Artificial Intelligence Pedagogical Content Knowledge

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Abstract: The Artificial Intelligence Pedagogical Content Knowledge (AIPACK) framework provides educators with strategies to apply AI tools effectively in education. It emphasizes flexibility in adapting to advancements in AI technologies, ensuring context-sensitive applications that align with specific pedagogical goals. By integrating AI capabilities with pedagogical and content expertise, AIPACK aims to improve teaching practices and prepare students for an AI-driven world.

The AIPACK framework

AIPACK framework builds upon the established TPACK framework (Mishra & Koehler, 2006) by replacing "Technology" with "Artificial Intelligence (AI)." This adaptation focuses on the integration of AI into teaching, emphasizing its potential to transform pedagogy, enhance content delivery, and create personalized learning experiences.

The AIPACK framework consists of three core domains: Artificial Intelligence Knowledge (AIK), Content Knowledge (CK), and Pedagogical Knowledge (PK) along with their intersections (Figure 1). AIK refers to understanding AI principles, tools, and their applications in education (Luckin et al., 2016). This includes familiarity with AI-powered systems such as adaptive learning platforms, AI tutors, and automated grading tools (Holmes et al., 2019). CK refers to mastery of the subject matter being taught, as conceptualized by Shulman (1986). PK refers to the understanding of teaching and learning processes, including effective instructional strategies, classroom management techniques, and knowledge of how students learn. PK encompasses the design and implementation of educational activities that are developmentally appropriate, engaging, and conducive to achieving learning outcomes (Shulman, 1986).

The intersections of these domains provide deeper understanding of the AIPACK. Artificial Intelligence Content Knowledge (AICK) involves understanding how AI tools can represent and analyze specific content areas. Roll and Wylie (2016) explore the evolution of Artificial Intelligence in Education, including how AI technologies can model and support subject-specific knowledge, making their work relevant to AICK. Artificial Intelligence Pedagogical Knowledge (AIPK) relates to understanding how AI impacts teaching strategies and student interaction. Seo et al. (2021) study the integration of AI into teaching and its effects on learner–instructor interactions and pedagogical practices. Pedagogical Content Knowledge (PCK), as introduced by Shulman (1986), focuses on the ability to teach specific content using pedagogical strategies that make it engaging and accessible to students.

Figure 1

The AIPACK Model
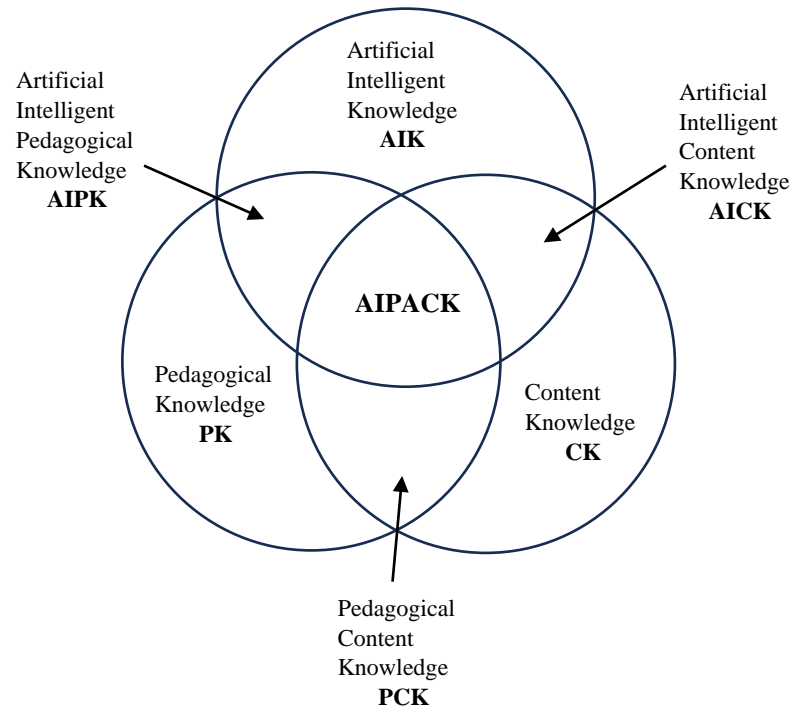
Teachers using AIPACK can design innovative, personalized, and efficient learning experiences while maintaining sound pedagogical foundations. This integration empowers educators to utilize AI in ways that complement both the subject matter and the instructional strategies, creating adaptive and meaningful learning environments.

The AIPACK framework emphasizes dynamic AI integration in teaching, not just as a tool but as a transformative element. AI facilitates personalized learning through adaptive systems tailored to individual needs, automates administrative tasks like grading, and provides real-time feedback to students and teachers (Holmes et al., 2019; Bredeweg et al., 2013).

The AIPACK framework provides a theoretical foundation for educators and teacher trainers to integrate AI into their teaching. It emphasizes the importance of professional development programs that equip educators with the skills to assess and implement AI tools effectively. Similar to TPACK, the AIPACK framework emphasizes the need for a cohesive approach to teaching that balances AI capabilities with pedagogical and content expertise. It provides a roadmap for leveraging AI to enhance educational outcomes in meaningful ways.

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