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Innovative Practice of AI Driven Teaching and Learning Models—Taking General Psychology as an Example

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In response to the teaching pain points of abstract concept understanding difficulties and lack of practical scenarios in the course of General Psychology, an AI based "three-stage four module" human-machine collaborative teaching model is constructed. This mode covers three stages: pre class, in class, and post class, integrating four major functions: personalized learning, intelligent diagnosis, interactive deepening, and feedback optimization. Utilize AI to push personalized preview resources, generate diagnostic tests, and predict learning progress before class; During class, teachers focus on difficult points based on learning reports and use AI tools to deepen conceptual understanding and higher-order thinking training; After class, AI provides adaptive exercises, intelligent writing feedback, etc. to promote knowledge transfer. Practice has shown that this model effectively enhances students' learning participation and autonomy, and promotes the transformation of teachers' roles from knowledge transmitters to learning guides and value shapers.

Keywords: artificial intelligence, teaching mode, learning mode, general psychology, teaching reform

Introduction

With the rapid development of artificial intelligence and big data technology, the demand for psychology related professionals by employers has undergone tremendous changes. As a compulsory foundational course in the training process of psychology professionals, General Psychology still faces the following core pain points in teaching. Firstly, there is a contradiction between theoretical abstraction and practical concretization. The course involves abstract concepts including sensation, perception, memory, and emotion, which are difficult for students to intuitively understand and connect with real phenomena. Secondly, practical teaching scenarios are insufficient. Classic psychological experiments are restricted by equipment, venues and ethical constraints, making it difficult to carry out in conventional classrooms and resulting in insufficient students' practical ability and immersive learning experience. Thirdly, unified standardized teaching cannot adapt to students' individual cognitive differences and personalized learning needs. Fourthly, the single evaluation system dominated by

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standardized tests fails to assess students' core competencies such as critical thinking and experimental design ability.

The booming development of large language model-based AI technology provides new opportunities for higher education teaching innovation. AI can automatically process and analyze massive text data, generate learning resources, provide real-time feedback, predict academic performance and evaluate assignments, showing great potential for optimizing educational tasks. Integrating AI into teaching to build a human-machine collaborative teaching paradigm has become a key approach to improve teaching quality and learning outcomes (Lee, 2024; O'Dea, 2024; Yan et al., 2024). This model emphasizes the collaboration between teachers and AI systems, aiming to free teachers from repetitive labor and focus more on guiding, inspiring, and cultivating higher-order thinking abilities (Li & Han, 2025).

In recent years, many domestic universities have carried out AI-enabled teaching practices, however, there are still shortcomings in the process of technology implementation.

Firstly, insufficient adaptability to disciplines, from the perspective of technological empowerment, artificial intelligence provides students with an embodied learning environment through multimodal data fusion, which can break through the cognitive limitations of "blackboard+text" in traditional classrooms and significantly improve the concrete teaching effect of abstract concepts in psychology, especially suitable for teaching abstract chapters such as "sensation and perception" and "memory mechanism" in "General Psychology". However, existing systems mostly focus on general models of cognitive science and have not yet been deeply coupled with the knowledge graph of psychology, leading to a prominent problem of fragmented concept mapping.

Secondly, there is insufficient matching of courses. From the perspective of practical application, innovative practices guided by the logic of artificial intelligence technology transplantation are still difficult to match the disciplinary characteristics of General Psychology, and it is urgent to seek a balance between technological innovation and education oriented tension. On the one hand, most AI teaching tools still prioritize "knowledge mastery" as the optimization goal, neglecting quantitative support for core competencies such as psychological assessment and ethical decision-making. On the other hand, the one-way expansion of technological applications has exacerbated the crisis of subjectivity between teachers and students: intelligent systems have taken on too many knowledge imparting functions, leading to teachers becoming "technical assistants" and their high-level teaching abilities being weakened.

Overall, there is a considerable amount of research on the application of artificial intelligence in the field of education both domestically and internationally. However, in the field of psychology, especially in terms of innovative teaching models for "General Psychology" based on artificial intelligence, it is still in the early stages of exploration. In view of this, this project intends to take the course of "General Psychology" as a case study, attempting to use artificial intelligence technology to innovate teaching and learning models, and construct a hybrid intelligent learning environment that covers the entire process before, during, and after class, in order to enhance students' learning experience and effectiveness, and provide practical experience for the teaching reform of basic courses in universities in the AI era, so that artificial intelligence can "light up" the path of education reform.

Theoretical Basis and Model Construction of AI Empowered Teaching

Theoretical Basis

Human machine collaborative. Human-machine collaboration theory refers to a relationship model and ideological system in which humans and machine systems (especially artificial intelligence systems) work

together closely and complement each other's strengths to complete tasks or solve problems. Its core goal is to achieve a collaborative intelligence effect of "1 + 1 > 2". Specifically reflected in four aspects: (1) In vitro intelligence extension: AI analyzes learning behavior data, mines implicit cognitive patterns, and provides learners with objective state diagnosis (such as identifying knowledge weaknesses) and adaptive feedback, achieving "thousand person, thousand face" education (Hao & Gu, 2025); (2) Self aware reinforcement of subjects: AI's real-time support (such as personalized resource push) compensates for learners' inherent limitations, triggers the metacognitive cycle of "planning monitoring adjustment evaluation", and promotes learners to improve decision quality in the dialectical interaction between external support and self perception (López-Meneses et al., 2025); (3) Emotional and behavioral synergy: Multimodal AI technologies can interpret learning emotions and engagement, intelligently screen and recommend relevant discussion topics, timely throw out inspiring questions, cleverly guide discussions to deeper levels, and comprehensively enhance subject agency from the three dimensions of cognition, behavior, and emotion (Wen, 2025); (4) Hybrid Intelligence: The co evolution and complementarity of human intelligence and machine intelligence (Long, Wang, & Zhang, 2025). In teaching, AI does not replace teachers, but serves as an intelligent teaching assistant, undertaking tasks such as data analysis, content generation, and preliminary Q&A, while teachers focus on curriculum design, complex problem solving, emotional support, and innovative thinking guidance, forming an efficient collaboration of "AI inside, teacher outside".

Construction of AI Teaching Mode for General Psychology

Based on the above theory, this study constructs a collaborative teaching model that runs through the three stages of pre-, in-, and post-class, and integrates four core functional modules, aiming to achieve the organic unity of large-scale education and personalized training.

Three stage closed-loop teaching process and AI empowerment (see Table 1)

Table 1

AI Based Three-Stage Closed-Loop Teaching Process

Stage & core objective	AI Empowered Design	Module
Stage 1: Pre-class—AI empowered personalized pre learning (Activate prior knowledge+ accurately diagnose academic situations)	(a) Intelligent content push: Teachers set weekly learning themes, and AI systems automatically filter and combine learning materials (such as core concept explanation videos, classic experiment introduction articles, and interesting psychology cases) from the course resource library based on the themes. Based on students' historical learning data, customized resource packages are pushed based on learning style diagnosis. (b) Generative preview test: After students complete the preview, the AI system dynamically generates multiple-choice and short answer questions to test their mastery of basic concepts. (c) AI teaching assistant preliminary Q&A: Students can ask questions to the AI chatbot at any time if they encounter any problems during the preview. AI teaching assistants will automatically compile deep problems that cannot be solved for teachers to explain in class. (d) Learning situation prediction: AI systems analyze students' preview data before class, generate learning situation reports, highlight common knowledge difficulties and misunderstandings, and help teachers accurately adjust the focus of classroom teaching.	Module 1: Personalized Learning Path Planning
Stage 2: In-class—Deep Study of Human Computer Collaboration (Deep understanding of concepts+cultivation of higher-order thinking)	(a) Precision teaching: Based on the learning report provided by AI, teachers skip the content that students have generally mastered, focus valuable classroom time on the difficult, key, and confusing points of knowledge, and conduct in-depth analysis and guidance. (b) Real time interaction and feedback: When discussing complex cases, teachers can use AI tools for real-time word cloud generation, anonymous voting, and quick Q&A, to instantly grasp students' viewpoint distribution and understanding level, and dynamically adjust teaching pace.	Module 2: AI Mentor Module 4: In depth Discussion

Table 1 to be continued

	(c) AI Assistant: During group activities, students can use generative AI as an "external brain" or "creative partner". For example, AI can be asked to play the role of different psychological schools for debate, or use AI to assist in designing a simple psychological experimental plan, thereby stimulating students' creativity and deepening their understanding and application of theoretical knowledge.	
Stage 3: After-class—Data Driven Metacognition Development (Knowledge transfer application+optimization of learning strategies)	(a) Adaptive practice: The AI system pushes personalized review questions and expanded reading materials based on students' performance in classroom interaction and preview tests. For students who perform well, the system will recommend more challenging tasks; For students facing difficulties, basic consolidation exercises are provided. (b) Intelligent Writing Scaffold: For course papers or report tasks, students can use AI writing assistants to obtain real-time feedback on article structure, logical fluency, language expression, and citation standards. This helps students make multiple revisions before submission, improve writing quality, and reduce teachers' grading burden. (c) Learning analytics dashboard: Generate a visual learning dashboard for students, displaying their mastery of different knowledge modules, learning progress, and comparison with peers, promoting self-evaluation and reflection, and clarifying the direction of future efforts.	Module 3: Formative Evaluation

The Collaborative Mechanism of Four-Dimensional Functional Modules

Module 1: Personalized Learning Path Planning—Solving Cognitive Resource Mismatch

The traditional teaching schedule of "one size fits all" is difficult to adapt to students' diverse knowledge backgrounds and cognitive styles. This module refers to existing research (Järvelä et al., 2025) and is based on an artificial intelligence learning style prediction model. At the beginning of the semester, it conducts a diagnostic assessment of students' prior knowledge and learning styles, aiming to recommend materials suitable for their learning styles, generate personalized learning maps and resource lists for each student, and achieve personalized learning. For example, for students who lack a foundation in biology, the system will recommend more introductory videos and reading materials on "The nervous system and behavior"; For students who prefer visual learning, the system will prioritize pushing relevant charts, animations, and documentaries. Throughout the entire learning process, the AI system will continuously track students' learning progress and mastery, dynamically adjust subsequent learning paths and resource recommendations, and achieve true adaptive learning. This model aims to reduce students' cognitive load and focus their cognitive resources on a deep understanding of core concepts.

Module 2: Generative AI Mentor—Realizing Concept Visualization

In response to the abstract and complex concepts in General Psychology, this module introduces generative AI (such as chatbots based on large language models) as a 24/7 "Socratic" conversational partner. Students can engage in in-depth discussions with AI on issues such as the nature of consciousness and the encoding and retrieval of memory at any time. Given that research has found that although AI can help improve students' task completion speed and information integration ability, excessive reliance and frequent use of AI by students can lead to memory decline and weakened critical thinking (Pardamean et al., 2022), the AI mentor in this module is designed to stimulate students' critical thinking by constantly asking questions, providing counterexamples, and guiding critical thinking. For example, when students ask "What is consciousness", AI not only provides a definition, but also asks "What are the special states of consciousness? Can you give an example of your personal experience?" At the same time, AI can generate various teaching cases based on instructions, and even simulate psychological experiments, providing students with rich virtual practice opportunities. This interactive approach to deep learning can help students connect theoretical knowledge with real-life situations, building deeper and more robust knowledge systems (Wei, Lin, & Zhang, 2026).

Module 3: Formative Evaluation Loop—Shortening Feedback Delay

Timely feedback is the key to effective learning. This module utilizes AI technology to achieve automated and high-frequency formative evaluation of students' learning processes. This includes automatic grading of objective questions, utilizing natural language processing techniques to analyze the logical structure and key concept coverage of short answer questions, and tracking student behavior data on learning platforms through learning analytics techniques. AI systems can provide real-time and personalized feedback for students' every assignment and test, not only pointing out errors but also explaining the reasons for them, and linking them to relevant learning resources for consolidation. This real-time feedback loop greatly shortens the time for students to go from "making mistakes" to "correcting mistakes", and can help students understand their learning situation in a timely manner, greatly improving learning efficiency (Liu, Chen, & Yao, 2022). At the same time, the AI system will summarize students' common problems and weak links into visual reports, providing data support for teachers to adjust teaching strategies and carry out precise interventions, which reflects the pursuit of modernization in educational evaluation and training (Zhang et al., 2025).

Module 4: Human Computer Collaboration Discussion—Reshaping Teacher Value

This module is the core of the entire model, aimed at freeing teachers from knowledge transmission and grading tasks, and focusing on higher-level teaching activities. Classroom teaching is no longer a one-way imparting of knowledge, but a transformation into in-depth discussions based on students' online learning situations. The role of teachers has changed from "knowledge transmitters" to "learning facilitators, thought guides, and value shapers". The specific forms include: (1) flipped classroom: students complete basic knowledge learning online through AI systems, and classroom time is used for high-level cognitive activities such as thematic debates, case analysis, and research design; (2) Accurate Q&A: Teachers provide focused explanations and in-depth analysis of students' common confusion based on the learning situation analysis report provided by AI; (3) Value guidance: Teachers guide students to explore ethical issues in psychological research, the social responsibility of psychological knowledge, and how to cultivate a sound personality. This is a teaching content that reflects humanistic care and is currently difficult for AI to handle (Rupp, 2024). This human-machine collaborative teaching model aims to achieve an organic combination of technical efficiency and humanistic warmth, promoting students' comprehensive development.

Pattern Innovation and Adaptability of Psychology Courses (See Table 2)

Table 2

Pain Points and AI Solutions in the Teaching of General Psychology Course

Dimension	Pain points of traditional mode	AI collaborative solution	Psychological teaching gain
Abstract concept understanding	Relying on textual descriptions leads to cognitive overload	Visualization+Generative Case Studies	Concrete psychoanalytic and other abstract theories
Individual differences in coping	Large class teaching is difficult to teach students according to their aptitude	Cluster push hierarchical task	Addressing cognitive gaps among students with interdisciplinary backgrounds
Cultivation of ethical reasoning	Limited to theoretical lectures and lacking practical scenarios	AI generated ethical dilemma cases+teacher guided criticism	Strengthening the social responsibility awareness of psychologists
Research method training	Experimental design is limited by site equipment	AI Virtual Experiment Platform	Enhance practical experimental skills

Teaching Practice Effectiveness and Challenges

Practical Achievements

Through semester practice in the course of General Psychology (with 79 students in Applied Psychology classes 2401/2402), the AI driven "three-stage four module" model significantly optimized teaching effectiveness (see Table 3).

Table 3

Comparison of Course Goal Achievement Before and After the Implementation of AI Teaching Mode

Evaluation dimension	Class 2401 (traditional mode)	Class 2402 (AI mode)	Increase
Overall goal achievement rate	85.54%	87.76%	+2.22%
Goal 1 (subject interest)	92.01%	93.33%	+1.32%
Goal 2 (knowledge mastery)	85.11%	87.13%	+2.02%
Goal 3 (problem solving)	86.58%	89.42%	+2.84%
Goal 4 (application migration)	81.37%	83.25%	+1.88%

The core breakthrough is reflected in three aspects: firstly, a significant leap in higher-order capabilities. The problem-solving ability (Goal 3) showed the most significant improvement (2.84% increase), with an average score of 87.64 in the innovation practice section. The score for the final applied exam questions (such as psychological mechanism analysis) increased by 4.81 points (84.44 → 89.25). Significant reduction in low segmentation: The number of people who did not meet Goal 3 decreased from 1 person in Class 2401 to 0 people in Class 2402, and the lowest achievement rate increased from 60.83% to 65.56%. The reason behind this is that through collaborative exploration and creative activities with AI in the classroom, students are no longer just passively receiving knowledge. They learned how to ask high-quality questions to AI, how to critically evaluate the content generated by AI, and how to use AI to solve complex problems, all of which promoted the cultivation of their information literacy and innovation abilities. The second is to optimize learning accuracy and efficiency. According to the in class test data, the error rate of concept confusion (such as distinguishing "mood/stress/passion") decreased by 23%, and the accuracy rate of multiple-choice questions related to Goal 2 increased by 5.3%. The reason behind this is that personalized preview and real-time feedback before class stimulate students' motivation for self-directed learning. In the classroom, due to more targeted teaching content and diverse interactive forms, students' attention is more focused, and their enthusiasm for participating in discussions and answering questions is also higher. Students generally reflect that AI teaching assistants and adaptive practice systems can provide assistance according to their own pace and needs, making the learning process more flexible and efficient. For difficult points in the course, they can be repeatedly studied and practiced, while the already mastered parts can be quickly skipped, effectively meeting the needs of students at different levels. The third is the successful transformation of teaching structure. The duration of classroom discussions has significantly increased, and the role of teachers has successfully transformed from "knowledge transmitters" to "learning guides and designers". More energy has been devoted to curriculum design, organizing seminars, stimulating student thinking, and providing personalized emotional and academic guidance. The value and creativity of teaching work have been better reflected.

Challenges and Limitations

This study systematically integrates AI technology into the entire teaching process of the specific course "General Psychology". Through the design of "three-stage four module", the role of AI is elevated from a simple

auxiliary tool to an "intelligent partner" that runs through the entire teaching process. The expected positive results largely support the effectiveness of this model, that is, through the complementary advantages of human and AI, the teaching quality and students' comprehensive literacy can be significantly improved. This discovery is highly consistent with the conclusions of existing literature and provides evidence from the discipline of psychology (Babu & Joseph, 2024). This not only provides a concrete and actionable disciplinary example for studying the deep application of AI technology in higher education, but also a vivid interpretation and development of the theories of "hybrid intelligence" and "self-regulated learning" in the field of education.

Despite its broad prospects, in the process of promoting human-machine collaborative teaching models, we must be aware of the challenges and limitations it faces.

Firstly, the complexity and potential risks of technology integration. The differences in technological readiness and the accuracy of AI content are common challenges in the current application of generative AI in the field of education. On the one hand, some students are not proficient in using AI tools and require early training and continuous technical support. Differences in equipment and network conditions among different students may lead to digital divide issues, affecting teaching fairness. At the same time, the development and maintenance of high-quality AI teaching systems require significant funding and technological investment, which poses a challenge to many universities, and traditional teaching evaluation systems and management systems may also become obstacles to reform (Hannan & Liu, 2023). On the other hand, AI algorithms may have biases, and personalized recommendations may lead to the "information cocoon" effect, limiting students' perspectives. Personalized learning relies on the collection and analysis of student data, which raises concerns about data privacy and security. When using AI platforms, it is necessary to ensure compliance with relevant regulations, protect student privacy, and examine the fairness of algorithms to avoid educational inequality caused by algorithmic bias. More importantly, excessive reliance on AI may weaken students' abilities in self-directed learning, information retrieval, interpersonal communication, independent thinking, and problem-solving. Especially the "serious nonsense" of generative AI may mislead students, so it is crucial to cultivate students' critical thinking and information discernment abilities. They must be guided to view AI as an auxiliary tool rather than the only source of knowledge.

Secondly, the limitations of research methods. This study is essentially an exploratory single case teaching practice, and its effectiveness evaluation mainly relies on classroom observation and qualitative feedback from students. Although these findings have significant implications, the lack of strict experimental control and quantitative data limits the generalizability of research conclusions and the strength of causal inference. For example, we have observed an increase in student engagement, but whether this is due to the novelty of AI tools or the lasting motivational effect brought by the teaching model itself still needs more rigorous design to verify. In addition, the practice period of one semester is relatively short, making it difficult to evaluate the long-term impact of this model on students' knowledge retention, deep development of critical thinking, and transfer of learning strategies.

Thirdly, the dynamism of technological development. Artificial intelligence technology is iterating and updating at an unprecedented speed, which means that the specific AI tools and platforms used in this study may soon be replaced by more powerful technologies (Damiano et al., 2024). Therefore, the value of this study lies more in providing a transferable set of instructional design concepts and organizational principles for human-machine collaboration, rather than recommending a specific "best tool". Future educational innovation requires continuous attention to the forefront of technology and maintaining the flexibility and adaptability of teaching modes.

Future Prospects

This study validates the enormous potential of AI technology in transforming traditional teaching, improving teaching quality, and achieving personalized education by designing and implementing an AI based teaching and learning model in the course of General Psychology. This model effectively enhances students' learning participation and higher-order thinking abilities by constructing a human-machine collaborative teaching ecosystem, and promotes the modernization transformation of teachers' roles.

However, integrating AI into education is not an overnight process, it is a complex system engineering involving multiple dimensions such as technology, teaching methods, and ethics. Future practice should focus on the following aspects: firstly, conducting more rigorous empirical research. Future research should adopt more rigorous experimental or quasi experimental designs, establish control groups, and quantitatively evaluate the impact of this teaching model on multidimensional indicators such as student academic performance, concept understanding depth, problem-solving ability, and computational thinking through pre- and post-tests. At the same time, longitudinal research can be conducted to track students' learning behavior and development trajectory over the long term, exploring the long-term effects of AI collaborative learning models. Secondly, deepen the research on the mechanism of human-machine collaboration. The future requires a deeper exploration of the optimal interaction mode between students and AI. For example, when and in what way can AI intervene to most stimulate students' deep thinking rather than lead to dependence? How to design an AI interactive language that can better stimulate students' curiosity and intrinsic motivation? The answers to these questions require the integration of knowledge from multiple disciplines such as education, psychology, computer science, and human-computer interaction. In addition, exploring the trust relationship between humans and AI during the learning process and its impact on learning outcomes will also be a valuable research direction (Williamson & Eynon, 2020). Thirdly, strengthen AI literacy education for teachers and students. The effective application of technology requires users to possess corresponding literacy. Universities should systematically incorporate AI literacy into teacher professional development and student training programs, which not only includes training in operational skills, but more importantly, cultivates their ability to use AI critically, creatively, and responsibly, as well as ethical awareness. Fourthly, establish an institutionalized ethical and governance framework. With the increasingly widespread application of AI in education, universities urgently need to establish clear policies and ethical guidelines. This should cover the standards for data collection and use, requirements for algorithm transparency and interpretability, as well as the establishment of accountability mechanisms to ensure that the application of AI always aims to enhance student well-being and educational equity.

Conclusion

This study demonstrates through innovative practice in the course of General Psychology that constructing a human-machine collaborative teaching model is an effective path to address educational challenges in the new era and promote the improvement of teaching quality. Artificial intelligence is not meant to replace teachers, but rather to serve as a powerful empowering tool, freeing teachers from heavy and repetitive labor and enabling them to focus more on their core mission of "educating people". However, the integration of technology is not an easy path. It requires us to adopt a cautious and optimistic attitude, while actively embracing technological changes, always adhering to the essence of education and paying attention to the comprehensive development of people. The future path needs to be explored through continuous practice, reflection, and research. Through the

deep integration of technological logic and educational laws, we are expected to truly "light up" the future of education and cultivate innovative talents who can dance with the era of intelligence.

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