Generative AI and Foundational Understanding of Whole-Process Teaching in Interior Design

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Abstract. To address the misalignment between generative AI's restructuring of the interior design industry and its insufficient integration into pedagogical practices—and in response to the digital transformation demands of New Engineering and vocational education—this study examines four key issues in current teaching methods: the fragmented use of AI tools, disconnections in human–AI collaboration, an imbalance among technical, creative, and ethical competencies, and outdated evaluation mechanisms. Drawing on research in interdisciplinary collaboration and AI tool application, we propose strategies such as an integrated AI toolchain for the entire design process, interdisciplinary fusion, phased human–AI collaboration, three-dimensional capability development, and diversified quantitative assessment. These strategies are validated through case studies. The study also suggests future optimization pathways across four dimensions, including technological integration. By constructing an adaptive framework and providing actionable teaching solutions, this research aims to support the cultivation of interdisciplinary talents skilled in "AI + Interior Design."

Keywords: Generative AI; Whole-Process Teaching; Adaptive Adjustment.

1. Introduction

1.1 Research Background and Significance

The Ministry of China's "New Engineering Research and Practice Project Guide" emphasizes that design education should promote interdisciplinary integration and digital transformation, offering policy support for incorporating generative AI into interior design instruction. From an industry perspective, AI-aided graphic design technologies (e.g., MidJourney, Adobe Sensei) are already deeply embedded in the curricula of higher education art and design programs. Meanwhile, the interior design industry is using generative AI to restructure its entire workflow—from demand analysis and concept generation to modeling, rendering, and construction. This shift has significantly increased the demand for professionals skilled in both AI and interior design [1]. However, current teaching practices remain plagued by issues such as the sporadic use of AI tools, a lack of cross-process collaboration, and a disconnect from real-world technological applications. These problems highlight a growing misalignment between the rapid evolution of generative AI and its adaptation into teaching frameworks. There is an urgent need for targeted research in this area.

This study aims to integrate theories of interdisciplinary collaboration with practice-oriented, AI-supported teaching across the entire design process. It seeks to overcome the limitations of existing research, which often focuses only on isolated aspects of teaching, by constructing a systematic adaptive framework for incorporating generative AI into whole-process interior design education. Using AI tools to enhance instructional effectiveness, the study provides feasible adjustment strategies for educational institutions, helps instructors develop human–AI collaborative teaching methods, enables students to acquire core competencies required in the AI era, and narrows the gap between student skills and industry needs [2]. The implementation of this systematic framework and teaching strategies will not only advance interior design education toward greater intelligence and interdisciplinarity but also improve educational quality, better preparing students for future industry trends. Furthermore, this research offers a replicable model for other art and design disciplines, promoting innovation and progress across design education and enhancing the international competitiveness of China's design education sector.

1.2 Current Research and Theoretical & Technical Foundations

Domestic scholars have conducted multidimensional research on the integration of AI into design education, interdisciplinary collaboration, and whole-process adaptation. First, studies on the application of AI-assisted technology in art and design education note that AI tools are often used in isolated segments of the design process (e.g., rendering, modeling), rather than within an integrated framework covering the entire workflow. Second, innovative research on AI-assisted interdisciplinary collaborative teaching in environmental art design emphasizes breaking down traditional disciplinary boundaries and integrating knowledge and techniques from diverse fields, offering insights for cross-process collaboration in interior design education. Third, although innovative teaching practices in AI-assisted urban design courses have demonstrated AI's applicability in tasks such as research analysis and concept generation, these studies focus on urban design and lack specificity to the whole process of interior design [3]. Fourth, research on AI-assisted UI design teaching models has found that the use of AI can lead to a disconnect between technical skills and creative development.

Studies on AI-assisted personalized learning paths in blended learning environments provide theoretical support for a collaborative "student–AI–teacher" teaching model under generative AI. Technologically, explorations into creative teaching models for animation design and digital media art mention the "text-to-image generation" and "parametric iteration" capabilities of generative AI tools. The application of a WeChat mini-program developed with Uniapp and Douban AI in teaching "Biostatistics and Experimental Design" demonstrates how AI-powered quantitative analysis can enhance teaching effectiveness [4], offering a reference for adapting AI technology to various stages of the interior design process. Additionally, project-based teaching approaches from reforms in AI-assisted advanced algorithm design courses provide valuable insights for integrating AI into whole-process interior design education. Overall, however, existing research lacks a systematic integration of generative AI into whole-process interior design teaching, and the depth of theoretical and technical fusion remains insufficient.

2. Adaptability Issues in Whole-Process Interior Design Teaching Under the Impact of Generative AI

2.1 Inadequate Adaptation Between Teaching Content and Generative AI

The misalignment between whole-process interior design teaching content and generative AI is first evident in the unsystematic integration of AI tools. Teaching often introduces AI tools in a fragmented manner, such as in modeling or rendering, without establishing a coherent toolchain that covers the entire design process from research and conceptualization to design development, visualization, and implementation. Consequently, students only learn to use tools in isolation and cannot achieve cross-process human–AI collaboration. This issue reflects the broader problem of fragmented AI tool use in university art and design education. Second, there is a significant lack of interdisciplinary knowledge integration. As interior design is an interdisciplinary field involving aesthetics, engineering, and information technology, its teaching content has yet to fully incorporate modules related to generative AI—such as AI generation logic and design ethics. This failure contradicts the requirements of interdisciplinary collaborative teaching in environmental art design, which calls for breaking disciplinary boundaries and integrating knowledge from multiple fields, ultimately hindering students' understanding of the technical principles and application limits of generative AI. Furthermore, updates to teaching content lag behind developments in generative AI technology. Current curricula do not promptly include new AI functionalities, such as parametric iteration of design solutions or multi-style text generation, nor do they adopt project-based teaching approaches to build a content system aligned with "AI tools and design tasks." As a result, teaching content becomes disconnected from real-world industry applications, mirroring the common problem found in UI design education where AI technology and course content are poorly aligned and fail to meet practical needs.

2.2 Inadequate Adaptation Between Teaching Methods and Human–AI Collaboration Scenarios

The disconnect between whole-process interior design teaching methods and human–AI collaboration scenarios are primarily reflected in the overreliance on traditional "teacher-led" instruction. Teaching often focuses on demonstrating basic operations of generative AI tools without establishing a tripartite interaction mechanism among students, AI, and teachers. This makes it difficult to guide students in critically analyzing and personally optimizing AI-generated solutions, a shortcoming consistent with the lack of deep interaction observed in AI tool applications in university art and design education. It also violates the requirement for multi-agent interaction in interdisciplinary collaborative teaching for environmental art design. Second, project-based teaching has not fully incorporated human–AI collaboration scenarios. Existing practical projects, such as course designs and graduation projects, largely follow traditional task frameworks. They do not draw on the practical experience of AI-assisted concept generation and iterative optimization from urban design courses, nor do they establish complete task chains such as "AI-collaborative demand analysis, multi-style solution generation, and contextual optimization (e.g., based on regional cultural elements)." Thus, students struggle to master the full-process logic of human–AI collaboration in practice, a problem similar to the misalignment between project practice and AI technology in UI design teaching, which fails to reflect actual industry human–AI collaboration models. Moreover, there is a lack of phased human–AI collaborative teaching design. A progressive system that matches students' skill levels—such as using AI to consolidate basic skills in the early stages, enabling AI-assisted design development in intermediate stages, and achieving AI-empowered innovation in advanced stages—has not been established. This approach is inconsistent with the logic of adapting technology use to student ability levels in blended learning and fails to meet the human–AI collaborative learning needs of students at different competency levels.

2.3 Inadequate Adaptation Between Competency Development and the Demands of the AI Era

The misalignment between competency development in interior design and the demands of the AI era is mainly seen in the imbalance among technical, creative, and ethical capabilities. On the technical side, students' mastery of generative AI tools is often limited to basic operations in isolated links (e.g., modeling or rendering). They lack the ability to collaboratively use AI tools across the entire process from research and conceptualization to design development and implementation. This reflects the common issues of fragmented AI tool use and weak technical integration skills in university art and design education, making it difficult to meet the industry's need for "full-process AI collaboration." In creative competency development, there is a conflict between "tool dependence and creative degradation." Some students over-rely on AI-generated solutions and lack awareness of original optimization, while others reject AI tools due to insufficient technical understanding, resulting in low efficiency in creative expression. This problem is similar to the disconnect between technical operation and creative development in UI design teaching. Furthermore, teaching has not adopted the practical approach used in urban design courses, where AI helps stimulate diverse creativity and guides critical solution optimization. Ethical competency development is virtually absent. Current teaching does not include content related to AI design, such as copyright attribution norms and cultural symbol compliance reviews. This omission contradicts the social ethical considerations required in interdisciplinary environmental art design education, leaving students unprepared to address practical issues such as infringement risks in AI-generated content and the misuse of regional cultural elements. Additionally, competency assessment has not adopted the combined "quantitative analysis and qualitative judgment" approach used in AI-assisted teaching, making it impossible to accurately measure students' acquisition of core competencies for the AI era and further widening the gap between competency development and industry demands.

2.4 Inadequate Adaptation Between Teaching Evaluation and Technological Change

The disconnect between whole-process interior design teaching evaluation and the technological changes brought by generative AI is first evident in the focus on outcomes rather than the AI collaboration process. Traditional evaluation primarily uses final deliverables such as renderings and construction drawings as key indicators, ignoring process data from AI-assisted workflows (e.g., number of design iterations, records of human–AI task division, optimization trajectories of AI-generated content). This approach neither meets the evaluation requirements of interdisciplinary collaborative teaching in environmental art design, which emphasizes multi-process engagement, nor overcomes the limitation in university art and design AI education of "valuing technical results over collaborative processes." Second, evaluation methods lack quantitative support from AI technology. They still rely heavily on instructors' subjective scoring (e.g., for "creativity" or "spatial rationality") and have not incorporated the use of technological tools for quantitative analysis as seen in AI-assisted teaching (e.g., using AI to detect solution originality or calculate spatial circulation optimization rates). This leads to inefficient evaluation and significant subjective bias, running counter to the trend toward "precision and data-driven" teaching evaluation in the context of technological change. Moreover, evaluation standards are not aligned with the core competency demands of the AI era. Dimensions such as "full-process AI tool collaboration capability" and "ethical compliance of AI-generated content (e.g., copyright labeling, cultural symbol adaptation)" have not been included in the evaluation system. This failure neither reflects the comprehensive literacy evaluation required by interdisciplinary teaching nor draws on the balanced "technical-creative" evaluation experience from UI design teaching, making it impossible to fully assess students' professional competence in the AI era. Furthermore, evaluation subjects are overly homogeneous, lacking participation from diverse stakeholders such as industry experts and AI technical consultants. Teaching has not adopted the multi-party collaborative evaluation model used in AI-assisted urban design courses, making it difficult to align with industry standards for evaluating AI-assisted interior design outcomes [5].

3. Adaptive Adjustment Strategies for Whole-Process Interior Design Teaching Under the Impact of Generative AI

3.1 Restructuring Teaching Content: Integrated AI Toolchain and Interdisciplinary Fusion

Restructuring interior design teaching content should focus on integrating a full-process AI toolchain and interdisciplinary fusion. To address the current fragmented use of AI tools, teaching can draw on the scenario-based integration of AI tools in university art and design education by matching generative AI tools to each stage of the interior design process—research, conceptualization, design development, modeling, rendering, and implementation. For example, embed AI data collection and analysis tools (e.g., NLP-based demand interview outline generation, intelligent floor plan diagnosis) in the research phase; introduce AI multi-style solution generation tools (e.g., text-driven spatial mood board generation) in the conceptualization phase; integrate parametric AI tools (e.g., intelligent modeling plugins, real-time rendering optimization tools) in the modeling and rendering phases; and add AI construction feasibility analysis tools in the implementation phase. This creates a coherent toolchain that spans the entire process, avoiding the limitations of isolated tool use. Teaching can also learn from the deep integration of AI and the design process in urban design courses by linking AI tool operations to specific design tasks, thereby strengthening the connection between tool application and design logic. For interdisciplinary fusion, following the requirements of interdisciplinary collaborative teaching in environmental art design, traditional disciplinary boundaries should be broken, and modularized interdisciplinary knowledge related to generative AI should be embedded into existing curricula. For instance, integrate AI generation principles and algorithm logic (referencing generative AI features like "text-to-image generation" and "parametric iteration") into Computer-Aided Design; add modules on AI design ethics and copyright norms (addressing ethical compliance issues in AI application from UI design teaching) to Design Regulations; and include AI data-driven design

modules (drawing on the use of AI quantitative analysis to enhance teaching effectiveness) in design research. Each interdisciplinary module should comprise 8–12 class hours and combine case studies and hands-on practice to achieve knowledge integration, addressing the current disconnect between technology and interdisciplinary knowledge [6]. Furthermore, project-based teaching ideas from algorithm design courses can be used to construct a tripartite content system of "AI tools—design tasks—interdisciplinary knowledge," ensuring that teaching content aligns with the professional demands of interior design in the AI era.

3.2 Innovating Teaching Methods: Phased Human–AI Collaborative Teaching

Innovating interior design teaching methods requires building a phased human–AI collaboration model. Its design can draw on the framework of phased learning paths based on progressive student abilities in blended learning, ensuring that each phase deeply adapts to the application of generative AI technology. The basic stage (for lower-grade students) focuses on consolidating AI-assisted skills. Combining the experience of basic AI tool instruction in university art and design programs, use AI to generate basic design materials (e.g., color schemes, spatial scale prototypes), guide students in analyzing the strengths and weaknesses of these materials, and perform basic optimizations. This lowers the barrier to skill acquisition while preventing a disconnect between tool operation and design principles. This stage can also incorporate simple interactive tasks (e.g., using AI to adjust floor plan layouts) to lay the groundwork for subsequent collaboration. The intermediate stage (for middle-grade students) uses project-based teaching as the vehicle. Learning from the practical approach of AI-assisted solution generation and iteration in urban design courses, construct a process for interior design projects (e.g., renovating old residential areas) that includes: "students defining requirements → AI generating multi-style solutions → students optimizing based on site context (e.g., regional cultural elements) → instructors guiding human–AI task division." This focuses on resolving the disconnect between technology application and creative development, ensuring that AI tools serve design logic rather than replace creativity. The advanced stage (for higher-grade students) emphasizes AI-empowered design breakthroughs. Referencing the use of AI to stimulate creativity in university animation design, guide students in using generative AI to explore unconventional design forms (e.g., complex curved spaces, new material combinations) and incorporate construction implementation considerations based on the project-based teaching requirements of algorithm design courses. Use AI quantitative analysis (e.g., spatial rationality detection) to assist in solution refinement, ultimately achieving collaborative improvement in "technology—creativity—practice." Additionally, teaching should respond to the requirements of interdisciplinary collaboration in environmental art design by incorporating AI ethical reviews (e.g., cultural symbol compliance) into projects and using the logic of quantitative feedback from AI-assisted teaching to optimize the timing of instructional interventions [7].

3.3 Upgrading Competency Development: Three-Dimensional Enhancement of Technology, Creativity, and Ethics

Upgrading competency development in interior design requires building a three-dimensional system that integrates technology, creativity, and ethics. For technical capabilities, move beyond isolated AI tool operation by drawing on the experience of scenario-based AI tool application in university art and design education and the practical integration of AI into the full design process from urban design courses. Focus on developing AI tool collaboration skills across the entire process—from research and conceptualization to design development and implementation—such as the coherent application of AI-assisted demand data analysis, parametric modeling optimization, and iterative rendering refinement. Also, learn from the technical integration improvements in UI design teaching to avoid disconnects between tool application and design logic. Creativity development should use AI as a vehicle for creative expansion. Referencing the use of AI to stimulate diverse creativity in university animation design, guide students in critically deconstructing AI-generated multi-style solutions (e.g., analyzing spatial circulation rationality, cultural element adaptability) and integrating

regional cultural symbols (e.g., traditional patterns, material textures) to achieve original reinterpretation. This echoes the practical logic of AI-assisted solution optimization in urban design courses and addresses the problem of creative degradation due to overreliance on technology. For ethical capabilities, following the social ethical considerations required in interdisciplinary environmental art design education, incorporate AI design copyright norms (e.g., source attribution for generated content, infringement risk avoidance) and cultural symbol compliance reviews (e.g., preventing misuse of regional cultural elements) into the curriculum. Strengthen ethical awareness through typical case analysis (e.g., cases of cultural infringement in AI-generated solutions), ensuring that technological application aligns with social values. Additionally, draw on the quantitative evaluation approach from AI-assisted teaching to dynamically monitor the attainment of three-dimensional competencies, thereby improving the precision of competency development [8].

3.4 Optimizing Teaching Evaluation: Combining Diversification and Quantification

Optimizing interior design teaching evaluation should focus on "diversified dimension coverage and quantitative technology support." First, construct a diversified evaluation dimension system. According to the comprehensiveness requirements of interdisciplinary collaborative teaching in environmental art design, move beyond traditional outcome-oriented limitations and integrate three-dimensional indicators: process, outcome, and ethics. The process dimension should include AI collaborative full-process data (e.g., number of solution iterations, records of human–AI task division, optimization trajectories of AI-generated content), drawing on the process evaluation practices of AI-assisted teaching in urban design courses. The outcome dimension should balance technical standardization (e.g., proficiency in AI tool application) and creative integrity (e.g., proportion of original design elements), reflecting the balanced "technical-creative" evaluation experience from UI design teaching. The ethics dimension should add AI design compliance indicators (e.g., completeness of copyright labeling, adaptability of cultural symbols) to ensure that evaluation covers the social value requirements of interdisciplinary teaching. Second, strengthen quantitative technology support. Learn from the use of quantitative analysis in AI-assisted teaching to improve evaluation precision by introducing AI tools to quantify key indicators: use intelligent analysis platforms to calculate spatial circulation optimization rates, solution originality similarity, etc., replacing traditional subjective scoring and reducing evaluation errors. Also, incorporate AI collaboration efficiency (e.g., reduced time spent on solution generation) into evaluation, drawing on the quantitative logic of technology application in AI teaching evaluation in university art and design, to enhance objectivity. Furthermore, expand the diversity of evaluation subjects. Based on the multi-party collaborative evaluation practice in urban design courses, involve industry experts and AI technical consultants in scoring to compensate for the lack of industry relevance in instructor-only evaluation. Additionally, establish a dynamic evaluation feedback mechanism. Following the dynamic adjustment logic of personalized learning paths in blended learning, regularly produce evaluation reports to guide teaching improvements, forming a closed loop of "evaluation—feedback—optimization."

4. Conclusion

Future optimization of adaptive adjustment for whole-process interior design teaching should advance systematically across four dimensions: technological integration, personalized teaching, teacher capacity, and resource systems. For technological integration, learn from the deep adaptation of AI to design scenarios in AI-assisted urban design courses and the logic of technology-enabled creativity in creative teaching models for university animation and digital media art. Deepen the integration of generative AI with digital twins and virtual simulation technologies to construct an immersive full-process teaching scenario encompassing "virtual site research, AI collaborative solution development, and digital construction simulation," thereby upgrading technology application from "tool embedding" to "scenario reconstruction." For personalized teaching, refer to the dynamic adaptation framework proposed in explorations of AI-assisted personalized learning path design in

blended learning. Build student capability profiles based on generative AI, capture learning data in real time (e.g., proficiency in AI tool application, deviations in solution optimization logic), and push customized learning resources (e.g., AI-specific practical training for weak areas, personalized creative guidance tasks) to resolve the conflict between uniform traditional teaching and diverse student abilities. Teacher capacity building should address the AI literacy shortfalls among instructors identified in research on AI-assisted UI design teaching models. Establish a tiered training system: basic training focused on generative AI tool operation (drawing on tool teaching experience from AI-assisted technology applications in university art and design education), and advanced training emphasizing human–AI collaborative teaching design (combining project-based ideas from teaching reform and practice in AI-assisted advanced algorithm design courses), ensuring that teachers can effectively lead the tripartite collaborative process of "student–AI–teacher." Resource system development can learn from the lightweight tool development logic of the WeChat mini-program built with Uniapp and Douban AI for teaching "Biostatistics and Experimental Design." Construct a cross-institution shared "AI Teaching Resource Library for Whole-Process Interior Design" that integrates core resources such as AI lesson plans, practical training projects, and ethical review cases. Simultaneously, incorporate interdisciplinary resources emphasized in innovative research on AI-assisted interdisciplinary collaborative teaching in environmental art design, adding modules on AI principles and design ethics to support continuous teaching improvement.

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