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Tables and Figures

Figure 1. Matrix of educational interactions with instructing agents in columns and learning agents in rows.

		Instructing			
Learning	Roles	**Human Instructor**	**AI Student**	**Human Student**	**AI Instructor**
	Human Student	Traditional Instruction	Informal Adaptive Instruction	Peer Instruction	Adaptive Instruction
	AI Student	Teaching Practice	Simulated Peer Instruction	Tutoring Simulation	Instructional Simulation
	Human Instructor	Instructional Peer Sharing	Field Supervisor Simulation	Student Teaching	Instructional Exploration
	AI Instructor	Co-Teaching Simulation	Research Simulation	Student Teaching Simulation	Peer Simulation

Figure 1. Matrix of educational interactions with instructing agents in columns and learning agents in rows.

1. Human Instructor to Human Student • Traditional instruction • Teacher applies pedagogical methods to engage students
2. Human Student to Human Student • Peer instruction • Students inform and teach each other
3. Human Student to Human Instructor • Student teaching • Students prepare and conduct teaching sessions under instructor supervision
4. Human Instructor to Human Instructor • Instructional peer sharing • Instructors collaborate on teaching practices
5. Human Instructor to AI Student • Teaching practice • Instructor teaches AI students to practice pedagogical methods • Adaptive instruction development provides feedback to improve AI tutoring capabilities
6. AI Instructor to Human Student • Adaptive instruction • AI system provides personalized learning experiences

7. Human Student to AI Student • Tutoring simulation • Student explains concepts to AI system, reinforcing their own understanding
8. AI Student to Human Student • Informal adaptive instruction • AI peer provides support and assistance to human students
9. Human Instructor to AI Instructor • Co-teaching simulation • Human instructor practices collaborative instruction with AI system
10. AI Instructor to Human Instructor • Instructional exploration • AI collaborates with human instructors on curriculum development and assessment
11. AI Instructor to AI Student • Instructional simulation • Fully simulated classroom for pedagogical research
12. AI Student to AI Instructor • Research simulation • AI student teaches or presents to AI instructor for research purposes
13. AI Student to Human Instructor • Field supervisor simulation • AI simulates student teaching for human supervision practice
14. Human Student to AI Instructor • Student teaching simulation • Student practices teaching in a simulated classroom with AI instructor
15. AI Student to AI Student • Simulated peer instruction • AI students exchange information to improve knowledge bases
16. AI Instructor to AI Instructor. Peer simulation. AI instructors analyzing learning analytics or demonstrating co-teaching methods.

AI Instructional Framework: A Comprehensive Approach to Learning with AI

Abstract

This article presents an innovative AI Instructional Framework that comprehensively explores the diverse interactions between human and artificial intelligence (AI) agents in educational settings. As AI technologies continue to evolve rapidly, their integration into education offers unprecedented opportunities to enhance teaching and learning experiences. Through a systematic examination of various learning scenarios, this framework provides a nuanced understanding of how AI can be leveraged to support and transform educational practices.

Our research employs a scoping review methodology to map the current landscape of AI applications in education. The framework categorizes educational interactions into four main types: Traditional Teaching & Learning, Adaptive Instruction, Advanced Simulations, and Pedagogical Collaboration. Within each category, we explore multiple subtypes of interactions, ranging from human-to-human to fully simulated AI-to-AI scenarios.

Key findings highlight the potential of AI to enhance educational experiences through personalized learning, real-time feedback, and adaptive instruction. The framework demonstrates how AI can support pedagogical research by enabling the creation of controlled, simulated environments for testing innovative teaching methodologies. Furthermore, it illustrates the role of AI in facilitating teacher development through virtual training environments and collaborative instructional tools.

Importantly, this study emphasizes the critical balance between human and AI interactions in learning environments. While acknowledging the transformative potential of AI, we argue for its role as a complement to, rather than a replacement for, human instruction. The framework showcases the value of simulations and exploratory learning for both students and educators, highlighting how these tools can foster skill development, critical thinking, and innovative pedagogical approaches.

The AI Instructional Framework presented in this article offers a roadmap for understanding and leveraging AI in education while also identifying crucial areas for future research and development. As AI continues to reshape the

educational landscape, this framework provides a foundation for thoughtful implementation and ongoing evaluation of AI technologies in learning environments.

Keywords: Artificial Intelligence in Education (AIEd), Adaptive Learning, Educational Simulations, Personalized Instruction, AI-assisted Teaching, Digital Pedagogy, Educational Innovation.