Chapter 11
Designing Transparent and Adaptive Evaluation Systems in AI-Based Learning Environments

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ABSTRACT

In this study, a new framework for designing adaptive and transparent assessment systems in smart learning environments is presented. Relying on large language models and modular architecture, a four-layer structure including data analysis, cognitive processing, adaptive decision-making, and explanatory feedback is designed that responds to educational and training needs with an ethics-based approach. Considerations related to algorithmic transparency, educational justice, psychological support, and privacy protection are integrated into this framework. The results show that such systems can enable meaningful and human learning in the context of advanced technologies.

1. INTRODUCTION

In today's world, where AI-based technologies are increasingly penetrating all aspects of life, education and learning are no exception. One of the fundamental challenges in modern learning environments is designing assessment systems that are not only accurate and fair, but also have the ability to adapt to the individual characteristics of learners. In the meantime, large language models, as one of the most advanced AI tools, have provided unique capabilities for shaping adaptive and

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transparent assessment systems. These models can help generate, modify, analyze, and explain assessments through natural language processing and complex data analysis, in a way that was previously only possible for humans.

Traditional assessment systems, especially in formal educational settings, are often static, unable to recognize individual differences, and lack sufficient transparency in analyzing learner performance. This lack of transparency not only reduces learner trust in the education system, but also eliminates the possibility of effective and targeted feedback (Sari, Tumanggor, & Efron, 2024). On the other hand, in many cases, existing tests and assessment methods are designed to measure only low-level cognitive abilities and do not pay attention to deeper analyses such as critical thinking, moral reasoning, or problem-solving ability (Nozari, Ghahremani-Nahr, & Najafi, 2023). In contrast, data-driven intelligent learning environments have the capacity to not only dynamically and adaptively implement the assessment process by leveraging artificial intelligence, but also to improve transparency in the production of results, model interpretability, and the quality of feedback (Rahmaty & Nozari, 2023).

With the advent of large language models, it has become possible to design assessments that adapt to learner responses in real time, adjust the difficulty of questions to the current level of knowledge, and at the same time provide explanations for the results that are understandable to the learner. This explainability is a key element of transparency in AI-based assessment systems (Movahed, Movahed, & Nozari, 2024). Unlike traditional algorithms, whose inner workings remain a black box to users, LLMs can provide natural language explanations that help the audience better understand the assessment process and communicate with its results (Movahed, Movahed, & Nozari, 2024). At the same time, these systems have the ability to analyze behavioral, temporal, and conceptual patterns in the learner's responses and are able to build a mental and cognitive model of the learner over time and use it as the basis for future assessments (Nozari, 2023).

The issue of transparency in assessment is not only a technical issue, but also a serious ethical concern. When the results of an assessment are the basis for educational, employment, or even social decisions, it is essential that the assessment process is traceable and explainable to all stakeholders. Lack of transparency can lead to bias, inequality, and ultimately distrust in educational systems (Strielkowski et al., 2025). In this regard, the use of LLMs should be done in a way that is ethically justifiable and does not make the audience a mere passive consumer of technology, but rather an active part of the learning and assessment process. Especially in environments where education is linked to transformative goals and deep learning, transparency and adaptability of assessments are recognized as critical criteria for educational quality (Szmelter-Jarosz, Ghahremani-Nahr, & Nozari, 2021).