An AI-Based Collaborative Teaching Platform for Art and Design Education under Industry-Education Integration

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Abstract. With the rapid development of artificial intelligence (AI), its application in education has become an important research topic, particularly in interdisciplinary fields such as art and design. However, traditional teaching approaches still face challenges in practical training, industry collaboration, and teaching efficiency. To address these issues, this paper proposes an AI-based collaborative teaching platform under the framework of industry-education integration. The platform integrates AI-assisted design tools, project-based learning, and collaborative interaction modules to support multi-party participation and improve the teaching process. A system framework is designed to enable efficient coordination among students, instructors, and enterprise mentors, while providing intelligent support for design tasks. Experimental results show that the proposed approach improves task efficiency, enhances design quality, and promotes collaborative learning. In addition, the platform creates a more engaging and user-friendly learning environment. These findings suggest that integrating AI technologies with collaborative teaching mechanisms provides an effective solution for art and design education.

Keywords: Artificial Intelligence, Industry-Education Integration,Collaborative Learning, Art and Design Education, Intelligent Teaching Platform.

1 Introduction

In recent years, artificial intelligence (AI) has significantly impacted higher education, particularly in digital art and design [1]. However, traditional teaching methods still face challenges such as insufficient practical training and weak industry collaboration. Industry-education integration has been proposed to address these issues [4], but existing approaches lack systematic technological support. Meanwhile, AI technologies, including intelligent agents and generative tools, provide new opportunities to improve teaching efficiency [2], yet their integration remains limited.

To address these problems, this paper proposes an AI-based collaborative teaching platform that integrates project-based learning, enterprise collaboration, and intelligent

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tools. Experimental results demonstrate improvements in teaching efficiency, design quality, and collaborative learning.

The main contributions of this paper are as follows:

1. An AI-based collaborative teaching platform for art and design education is proposed;
2. A system framework integrating AI tools and collaborative learning is designed;
3. A quantitative evaluation method combining system and educational metrics is established;
4. The effectiveness of the proposed approach is validated through experiments.

2 Literature Review

2.1 Artificial Intelligence in Education

With the rapid development of artificial intelligence (AI), its application in education has attracted increasing attention. AI technologies, including intelligent agents, machine learning, and generative models, have been widely used to support personalized learning, intelligent tutoring, and content generation [2]. In art and design education, these tools assist in idea generation and visual creation, improving learning efficiency.Recent studies have explored the application of AI in digital art education. Generative tools have been used for visual design tasks [3], while intelligent systems provide adaptive feedback and recommendations [6]. However, most existing studies focus on isolated tools and lack a systematic approach to integrating AI into the overall teaching process.

2.2 Collaborative Learning and Industry-Education Integration

Collaborative learning is widely recognized for improving student engagement and learning outcomes [5]. It promotes interaction among students, instructors, and external stakeholders, supporting knowledge sharing and cooperative problem-solving. Industry-education integration further extends this model by incorporating enterprise participation into teaching.

Through industry collaboration, students engage in real-world projects and gain practical experience. Project-based learning and school-enterprise cooperation have become common approaches in art and design education [7]. However, existing methods often rely on manual coordination and lack unified platforms for efficient communication and project management, limiting their effectiveness[8].

3 Methodology

3.1 System Overview

To address the limitations of traditional art and design education, this paper proposes an AI-based collaborative teaching platform under industry-education integration. The system adopts a three-layer architecture (user, application, and data layers), integrating AI-assisted design, project management, and collaborative interaction modules to enable efficient multi-party coordination and support the entire teaching workflow.

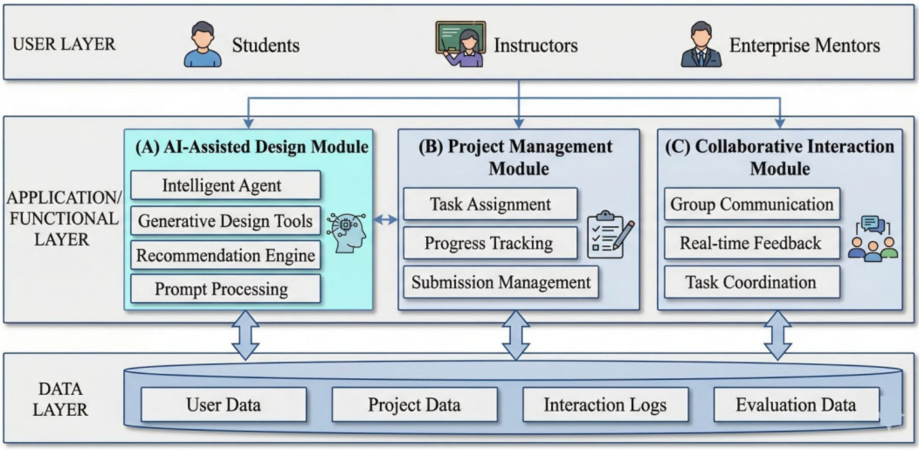

Fig. 1. Architecture of the proposed system: (A) AI-assisted design module, (B) project management module, (C) collaborative interaction module.

3.2 AI-Assisted Design Module

The AI-assisted design module, as shown in Fig. 1(A), integrates intelligent agents, generative design tools, recommendation mechanisms, and prompt processing techniques to support the creative process.

Specifically, the intelligent agent analyzes user inputs and historical design data to generate design suggestions. Generative tools assist in producing visual content, while the recommendation engine provides personalized guidance based on user behavior. The prompt processing component optimizes user inputs to improve the quality of generated results.

To evaluate the effectiveness of AI assistance, the task completion efficiency is defined as:

$$[E = \frac{T_{\text{baseline}} - T_{\text{AI}}}{T_{\text{baseline}}}] \tag{1}$$

where T_{baseline} represents the time required to complete a task without AI support, and T_{AI} denotes the time with AI assistance. A higher value of (E) indicates better efficiency improvement.

To address the potential issue of stylistic convergence caused by AI-assisted design tools, the proposed platform incorporates mechanisms to promote divergent thinking and individual artistic expression.

First, a multi-solution exploration strategy encourages students to generate multiple design alternatives, emphasizing idea diversity rather than a single optimal result. Second, a guided workflow requires students to refine and reinterpret AI-generated content, ensuring human-centered creative control. Third, a process-oriented evaluation mechanism assesses not only final outcomes but also intermediate design iterations and decision-making processes. Finally, personalized design profiles are used to provide adaptive recommendations aligned with individual styles.

3.3 Project Management and Collaborative Interaction

The project management and collaborative interaction modules jointly support project-driven teaching and multi-party collaboration. The project management module handles task assignment, progress tracking, and performance monitoring, while the collaborative interaction module enables group communication, real-time feedback, and coordination, facilitating effective interaction among students, instructors, and enterprise partners.

To quantify collaboration effectiveness, a collaboration index is defined as:

$$[C = \frac{N_{ts}+N_{ss}+N_{se}}{3}] \tag{2}$$

where (N_{ts}), (N_{ss}), and (N_{se}) denote the number of interactions between teacher-student, student-student, and school-enterprise, respectively. This metric reflects the overall level of collaborative engagement within the system.

3.4 Data Layer and Evaluation Metrics

The data layer provides fundamental support for the system by storing and managing various types of data, including user data, project data, interaction logs, and evaluation data, which are used for system optimization and performance analysis. Based on these data, four key evaluation metrics are adopted: task completion time to measure design efficiency, system response time to reflect system performance, project quality score to assess the quality of student work based on a structured multi-dimensional evaluation rubric, and user satisfaction to evaluate user experience through questionnaires. These metrics enable a comprehensive assessment of both system performance and educational effectiveness.

4 Experiments and Comparative Analysis

4.1 Experimental Setup

To evaluate the proposed AI-based collaborative teaching platform, experiments were conducted in a digital art and design course. A total of 68 undergraduate students were randomly divided into a control group (traditional teaching) and an experimental group (proposed platform), with 34 students in each group.

All participants were assigned the same project-based tasks derived from real industry cases, including visual design and digital media production. The experiment lasted for 8 weeks to ensure sufficient data collection.

The experimental data were collected from multiple sources to ensure objectivity. Task completion time and system response time were automatically recorded by system logs. Project quality was evaluated by three instructors and two enterprise mentors using the predefined rubric. To reduce subjectivity, all evaluators were provided with unified scoring guidelines prior to assessment. The final score for each project was calculated as the average of all evaluators' scores. Inter-rater consistency was monitored to ensure reliability of the evaluation results.

All experimental conditions, including teaching content and evaluation criteria, were kept consistent across both groups to ensure fairness. The platform was deployed on a standard web-based environment with stable system performance.

4.2 Main Experimental Results

To evaluate the effectiveness of the proposed AI-based collaborative teaching platform, a comparative experiment was conducted between the experimental group and the control group based on the defined evaluation metrics.

Table 1. Performance Comparison between Control Group and Experimental Group.

Metric	Control Group	Experimental Group	Improvement
Task Completion Time (h)	5.8	4.2	-27.6%
System Response Time (s)	1.82	1.21	-33.5%
Project Quality Score (0–100)	78.4	86.7	+10.6%
User Satisfaction (1–5)	3.92	4.46	+13.8%

As shown in Table 1, the experimental group outperforms the control group across all metrics.Task completion time is reduced, indicating improved efficiency with AI assistance. System response time is also decreased, demonstrating stable platform performance. In addition, project quality scores are higher in the experimental group, suggesting that AI tools and collaborative mechanisms contribute to better design outcomes. User satisfaction is also improved, reflecting a more positive learning experience.Overall, the results confirm that the proposed platform enhances both efficiency and learning quality in art and design education.

4.3 Discussion

The results indicate that the platform improves both system performance and learning outcomes. Reduced task completion time reflects higher efficiency, while improved project quality—across creativity, technical implementation, and practicality—demonstrates the effectiveness of combining AI assistance with collaborative learning. Increased user satisfaction further suggests a more engaging learning experience.

From an educational perspective, the platform enhances learning through explainable AI feedback that links suggestions to design principles (e.g., layout, color, visual hierarchy) and supports reflection via comparative, iterative processes.

However, the study is limited by a single course context and small sample size, which may affect generalizability. Design quality evaluation also retains some subjectivity despite a structured framework.

The integration of AI and industry data raises concerns about IP ownership and data confidentiality. To address this, the platform adopts a privacy-aware framework: student work remains student-owned, enterprise data are processed in isolated environments, and AI models avoid cross-project training. Access control and logging further ensure security and transparency.

Future work will focus on large-scale validation across diverse contexts and on improving AI explainability and personalization.

5 Conclusion

This paper presents an AI-based collaborative teaching platform for art and design education within the framework of industry-education integration. The system integrates AI-assisted design, project-based learning, and collaborative interaction to enhance both teaching efficiency and learning outcomes.

Experimental results show that the proposed platform outperforms traditional teaching methods in task completion time, system performance, project quality, and user satisfaction, demonstrating the effectiveness of the AI module and collaborative mechanisms.

Overall, the approach provides a practical solution for integrating AI technologies into art and design education. Future work will focus on large-scale deployment and further optimization of intelligent functionalities.

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