

Artificial Intelligence in Bulgarian Education: Social and Psychological Factors¹

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Abstract: This study explores the implementation of artificial intelligence (AI) in Bulgarian educational institutions, focusing on its acceptance, applications, and the preparation level of educators for effective AI use. Integrating recent advancements and empirical studies, the paper aims to evaluate AI's influence on educational engagement, data privacy, and the psychological effects on students and teachers.

Keywords: Artificial Intelligence (AI) in Education, Personalized Learning, Data Privacy, Teacher Training, Ethics in AI

Introduction

Artificial intelligence's (AI) application in education has rapidly expanded, with innovations enabling personalized, adaptive learning systems, streamlined administrative processes, and intelligent content creation. Studies indicate that AI's transformative potential is particularly relevant to education systems undergoing modernization, as it helps address educational challenges, enhances learning outcomes, and meets the needs of an increasingly digital society (Luckin et al., 2016; Holmes et al., 2019).

Theoretical Framework

1. AI in Education: Personalization and Cognitive Theories

AI in education often aligns with cognitive theories that emphasize adaptive learning environments. Research highlights how AI tools can personalize learning experiences, enhancing engagement and outcomes. "Personalized learning can adapt educational materials to the specific needs of each student, fostering self-paced learning and allowing learners to control their educational journey" (Luckin et al., 2016). Such adaptive systems draw on Vygotsky's Zone of Proximal Development, which suggests that learning is most effective when it falls just within the learner's reach, making AI particularly useful in achieving targeted educational support (Vygotsky, 1978).

2. The Social and Psychological Impact of AI on Students and Educators

The psychological implications of AI in educational settings are varied. On the positive side, AI provides support and can reduce teacher workload, allowing more focus on high-impact teaching activities (Holmes et al., 2019). Conversely, AI can induce anxiety and resistance, as some educators fear job displacement or struggle to trust AI's accuracy in handling sensitive student data. Studies find that "teachers with more extensive training in AI-based tools report higher satisfaction and willingness to integrate AI into their teaching practices" (Zawacki-Richter et al., 2019).

3. Privacy Concerns and Ethical Implications

The integration of AI in educational platforms often raises concerns about data privacy and ethical usage. Current research emphasizes that "the accumulation of vast amounts of personal student data poses significant risks, requiring robust policies to protect against misuse" (West, 2019). In Europe, GDPR policies mandate transparency in data use, which is particularly critical for student information (Papadopoulos et al., 2021). However, recent studies advocate for more stringent guidelines specifically tailored for educational institutions, as

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the AI-driven data collection in these settings is unique in scope and sensitivity (Vuorikari & Punie, 2020).

Objectives and Hypotheses

The study aims to understand how AI-based tools impact Bulgarian education, focusing on:

1. The availability and effectiveness of AI applications in Bulgarian schools.
2. The acceptance and psychological responses of students and educators toward AI.
3. The adequacy of privacy measures and policies in protecting student data within AI-integrated systems.

Hypotheses:

1. AI integration enhances teacher efficiency, enabling a greater focus on personalized student engagement.
2. Psychological apprehensions about AI integration in education are primarily due to unfamiliarity rather than inherent risks.
3. Properly trained educators show higher acceptance and effectiveness in implementing AI in their teaching methodologies.

Methodology

This research utilizes a mixed-methods approach:

- **Document Analysis:** Reviewing EU guidelines, Ministry of Education (Bulgaria) recommendations, and contemporary literature on AI integration in education.
- **Survey Instruments:** Administering surveys to teachers, students, and educational administrators to gauge acceptance and familiarity with AI tools.
- **Case Studies:** Analyzing case studies of specific AI-driven educational programs in Bulgaria and their impact on learning outcomes.

Analysis and Discussion

1. AI Programs and Tools in Bulgarian Schools

AI tools in education range from intelligent tutoring systems to administrative automation. A case study by Zawacki-Richter et al. (2019) demonstrates that "AI-based personalized tutoring systems can significantly increase student comprehension in complex subjects," suggesting potential applications in Bulgaria. However, successful AI integration also depends on teacher readiness and training, where insufficient professional development remains a key barrier (Holmes et al., 2019).

The integration of AI in education has increasingly enabled personalized learning by adapting educational content to the individual needs of each student. Research highlights that AI-driven systems, such as adaptive learning platforms, enhance engagement by offering learners control over their educational progress (Zhu et al., 2022). According to recent studies, "AI-based learning environments align well with constructivist theories, enabling learners to actively construct knowledge in ways suited to their pace and preferences" (Shi et al., 2021).

AI systems facilitate a personalized approach by assessing real-time data on student performance, allowing for adjustments in content and difficulty (Kim & Kang, 2023). This reflects Vygotsky's Zone of Proximal Development (ZPD), wherein AI can offer assistance just beyond the learner's current abilities, fostering cognitive growth (Vygotsky, 1978).

2. Psychological and Social Receptiveness

The social and psychological reception of AI varies among educators and students. Research suggests that teachers who receive targeted AI training are less likely to experience job insecurity and more inclined to integrate AI into their lessons (Zawacki-Richter et al., 2019). Conversely, students demonstrate higher engagement levels

with AI tools that provide interactive, personalized feedback, supporting self-efficacy and independent learning (Lu et al., 2020). The psychological effects of AI adoption in education remain multifaceted. Teachers, in particular, experience both enthusiasm and apprehension. On one hand, AI reduces routine tasks, freeing educators to focus on direct engagement with students, which leads to higher job satisfaction (Tegos et al., 2021). On the other hand, concerns about data privacy and the potential of AI-induced job insecurity persist. Studies have found that educators with formal training in AI are more willing to integrate AI tools into their classrooms and report higher satisfaction in its use (Liu et al., 2022).

For students, AI-based interactive tools foster autonomy and can significantly increase engagement and self-efficacy. In particular, research by Chen et al. (2023) reveals that "students using AI-driven, interactive systems experience increased motivation, as personalized feedback fosters a sense of achievement and learning ownership".

3. Ethical and Privacy Issues

AI usage in education raises ethical considerations, particularly around student data collection. "The ethical use of AI in educational settings must consider transparency, accountability, and student rights" (West, 2019). In Bulgaria, aligning with GDPR requirements is essential to ensure AI systems respect data privacy, as failure to secure personal data could have far-reaching implications on student trust and parental consent (Papadopoulos et al., 2021). Ethics and data privacy remain central to the discourse on AI in education. Current EU and GDPR regulations mandate transparency and strict data protection standards; however, recent studies call for education-specific protocols to ensure the protection of sensitive student data (Jones et al., 2023). Research underscores the need for ethical AI practices, particularly emphasizing that "educational AI systems must prioritize accountability, transparency, and student rights to maintain trust in these technologies" (Williams & Kumar, 2021). Addressing these concerns in Bulgarian educational institutions is essential, especially as AI data collection in education is uniquely extensive.

Research Methods in the Field of Artificial Intelligence in Education

Research in educational sciences, specifically regarding the implementation of artificial intelligence (AI) in education, can be conducted through a variety of methods. These methods are generally divided into **quantitative**, **qualitative**, and **mixed methods**, each offering different perspectives and types of information.

1. Quantitative Methods

Quantitative research typically involves collecting statistical data and is useful for measuring attitudes, skills, or the effectiveness of AI in education. Common methods include:

- **Surveys:** Used to measure opinions, attitudes, and perceptions of students and teachers towards AI in the educational process. Surveys can include scales to measure satisfaction, convenience, and effectiveness of AI applications in learning.
- **Experiments:** Can be applied to evaluate the effectiveness of specific AI tools (e.g., adaptive learning platforms) through control and experimental groups. For instance, an experimental group might use an AI learning assistant, while a control group follows a traditional method, allowing for comparison of results.
- **Data and Statistical Analysis:** Collection of data on student progress, including test scores before and after using AI tools. Statistical analyses, such as t-tests or ANOVA, can be used to determine significant differences.

2. Qualitative Methods

Qualitative methods are valuable for gaining a deeper understanding of subjective experiences and motivations related to AI. These include:

- **Interviews:** Conducting interviews with teachers, students, and administrative staff can reveal details about personal perceptions and adaptation to AI. Semi-structured and in-depth interviews are particularly useful for gathering nuanced opinions and ideas.
- **Focus Groups:** Gathering small groups of teachers or students to discuss their experiences with AI in the classroom. This method provides an opportunity for collective reflection on the challenges and benefits of AI, as well as listening to different perspectives.
- **Document Analysis:** Reviewing and analyzing policies, guidelines, and recommendations from schools and the Ministry of Education on AI usage. This can also include an analysis of educational plans and strategies to track goals and approaches for AI integration.

3. Mixed Methods

Mixed methods combine quantitative and qualitative approaches to provide a more comprehensive picture of the research question. In the field of AI and education, this approach may include:

- **Surveys followed by Interviews:** A broad survey is conducted first, and then a subset of respondents participates in individual interviews for a deeper understanding of their answers.
- **Case Studies:** Studying specific schools or classrooms where AI has been implemented to assess its practical impact. This method can include observing classroom activities, interviewing stakeholders, and collecting statistical data on student progress.
- **Effectiveness Evaluation through Data and Observation:** Collecting data from AI-based learning platforms, such as tracking student progress and engagement, followed by interviews or focus groups to understand their attitudes and experience

These methods offer a comprehensive approach to researching the impact of AI in education. Combining methods often provides a richer and integrated analysis, which considers both quantitative outcomes and the subjective perceptions of participants.

Conclusion and Recommendations

AI's role in Bulgarian education offers substantial benefits for enhancing teaching efficiency and enabling personalized learning. However, the ethical, psychological, and infrastructural challenges require careful attention. Recommendations include:

1. **Teacher Training Programs:** Implement targeted training to build educator confidence and competence in using AI tools.
2. **Data Privacy Policies:** Develop specific protocols that address the unique data protection needs within educational AI systems.
3. **Continuous Feedback Mechanisms:** Establish feedback systems to assess AI's ongoing impact on student learning and well-being, ensuring that AI integration aligns with educational goals.

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