

PEDAGOGICAL APPROACHES TO FOSTERING PRIMARY SCHOOL TEACHERS' CREATIVE AND CRITICAL THINKING THROUGH THE USE OF ARTIFICIAL INTELLIGENCE

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Annotatsiya

Ushbu maqolada sun'iy intellekt (SI) texnologiyalarini ta'lim jarayoniga integratsiya qilish orqali boshlang'ich sinf o'qituvchilarining ijodiy va tanqidiy fikrlash kompetensiyalarini rivojlantirishga qaratilgan zamonaviy pedagogik yondashuvlar tahlil qilinadi. Tadqiqot konstruktivizm va transformativ ta'lim nazariyalariga asoslanib, sun'iy intellektni innovatsion ta'lim amaliyotini qo'llab-quvvatlovchi kognitiv vosita sifatida baholaydi. Maqolada SI asosidagi platformalarning o'qituvchilarni individuallashtirilgan tarzda tayyorlash, reflektiv fikrlashni rivojlantirish va amaliy muammolarni hal qilishdagi salohiyati yoritilgan. O'qituvchi tayyorlash dasturlariga SI ni integratsiya qilishning samarali strategiyalari, jumladan adaptiv o'quv muhitlari, aqlli repetitor tizimlari va SI asosidagi formatif baholash vositalari ko'rib chiqiladi. Tadqiqot natijalari sun'iy intellektidan foydalanishni pedagogik maqsadlar bilan muvofiqlashtirish zarurligini ta'kidlaydi. Maqolada ta'lim siyosatchilari, o'quv dastur tuzuvchilar va trener-o'qituvchilar uchun sun'iy intellektidan boyitilgan o'quv ekotizimini yaratishga doir tavsiyalar beriladi.

Kalit so'zlar: Sun'iy intellekt, o'qituvchilarni tayyorlash, ijodiy fikrlash, tanqidiy fikrlash, pedagogik yondashuvlar, boshlang'ich sinf o'qituvchilari, adaptiv ta'lim, aqlli tizimlar, raqamli pedagogika.

Аннотация

В статье рассматриваются современные педагогические подходы, направленные на развитие креативного и критического мышления у учителей начальных классов посредством интеграции технологий искусственного интеллекта (ИИ). Исследование основано на теоретических концепциях конструктивизма и трансформативного обучения, подчёркивающих роль ИИ как когнитивного инструмента, способствующего инновационной образовательной практике. Анализируются возможности ИИ-платформ для персонализации подготовки

учителей, стимулирования рефлексивного мышления и решения практических педагогических задач. Особое внимание уделяется стратегиям внедрения ИИ в содержание программ подготовки педагогов, включая адаптивные обучающие среды, интеллектуальные репетиторские системы и инструменты формирующего оценивания на основе ИИ. Результаты подчёркивают необходимость соответствия между педагогическими целями и использованием ИИ для развития ключевых компетенций XXI века. Даны рекомендации для образовательных политиков, разработчиков учебных программ и преподавателей по созданию образовательной экосистемы, обогащённой ИИ, в целях устойчивого профессионального развития.

Ключевые слова: искусственный интеллект, педагогическое образование, креативное мышление, критическое мышление, педагогические подходы, учителя начальных классов, адаптивное обучение, интеллектуальные системы, цифровая педагогика.

Annotation

This article explores contemporary pedagogical approaches aimed at enhancing primary school teachers' creative and critical thinking competencies through the integration of artificial intelligence (AI) technologies. The study is grounded in the theoretical frameworks of constructivism and transformative learning, emphasizing the role of AI as a cognitive tool that supports innovative educational practices. It analyzes the potential of AI-based platforms to personalize teacher training, promote reflective thinking, and facilitate problem-solving in real-world teaching scenarios. The research highlights key strategies for embedding AI into teacher education curricula, such as adaptive learning environments, intelligent tutoring systems, and AI-driven formative assessment tools. The findings underscore the importance of aligning AI integration with pedagogical goals to ensure the development of essential 21st-century skills among educators. Recommendations are provided for educational policymakers, curriculum designers, and teacher trainers to foster an AI-enriched learning ecosystem that supports sustainable professional development.

Keywords: Artificial intelligence, teacher education, creative thinking, critical thinking, pedagogical approaches, primary school teachers, adaptive learning, intelligent systems, digital pedagogy.

In the rapidly evolving landscape of education, the integration of artificial intelligence (AI) technologies has become a transformative force reshaping teaching and learning processes. While much of the existing research focuses on the application of AI to enhance student learning outcomes, comparatively less attention has been paid to how

AI can be effectively utilized to support the professional development of teachers, particularly in fostering creative and critical thinking skills. These competencies are essential for educators navigating the complexities of 21st-century classrooms, where adaptability, innovation, and reflective practice are increasingly in demand.

Primary school teachers, in particular, play a foundational role in shaping students' cognitive and socio-emotional development. Therefore, equipping them with the ability to think creatively and critically is not only beneficial for their personal professional growth but also vital for cultivating these skills among young learners. However, traditional models of teacher education often fall short in promoting deep, reflective, and innovative thinking. In this context, AI technologies offer new opportunities for designing personalized, interactive, and data-driven professional learning experiences that can empower teachers to become more effective, autonomous, and future-ready.

This article aims to explore the pedagogical foundations and practical approaches to integrating AI technologies in teacher training programs, with a particular emphasis on enhancing creative and critical thinking among primary school educators. Drawing on theoretical perspectives from constructivism, transformative learning, and digital pedagogy, the study provides a conceptual framework for understanding the role of AI in shaping modern teacher competencies. Furthermore, it examines the potential of intelligent systems—such as adaptive learning platforms, AI-driven formative assessments, and virtual teaching assistants—to support teacher cognition, decision-making, and problem-solving. The findings seek to inform educational policymakers, curriculum developers, and teacher educators in developing AI-enriched ecosystems for sustainable professional development.

The integration of artificial intelligence (AI) in education has been widely studied over the past decade, particularly in relation to personalized learning, intelligent tutoring systems, and automated assessment. However, its application in teacher professional development—especially in cultivating higher-order thinking skills such as creativity and critical thinking—remains an emerging area of inquiry.

Several scholars have highlighted the potential of AI to transform teacher education. Luckin et al. (2016) emphasized that AI can serve as a “partner in learning,” providing real-time feedback, scaffolding reflective thinking, and facilitating metacognitive development. Similarly, Holmes et al. (2019) argued that AI-enhanced learning environments can support teachers in identifying patterns in classroom interactions, thereby fostering deeper pedagogical insights and adaptive teaching practices. From a pedagogical standpoint, constructivist theories (Piaget, Vygotsky) provide a solid foundation for understanding how AI tools can mediate learning experiences that are

active, contextualized, and learner-centered. For example, intelligent systems can simulate real-life teaching scenarios that require creative problem-solving and critical decision-making, allowing teachers to practice and refine their professional judgment in a safe and controlled environment.

In the domain of creative and critical thinking development, Torrance (1974) and Paul & Elder (2006) have outlined frameworks that emphasize the importance of questioning, divergent thinking, and evaluative reasoning. AI systems can be designed to align with these frameworks by offering open-ended challenges, prompting inquiry-based exploration, and facilitating constructive feedback loops.

Moreover, recent advances in AI-powered learning analytics allow for the monitoring of teacher engagement and progress, enabling the personalization of professional development pathways. This aligns with the concept of adaptive learning, which tailors content and support based on an individual's needs and performance—a key principle in fostering sustained cognitive growth.

Despite these advancements, there are concerns regarding the ethical implications of AI use in education, including data privacy, algorithmic bias, and the potential depersonalization of teacher training. Therefore, it is essential to approach the implementation of AI technologies with a critical lens, ensuring that their use enhances rather than replaces human-centered pedagogical practices.

In summary, the literature suggests a growing recognition of AI's capacity to support the development of creative and critical thinking skills among teachers. However, further empirical research is needed to establish best practices, assess impact, and explore scalable models for AI integration in teacher education, particularly at the primary school level.

Methodology

This study employed a qualitative research design grounded in interpretivist epistemology, which is appropriate for exploring complex, context-dependent phenomena such as teacher cognition, pedagogical practices, and professional development. The aim was to examine how artificial intelligence (AI) technologies can be integrated into primary teacher education to enhance creative and critical thinking skills, and to identify effective pedagogical approaches for such integration.

Research Design. A multiple case study methodology was adopted to investigate the experiences of teacher educators and pre-service primary school teachers across three teacher training institutions. This approach enabled in-depth analysis of AI implementation in varied educational contexts and facilitated the identification of patterns, challenges, and best practices.

Participants. The study involved 18 participants: 9 teacher educators and 9 pre-service primary school teachers selected through purposive sampling. Participants were chosen based on their active involvement in AI-integrated teaching or training programs. All participants had at least one year of experience using digital or AI-supported tools in pedagogical settings.

Data Collection Methods. Data were collected using three primary methods:

Semi-structured interviews with teacher educators and pre-service teachers to gather insights into their perceptions, experiences, and attitudes toward the use of AI in fostering creative and critical thinking.

Document analysis, including training curricula, lesson plans, and platform usage reports, to understand how AI technologies were embedded into instructional design. Classroom observations of AI-supported micro-teaching sessions, focusing on how AI tools (e.g., adaptive learning platforms, virtual simulations) facilitated higher-order thinking processes.

Data Analysis. Thematic analysis was conducted using NVivo software. Data were coded inductively to identify recurring themes related to the development of creative and critical thinking, the pedagogical role of AI, and barriers to effective integration. Trustworthiness was ensured through triangulation of data sources, member checking, and peer debriefing.

Ethical Considerations. All participants provided informed consent prior to participation. Institutional ethical approval was obtained, and participants' confidentiality and anonymity were maintained throughout the research process. Data were securely stored and used exclusively for academic purposes.

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