MEASURING THE EFFECTIVENESS OF PEDAGOGICAL DIAGNOSTICS THROUGH ARTIFICIAL INTELLIGENCE: RESEARCH AND PRACTICAL ANALYSIS

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Abstract. *This scientific article explores methods for evaluating the effectiveness of artificial intelligence (AI)-based diagnostic systems in education. Through statistical data and comparative analysis, it highlights the advantages and disadvantages of AI-based diagnostic systems compared to traditional methods. The results aim to contribute to the improvement of educational assessment tools using AI technologies.*

Key words: *Artificial Intelligence, Pedagogical Diagnostics, Educational Effectiveness, Machine Learning, Data Analysis, Student Assessment, Teaching Quality, Intelligent Systems, Educational Measurement, Learning Analytics, Predictive Modeling, Research Methods, Practical Applications, Digital Education, Innovation in Pedagogy.*

Introduction.

Pedagogical diagnostics is a crucial component of modern education, enabling the identification of students' learning needs, strengths, and weaknesses. Although traditional diagnostic systems have proven effective, they lack the adaptability and speed required in today's dynamic educational environment. AI is increasingly viewed as a promising tool for enhancing the efficiency and accuracy of diagnostic processes.

Problem Statement

Despite the widespread use of AI technologies in education, research specifically focused on evaluating the effectiveness of AI-based diagnostic systems remains underdeveloped. Key questions remain unanswered: How do these systems compare to traditional methods? What are their measurable benefits and limitations?

Research Objectives

- To analyze methodologies used to measure the effectiveness of AI-based pedagogical diagnostics.

- To compare AI systems with traditional methods based on statistical evidence.

- To develop practical recommendations for educators and policymakers for the effective implementation of AI technologies.

- What metrics can be used to assess the effectiveness of AI-based diagnostic systems?

- How do AI diagnostics perform in terms of accuracy, efficiency, and scalability compared to traditional approaches?

Methodology

This study employs a mixed-methods approach, combining quantitative analysis of diagnostic accuracy and efficiency with qualitative evaluation of feedback from educators and students.

The research involved 500 students and 50 educators from various educational institutions. Two diagnostic systems were tested: an AI-based diagnostic platform and a traditional system (paper-based and observational methods). The following metrics were evaluated:

- **Diagnostic Accuracy** (measured by alignment with expert assessments),

- **Time Efficiency** (measured by the time taken to complete diagnostics),

- **User Satisfaction** (measured via surveys and interviews).

Statistical tests, including t-tests and ANOVA, were used to compare the performance of the two systems. Qualitative data from surveys and interviews were analyzed using thematic coding.

Results

In terms of accuracy, the AI system showed an 87% alignment with expert evaluations, while traditional methods demonstrated 72%. The AI-based diagnostic process reduced completion time by an average of 40%. Regarding scalability, the AI system efficiently covered a larger number of students simultaneously while maintaining consistent results.

Educators highly appreciated the AI system's ability to provide detailed real-time analytics but expressed concerns about the transparency of AI decision-making processes. Students found AI diagnostics more engaging and less intimidating compared to traditional evaluations.

The AI system's ability to quickly process large datasets enables timely interventions in educational settings. AI algorithms reduce human error and provide data-driven insights. They also adapt to individual learning needs and offer personalized recommendations.

However, a lack of understanding of how AI algorithms function may lead to distrust among educators and students. AI systems require robust technological infrastructure, which may not be available in every institution. Additionally, AI diagnostics may inherit biases present in the training data.

While traditional methods are perceived as more transparent and user-friendly, they are time-consuming and less scalable. AI diagnostics offer significant improvements but require cautious and strategic implementation.

Conclusion and Recommendations

The study concludes that AI-based diagnostic systems outperform traditional methods in terms of accuracy, efficiency, and scalability. However, challenges related to transparency and infrastructure must be addressed.

Educational institutions should consider integrating AI systems into diagnostic processes, ensuring educator training and the resolution of ethical issues.

Future research should focus on:

- Developing frameworks to enhance the transparency of AI decision-making in diagnostics.

- Studying the long-term impact of AI diagnostics on student outcomes.

- Evaluating the cost-effectiveness of implementing AI in various educational contexts.

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