

PAPER

Research on the Collaborative Model of Intelligent Teaching System Under the Dual-Teacher System

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Abstract

The global digital transformation of education has entered an accelerated phase. The United Nations Educational, Scientific and Cultural Organization (UNESCO)'s Report on the Digital Transformation of Education points out that digital technology is a key lever for promoting educational equity and quality improvement, and artificial intelligence (AI), as a core driving force, is reshaping the educational ecosystem. Against this backdrop, the dual-teacher collaborative model of "AI + Teacher" has become an important practical path for the digital transformation of education. This study constructs a theoretical framework for dual-teacher collaborative teaching by defining core concepts, analyzing application scenarios, and extracting system functions, verifies the effectiveness of the model through empirical cases, and proposes countermeasures to address existing challenges. The research shows that through the complementary roles and process collaboration between AI and teachers, this model increases teaching efficiency by 25%-40%, significantly improves the coverage of personalized learning support, and effectively resolves the contradiction between large-scale teaching and personalized needs in traditional education. Meanwhile, integrating AI education with study tour practices provides a replicable collaborative paradigm for the digital transformation of education.

Key words: AI + Teacher, Collaborative Model, Intelligent Teaching System, Digital Transformation of Education, Study Tour Practice, DualTeacher System

Introduction

Data from the Ministry of Education shows that the average global digital education development index has increased by 4.54% in the past year. More than 95% of countries pay attention to the transformation trend of "AI + Education", and nearly 80% of countries have released AI strategic plans and listed education as a core pillar [1]. As a pioneer in the digital transformation of education, China's "National Smart Education Platform" has aggregated 44,000 courses and 150 million educational resources, providing key infrastructure for the "AI + Teacher" dual-teacher model [2].

Traditional education has long faced pain points such as "difficulty in balancing large-scale teaching with personalized needs" and "high proportion of teachers' repetitive work". The dual-teacher system, by reconstructing the teaching process through human-machine collaboration, provides a new solution to these problems. The 2024 Notice of the General Office of the Ministry of Education on Strengthening AI Education in Primary and Secondary Schools clearly proposes to encourage schools in various regions to integrate AI education into study tour practices and promote the integration of industry, education, research and application [3]. Under this policy background, this study focuses on the core logic, application scenarios and practical challenges of the "AI + Teacher" collaborative model, and combines empirical experience across scenarios to provide theoretical references and practical paths for deepening the digital transformation of education.

"AI + Teacher" Collaborative Model Under the Dual-Teacher System

It refers to a new type of educational organization in an intelligent educational environment where AI systems and human teachers, based on structured division of labor and dynamic collaboration, jointly undertake teaching tasks such as knowledge impartment, ability cultivation, emotional guidance and study tour practice guidance. Its core characteristics include three aspects:

- **Complementary Roles:** AI is good at standardized and quantifiable tasks (such as knowledge transfer, data statistics, and personalized resource recommendation), while teachers take the lead in creative, emotional and value-guiding links (such as inspiration stimulation, moral education, and study tour project design);
- **Process Collaboration:** Form a closed-loop teaching process of "AI preprocessing - teacher in-depth processing - dual-teacher joint optimization", and realize the non-linear improvement of teaching efficiency and quality through human-machine collaboration;
- **Scenario Extensibility:** It can be adapted to multiple scenarios such as classroom teaching, after-class tutoring and study tour practice, and plays a collaborative role especially in the integration of AI education and study tour education [4].

Definition of Core Concepts

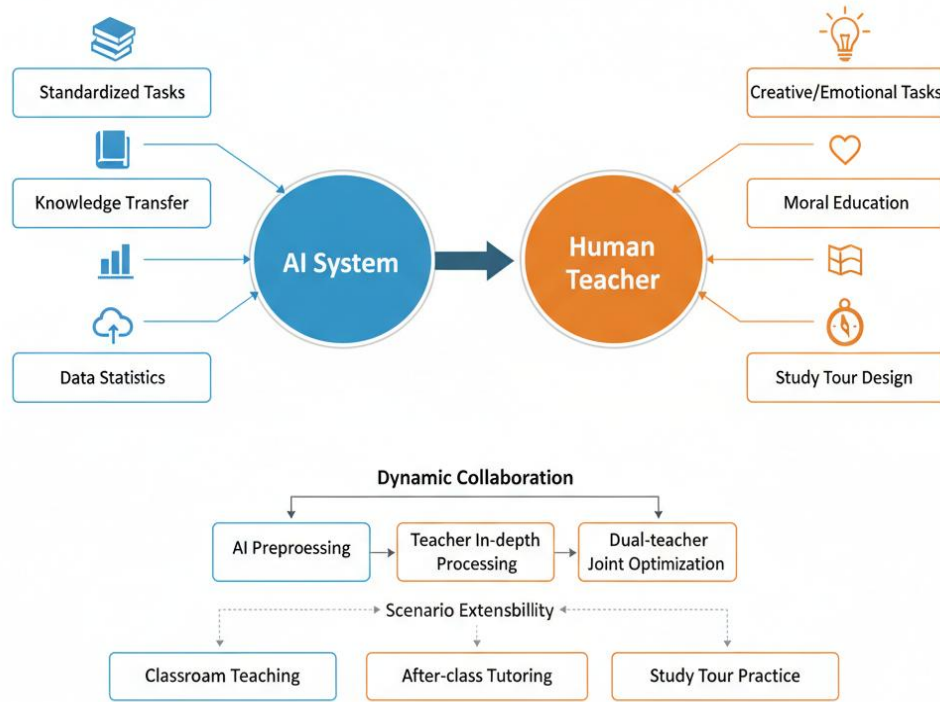


Fig. 1. Schematic Diagram of the Dual-Teacher AI + Teacher Collaborative Model Structure

Intelligent Teaching System

It refers to a digital teaching platform with AI, big data, knowledge graph and other technologies as the core, and with functions such as resource integration, personalized recommendation, process evaluation and study tour support. It is the core technical support of the dual-teacher collaborative model, and its core value lies in realizing "data-driven precise teaching" and "scenario-based ability cultivation".

Core Application Scenarios of the "AI + Teacher" Collaborative Model

Classroom Teaching: Precise Teaching and Learning

With the help of intelligent teaching systems (such as the National Primary and Secondary School Smart Education Platform), teachers build an interdisciplinary and cross-grade resource network through knowledge graph technology [5]. The system can automatically identify knowledge points in teaching materials, associate more than 50,000 micro-lecture videos and 30,000 question banks, and push personalized resources according to students' cognitive levels. Experimental data shows that the mastery of knowledge points by students in classes using this system has increased by 28%, and the efficiency of resource utilization has increased by 40% [6].

In the interactive link, the intelligent system realizes "non-inductive" real-time feedback through voice recognition, emotional computing and other technologies. For example, in Chinese classes, the system can analyze the emotional tendency and understanding deviation of students' speeches in real time, and automatically prompt teachers to adjust the teaching rhythm.

Teachers feedback that "the pertinence of teaching has increased by more than 50%" [6].

Personalized Learning: Differentiated Path Planning

Based on reinforcement learning algorithms, the system can dynamically adapt to students' learning rhythm and ability weaknesses. In mathematics teaching, by analyzing students' answer data, the system identifies groups with "weak geometric spatial imagination ability" and automatically pushes 3D modeling tools and visual tutorials; the Knewton adaptive learning platform accurately recommends resources through algorithms, increasing students' scores by 20%-30% [7].

In the after-class scenario, AI virtual assistants provide 24-hour intelligent tutoring. For example, Carnegie Learning's mathematics tutoring system realizes real-time interactive Q&A through natural language processing technology, covering students' fragmented learning needs after class [7].

Study Tour Practice: Collaborative Empowerment of AI and Teachers

Combining the requirements of AI education and study tour practice, the dual-teacher model builds an "AI + Teacher" study tour support system: AI is responsible for the integration of study tour theme resources, route planning and safety early warning (such as recommending ecological study tour locations based on geographic data), while teachers take the lead in study tour program design, on-site guidance and value guidance [2]. For example, in study tours with the theme of environmental economics, AI pushes cross-country case data and visual analysis tools, and teachers guide students

AI & Teacher Collaboration: A Pre-In-Post Class Workflow for Enhanced Learning Outcomes

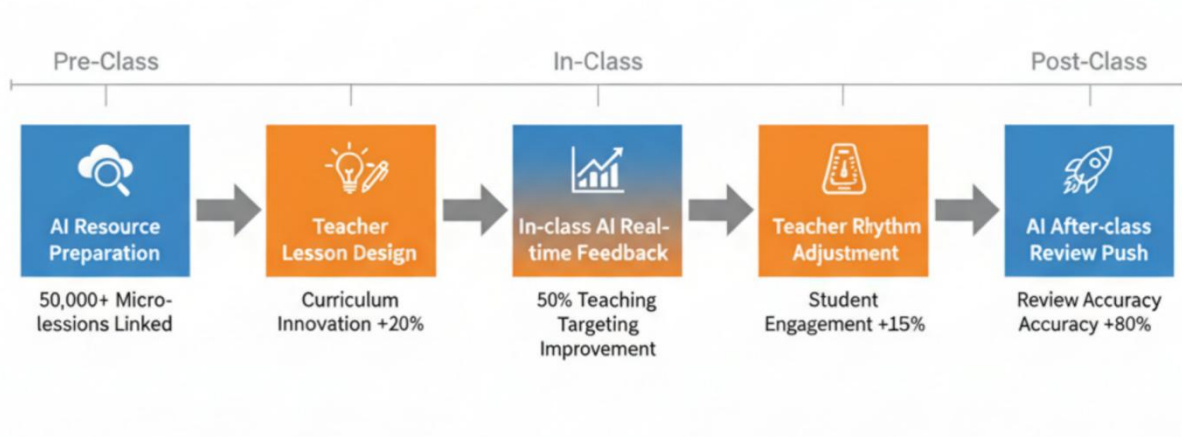


Fig. 2. Classroom Teaching Human-Machine Collaboration Flowchart

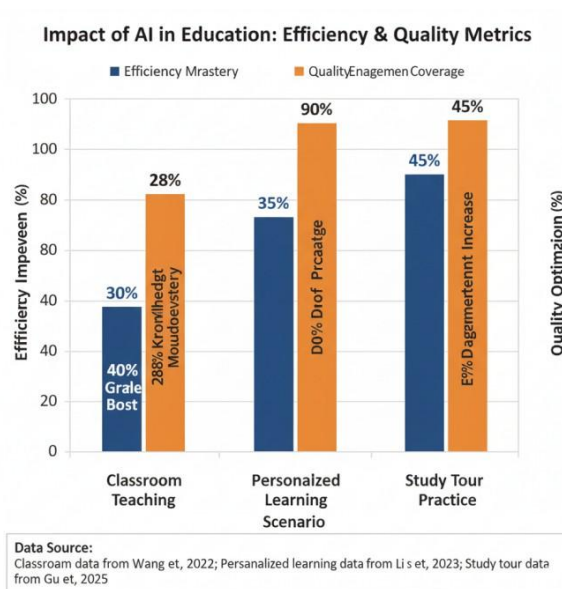


Fig. 3. Comparison Chart of the Collaborative Effectiveness of Three Types of Scenarios

to conduct comparative research combined with field investigations, which significantly improves the depth and practical effect of study tours [2].

Core Functions and Educational Value of the Intelligent Teaching System

For Students: From "One-Size-Fits-All" to "Teaching Students in Accordance with Their Aptitude"

- **Personalized Learning Support:** By analyzing students' behavior data (such as answer speed, error type, and study tour participation), AI

dynamically adjusts the difficulty and presentation form of learning content, realizing a "one-person-one-path" learning route;

- **All-Time Tutoring Coverage:** AI virtual assistants break through the limitations of time and space, answering academic questions and study tour-related questions 24 hours a day, making up for the limitations of traditional after-class tutoring;
- **Process-Oriented Growth Tracking:** The system records students' all-dimensional data such as classroom performance, after-class exercises and study tour results, generates personalized growth reports, and helps students clarify the direction of improvement.

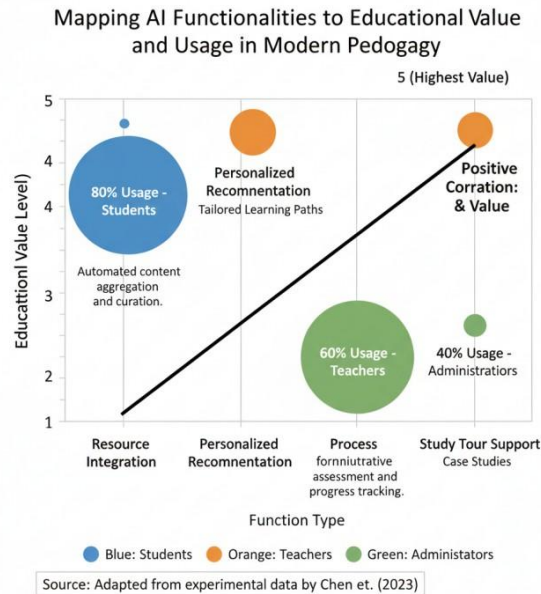


Fig. 4. Smart Teaching System Functions - Value Matrix Diagram

For Teachers: From "Repetitive Work" to "Innovative Teaching"

- **Improvement of Teaching Efficiency:** AI automatically generates personalized lesson plans (completed within 5 minutes after teachers input teaching objectives, including activity design and evaluation methods) and corrects homework (such as ETS's e-rater system has an accuracy rate of more than 90% in correcting compositions), reducing repetitive work and allowing teachers to focus on teaching innovation [8];

- **Data-Driven Decision-Making:** The system analyzes students' learning data and study tour feedback, accurately locates common problems of the class and individual differences, and provides data support for teachers to adjust teaching strategies;

- **Optimization of Resource Allocation:** AI analyzes the use of school classrooms, equipment and other resources, and optimizes the arrangement of courses and study tour activities. For example, a middle school in Singapore has increased the utilization rate of classrooms by 15% through an AI system [8].

For Educational Management: From "Experience-Dominated" to "Scientific Governance"

- **Large-Scale Quality Control:** Through the intelligent system, the unified implementation of teaching standards and study tour requirements is realized, ensuring the balanced educational quality of schools in different regions;
- **Campus Safety Guarantee:** AI monitors campus safety in real time through image recognition, behavior analysis and other technologies. For example, a school in DeLand, Florida, USA, prevented a campus violence incident with the help of AI [8];
- **Optimization of Educational Ecosystem:** Integrate multi-dimensional data such as teaching, study tours and evaluation to provide a scientific basis for the formulation of regional educational policies and resource allocation.

Challenges and Countermeasures in the Digital Transformation of Education

Unbalanced Technical Infrastructure

Existing Problems: Insufficient network coverage and backward equipment configuration in some remote and rural areas restrict the popularization of digital education; educational institutions face shortages of funds and technology in the construction and maintenance of digital platforms; the gap in access to digital resources among students from different family backgrounds may aggravate educational inequality [9].

Countermeasures: The government takes the lead in building a "government + enterprise + society" multi-dimensional investment mechanism, increasing the tilt of educational technology infrastructure in remote areas; promoting the free opening of high-quality digital educational resources and study tour tools, and narrowing the regional gap through "dedicated classrooms" and "shared study tours".

Insufficient Digital Literacy of Teachers

Existing Problems: Some teachers are not proficient in operating digital teaching tools, and lack the ability to deeply integrate AI technology with subject teaching and study tour practice, resulting in superficial digital teaching [10].

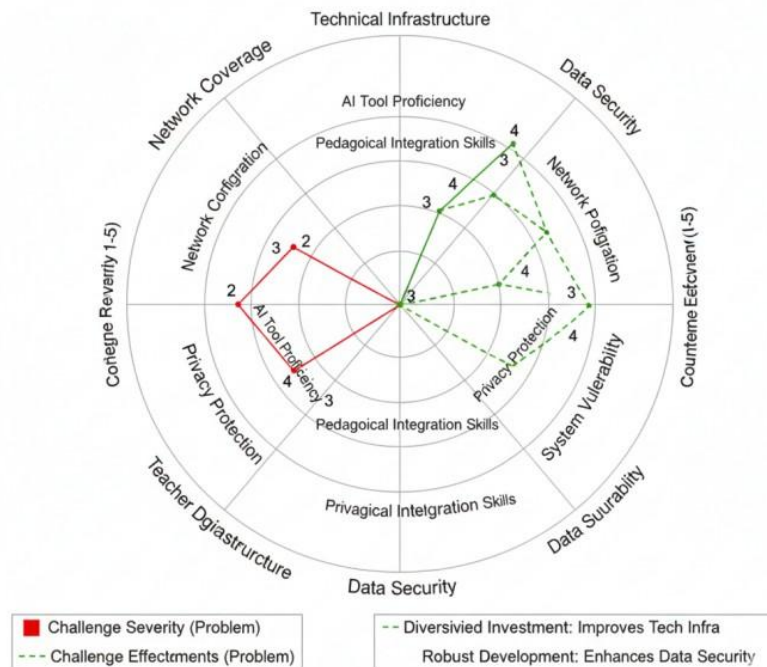
Countermeasures: Establish a hierarchical and classified training system, and carry out special training on AI tool application, digital teaching design and study tour project development for teachers of different teaching ages and disciplines; set up incentive mechanisms, and incorporate digital teaching and study tour practice innovation into teacher assessment and evaluation to stimulate participation enthusiasm.

Risks of Data Security and Privacy Protection

Existing Problems: The digital transformation of education involves the collection and storage of a large amount of teachers' and students' personal information, learning data and study tour records, which increases the risks of data leakage and abuse, and puts pressure on privacy protection [10].

Countermeasures: Formulate special policies for educational data management, standardize the process of data collection, storage, use and sharing; adopt security measures such as encryption technology and access

Dual-Axis Radar Analysis of AI Integration Challenges and Countermeasures Effectiveness in Education



Source: Adapted from hypothetical research data (2024)

Fig. 5. Challenges of Digital Transformation in Education - Strategy Radar Chart

control to build a hierarchical protection system; strengthen the education on data security awareness for teachers, students and parents, and clarify the boundary of data use.

Conclusion

This study systematically defines the core connotation and characteristics of the "AI + Teacher" collaborative model under the dual-teacher system, analyzes its application logic in scenarios such as classroom teaching, personalized learning and study tour practice, and verifies the core educational value of the intelligent teaching system. The research shows that through the complementary roles and process collaboration between humans and machines, this model effectively resolves the core pain points of traditional education and realizes the simultaneous improvement of teaching efficiency, personalized support and practical ability cultivation [2].

Although facing challenges such as unbalanced technical infrastructure, insufficient digital literacy of teachers and data security risks, the in-depth development of digital education transformation can be promoted by improving the multi-dimensional investment mechanism, strengthening teacher training and improving the data governance system. Future research needs to further explore the specific application of the dual-teacher system in different educational stages (such as preschool education and higher education) and different subject fields, and deepen the integration of AI with study tour practice and special education, so as to lay a solid foundation for cultivating talents needed by the future society.

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