

Article

Didactic Capabilities of Artificial Intelligence Technologies

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Abstract: This article presents a comprehensive scientific analysis of one of the most pressing contemporary challenges: the integration of artificial intelligence (AI) into the educational sphere and its effectiveness. The study examines the theoretical foundations of AI technologies, their historical development, and their practical applications in modern educational contexts, with particular emphasis on foreign language instruction. The scientific perspectives of leading scholars in this domain are extensively reviewed and synthesized. Furthermore, the article provides a detailed exploration of AI technology integration in education, examining the opportunities available to educators and the competencies required for effective implementation. The research employs classification, descriptive, historical-comparative, contextual, complex, statistical, and functional analysis methods. The findings reveal that AI technologies offer significant potential for personalizing learning experiences, automating routine pedagogical tasks, and enhancing educational outcomes. However, successful integration requires appropriate teacher training, technological infrastructure, and pedagogical frameworks. The article concludes by identifying key challenges and proposing pathways for effective AI implementation in educational settings

Keywords: *artificial intelligence, neural networks, expert systems, ChatGPT, generative artificial intelligence, machine translation technologies, chatbots, educational technology, personalized learning, digital pedagogy.*

1. Introduction

The rapid advancement of information and communication technologies has exerted a transformative influence on every domain of human activity, with the field of foreign language teaching being no exception. Among the most significant developments in this regard is the integration of artificial intelligence (AI) into language learning and instruction [1]. AI encompasses a broad spectrum of technologies and methodologies, including machine learning, adaptive learning, natural language processing, data mining, crowdsourcing, neural networks, and algorithmic systems [2]. The accelerated development of AI technologies and the creation of AI-based tools have prompted their swift adoption across various professional domains, catalyzing a corresponding increase in pedagogical and methodological research dedicated to the utilization of AI tools in educational processes [3].

The emergence of generative AI technologies, particularly the release of ChatGPT by OpenAI in late 2022, has fundamentally altered the landscape of educational technology [4]. This development has been accompanied by growing scholarly interest in understanding the didactic capabilities of AI and developing effective frameworks for its integration

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into teaching and learning practices [5]. The present study aims to contribute to this growing body of knowledge by examining the theoretical foundations, practical applications, and pedagogical implications of AI technologies in education, with particular attention to foreign language instruction [6].

The significance of this research is underscored by the unprecedented pace at which AI technologies are being developed and integrated into professional practice. Educators worldwide are confronting the challenge of adapting their pedagogical approaches to leverage the potential of AI while maintaining the quality and integrity of the educational experience. This study seeks to provide a comprehensive analysis that can inform both theoretical understanding and practical implementation [7].

2. Materials and Methods

The object of this research encompasses the extent and nature of artificial intelligence technology integration into the educational system, the effectiveness of such integration, and the analysis of scholarly works addressing these issues. The study examines both the theoretical foundations of AI in education and the practical applications of AI tools in pedagogical contexts, with particular attention to foreign language instruction.

To comprehensively address the research objectives, the following methodological approaches were employed:

Classification method: For categorizing AI technologies and their educational applications

Descriptive method: For characterizing AI tools and their pedagogical functions

Historical-comparative method: For tracing the development of AI concepts and their evolving role in education

Contextual method: For examining AI applications within specific educational contexts

Complex method: For integrating multiple perspectives on AI in education

Statistical method: For analyzing research trends and publication data

Functional analysis method: For examining the operational capabilities of AI tools in educational settings

These methods were applied systematically to ensure a comprehensive and rigorous analysis of the research subject.

3. Results

The concept of artificial intelligence has evolved considerably since its inception. The term was first introduced by John McCarthy in 1956 at a seminar at Dartmouth College, where he defined artificial intelligence as “the science and engineering of making intelligent machines” (Russell & Norvig, 2010). McCarthy’s foundational definition characterized AI as machines that demonstrate intelligent properties, with the capability to simulate various aspects of human intelligence [8], including language use, abstraction formation, problem-solving, and self-improvement.

McCarthy's initial propositions regarding AI, including the possibility that computers could replicate human cognitive functions and that AI tools might eventually think like humans, sparked extensive debate and philosophical inquiry [9]. While subsequent research has not substantiated the claim that AI systems can truly "think" in the human sense, the field has nonetheless made remarkable progress in developing systems capable of performing tasks that traditionally required human intelligence [10].

The theoretical framework of AI encompasses several key subfields:

Expert Systems: This branch of AI focuses on collecting and analyzing human experiential knowledge for application in specific domains. Expert systems continuously evolve through interaction with AI devices, adapting to situations and problems encountered by users, thereby contributing to the improvement of educational processes and decision-making [11].

Neural Networks: Inspired by biological neural networks, these computational systems learn from data and improve their performance through experience, forming the basis for many contemporary AI applications.

Natural Language Processing (NLP): This subfield enables AI systems to understand, interpret, and generate human language, serving as the foundation for chatbots, machine translation, and language learning tools [12].

Machine Learning: This approach allows AI systems to learn from data without explicit programming, enabling adaptive and personalized educational experiences [13].

The evolution of AI research has been characterized by shifting perspectives on the relationship between artificial and human intelligence. While early researchers aimed to replicate human cognitive processes comprehensively, contemporary approaches increasingly focus on developing AI systems that augment rather than replace human capabilities, particularly in educational contexts [14].

The period from late 2022 through 2023 witnessed a dramatic acceleration in both the development of AI technologies and scholarly interest in their educational applications. Two significant factors drove this trend:

First, the release of ChatGPT by OpenAI demonstrated the capacity of generative AI to provide high-quality, contextually appropriate responses across a wide range of topics and tasks. This technology showcased the potential for AI to serve as an interactive learning companion, capable of engaging in dialogue, providing explanations, and generating educational content [15].

Second, a widely publicized incident in Russia, where a student at the Russian State University for the Humanities used ChatGPT to write his thesis, generated substantial public debate about the implications of AI for academic integrity and educational practice. This event, while controversial, highlighted both the capabilities of AI technologies and the urgent need for educational institutions to develop appropriate policies and practices for their use.

According to data from the Russian Index of Scientific Citation (RINTS), over 600 scientific works were published by Russian authors in 2023 alone on the use of artificial intelligence and AI tools in foreign language teaching. This dramatic increase in scholarly

output reflects the growing recognition of AI's significance for language education and the urgent need to develop effective pedagogical frameworks for its integration.

The pedagogical community has thus encountered, for the first time, the challenge of responding to rapidly emerging AI tools being integrated into professional practice at an unprecedented pace. The resulting surge of research, characterized by varying scope, content, and quality, demonstrates both the vitality of scholarly engagement with this topic and the need for systematic analysis to identify coherent directions for future research and practice.

In considering the didactic and linguodidactic capabilities of artificial intelligence technologies, P.V. Sysoev proposes conceptualizing AI as a subject of the educational process, introducing the triad "earner – artificial intelligence – teacher". This framework acknowledges the evolving role of AI from a simple tool to an interactive participant in the learning process.

According to Sysoev's analysis, as learners develop autonomous learning skills and educational autonomy, artificial intelligence becomes a reliable assistant in the continuous learning process. AI can support each learner in selecting the direction, style, and means of learning, educational content, and pace of acquisition in accordance with their personal and professional interests, needs, and abilities. This personalized approach represents a significant departure from traditional one-size-fits-all educational models.

The "learner – AI – teacher" triad suggests a collaborative model in which:

The learner maintains agency and responsibility for their learning journey

AI provides personalized support, resources, and feedback

The teacher guides the overall learning process, provides human mentorship, and ensures quality.

This framework highlights the complementary rather than competitive relationship between AI and human educators. The integration of AI into this triad can enhance rather than diminish the role of teachers, freeing them from routine tasks to focus on higher-order pedagogical activities.

Research by M.S. Kogan emphasizes that effective use of generative artificial intelligence requires:

Understanding of AI functioning: Both teachers and students need to comprehend how modern AI systems operate, including their capabilities and limitations.

Awareness of automated text processing technologies: Familiarity with the technologies underlying AI language processing is crucial for effective use.

Specialized skills for AI interaction: Students must develop specific competencies to work effectively with AI, including prompt engineering and critical evaluation of AI-generated content.

The successful integration of AI in modern education largely depends on teachers' level of proficiency with these technologies. Evstigneev, Sysoev, and Evstigneeva identify several key competency areas for foreign language teachers in the context of AI integration (Table 1):

Table 1

Competencies of AI integration	
Technical Competencies	-Understanding of AI technologies and their operational principles;
	-Ability to use AI tools for educational purposes;
	-Capacity to evaluate AI tools for pedagogical appropriateness;
	-Skills in integrating AI with other educational technologies.
Pedagogical Competencies	-Ability to design learning activities incorporating AI;
	-Capacity to facilitate student-AI interaction;
	-Skills in assessing student learning with and through AI;
	-Understanding of AI's implications for instructional design.
Ethical Competencies	-Awareness of ethical issues in AI use (privacy, bias, authenticity);
	-Ability to teach responsible AI use;
	-Understanding of academic integrity implications;
	-Capacity to address equity and access concerns.
Professional Development Competencies	-Commitment to continuous learning about AI;
	-Ability to evaluate and adopt new AI tools;
	-Capacity to share AI knowledge with colleagues;
	-Understanding of AI's evolving role in the profession.

Research by Radwan identifies several ways in which artificial intelligence can address challenges in English language teaching and learning:

AI technologies facilitate the development of reading comprehension skills through: automated text summarization, vocabulary support and contextual definition, adaptive reading materials tailored to learner proficiency, interactive reading activities with immediate feedback.

Machine translation technologies contribute to the development of translation skills by: providing immediate translation options, offering multiple translation alternatives, facilitating comparison of different translation approaches, supporting contrastive language analysis.

Automatic speech recognition technologies enable learners to: practice pronunciation with real-time feedback, identify specific pronunciation errors, compare their pronunciation with native speaker models, develop self-monitoring skills.

Text-to-speech technologies create opportunities for: supporting blind and visually impaired students, providing audio versions of texts, facilitating listening and reading simultaneously and supporting diverse learning preferences.

Baker and Smith (2019) propose a useful triadic classification of AI tools in education, categorizing them according to their primary beneficiary (Figure 1):

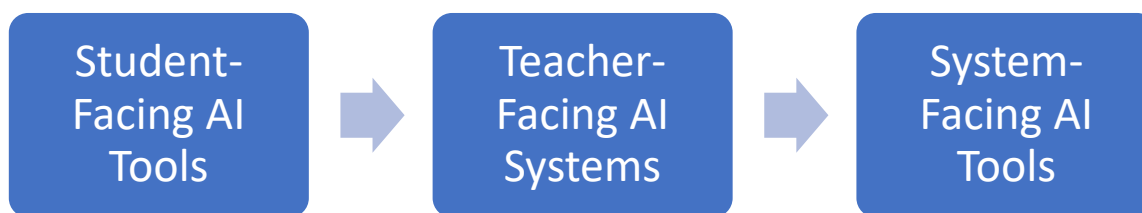


Figure 1. Triadic classification of AI tools

Students facing AI tools are software applications that students use to learn subject matter. Examples include: intelligent tutoring systems that provide personalized instruction, adaptive learning platforms that adjust to learner performance, language learning applications with gamification elements and writing assistants that provide real-time feedback.

Teacher facing AI systems are used by teachers to reduce workload and increase efficiency in specific tasks such as: administrative task automation, assessment and grading, feedback generation, plagiarism detection, lesson planning assistance, and resource recommendation.

System facing AI tools provide institutional-level information for administrators and managers, including: student retention prediction and monitoring, faculty performance analysis, resource allocation optimization, curriculum effectiveness evaluation and institutional planning support.

AI-based education offers the potential for more personalized, adaptive, inclusive, and engaging learning experiences. AI can provide teachers and learners with tools that respond not only to what is being learned but also to how it is being learned and to the learner's emotional state.

CHALLENGES AND LIMITATIONS

Despite these advantages, the implementation of AI technologies in foreign language education is associated with several challenges and limitations. One of the major challenges is the insufficient preparation of teachers to use AI technologies effectively. Lack of appropriate technological and pedagogical knowledge may make the integration of AI into the teaching process difficult.

Another important issue concerns the quality and reliability of AI-based tools. In particular, chatbot and machine-translation systems are not yet perfect and may fail to identify certain grammatical, contextual, or pragmatic errors accurately. Therefore, AI-generated feedback should not always be accepted without critical evaluation.

The chapter also emphasizes that excessive automation through AI may negatively affect students' independence in the learning process. If learners rely excessively on automated systems, they may become less engaged in independent thinking, problem-solving, and language production.

For this reason, the effective implementation of Intelligent Computer-Assisted Language Learning (ICALL) requires teachers to receive specialized training in the pedagogical and technical use of AI-based tools. Such training should enable teachers to integrate technological knowledge with appropriate pedagogical strategies.

Ultimately, teachers' positive attitudes toward and confidence in AI technologies represent important factors in their successful implementation. Effective AI integration therefore requires not only access to appropriate technological tools but also teachers who possess the knowledge, skills, and pedagogical awareness necessary to use these technologies purposefully and critically.

4. Conclusion

Artificial Intelligence (AI) technologies are bringing significant changes to the field of education, particularly to foreign language teaching and the development of students' speech skills. This chapter examined the significance of AI in education, its opportunities and challenges in foreign language learning, as well as the readiness of teachers and students to use these technologies. The role of AI in education was analyzed from several perspectives. AI enhances the effectiveness of the educational process by personalizing, automating, and optimizing learning activities. It can automate teachers' routine tasks, allowing them to devote more time to creative, pedagogical, and cognitively demanding activities. For students, AI provides opportunities for real-time personalized feedback, adaptive learning environments, and the organization of intelligent learning groups. These opportunities enable students to receive support according to their individual learning needs and progress. AI technologies, including Natural Language Processing (NLP), machine learning, neural networks, and big-data analytics, make the educational process more interactive, flexible, and adaptive.

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