Article

Research on Training and Application of Artificial Intelligence Models Based on Digital Resource Libraries

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Abstract: This study conducts research on the construction and application of an AI-assisted teaching system, supported by the digital teaching resource library of the Shanghai Excellent Course "Mechanical Drawing" and the AI model of the Chaoxing website. By integrating diverse digital resources such as existing course videos, animations, and exercises, the research builds a knowledge graph containing 128 knowledge point nodes and 326 semantic association relationships, trains an AI Q&A robot integrated with over 500 typical question-answer pairs, and develops a dynamic learning analytics module, thus forming a solution for applying AI in teaching. The research shows that the AI system can effectively improve teaching efficiency and learning quality, confirming that customized training to achieve deep integration between AI models and professional teaching resources is the key to AI empowering vocational education. It provides a replicable and promotable practical paradigm for the intelligent transformation of vocational education courses. The results indicate that the AI model system can effectively enhance students' learning efficiency and classroom participation, reduce teachers' teaching burden, and offer a replicable practical paradigm for the intelligent transformation of vocational education courses.

Keywords: Artificial Intelligence; Digital Resource Library; Mechanical Drawing; Vocational Education; Personalized Learning; Knowledge Graph

1. Introduction

Against the backdrop of the rapid development of artificial intelligence technology, educational intellectualization has become the core direction of vocational education reform [1]. As a key hub for cultivating highly skilled talents, vocational education is facing a contradiction between traditional teaching models and the demands of intelligent development. Particularly in theoretical and practical courses, problems such as significant differences in students' thinking patterns and insufficient personalized guidance from teachers are prominent. The rapid development of AI technology brings both opportunities and challenges to vocational education: its application is expected to realize individualized instruction, improve teaching efficiency and quality through forms such as intelligent learning companions; AI can also enrich teaching resources, expand teaching scenarios like virtual simulation, and further enhance teacher-student interaction efficiency [2]. Meanwhile, it poses challenges: the vocational education sector needs to promote the transformation of traditional models to intelligent ones in accordance with policy requirements, and the rapid development of AI brings the risk of job displacement, making society's demand for highly skilled talents more urgent [3].

A review of existing studies confirms the application value of AI technology in education, but obvious limitations remain: first, most studies focus on the direct application of general AI models, lacking customized training tailored to the characteristics of vocational education courses; second, in terms of resource integration, they fail to fully leverage the supporting role of professional digital resource libraries, resulting in insufficient adaptability between resources and models; third, practical applications mostly focus on single functional modules, lacking an integrated solution

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covering the entire "preview-in-class-after-class" process. These research gaps are the key issues addressed by this study [4].

This research, relying on the rich digital resource library of the Shanghai Excellent Course "Mechanical Drawing" and based on the AI model of the Chaoxing website [5], conducts targeted training and application exploration, which holds significant theoretical and practical significance. Theoretically, it focuses on customized training methods for AI models in vocational education, filling the research gap in the application of AI technology in professional skills courses [6], enriching the theoretical system of "Internet + Vocational Education", and providing a new theoretical perspective for the deep integration of artificial intelligence and subject teaching. Practically, it realizes intelligent matching and precise recommendation of course resources through AI technology, addressing the drawback of the "one-size-fits-all" approach in traditional teaching; by means of AI tutors and learning analytics systems, it builds a comprehensive personalized learning ecosystem, providing a practical model for the intelligent transformation of vocational education courses with strong promotional value.

Based on this, this study aims to construct an intelligent auxiliary system covering the entire "teaching, learning, assessment, and management" process, provide practical solutions to problems in the intelligent transformation of vocational education, and offer references for the intelligent reform of similar courses. Through customized training and full-scenario application of AI models based on the "Mechanical Drawing" digital resource library, it is expected to fill existing research gaps and promote the in-depth implementation of artificial intelligence technology in vocational education.

2. Application of the AI Model

2.1. Online Resource Construction

The "Mechanical Drawing" excellent course has built a comprehensive and diverse digital teaching resource library, covering teaching videos, dynamic courseware demonstrations, supplementary after-class exercises, a continuously updated license exam question bank, and a series of micro-courses. The course team independently developed multimedia courseware integrating audio, images, text, and animations, featuring rich illustrations, vivid presentations, and large information capacity. Currently, the resource library contains 1211 minutes of recorded teaching videos, 40 interactive teaching animations, over 400 pages of teaching courseware, and over 300 exercise questions, with video and animation resources accounting for more than 70%, reflecting the advancement and comprehensiveness of information technology.

Relying on the Chaoxing website, all online resources and diverse information-based teaching methods are open for free to both on-campus students and social learners, supporting independent learning and open sharing. This interactive learning platform provides rich and flexible learning methods and tools to help learners improve their professional qualities and skills, and enables convenient retrieval and access to online resources.

The achievements in building the excellent course and teaching resource library have laid a solid foundation for research on the educational application of artificial intelligence. As an upgraded version of Chaoxing website, the Chaoxing AI has continuously introduced various AI tools in recent years, becoming an important platform supporting teachers in developing smart courses and conducting teaching practices. The platform is divided into teacher and student terminals based on user types, integrating functional modules such as knowledge graphs, intelligent resource recommendation, AI Q&A robots, and learning analytics. It currently connects to large models such as DeepSeek and Huiya, for teachers to select flexibly. Resources organized on the teacher terminal can be directly synchronized to the student terminal, supporting students in personalized learning.

2.2. Training of Core AI Functions

Different from traditional knowledge organization methods, a knowledge graph visually presents the associative structure between knowledge points and can re-integrate

teaching resources [7]. Based on the resources in the online resource library, teachers used the knowledge graph function of the Chaoxing AI to organically connect knowledge points and videos in line with the teaching logic of "Mechanical Drawing", and integrated course materials and exercises into corresponding chapters (Figure 1). This graph integrates 128 knowledge point nodes and 326 semantic association relationships, covering various knowledge elements such as concepts, principles, and drawing skills. It realizes the visual presentation and navigation of knowledge structures, providing underlying support for subsequent personalized learning services [8].

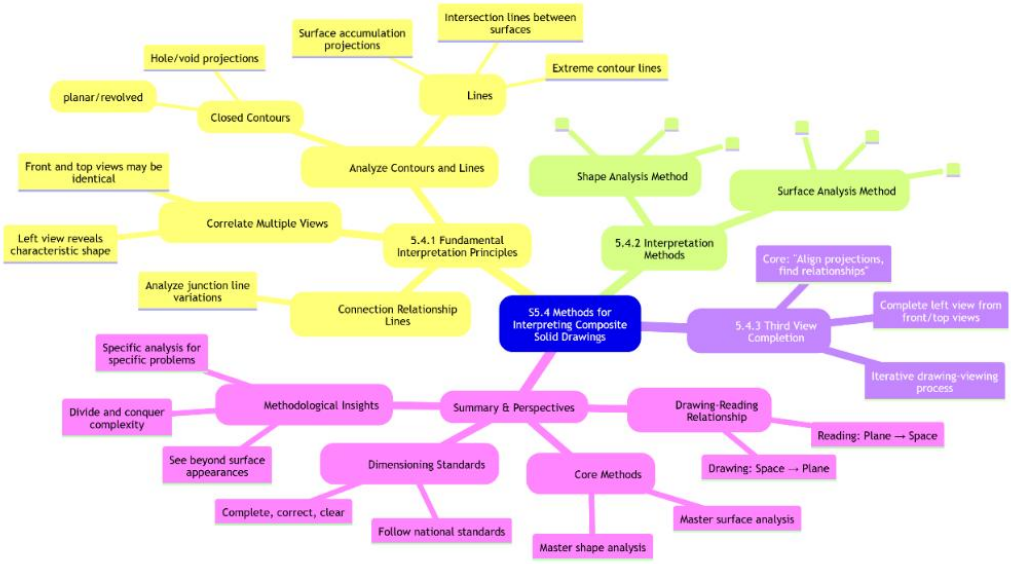


Figure 1. Partial Knowledge Graph of "Mechanical Drawing"

The AI Q&A robot is built based on an advanced large language model architecture, with the ability of continuous learning and knowledge evolution. In terms of knowledge base construction, the system can synchronize teacher-specified course documents, textbook chapters, and related reference materials to the knowledge base with one click. After synchronization, the backend large model conducts in-depth analysis and intelligent semantic extraction of the document content, automatically identifying key knowledge points, concept definitions, and technical specifications [9]. After completion of the analysis, the robot can automatically answer questions raised by users based on document semantic understanding. To further improve the quality and coverage of answers, the project team systematically collected and sorted over 500 typical questions (Figure 2) raised by students during learning, organized professional teachers to provide manual answers and content review, and formed high-quality question-answer pairs. These question-answer pairs were imported into the system knowledge base one by one through the knowledge rule addition function provided by the platform, effectively expanding the robot's knowledge reserve [10]. On this basis, the coverage and response capability of the knowledge base are continuously expanded based on forum questions and answers in each course session. In addition, the AI system integrates a feedback collection mechanism, and optimizes answer content based on feedback data, which can improve the semantic understanding accuracy and answer generation quality of the robot in the professional field of mechanical drawing, forming a sustainably improved intelligent Q&A system.

Question	Answer
Basic orthographic projection features?	Truthfulness: Line/plane parallel to projection plane actual length/shape. Accumulation: Line/plane perpendicular to it line →point , plane → straight line. Similarity: Inclined line/plane → shorter line or similar plane shape.
"Length/height alignment, width equality" in 3 views?	Length alignment: Front & top views align in length. Height alignment: Front & left views level in height. Width equality: Top & left views have equal width.
Projection correspondence of 3 views?	Front view: Length + height. Top view: Length + width. Left view: Height + width.
Straight line projection situations?	Parallel to 1 projection plane: Actual length + inclinations. Perpendicular to 1: Projects to point or actual length. General position: Shortened projections.

Figure 2. Some Questions in Training AI Q&A Robot

In the past, when using the "Mechanical Drawing" excellent course resource library, students were confused about how to use the abundant resources. The AI personalized resource recommendation function continuously collects and analyzes students' learning behavior data on the platform-including learning duration, answer accuracy rate, distribution of error types, resource access frequency, and interaction participation-to build dynamically updated learner profiles. These profiles not only reflect students' current knowledge mastery status but also identify their learning preferences and cognitive habits, thereby realizing adaptive matching between knowledge points and learning resources. The system can automatically recommend various types of resources to students, such as video explanations, extended documents, and targeted exercises. Practical applications show that this model plays a significant role in improving resource utilization efficiency and enhancing students' willingness and effectiveness in independent learning, effectively supporting the construction of personalized learning paths.

The learning analytics module can realtime collect and integrate multiple types of learning data, such as homework completion quality, unit test scores, and resource learning trajectories, and automatically generate multidimensional learning reports covering individual and class levels [11]. This module can accurately identify students' weak areas in different knowledge units, and automatically push corresponding intensive training content based on diagnostic results. At the same time, the system intuitively presents changes in learning status in the form of charts and trend curves, helping teachers quickly grasp overall teaching effectiveness and individual differences, and providing data support and decisionmaking basis for implementing targeted teaching interventions [12].

3. Application Effects and Analysis

3.1. Significant Improvement in Learning Effectiveness

In the final course assessment, the theoretical scores of students in the experimental class (using the AI system) were significantly higher than those in the control class (using traditional teaching), with statistically significant differences. In the practical drawing assessment, the average completion time of students in the experimental class was shortened, the error rate was reduced, and the drawing quality was effectively improved. Questionnaire feedback showed that most students believed the AIassisted system helped improve the efficiency of mastering drawing skills and had a positive effect on enhancing their spatial thinking abilities.

3.2. Effective Optimization of Teaching Efficiency

The AI system undertakes a large number of routine Q&A and assignment correction tasks, significantly reducing teachers' workload and allowing them to devote more time to personalized tutoring and teaching innovation. With the help of the learning analytics function, teachers' accuracy in identifying students' knowledge weak areas has been greatly improved, and teaching interventions have become more precise and effective. Teachers generally believe that AI tools provide substantial support for optimizing teaching processes.

3.3. Steady Advancement of Curriculum Reform

The implementation of the system in the "Mechanical Drawing" course has gradually formed a new teaching model characterized by intelligent resource integration, precise teaching implementation, and personalized learning guidance. The knowledge graph and intelligent recommendation mechanism have effectively optimized the allocation of teaching resources, while AI Q&A and learning analytics provide a basis for dynamic adjustments to the teaching process, laying the foundation for continuous curriculum improvement.

4. Conclusions and Prospects

Based on the "Mechanical Drawing" digital resource library, this study constructed an AIassisted teaching system integrating knowledge graphs, intelligent resource recommendation, AI Q&A, and learning analytics. Practical applications show that the system plays a significant role in improving students' learning effectiveness and optimizing teachers' teaching processes, providing an implementable reference path for the intelligent transformation of vocational education courses. The research indicates that achieving deep integration between AI models and professional teaching resources through customized training is a key mechanism for promoting the effective implementation of artificial intelligence in vocational education.

Looking forward, on the basis of continuously optimizing system performance, the focus will be on exploring the interconnection mechanism with professional drafting software such as CAD to expand the support dimensions of AI in the teaching process. At the same time, potential risks in the application of AI technology will be carefully evaluated, and usage standards and ethical constraints will be established and improved to ensure that artificial intelligence plays a stable and sustainable positive role in vocational education.

References

1. Ministry of Education, China, "National Strategy for AI Integration in Vocational Education," *Chinese Vocational and Technical Education*, vol. 42, no. 12, p. 115, 2023.
2. Z. Wang et al., "AI-Driven Virtual Drafting Assistant for Vocational Training," *Simulation & Gaming*, vol. 54, no. 4, pp. 456–472, 2023.
3. M. Zhou and Y. Gu, "Ethical Considerations of AI in Mechanical Drafting Education," *International Journal of Technology and Design Education*, vol. 35, no. 3, pp. 679–695, 2025.
4. P. Hao et al., "Digital Resource Library-Driven AI Model Customization in Vocational Education," *Chinese Journal of Mechanical Engineering (English Edition)*, vol. 38, no. 3, p. 112, 2025.
5. H. L. Xiang et al., "Chaoxing AI Platform in Vocational Mechanical Education: A Multi-Case Study," *Journal of Educational Technology & Society*, vol. 28, no. 2, pp. 234–247, 2025.
6. Idaho State Department of Education, "AI-Enhanced Competency Mapping for Mechanical Drafting Careers," *Career and Technical Education Research*, vol. 49, no. 2, pp. 111–128, 2024.
7. Y. Liu et al., "Ontology-Driven Knowledge Graph Construction for Mechanical Drawing," *Knowledge-Based Systems*, vol. 283, p. 109567, 2024.
8. Y. Li, Y. Gu, and L. Zhang, "Knowledge Graph-Enhanced Personalized Learning for Mechanical Drawing: A Vocational Education Case," *Computers & Education*, vol. 205, p. 104682, 2025.
9. H. Chen et al., "Domain-Specific Q&A Robot Training for Mechanical Drafting: A Vocational Education Perspective," *IEEE Transactions on Learning Technologies*, vol. 17, no. 3, pp. 654–667, 2024.
10. M. Li et al., "Continual Learning for Mechanical Drafting Q&A Robots," *Applied Intelligence*, vol. 55, no. 5, pp. 7890–7905, 2025.

11. X. Chen et al., "Visual Analytics for Mechanical Drawing Learning Trajectories," *Computers in Human Behavior*, vol. 145, p. 107682, 2023.
12. L. Zhao and C. Liu, "Cognitive Diagnosis of Mechanical Drawing Skills via AI-Learning Analytics," *International Journal of Engineering Education*, vol. 41, no. 2, pp. 567–578, 2025.

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