DIDACTIC MECHANISMS OF ADAPTIVE LEARNING BASED ON ARTIFICIAL INTELLIGENCE IN THE EDUCATIONAL PROCESS

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Abstract. This article analyzes the didactic mechanisms for organizing adaptive learning through the use of artificial intelligence (AI) technologies in the educational process. Adaptive learning enables the formation of educational content tailored to learners' individual characteristics, knowledge levels, and learning pace. AI technologies facilitate automated analysis of educational materials, personalization of learning trajectories, and effective assessment of students' knowledge. The paper also examines models of adaptive learning, their pedagogical significance, and their role in enhancing educational effectiveness.

Keywords: artificial intelligence, adaptive learning, didactic mechanisms, digital education, individualized learning trajectory, educational technologies, assessment.

Introduction. The rapid development of artificial intelligence technologies has significantly influenced modern education systems. One of the most promising directions is adaptive learning, which allows the educational process to be tailored to the individual needs of learners. Unlike traditional approaches, adaptive learning relies on data-driven decision-making, ensuring a more efficient and personalized learning experience.

This study aims to explore the key didactic mechanisms underlying AI-based adaptive learning, focusing on diagnostic, personalization, and feedback mechanisms.

Diagnostic Mechanism. The diagnostic mechanism represents a crucial component of the didactic process, enabling an objective assessment of a learner's knowledge state. In traditional education, teachers often evaluate students using limited tools such as classroom participation, oral questioning, written assignments, or test results. However, such assessments are frequently subjective, as it is difficult for teachers to comprehensively analyze each student's learning process simultaneously.

Artificial intelligence automates and enhances this process by expanding diagnostic capabilities. It allows educators to identify specific areas where students encounter difficulties, determine which competencies remain underdeveloped, and detect barriers at different stages of cognition.

Moreover, the diagnostic mechanism facilitates the creation of a **student model**, which represents a structured knowledge map of the learner. This model reflects strengths and weaknesses, learning needs, acquisition speed, motivation, and aspects requiring individualized support. Consequently, pedagogical decisions become evidence-based rather than intuitive, increasing the scientific validity of teaching practices.

Another important feature of the diagnostic mechanism is its ability to track learners' development dynamics. Instead of focusing solely on final outcomes, AI systems monitor incremental progress over time, enabling predictive analysis. This allows educators to anticipate potential learning difficulties and implement timely interventions.

Thus, the diagnostic mechanism serves as the first key factor enhancing the didactic effectiveness of adaptive learning by ensuring systematic monitoring and control of the educational process.

Personalization Mechanism. The second essential mechanism of AI-based adaptive learning is personalization. This involves designing individualized learning pathways, adapting educational content to learners' cognitive abilities, differentiating tasks, and applying varied teaching methods.

In traditional education, personalization largely depends on the teacher's experience and intuition. However, this approach is limited, especially in large classrooms where it is difficult to develop individual programs for each student. AI-driven adaptive systems overcome this limitation by providing technological solutions.

Based on diagnostic data, AI systems automatically recommend appropriate content, exercises, tests, and learning resources. This makes the didactic process highly flexible: students who quickly master a topic can advance to the next level, while those facing difficulties receive additional explanations, simplified tasks, or revision materials.

As a result, the traditional "average student" model is replaced by a "learner-centered" approach. Personalization also enhances student motivation, as tasks are aligned with individual capabilities—neither too easy nor overly complex. This balance fosters confidence, encourages independent learning, and improves overall educational outcomes.

Furthermore, personalization optimizes the content component of the didactic process by eliminating redundant instruction and focusing on advanced topics when appropriate. This leads to more efficient use of instructional time.

Importantly, personalization also expands opportunities for inclusive education by enabling tailored instruction for learners with special needs. It supports flexible pacing and provides additional resources, thereby reinforcing the principle of educational equity.

Therefore, the personalization mechanism constitutes the second major factor enhancing the effectiveness of adaptive learning by aligning educational content and methodology with individual learner characteristics.

Feedback Mechanism. The third key mechanism is feedback, which is a fundamental element of the didactic process. Without timely feedback, opportunities for reinforcing knowledge and correcting errors are significantly limited.

In traditional education, feedback is often delayed: students complete tasks, teachers evaluate them, and results are provided later. This delay reduces the effectiveness of learning, as students may not immediately recognize and correct their mistakes.

AI-based adaptive systems provide **real-time feedback**. When a student answers incorrectly, the system instantly identifies the error, offers explanations, and provides guidance toward the correct solution. This continuous support enhances cognitive engagement and creates the perception of constant instructional assistance.

Feedback also has a strong motivational impact. Immediate visibility of results allows students to track their progress, increasing their interest in learning. AI systems may incorporate gamification elements such as points, rankings, certificates, or level progression to further enhance motivation.

From the teacher's perspective, feedback systems provide valuable analytical data. Educators can identify challenging topics and adjust teaching strategies accordingly. Thus, feedback serves as a reflective tool for both learners and teachers.

In summary, the feedback mechanism represents the third major factor enhancing adaptive learning by enabling dynamic process management, fostering reflection, and increasing motivation.

Conclusion. Artificial intelligence significantly transforms the educational process by enabling adaptive learning based on data-driven insights. The diagnostic, personalization, and feedback mechanisms collectively enhance the didactic effectiveness of education by ensuring objectivity, flexibility, and responsiveness.

The integration of these mechanisms leads to improved learning outcomes, increased student engagement, and more efficient use of educational resources. Therefore, AI-based adaptive learning represents a key direction for the future development of modern education systems.

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