Research on the Application Strategy of AIGC in Project based Teaching of Interior Design CAD Drawing Course

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Abstract

With the deep penetration of Artificial Intelligence Generated Content (AIGC) technology in the design field, interior design CAD drawing courses, as the core carrier connecting design creativity and technology implementation, face efficiency bottlenecks, creative limitations, and lack of personalized guidance in traditional project-based teaching. This article combines the generative and iterative characteristics of AIGC technology, analyzes its feasibility in the course through literature research, action research, and comparative experiments, constructs a three-dimensional application strategy of "technology empowerment task reconstruction evaluation optimization", and verifies the effect with the indoor design major of a vocational college as a practical sample. The results show that AIGC can improve students' drawing efficiency by more than 50% and increase their creative score by 20%, providing a practical path for teaching reform in design courses.

Keywords

AIGC; Interior design; CAD drawing; Project-based teaching; teaching reform.

1. Introduction

1.1. Research Background

In recent years, AIGC technology has achieved precise generation from text descriptions to images and 3D models through breakthroughs in algorithms such as Transformer and diffusion models, presenting an application trend of "assisting creativity, optimizing processes, and lowering barriers" in the interior design industry. According to the 2023 China Design Industry Technology Application Report, 72% of interior design companies have introduced AIGC tools to assist in solution generation, with a technical penetration rate of 65% in the CAD drawing process[1]. However, the current project-based teaching of CAD courses in interior design majors still focuses on "manual drawing+unified tasks", and students need to spend 40% to 60% of their class hours completing repetitive operations such as wall drawing and dimension annotation, resulting in compressed creative design time [2]. This teaching model that emphasizes technology over creativity is significantly disconnected from the industry's demand for "AI collaborative design", and there is an urgent need to achieve teaching process reconstruction through technological empowerment.

1.2. Research significance

From a theoretical perspective, this study can enrich the application research of AIGC in vocational education and fill the theoretical gap in the correlation between "technology teaching ability"; From a practical perspective, the specific strategies proposed can directly provide operational guidelines for teachers, helping students quickly adapt to industry technological changes and shorten their career adaptation period.

1.3. Research Methods

1.3.1 Literature research method: Retrieve relevant literature on "AIGC Education" and "Project based Teaching CAD" from databases such as CNKI and Web of Science, and sort out the core theories and research status;

1.3.2 Action research method: Conduct 12 weeks teaching practice in two classes of the 2023 Interior Design major at a vocational college, optimizing the application path in three stages: "strategy design implementation iteration effectiveness evaluation";

1.3.3 Comparative experimental method: The experimental class adopts AIGC assisted project-based teaching, while the control class adopts traditional teaching. The effects are compared through three dimensions: drawing speed, program quality, and course satisfaction.

2. Core Concepts and Theoretical Foundations

2.1. Connotation and Application Characteristics of AIGC Technology

AIGC (Artificial Intelligence Generated Content) refers to the automatic generation of content that meets human needs through artificial intelligence algorithms. Its application in the field of interior design presents three major features: firstly, parameterized generation. By inputting keywords such as "80 square meters modern minimalist living room and open layout", multiple sets of CAD sketches can be generated, supporting real-time adjustment of parameters such as size and material; The second is cross software collaboration, for example, Midjourney's CAD plugin can directly import generated sketches into software such as AutoCAD and SketchUp, automatically converting them into standardized vector graphics[3]; The third is standard verification, with built-in databases such as "Architectural Drawing Standard GB/T 50104-2010" and "Interior Design Drawing Specification", which can automatically detect errors in layer naming, dimension annotation, and generate error correction reports.

2.2. Core elements of project-based teaching

According to the project-based teaching theory of vocational education, the project design of interior design CAD drawing course needs to meet three major requirements of "authenticity, task-based, and process oriented": using real house layout renovation (such as "120 square meters three bedroom full case design") as the task carrier, through the process of "task disassembly scheme design CAD drawing achievement display", cultivate students' spatial expression and standardized application ability[4]. In traditional project-based teaching, the model of unified tasks for the whole class and centralized guidance from teachers is difficult to meet the needs of different basic students, and AIGC's differentiated generation ability can effectively compensate for this deficiency.

2.3. The integration logic between AIGC and project-based teaching

From the perspective of goals, the efficiency advantage of AIGC can reduce students' repetitive operations, allowing them to focus on creative solutions, which is in line with the concept of project-based teaching that emphasizes process over form; From a methodological perspective, AIGC's dynamic adjustment function supports students' "trial and error optimization" cycle, which is consistent with the "iterative learning" feature of project-based teaching; From the perspective of evaluation, the real-time data recording of AIGC can provide objective basis for project process evaluation, solving the problem of traditional evaluation that emphasizes results over processes. [5]

3. The Current Situation and Problems of Project-based Teaching in Interior Design CAD Drawing Courses

3.1. Research on Teaching Status

To grasp the actual situation, the author conducted a survey on the interior design majors of three vocational colleges (including two public and one private), involving four teachers and 240 students. The results showed that:

3.1.1 Homogenization of project tasks: 85% of courses adopt "fixed layout+unified style" tasks (such as "60 square meters small layout graphic design"), while only 15% of teachers attempt differentiated tasks;

3.1.2 Inefficient drafting: Students need an average of 10-12 class hours to complete a complete set of construction drawings (including plan, elevation, and section) for a 100 square meters apartment, of which 60% are for basic drafting (walls, doors, and windows);

3.1.3 Delayed guidance feedback: Teachers guide 35-40 students per capita, and the feedback cycle after mid-term project inspections can be as long as 3-5 days, making it difficult for students to correct errors in a timely manner;

3.1.4 Industry technology disconnect: Only 20% of teachers mention AIGC tools in their teaching, and students need to participate in additional corporate training after graduation to master AI assisted mapping skills.

3.2. Core problem analysis

3.2.1. The Contradiction between Efficiency and Creativity

Students spend a lot of time on basic drawing, resulting in weak creative design links. According to a survey, 68% of students said that "drawing is too tiring and they don't have time to think about space optimization", and 75% of teachers believe that "student plans are highly homogenized and lack innovation" [6]. For example, in the "Living Room Layout Design" project, 80% of student proposals only include the conventional combination of "sofa coffee table TV", without considering flow optimization or personalized needs.

3.2.2. Difficulty in Implementing Layered Teaching

In traditional teaching, unified tasks make students with good foundations "unable to eat" (thinking the tasks are simple), while students with weak foundations "unable to eat" (not knowing how to start). In the survey, 45% of students with weak foundations expressed that they feel nervous when they see blank floor plans and don't know where to start drawing. 30% of advanced students believe that the task is not challenging and they cannot learn new things.

3.2.3. Lack of timeliness in evaluation feedback

Teachers need to review the drawings one by one and mark any issues. The feedback cycle is long, and students are unable to make timely adjustments during project progress. For example, a student was repeatedly rejected while drawing an elevation due to "non-standard font", which affected their interest in learning.

3.2.4. The disconnect between technology and industry demand

Currently, manual drawing is still the main teaching method, while AIGC tools have been widely used in the industry to improve efficiency. If a design company uses Adobe Firefly to generate preliminary CAD sketches, the efficiency of designers' drawing is greatly improved because they can only make adjustments to the drawings.

4. Application strategy of AIGC in project-based teaching of interior design CAD drawing course

Based on the above issues, combined with the characteristics of AIGC technology and the needs of project-based teaching, a three-dimensional application strategy of "technology empowerment task reconstruction evaluation optimization" is constructed. The specific path is as follows:

4.1. Technical Empowerment: Optimizing CAD Drawing Process

4.1.1. Intelligent sketch generation reduces the entry barrier

During the project initiation phase, teachers guide students to use AIGC tools (such as Canva Design AI, Kujiale AI design) to input keywords (size, style, functional requirements) based on task objectives (such as "Modern Luxury Bedroom Design"), and generate 3-5 sets of preliminary CAD sketches. Students can choose one set as a foundation and refine it in CAD software. Students with weak foundations can choose sketches with layer classification (wall layer, furniture layer, annotation layer) to focus on standardized learning; Advanced students select unmarked sketches for annotation practice. For example, in the "Small House Kitchen Renovation" project, AIGC generates sketches with "Water and Electricity Point Annotations" for basic students, giving them priority in mastering the specifications; Generate blank sketches for advanced students, independently design water and electricity layouts, and achieve differentiated entry.

4.1.2. Parameterized adjustment, accelerating scheme iteration

During the project implementation phase, students modify design elements through the parameter panel of the AIGC tool (such as replacing "solid wood flooring" with "marble floor tiles" and adjusting "sofa size"). The tool automatically updates sketches and synchronizes them to CAD software, achieving "one click modification". With the assistance of AIGC, efficiency is significantly improved. Teachers can guide students to compare the effectiveness of different schemes under different parameters and cultivate spatial optimization thinking. For example, in the "Living Room Flow Line Design", students adjust the "Tea Table Position" parameter to view real-time changes in the flow line and quickly find the optimal solution.

4.1.3. Standardize automatic verification and strengthen rigor

The AIGC tool has a built-in industry standard database that can detect drawing errors in real time (such as missing dimensions, improper layer naming, and incorrect legend usage) and generate a "correction checklist". Students make corrections based on the checklist, and teachers focus on explaining high-frequency errors (such as "axis number too close to wall" and "elevation drawing not labeled with material") to enhance guidance specificity.

4.2. Task Refactoring: Design a Layered Project Architecture

4.2.1. Capability based task stratification

Divide students into three levels: A (Advanced), B (Intermediate), and C (Basic) through pre class tests, and use AIGC to generate differentiated tasks:

A-level task: Generate an original layout plan without functional zoning, requiring independent completion of layout design and a complete set of construction drawings (including plan, elevation, section, and node details); B-level task: Generate sketches with functional zoning, requiring detailed design floor plan main elevation view; C-level task: Generate a complete sketch with furniture positioning and make adjustments based on personal design plans. For example, in the "120 square meters Four Bedroom Design" project, A-level students need to consider details such as "accessible design for senior living rooms", B-level students focus on

"spatial functional zoning", and C-level students prioritize mastering "size labeling standards" to achieve "everyone has something to do, everyone has a challenge".

4.2.2. Flexible Cycle Based on Progress

The traditional project cycle is fixed (such as completing one project in 2 weeks), and AIGC supports dynamic adjustment based on student progress: students with fast progress can generate "additional tasks" through AIGC (such as automatically generating 3D renderings for scheme display after completing the floor plan); Students with slow progress can call AIGC's "simplified mode" (automatically omitting non core details and prioritizing the integrity of basic elements) to avoid giving up deep participation due to schedule pressure.

4.3. Evaluation optimization: Building a human-machine collaborative evaluation system

4.3.1. Process evaluation: AIGC records learning trajectories

The AIGC tool records students' drawing operation data in real-time and generates a "process report", which includes three major indicators: efficiency indicators, creativity indicators, and standardization indicators for evaluation.

4.3.2. Industry evaluation: aligning with real standards

The AIGC tool accesses the project databases of three well-known local design companies, analyzes the similarity between student proposals and excellent industry cases, and generates an "Industry Matching Report".

5. Teaching Experiment and Effect Analysis

5.1. Experimental Design

Two classes of interior design major in a vocational college of 2023 were selected as research objects. The experimental class (using AIGC assisted project-based teaching) and the control class (using traditional project-based teaching) conducted a 12 week "CAD Drawing Comprehensive Project" teaching experiment. The following indicators were tested before and after the experiment:

5.1.1 Drawing speed: Time to complete the 100 square meters floor plan (including basic annotations);

5.1.2 Quality of the Plan: Three industry experts (with over 10 years of experience) will score from three dimensions: "creativity", "standardization", and "practicality" (out of 100 points);

5.1.3 Course satisfaction: Conduct a questionnaire survey on students' satisfaction with the teaching mode (including three dimensions: "efficiency improvement", "creativity stimulation", and "guidance effect").

5.2. Experimental Results

5.2.1. Significant improvement in mapping speed

The average completion time of the experimental group was 42 minutes, while the control group was 95 minutes, resulting in a 56% increase in efficiency; Among them, students with weak foundations (level C) showed the most significant improvement, with an average of 65 minutes in the experimental class and 130 minutes in the control class, with a difference of 65 minutes (Table 1).

Average time of student level experimental class (minutes), average time of control class (minutes), improvement rate, as shown in Table.1.

Table 1. Comparison of drawing speed

A-level (Advanced)	30	75	60%
C-level (medium)	45	90	50%
C-level (basic)	65	130	50%

5.2.2. Significant optimization of case quality

The average score of the experimental group was 81.2 points, while the control group scored 64.5 points, with a significant difference; The "creativity" dimension has the largest gap, with an average score of 83.5 for the experimental class and 61.8 for the control class, an increase of 35% (Table 2).

Evaluation dimension: difference between the average score of the experimental class and the control class.

Table 2. Comparison of Scheme Quality Optimization

Creativity	83.5	61.8	21.7
Normative	78.6	68.2	10.4
Practicality	81.5	63.5	18.0

5.2.3. Significant improvement in course satisfaction

The satisfaction rate of the experimental class reached 95%, among which 90% of students believed that "AIGC helped me save drawing time and had more energy to think creatively", and 85% of students said that "the real-time error correction function saved me a lot of detours"; The satisfaction rate of the control class was 68%, mainly complaining about "tedious drawing" and "untimely teacher guidance" (Table 3).

Satisfaction dimension: experimental class satisfaction and control class satisfaction

Table 3. Comparison of course satisfaction

Efficiency improvement	92%	45%
Creativity Inspiration	90%	50%
Guidance effectiveness	88%	62%

6. Conclusion and Prospect

6.1. Research Conclusion

6.1.1 The three-dimensional strategy of "technology empowerment task reconstruction evaluation optimization" proposed in this study can effectively solve the efficiency, stratification, and feedback problems of traditional project-based teaching, improve students' drawing efficiency by more than 50%, and increase program creativity scores by more than 20%;

6.1.2 AIGC's differentiated generation capability can achieve "personalized teaching" to meet the needs of students with different foundations, resulting in a 27% increase in course satisfaction;

6.1.3 The evaluation system that aligns with industry standards can shorten students' career adaptation period and provide reference for the teaching reform of design courses.

6.2. Shortcomings and Prospects

There are two limitations to this study: firstly, the experimental sample only came from one university, and the scope needs to be expanded to verify universality; Secondly, the industry standard database of AIGC tools needs to be continuously updated (such as differences in local mapping standards). In the future, research can be deepened from three aspects: at the technical level, developing exclusive AIGC plugins that are compatible with AutoCAD and SketchUp to improve operational convenience; Teaching level: Build a collaborative teaching model of " AI+ teacher+ industry mentor " and introduce real project cases.

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