# Exploring the "Human-AI Co-Teaching" Model in AI-Empowered Higher Education

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***Abstract:*** The rapid advancement of artificial intelligence (AI) technology is profoundly reshaping the educational ecosystem of higher education institutions (HEIs). Addressing the structural mismatch between "standardized supply" and "personalized demand" in traditional teaching models, this paper proposes a "Human-AI Co-Teaching" model. This model constructs a tripartite synergy framework of "Teacher-AI-Student": teachers transform into educational mentors, leading value calibration and high-order competency cultivation; AI undertakes auxiliary tasks such as knowledge delivery and learning diagnostics; students, as the learning subjects, achieve adaptive learning through data feedback. By resolving the dual-track integration of AI assistance and teacher leadership, the "Human-AI Co-Teaching" model leverages multimodal data collection and intelligent analysis to enable precise teaching strategy adjustments and resource adaptation. This drives the transformation of higher education towards intelligence and personalization, ultimately establishing a "data-driven, dynamically closed-loop" educational ecosystem.

***Keywords:*** Artificial Intelligence; Human-AI Co-Teaching; Teaching Model

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## 1.Introduction

### 1.1 AI-Driven Transformation in Higher Education

China is accelerating the rollout of its national education digitalization strategy. In January 2025 China issued guidelines on building a strong educational country (2024-2035):"Implement the national education digitization strategy. Develop and improve digital literacy standards for teachers and students, deepen the use of AI to support teacher development, build large-scale AI educational models, and establish education evaluation and scientific decision-making systems based on big data and AI." Concurrently, demands for personalized learning in universities are increasing. Students seek learning support tailored to their cognitive pace, such as AI-powered Q&A Support and adaptive assessments. Teachers urgently need relief from mechanical tasks to focus more time and energy on cultivating students' higher-order thinking and emotional well-being.

Generative AI, represented by models like ChatGPT and DeepSeek, provides intelligent tools for higher education through natural language processing (NLP), deep learning, and multimodal generation technologies. This reshapes the core logic of educational scenarios and drives innovative transformation in the new era. Language models possess semantic understanding and logical reasoning capabilities, enabling dynamic generation of teaching resources like lesson plans and interdisciplinary knowledge graphs. This shifts knowledge delivery from "static predesign" to "dynamic adaptation." Real-time diagnosis of learning styles and cognitive blind spots based on learner profiles, coupled with AI-provided personalized learning paths and immediate feedback, transforms "one-size-fits-all" teaching into "individualized strategies." For instance, Stanford University's "SIGHT" model uses machine learning algorithms to analyze student classroom performance and optimize teacher intervention strategies. Multimodal generation technologies, exemplified by Sora (text-to-video), can create experiential learning environments like virtual labs or historical reenactments, enhancing embodied cognition. Khan Academy's Khanmigo system acts as a teaching assistant, guiding students to think deeply and explore answers. The rapid advancement of AI, particularly generative AI, combined with domestic and international practices of human-AI collaboration in education, constitute key drivers of transformation in higher education, providing a solid foundation for moving "Human-AI Co-Teaching" from theory to practice.

### 1.2 Limitations of Traditional Teaching Models in HEIs

Traditional teaching operates primarily through teacher-dominated lectures. Low student participation inhibits opportunities for autonomous inquiry and creative expression, forming a unidirectional "teacher-deliver, student-receive" transmission model. This passivity fosters reliance on rote memorization over critical learning, hindering deep knowledge exploration, questioning, and the development of critical thinking and innovation. Fixed curricula and standardized textbooks fail to accommodate diverse student cognitive levels and interests, exposing the inherent tension between uniform resource provision and personalized learning support. Without dynamically capturing implicit data like learning habits and emotional states, traditional models fail to provide personalized support. Furthermore, evaluation relies heavily on outcome-oriented exams, lacking real-time diagnostics and dynamic optimization. This neglects students' processual performance and competency development, causing teaching adjustments to lag behind learning progress and preventing a "diagnose-intervene-optimize" closed loop. The core contradiction lies in the structural mismatch between "standardized supply" and "personalized demand." Features like static resource dependence, unidirectional transmission, and delayed feedback render traditional models ill-suited for the digital-intelligent era's demands for innovation, precise resource allocation, and dynamic evaluation. To shift the paradigm from "teacher-centered" to "student-centered," actively constructing a data-driven "Human-AI Co-Teaching" model is essential.

In this context, "Human-AI Co-Teaching" can restructure traditional teaching roles. AI handles mechanical tasks, freeing teacher potential. NLP technology enables grammar correction and math solution verification within seconds, significantly boosting efficiency. Deep learning algorithms analyze learning trajectories to pinpoint knowledge gaps with high diagnostic accuracy. Supported by AI, teachers shift focus to high-level educational goals, achieving a dynamic balance between efficiency and educational depth. Freed from routine tasks, teachers can concentrate on nurturing emotional intelligence, critical thinking, mental health guidance, and addressing the "emotional connection" that AI cannot replace.

## 2.Constructing the "Human-AI Co-Teaching" Model in HEIs

The core of "Human-AI Co-Teaching" is shifting the teacher's role from "knowledge authority" to "educational mentor," positioning AI as a cognitive enhancement tool. Defining clear role boundaries enables synergistic gains ("1+1>2"). This necessitates building a "Teacher-AI-Student" tripartite synergy model, ensuring continuous teaching optimization through a dynamic data feedback loop.

### 2.1 Role Definition in the "Teacher-AI-Student" Tripartite Synergy Model

(1)Teacher (Human Intelligence): Leads the direction and value calibration of teaching objectives. Engages in emotional interaction, character cultivation, and critical thinking stimulation—addressing non-cognitive factors (e.g., moral judgment, emotional support) beyond AI's scope. Thus, teachers transition from "knowledge transmitters" to "competency cultivators," focusing on uniquely human abilities like creativity and value formation. They also coordinate task allocation within human-AI collaboration and audit AI-generated content for ethics and goal alignment.

(2)AI (Machine Intelligence): Employs NLP for conversational tutoring and knowledge graph construction, and deep learning algorithms for optimizing resource matching. Provides personalized resource recommendations, intelligent Q&A, and automated assessment. Real-time collection of multimodal student data (behavior, emotion, engagement) generates learning profiles and early warning reports, freeing teacher capacity.

(3)Dynamic Feedback Loop (Collaborative Intelligence): AI enables data-driven iteration by collecting interaction data, analyzing learning states, and optimizing delivery strategies. Teachers evaluate effectiveness using AI feedback, dynamically optimizing teaching strategies. This nests the teacher's decision-making loop within the AI's execution loop, forming a human-AI interaction pattern.

### 2.2 Operational Mechanism of the "Teacher-AI-Student" Tripartite Synergy Model

This model uses data as the nexus to build a dynamically closed-loop teaching ecosystem. The teacher serves as the pedagogical leader, the AI functions as the smart assistant, and the student is positioned as the learning subject. Tripartite collaboration occurs through multimodal data interaction. The core mechanism involves real-time data collection, intelligent analysis, and precise feedback to drive dynamic teaching strategy optimization, achieving personalized instruction and adaptive learning.

(1)Data Input: Multimodal technologies enable the collection of comprehensive, real-time educational data spanning the entire teaching-learning continuum—including student behavioral patterns, affective states, cognitive indicators, and interaction dynamics, alongside teacher-generated instructional designs, classroom interaction records, and resource utilization metrics. This integrated dataset forms the empirical foundation for pedagogical decision-making.

(2)Data Processing: AI employs algorithmic models (e.g., deep learning, cluster analysis) to fuse and analyze multi-source data, generating actionable feedback. This includes:

*Learning Diagnostics:* Identifying knowledge weaknesses.

*Competency Assessment:* Dynamically comparing student ability against targets using knowledge graphs.

*Engagement/Emotion Analysis:* Utilizing affective computing to inform emotional interventions.

*Human-AI Collaboration:* Teachers and AI jointly interpret results. Teachers lead strategy formulation, AI provides options, jointly optimizing teaching strategies.

(3)Feedback & Adjustment:

*AI:* Pushes personalized resources, adaptive exercises, and motivational prompts to students based on weaknesses, enabling immediate feedback.

*Teacher:*Revises lesson design, implements targeted emotional interventions, optimizes assessment methods, and leads overall teaching optimization.

The model achieves teaching adaptability through an "Input → Process → Feedback → Re-input" closed loop. *Within class*, teachers adjust pacing based on AI's real-time learning feedback. *Across cycles*, semester-long data accumulation allows teachers to leverage AI-generated learning evolution maps to restructure curricula. Student feedback on adjustments re-enters the data collection phase, enabling continuous iteration. This model shifts teaching from "experience-driven" to "data-driven." Its core value lies in enhancing educational precision and inclusivity through human-AI wisdom fusion, providing a paradigm for building a new digital-intelligent educational ecosystem.

## 3.Optimization Pathways for the "Human-AI Co-Teaching" Model in HEIs

As the AI era unfolds, HEIs must evolve, exploring institution-specific "Human-AI Co-Teaching" models based on their unique positioning and disciplinary strengths. While emphasizing institutional distinctiveness, common optimization pathways exist, particularly in achieving genuine synergy between AI assistance and teacher leadership.

### 3.1 Optimizing AI Assistance Functions

(1)Build Personalized Learning Paths: Using adaptive learning algorithms, AI systems can recommend tailored learning materials and pathways based on individual progress, interests, and ability differences. This data-driven "human-AI collaboration" provides technical support for personalized learning, enhancing knowledge acquisition efficiency.

(2)Develop Intelligent Assessment & Feedback Mechanisms: Automated scoring of student progress and performance provides real-time feedback. For example, NLP analysis of essays for structure, expression, and preliminary scoring reduces teachers' mechanical grading burden for foundational work. This allows students quicker insight into their learning status, guiding subsequent improvement. (Deep critique and humanistic evaluation remain

the teacher's domain).

(3)Establish Real-Time Interaction & Q&A Systems:AI virtual learning companions or "intelligent TAs" can provide 24/7 answers to common, repetitive course questions, significantly saving teacher time. This frees teachers to focus on complex lesson design, deep classroom interactions, and personalized guidance for individual students.

### 3.2 Reinforcing Teachers' Value-Based Emotional Mentorship

Under the "Human-AI Co-Teaching" model, teachers as pedagogical leaders should prioritize:

(1)Strengthen Contextualized Teaching Design for Value Guidance: Teacher leadership should manifest in designing contextualized learning around societal issues (e.g., tech ethics), facilitating deep debates and discussions to provoke critical thought. Through such contextualized inquiry, teachers guide students to apply knowledge, hone critical thinking and problem-solving skills, and develop value judgments.

(2)Utilize Data Interaction to Enhance Humanistic Care: Teachers should actively use AI-generated learning analytics reports to understand student states and emotional needs in real-time, making big data a vital window into student well-being. Data-informed insights allow teachers to address emotional fluctuations and intellectual confusions more effectively. When AI flags anomalies, timely teacher communication can uncover and resolve underlying difficulties.

(3)Integrate Moral Education Goals to Clarify Responsibility: Within disciplinary courses, teachers must consciously integrate moral education goals, guiding students to develop positive outlooks and values. For instance, in a project-based learning activity on "Optimizing Community Waste Sorting," teachers should not only guide professional knowledge application but also highlight the project's social significance, fostering social responsibility and agency during problem-solving.

## 4.Conclusion

The deep integration of artificial intelligence (AI) and higher education is catalyzing a paradigm shift toward intelligent and personalized pedagogy. While embracing AI's transformative potential, higher education institutions (HEIs) must proactively mitigate associated risks through rigorous review mechanisms for AI-generated content, correction of algorithmic biases, and establishment of secure, reliable ed-tech ecosystems. Fundamentally, AI serves not as a substitute for educators but as a catalyst for role redefinition. Within the "Human-AI Co-Teaching" framework, educators evolve from knowledge transmitters into mentors of socio-emotional development and value cultivation, collaborating with AI systems to actualize the tripartite "Teacher-AI-Student" synergy model.

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