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Exploring the Role of AI-Based Assessment and Feedback Mechanisms in Higher Education

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Abstract-- Assessment and feedback constitute critical components of the higher education ecosystem, influencing students, instructors, and administrators alike. Traditional assessment methods face limitations including heavy educator workload, provision of discrete performance snapshots rather than comprehensive learning insights, lack of personalization, and potential inauthenticity. This paper examines how artificial intelligence technologies can transform assessment and feedback practices in higher education environments. Through theoretical analysis and exploration of practical applications, this study demonstrates that AI-powered tools offer opportunities for personalized feedback systems, automated grading, continuous monitoring, and novel assessment formats that measure twenty-first-century skills beyond conventional academic knowledge.

Keywords-- Artificial Intelligence, Assessment, Feedback, Higher Education, Educational Technology, Formative Assessment, Summative Assessment

I. INTRODUCTION

Well-designed assessments serve as fundamental instruments for determining student learning outcomes (Almond, Steinberg, & Mislavy, 2002). In contemporary higher education environments, assessment and feedback represent focal points that significantly impact all stakeholders within the academic community. Despite educators investing substantial time in assessment and feedback processes, limited progress has been made in strategizing assessment approaches, developing reliable feedback mechanisms, and analyzing their collective impact on educational outcomes.

The emergence of artificial intelligence presents transformative potential for reimagining the relationship between students and assessment feedback. Assessment represents perhaps the most significant domain where artificial intelligence can catalyze fundamental change in educational practice. However, this transformation extends beyond conventional assessment paradigms.

AI-enabled assessment employs dramatically different artifacts and processes compared to traditional methodologies, potentially heralding the abandonment and replacement of established assessment practices and, consequently, transforming broader educational processes (Cope, Kalantzis, & Sears, 2021).

There exists broad consensus among educational technologists that artificial intelligence will emerge as one of the most valuable technologies in coming years, functioning in conjunction with complementary innovations including robotics, virtual reality, 3D printing, and advanced networking capabilities.

II. RATIONALE FOR THE STUDY

Traditional assessment practices—encompassing multiple-choice questions, essays, and short-answer formats—have been extensively employed to infer student knowledge and learning (Kaipa, 2021). However, these conventional approaches present several significant challenges that warrant reconsideration.

First, traditional assessments can be onerous for educators to design and implement, consuming valuable time and cognitive resources. Second, they frequently provide only discrete snapshots of student performance rather than offering nuanced, comprehensive views of learning progression. Third, traditional assessments often employ uniform approaches that remain unadapted to the particular knowledge, skills, and backgrounds of individual participants, potentially disadvantaging diverse learners. Fourth, they may lack authenticity, adhering primarily to the culture of schooling rather than reflecting the authentic contexts and competencies that education should prepare students to navigate.

Research examining how methodologies applied in artificial intelligence can enhance assessment processes remains limited. The primary objective of this study is to provide theoretical frameworks and practical approaches that facilitate improved understanding of assessment and feedback practices applicable to enhancing student outcomes in higher education settings.



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III. EDUCATIONAL APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Artificial intelligence has found particularly relevant applications within educational domains. The conceptual origins of automatic learning processes trace back to B.F. Skinner's teaching machine and programmed learning theories (Fry, 1960), though substantial evolution has occurred since these foundational developments.

The significance of AI in education gained international recognition at the 2019 Beijing Conference, where experts convened to establish the "Beijing Consensus on AI and Education." This document emphasizes the importance of promoting artificial intelligence in education, aligning with UNESCO's Sustainable Development Goal 4, which addresses quality education and lifelong learning opportunities (Beijing Consensus on Artificial Intelligence and Education; UNESCO: Paris, France, 2019).

IV. AI-POWERED ASSESSMENT IN HIGHER EDUCATION

- *Formative and Summative Assessment Applications*

The capabilities of artificial intelligence can be leveraged across both primary assessment categories in higher education: formative and summative assessments.

Formative Assessment: Contemporary formative assessment applications encompass diverse functionalities ranging from discussion forums to quizzing platforms, polling systems, and student response mechanisms for interactive lessons and video content. Artificial intelligence primarily contributes to formative evaluation processes and facilitates automatic grading of student work. AI-based assessments enable the provision of personalized feedback on student performance, adapting to individual learning needs and progress patterns.

Summative Assessment: When artificial intelligence-based tools are employed in summative assessment contexts, they significantly reduce time duration requirements and enhance manual correction activities. AI integration in educational assessment enables performance measurement through scored constructed responses, liberating educators from time-consuming hand-scoring obligations.

Several AI-powered tools have emerged to support assessment practices, including Book Widgets, Quizlet, EDpuzzle, and Insert Learning, among others.

- *Key AI Applications for Assessment*

1 *From Onerous to Feasible*

Artificial intelligence can generate assessment tasks, identify appropriate peers for grading work, and automatically score student submissions, transforming previously labor-intensive processes into manageable educational activities.

2 *AI-Assisted Peer Assessment*

Various educational platforms have been developed to support peer assessment processes, including Mechanical TA (Wright, Thornton, & Leyton-Brown, 2015), Dear Beta and Dear Gamma (Glassman, Lin, Cai, & Miller, 2016), Aropa (Purchase & Hamer, 2018), and CrowdGrader (De Alfaro & Shavlovsky, 2014). These systems facilitate structured peer review while incorporating AI elements to enhance reliability and fairness.

3 *Writing Analytics*

Several systems have been developed and implemented for automated essay scoring. MI Write (Graham, Hebert, & Harris, 2015) represents a notable example of such technology, employing sophisticated algorithms to evaluate written compositions across multiple dimensions of writing quality.

4 *Electronic Assessment Platforms*

Electronic assessment platforms (EAPs) offer key advantages including the ability to deliver questions that would prove difficult or impossible to administer on paper—such as questions incorporating multimedia elements. These platforms can present questions in predetermined or randomized sequences while providing learners with rapid and personalized feedback (Dennick, Wilkinson, & Purcell, 2009).

5 *Stealth Assessment*

The term "stealth assessment" was coined by Shute and Ventura (2013) to describe an approach utilizing data automatically collected from learners as they engage with digital games. Their research developed measures of conscientiousness, creativity, and physics ability by analyzing data generated through interaction with digital physics games commonly employed in educational settings. This methodology enables assessment to occur seamlessly within learning activities rather than as separate evaluative events.

V. AI-POWERED FEEDBACK MECHANISMS

Providing feedback constitutes one of many pedagogical tasks educators perform to guide students toward increased learning and performance. Research identifies feedback as one of the most powerful practices for enhancing student learning (Henderson et al., 2019). However, when classes contain numerous students—a common scenario in higher education—providing effective individual guidance to all students becomes extremely challenging for instructors.

Research has demonstrated that effective feedback and action recommendations prove essential for self-regulated learning (SRL) and correlate significantly with students' learning outcomes and performance (Algayres and Triantafyllou, 2020).

▪ *AI-Enhanced Feedback Delivery*

Artificial intelligence can address feedback challenges by providing customizable, safe platforms for early rounds of feedback, helping students become accustomed to dialogic feedback processes. Through chatbot technologies, students can select the gender and conversational approach of their AI assistant—for instance, choosing a male voice with an informal communication style—thereby personalizing their feedback experience.

▪ *Alternative Feedback Modalities*

Universities can explore diverse feedback modalities including audio or voice-note feedback, video or screencast feedback, and graphic feedback employing mind maps and sketch-notes where concepts are represented through figures, icons, and arrows. Artificial intelligence can support institutional efforts to implement and scale these alternative feedback formats, making them more accessible and manageable for educators.

VI. DISCUSSION

Artificial intelligence currently represents one of the primary technologies being applied across all fields and educational levels. However, its adoption in education remains limited, likely attributable to knowledge gaps among potential users (Espinosa et al., 2020). Nevertheless, AI is positioned to become one of the principal tools employed in educational contexts. The primary applications of AI in education relate to tutoring and assessment functions (Perikos, Grivokostopoulou, & Hatzilygeroudis, 2017).

It is crucial to emphasize that artificial intelligence cannot and should not replace face-to-face feedback interactions.

Rather, AI can help dismantle barriers inhibiting students' capacity to receive feedback, thereby supporting the development of lifelong skills necessary for constructive dialogue. These considerations position AI as a phenomenon worthy of thoughtful and careful exploration within educational contexts.

Educational institutions must approach AI integration with careful consideration of pedagogical goals, ethical implications, and the preservation of human elements in teaching and learning. While AI offers powerful capabilities for scaling personalized feedback and reducing educator workload, the technology should augment rather than replace human judgment and interpersonal connection in educational contexts.

VII. CONCLUSION AND FUTURE DIRECTIONS

Artificial intelligence in assessment demonstrates significant potential to create more personalized feedback systems and enhance overall learning experiences. AI-powered tools can continuously monitor, assess, and evaluate students, providing valuable quantitative and qualitative information that informs instructional decisions.

Through automation and data-driven insights, educators can more effectively identify learning gaps and provide targeted interventions for struggling students. This capability proves particularly valuable in higher education contexts where large class sizes often prevent individualized attention.

As artificial intelligence becomes increasingly integrated into assessment processes, it may enable novel assessment formats that measure competencies beyond traditional academic knowledge, including creativity, collaboration, and critical thinking—skills increasingly recognized as essential for success in contemporary professional and civic contexts.

The continued development and implementation of AI-based assessment and feedback mechanisms will require ongoing research to evaluate effectiveness, address equity concerns, and refine technological capabilities. Educational institutions must invest in professional development to ensure educators can effectively leverage these tools while maintaining pedagogical integrity and student-centered approaches to teaching and learning.

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