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Innovation of Adaptive Learning Based on Artificial Intelligence

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ABSTRACT

The development of digital technology encourages transformation across various sectors, including education. Adaptive learning based on Artificial Intelligence (AI) is an innovation that enables the teaching and learning process to take place in a personalized, dynamic manner, and aligned with students' characteristics. This article discusses the implementation of AI-based adaptive learning as a strategy to improve learning effectiveness through learning needs analysis, curriculum differentiation, and the use of data as the basis for learning recommendations. The research method employed is a literature study by reviewing recent journals and scientific publications. The findings show that AI-based adaptive learning can increase learning motivation, independence, and learning achievement through the delivery of materials aligned with students' competency levels, learning styles, and learning pace. In conclusion, this innovation becomes a potential solution for improving the quality of education in the digital era, provided that technological infrastructure, teacher readiness, and students' digital literacy are adequately supported.

Keywords: artificial intelligence, adaptive learning, digital learning, educational innovation, learning technology.

INTRODUCTION

Education in the 21st century is marked by the development of digital technology that supports learning processes. Traditional learning systems, which tend to be uniform, often fail to accommodate the diversity of students' competencies, interests, and learning styles (I. W. Distrik1, 2024). This condition demands learning innovations capable of providing personalized learning experiences to optimize competency achievement (Nur Farha Hassana, 2015).

Artificial Intelligence (AI) serves as a strategic breakthrough in education through the application of adaptive learning, which adjusts material delivery, assessment, and learning recommendations based on each student's unique profile (Nur Farha Hassana, 2015). Through AI, systems can automatically analyze students' learning progress, provide instant feedback, and present differentiated learning paths for each individual (Handhika, 2012).

This demonstrates that AI-based adaptive learning not only modernizes education but also becomes a solution to the challenges of learning effectiveness in the digital era (Martoredjoa, 2023). This research is motivated by the need to identify and develop strategies so that the discussion in this article remains focused. Therefore, the scope of the study is limited to the application of AI-based adaptive learning in the learning process, not digital technology in general.

The main problems identified include: 1. AI-based adaptive learning (Nur Farha Hassana, 2015). 2. Implementation of AI-based adaptive learning in education. 3. Its impact on learning effectiveness.

This study aims to: 1.Explain the concept of AI-based adaptive learning (Nur Farha Hassana, 2015). 2. Describe its implementation. 3. Analyze its impact on improving learning quality. Theoretically, this article contributes to the development of educational science and learning technology. Practically, it provides references for schools, teachers, and policymakers in implementing AI for learning (Martoredjoa, 2023).

LITERATURE REVIEW

Artificial Intelligence (AI) in Education

AI refers to computer systems capable of mimicking human intelligence, including thinking, analyzing, and decision-making. In education, AI is applied for analyzing student abilities, automated assessments, adaptive learning platforms, educational chatbots, and monitoring students' learning progress (Z. Ramdani1, 2022).

Concept of Adaptive Learning

Adaptive learning is an instructional approach that adjusts content, methods, and assessment based on learner characteristics (Nur Farha Hassana, 2015). Adaptive learning systems use behavioral data such as scores, completion time, speed of understanding topics, and learning preferences (Z. Ramdani1, 2022).

AI-Based Adaptive Learning

In this system, AI functions as a digital learning manager that:

- Identifies student learning profiles
- Personalizes learning pathways
- Provides automated recommendations for materials and assignments
- Delivers real-time feedback

Examples of adaptive AI platforms include Duolingo, Khan Academy, and Coursera.

Advantages and Challenges

Advantages

- Significant improvement in learning outcomes
- More personalized learning
- Automated and accurate evaluation
- Minimizes learning gaps among students

Challenges

- Unequal technological infrastructure
- Teachers' readiness and digital literacy
- Student data protection
- Potential technology overdependence

METHOD

This study uses library research by analyzing various scientific sources including national and international journals, books, research reports, and relevant academic documents. The steps include:

1) Identifying and collecting literature on adaptive learning and AI
2) Selecting sources based on relevance and recency
3) Conducting content analysis
4) Synthesizing data to draw conclusions

RESULTS AND DISCUSSION

Analysis of various literature shows that integrating AI into adaptive learning has positive impacts on the learning process.

Changes in Learning Models

Learning has evolved from teacher-centered to learner-centered, where students receive individualized learning paths based on their abilities.

Learning Effectiveness

Studies show that adaptive AI improves:

- Learning motivation
- Retention and understanding of materials
- Speed of competency achievement
- Self-regulated learning

The Role of Teachers in the AI Ecosystem

AI does not replace teachers but serves as a tool. Teachers act as facilitators, learning analysts, and guides in digital ethics (D. Nurdin1, 2023). Teachers ensure AI information remains accurate and aligned with instructional goals, design AI-assisted learning experiences, and help students avoid excessive dependence on technology (Nurlina1, 2022; Martoredjoa, 2023).

Teachers also foster AI literacy, moderate AI use, and uphold ethical, safe practices. They remain decision-makers who combine AI data with pedagogical intuition and continue to innovate to create relevant learning experiences (Syafril1, 2024; Yusrizal1, 2017).

Implications for Schools/Madrasah

Successful implementation requires:

- Teacher training
- Adequate ICT infrastructure
- Flexible curriculum
- Strong data protection policies

CONCLUSION

AI-based adaptive learning is a strategic innovation that enables personalized learning, improves effectiveness, and accommodates diverse student needs. It has proven to enhance motivation, independence, and academic achievement.

Recommendation

1) Teachers must strengthen digital literacy to optimize AI use.
2) Schools must develop sustainable AI implementation policies.
3) Government must enhance digital infrastructure for equitable technology access.
4) AI development in education must consider ethics and data security.

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