence, GenAI is capable of generating text, source code, images, and problem-solving strategies that support students in

completing complex academic tasks. Recent studies indicate that GenAI enhances learning through intelligent tutoring, automated feedback, adaptive assessment, and personalized learning experiences. Nevertheless, scholars also caution that unrestricted AI use may lead to overdependence, reduced critical thinking, plagiarism, and challenges in verifying authentic student performance. Consequently, contemporary educational assessment is shifting from evaluating products alone toward assessing students' reasoning processes, AI-assisted problem-solving, and reflective learning (Qomariah et al., 2026).

A growing body of literature emphasizes the concept of Human AI Collaboration, which positions artificial intelligence as a collaborative partner rather than a replacement for human intelligence. Human AI Collaboration promotes complementary interactions in which AI contributes computational efficiency, data processing, and automation, while humans provide critical thinking, ethical judgment, creativity, contextual interpretation, and decision-making. In informatics education, this collaborative paradigm encourages students to utilize AI responsibly for programming, debugging, algorithm design, and computational problem-solving while maintaining accountability for the quality, originality, and ethical implications of their work. This perspective aligns with human-centered learning theories, which recognize educators and learners as the primary agents of meaningful knowledge construction, with AI serving as an intelligent support system rather than an autonomous evaluator (Zainal & Sofa, 2026).

Another important dimension is Learning Analytics, which employs educational data to monitor learning behavior, predict academic performance, and provide evidence-based interventions. Through digital learning platforms, learning analytics enables lecturers to evaluate students' engagement, competency development, and learning progress in real time. When integrated with AI technologies, learning analytics supports adaptive assessment by generating personalized feedback and identifying learning needs more accurately than conventional assessment methods. However, researchers consistently highlight ethical concerns regarding data privacy, transparency, algorithmic fairness, informed consent, and responsible governance of educational data. These concerns have led to the emergence of Responsible AI, which advocates for transparent, explainable, accountable, and equitable AI systems that prioritize human welfare and educational integrity (Islam et al., 2026).

From the perspective of Islamic educational philosophy, assessment extends beyond measuring academic achievement to encompass the development of ethical character, spiritual awareness, and social responsibility. Islamic Ethical Intelligence is grounded in values such as *amanah* (trustworthiness), *sidq* (honesty), *'adl* (justice), *ihsan* (excellence), *taqwa* (God-consciousness), and *maslahah* (public benefit), all of which provide ethical guidance for the responsible use of artificial intelligence in education. Despite the increasing number of studies on GenAI, Human AI Collaboration, Learning Analytics, and AI ethics, relatively few have integrated these concepts into a unified assessment framework for informatics education within Islamic higher education (Putri & Sofa, 2026). This study addresses this gap by proposing a Responsible Generative AI Assessment Framework that combines technological innovation with Islamic Ethical Intelligence and human-centered learning, thereby contributing a holistic paradigm for competency-based, ethical, and sustainable assessment in the era of Generative AI (Abd Salam et al., 2026).

RESEARCH METHODS

This study employed a qualitative library research design to develop a conceptual framework for Responsible Generative AI Assessment in informatics education by integrating HumanAI Collaboration, Learning Analytics, and Islamic Ethical Intelligence. Library research was selected because the study aimed to synthesize and reconstruct theoretical perspectives rather than collect empirical field data. The analysis was based on scholarly literature concerning Generative Artificial Intelligence, Responsible AI, educational assessment, informatics education, learning analytics, human-centered learning, and Islamic educational philosophy. Data sources included peer-reviewed journal articles, academic books, conference proceedings, international policy documents, and recent publications indexed in reputable databases, with priority given to studies published within the last five years to ensure the framework reflects current developments in Artificial Intelligence in Education (AIED) (Hasanah & Sofa, 2026).

The collected data were analyzed using qualitative content analysis following the interactive model of Miles, Huberman, and Saldaña, consisting of data condensation, data display, and conclusion drawing/verification. The analysis focused on identifying conceptual relationships among Responsible Generative AI, HumanAI Collaboration, Learning Analytics, informatics competencies, and Islamic Ethical Intelligence. To strengthen the credibility of the findings, source triangulation was conducted by comparing theoretical perspectives from educational technology, artificial intelligence, informatics education, educational assessment, and Islamic education literature. The synthesis of these sources resulted in the formulation of an integrated conceptual framework for responsible, human-centered, and ethically grounded AI-supported assessment in informatics education within Islamic higher education.

RESULTS AND DISCUSSION

The literature synthesis reveals that the emergence of Generative Artificial Intelligence (GenAI) has fundamentally transformed assessment practices in informatics education. Unlike conventional digital assessment, GenAI enables adaptive feedback, automated code evaluation, intelligent content generation, and personalized learning support. These capabilities improve assessment efficiency while allowing lecturers to monitor students' learning progress continuously. However, the review also indicates that unrestricted reliance on GenAI may weaken students' computational thinking, problem-solving abilities, academic integrity, and independent learning. Recent scholarship therefore emphasizes that assessment should move beyond evaluating AI-generated outputs toward assessing students' reasoning processes, decision-making, creativity, and responsible engagement with AI technologies. This finding demonstrates that the future of assessment depends on balancing technological innovation with authentic evidence of student competence (Saputra & Sofa, 2026).

The analysis further highlights the importance of HumanAI Collaboration as a new paradigm in informatics education. Rather than viewing artificial intelligence as a substitute for human intelligence, contemporary educational theories position AI as an intelligent partner that enhances learning through collaboration. Within this paradigm, AI performs computational tasks such as code generation, data analysis, debugging, and personalized feedback, while students remain responsible for critical thinking, ethical reasoning, contextual interpretation, and final decision-making. Consequently,

assessment should evaluate students' ability to collaborate effectively with AI by examining prompt design, validation of AI-generated responses, reflective thinking, originality, and responsible technology use. Such an approach shifts assessment from measuring technical outcomes alone to assessing collaborative intelligence and higher-order cognitive competencies required in the era of Generative AI (Wulandari & Sofa, 2026).

The findings also demonstrate that Learning Analytics provides a strategic foundation for intelligent assessment by transforming educational data into meaningful information for improving learning quality. Learning analytics enables lecturers to monitor learner engagement, identify competency gaps, predict academic performance, and provide timely interventions through evidence-based decision-making. Nevertheless, the increasing use of educational data introduces important ethical challenges concerning privacy protection, algorithmic transparency, fairness, accountability, and informed consent. From the perspective of Islamic Ethical Intelligence, these challenges should be addressed through values such as *amanah* (trustworthiness), *sidq* (honesty), *'adl* (justice), *ihsan* (excellence), and *maslahah* (public benefit). Accordingly, learning analytics should function not merely as a technological monitoring system but as an ethical decision-support mechanism that protects students' rights while promoting responsible, equitable, and human-centered assessment practices (Qumariyah et al., 2026).

Based on the integration of the reviewed literature, this study proposes a Responsible Generative AI Assessment Framework consisting of five interconnected dimensions: (1) Responsible GenAI Utilization, ensuring transparent, explainable, and accountable AI-supported assessment; (2) HumanAI Collaborative Assessment, evaluating students' ability to interact critically and responsibly with AI technologies; (3) Learning Analytics, employing educational data for continuous, evidence-based, and personalized assessment; (4) Informatics Competency Assessment, measuring computational thinking, programming proficiency, AI literacy, data literacy, cybersecurity awareness, and digital problem-solving; and (5) Islamic Ethical Intelligence, assessing integrity, ethical decision-making, digital responsibility, spiritual awareness, and social accountability throughout the assessment process. This integrated framework extends conventional assessment models by combining technological innovation with ethical governance and human-centered learning. The proposed model contributes theoretically to the emerging discourse on Responsible AI in Education while providing practical guidance for designing sustainable, competency-based, and ethically grounded assessment systems in informatics education within Islamic higher education.

CONCLUSION

This study concludes that the rapid adoption of Generative Artificial Intelligence (GenAI) requires a fundamental transformation of assessment practices in informatics education, particularly within Islamic higher education. Conventional assessment models that primarily measure cognitive achievement are no longer sufficient to evaluate students' competencies in AI-supported learning environments. The literature synthesis demonstrates that effective assessment should integrate Responsible GenAI, HumanAI Collaboration, Learning Analytics, informatics competencies, and Islamic Ethical Intelligence to provide a more comprehensive evaluation of students' knowledge, technical skills, ethical responsibility, critical thinking, and spiritual development. Such

an approach positions artificial intelligence as an educational partner that supports, rather than replaces, human judgment and meaningful learning.

This study proposes a Responsible Generative AI Assessment Framework comprising five interconnected dimensions: responsible AI utilization, HumanAI collaborative assessment, learning analytics, informatics competency assessment, and Islamic ethical intelligence. The framework contributes theoretically by extending the discourse on AI-supported assessment through the integration of educational technology, informatics education, learning analytics, and Islamic educational philosophy into a unified conceptual model. Practically, it provides guidance for universities, curriculum developers, and lecturers in designing transparent, accountable, competency-based, and human-centered assessment systems that foster responsible AI use and holistic student development. Future studies are recommended to empirically validate the proposed framework across different informatics education contexts and investigate its effectiveness in improving learning outcomes, digital competence, and ethical decision-making in the era of Generative Artificial Intelligence.

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