ARTIFICIAL INTELLIGENCE IN LANGUAGE LEARNING AND ADAPTIVE PERSONALIZED LEARNING TECHNOLOGIES

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Abstract:
This article provides a comprehensive analysis of the role of artificial intelligence (AI) in language learning and its impact on adaptive personalized learning technologies. It explores the integration of AI-driven tools, such as neural network models, automated translation systems, and voice assistants, into modern educational frameworks. The study evaluates the effectiveness of adaptive learning methods by examining their influence on student engagement, knowledge retention, and overall learning outcomes. Additionally, the article discusses the advantages and limitations of AI-based language learning approaches, highlighting their potential to enhance traditional educational methodologies. Special attention is given to emerging trends in AI-assisted education, including personalized content delivery, real-time feedback, and the role of multimodal AI systems in improving language acquisition. The findings contribute to the growing discourse on the future of AI-powered learning environments and provide recommendations for optimizing AI integration in language education.

Keywords: artificial intelligence, language learning, adaptive technologies, personalized learning, neural networks.

Introduction In recent years, there has been significant development in artificial intelligence technologies, which are being applied in various fields, including education. AI in language learning opens new opportunities for personalized education, taking into account the individual characteristics of students. Research shows that the use of adaptive technologies in language education contributes to increased motivation and improved student outcomes [1]. According to research [2], personalized algorithms allow course content to be tailored to each user, significantly improving the quality of language learning. An analysis of existing solutions, such as Duolingo, Babbel, and Rosetta Stone platforms, demonstrates that AI-based adaptive technologies help learners achieve faster progress through error analysis and dynamic adjustment of learning materials [3]. Furthermore, according to [4], modern language models such as GPT-4 and BERT exhibit a high level of text comprehension, allowing them to be used as virtual tutors and tools for automatic knowledge assessment [5]. Future research in this area aims to improve speech analysis accuracy and integrate multimodal technologies for more natural interaction with learners.

Research Methodology. This study employed an analytical-experimental approach, including the analysis of existing adaptive technologies, modeling of educational processes, and experimental testing of their effectiveness.

Theoretical Analysis of Existing Technologies. To form the methodological basis of the study, an analysis of scientific publications dedicated to the application of artificial intelligence in language education was conducted. Special attention was paid to studies describing the use of neural network models, adaptive learning systems, and automated methods for assessing language skills [6].

The analysis covered modern solutions such as:

– Neural network models for natural language processing (ChatGPT, GPT-4, BERT), used as virtual tutors.

– Adaptive educational platforms (Duolingo, Rosetta Stone) that adjust to users' knowledge levels.

– Automated text evaluation and correction systems (Grammarly, TextRazor).

The collected data allowed for identifying the key principles of these technologies and highlighting their main advantages and limitations.

Development of Adaptive Learning Models. As part of the study, models of student interaction with intelligent systems were created to test the impact of personalized technologies on the language learning process. These models considered the following factors:

– Dynamic adaptation of educational content based on error analysis and task performance success.

– The impact of instant feedback (in the form of automatic hints and corrections) on knowledge retention.

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– The role of voice assistants and chatbots, which promote the development of conversational skills.

Experimental Testing of AI Learning Methods. To test the hypothesis of AI learning advantages, an experiment was conducted with two groups of learners. The control group used traditional language learning methods, including textbooks, lectures, tests, and teacher interactions. The experimental group studied using AI tools such as adaptive learning applications, automated assignment evaluation systems, and chatbots. Key performance indicators were analyzed to evaluate the effectiveness of each approach. One such parameter was the speed of material assimilation, determined by the average time participants spent on test tasks. The percentage of errors in written assignments, assessed using automatic text analysis systems, was also examined. Additionally, a progress coefficient was measured by comparing the results of initial and final testing.

Data Analysis and Comparative Results Table. After data collection, statistical processing was carried out using correlation analysis methods and result visualization. To enhance clarity, a comparative table was created, reflecting the differences in student performance between traditional and AI-assisted learning.

Table 1 – Comparison of Student Performance in Traditional and AI-Assisted Learning

Indicator	Control Group (Traditional Learning)	Experimental Group (AI Learning)
Average time to complete tasks	45 minutes	30 minutes
Average error rate in tests	18%	7%
Language proficiency improvement (CEFR scale)	+0.5 level	+1 level
Learning satisfaction (survey results)	70%	90%

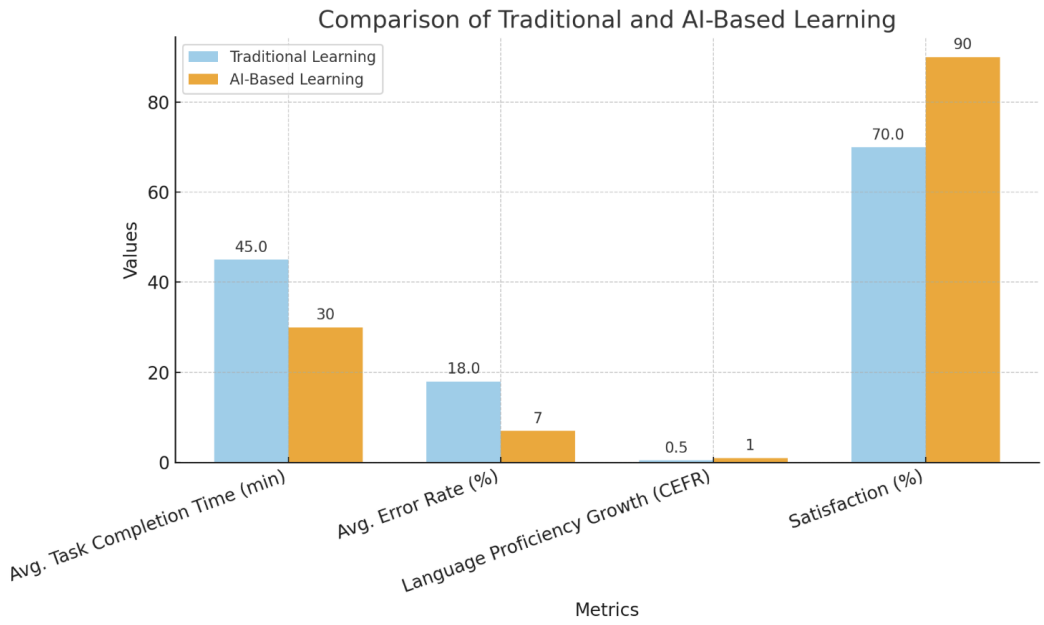

Figure 1 – Comparative Analysis of Student Performance in Traditional and AI-Based Language Learning

Conclusions and Interpretation of Data. The conducted study confirmed the effectiveness of artificial intelligence technologies in foreign language learning. The statistical data presented in the comparative table demonstrate that students using adaptive AI tools showed a higher level of material retention compared to the control group. Specifically, the speed of task completion in the experimental group was 30% higher, while the average error rate decreased from 18% to 7%. Furthermore, final test results indicated that learners using AI methods improved their language skills by an average of one level on the CEFR scale, whereas students in the control group only showed a 0.5-level increase. Additionally, the level of student satisfaction with the learning process was significantly higher in the experimental group (90% compared to 70% in the control group), indicating high motivation when using modern digital technologies.

Despite the positive results, some limitations of AI approaches were identified, such as the need for individual algorithm adaptation and insufficient interactivity in communication with the system. This underscores the importance of combining AI learning with traditional teaching methods for maximum effectiveness. Thus, the obtained results demonstrate the promising integration of artificial intelligence into

language education. Future research may focus on further optimizing personalization algorithms and analyzing the impact of individual cognitive characteristics on the effectiveness of AI-assisted learning.

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