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# Paths for Teaching Reform in the Architectural Design Major Empowered by Generative Artificial Intelligence

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**Abstract:** With the continuous development of society and the advancement of science and technology, information technology has been fully popularized and promoted in various fields. At present, artificial intelligence technology has been further applied in the educational sector, and its application in the architectural design major is driving the transformation of teaching towards intelligence and integration. This paper first analyzes the value of generative artificial intelligence in empowering teaching for the architectural design major, and on this basis, extracts the paths for teaching reform in this major empowered by generative artificial intelligence. It is hoped that this paper can provide teaching inspiration and practical references for frontline teachers, and promote the reform and innovation of the architectural design major.

**Keywords:** Generative; Artificial intelligence; Architectural design major

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## 1. Introduction

In the AI era, education should actively learn and apply tools and methods of teaching empowerment through artificial intelligence. The application of this technology in the educational field has been recognized and supported, and educators should actively explore how to use artificial intelligence technology to improve teaching efficiency and effectiveness. Generative artificial intelligence technology has multiple advantages, such as efficient content generation, personalized teaching, real-time interaction, and dynamic response. Therefore, exploring the paths for teaching reform in the architectural design major empowered by generative artificial intelligence is of great practical significance.

## 2. The significance of generative artificial intelligence in empowering architectural design education

### 2.1. Efficient content generation: Breaking the shackles of traditional design processes

The architectural design major has long been confronted with the contradiction between creative expression and technical implementation. Students are required to complete the entire process from conceptualization to scheme deepening within a limited timeframe. However, in traditional teaching and learning practices, reliance on manual drafting or conventional

software operations consumes a substantial amount of time, thereby constraining students' creative expression. Generative AI technology can effectively address this issue.

On the one hand, it enables rapid concept generation and scheme iteration. By leveraging generative AI, supporting design schemes can be produced based on input keywords, providing students with creative inspiration and initial ideas. On the other hand, it facilitates automated drafting and modeling. Traditional design software demands that students master complex commands, resulting in a steep learning curve. In contrast, generative AI can automatically generate precise models. For instance, students can verbally describe a building, and the AI can swiftly generate a corresponding 3D model, upon which students can perform detailed design refinement, effectively lowering the threshold for architectural design. Finally, it assists in performance simulation and optimization. A key focus of contemporary architectural education is achieving sustainable design. Traditional performance analysis tools require manual parameter input by students, whereas generative AI can integrate multi-dimensional data such as climate and lighting, automatically generating architectural performance optimization data and unlocking greater potential for sustainable design.

## **2.2. Personalized teaching: Precise empowerment to meet diverse learning needs**

Students majoring in architectural design exhibit significant individual differences: some excel in spatial imagination but lack software operation skills, while others are proficient in technical tools but suffer from a shortage of creative inspiration. The traditional "one-size-fits-all" teaching model fails to cater to students' personalized needs. Generative AI can analyze student data and formulate customized learning pathways for each student.

First, it dynamically adjusts the difficulty of teaching content. AI can integrate students' in-class learning data—such as modeling speed, scheme rationality, and software operation proficiency—to automatically assess their learning status and recommend suitable learning resources. For students lacking software skills, it can push training materials related to basic parametric design tutorials; for students with outstanding creative abilities, it can provide foundational parametric design tutorials alongside challenging design projects. This approach of dynamically adjusting teaching content based on individual capabilities better promotes the development of every student.

Second, it recommends personalized case libraries and tools. Given students' diverse interests within architectural design, generative AI can analyze their historical assignments and browsing data to construct personalized case libraries and corresponding software toolkits, effectively satisfying their individualized learning demands.

Third, it implements career-oriented skills training. The architectural industry encompasses various fields, including interior design and landscape architecture, each with distinct skill requirements. AI can align with students' career plans to provide targeted skills training. For example, students aspiring to join tech enterprises can receive training in Python programming and machine learning fundamentals, while those aiming for design institutes can focus on practical skills such as construction drawing, production, and code interpretation. Such career-oriented training effectively enhances students' employability and competitiveness.

## **2.3. Real-time interaction and dynamic response: Constructing an immersive learning experience**

Traditional architectural design teaching primarily consists of teacher lectures and student exercises, lacking in-depth interaction between instructors and students, and students often fail to obtain timely and effective feedback. Generative AI, with its advantages in linguistic interaction and virtual scene simulation, enables real-time interaction and dynamic response throughout the teaching process.

First, it provides intelligent Q&A and concept clarification. Students frequently encounter conceptual ambiguities and technical challenges in architectural design, such as distinguishing between circulation organization and functional zoning. In traditional teaching, students must wait for after-class explanations from teachers to resolve such confusion. Generative AI, however, offers real-time explanations and feedback: students can directly input their questions, and the AI provides detailed answers, promptly addressing learning difficulties.

Second, it facilitates collaborative design in virtual scenarios. Through AR and VR technologies, AI can create an

immersive collaborative environment for students to engage in team-based design, meeting their practical learning needs. For example, in urban design courses, students can use VR devices to enter virtual scenes; the AI adjusts design schemes based on students' gestures and voice commands, presenting intuitive renderings that allow students to visually perceive design changes, thereby enhancing their spatial cognitive abilities.

Third, it enables dynamic optimization through multiple iterations. In traditional teaching, teachers can only analyze and provide feedback on students' work after submission, resulting in a lengthy feedback cycle. Generative AI establishes a closed loop of "design-feedback-revision." For instance, after students complete a preliminary scheme, AI can simulate user evaluations to analyze issues such as "insufficient lighting in public spaces" and "circulation conflicts", and propose targeted solutions. Following students' revisions based on feedback, the AI can re-evaluate the scheme until satisfactory results are achieved. This dynamic response mechanism effectively shortens the design iteration cycle.

#### **2.4. Cost optimization and resource conservation: Promoting inclusive and sustainable education**

Architectural design education relies heavily on auxiliary teaching resources. High software licensing fees and substantial consumption of physical model materials often hinder the orderly implementation of many teaching activities. Generative AI optimizes resource allocation, effectively reduces teaching costs, and advances educational equity.

On the one hand, virtualization replaces physical resources. In traditional teaching, students need to construct physical models to verify design feasibility, which incurs high material costs and is time-consuming. Generative AI can generate high-precision 3D models, effectively substituting physical resources. On the other hand, it develops shared teaching resource repositories. AI can integrate global teaching resources related to architectural design—such as design cases and course videos—to build a shared platform for students, meeting their learning needs and promoting educational equity<sup>[1]</sup>.

### **3. Problems in empowering architectural design teaching with generative artificial intelligence**

#### **3.1. Low integration of the curriculum system and marginalization of humanistic care content**

In the construction of architectural design courses under the integration of artificial intelligence, many schools simply piece together curriculum content. For example, they mechanically incorporate basic operation courses of generative artificial intelligence, failing to deeply explore the inherent connections between AI technology, architectural design theories, and design processes. As a result, students cannot effectively apply the new technology to architectural design practice. In addition, in the pursuit of integrating generative artificial intelligence technology into courses, many teachers overemphasize technical aspects while neglecting humanistic care. The content related to architectural history and culture in the curriculum has been compressed, which impairs the overall teaching effectiveness.

#### **3.2. Inadequate virtual training platforms and limited platform resources**

Current virtual training platforms have technical limitations in simulating real architectural scenarios and supporting design practices. For example, virtual scenes lack realism, with insufficient detailed rendering of building materials and light-shadow effects. As a result, students cannot gain authentic spatial experiences in the virtual environment. Meanwhile, the interactivity of virtual platforms needs to be enhanced—students cannot smoothly perform spatial rotation operations, which hinders their understanding and imagination of architectural spatial forms. Furthermore, building a platform that integrates virtual and real elements is intended to improve the convenience of virtual experiments and the authenticity of practical operations. However, there remain certain problems and deficiencies in the connection between virtual and real training in actual teaching. There are discrepancies between the software tools used in virtual training and those applied in real-world practice, meaning students cannot rely on virtual platforms to complete genuine project training. In addition, the training lacks transitional links, making it difficult for students to smoothly adapt when shifting from virtual training to hands-on operations. Last but not least, platform resources are insufficient. Due to limited resources in some schools, there

are obvious shortages in the hardware facilities and software resources of training platforms, which fail to provide students with the necessary training support.

### **3.3. Unreasonable selection of teaching projects and superficial interdisciplinary integration**

The selection of projects is crucial to the implementation of project-based learning. However, many institutions fail to take the practical value of projects into account when making selections, leading to a monotonous range of project content that cannot truly meet the needs of students' development. Most projects are designed around the inherent knowledge and skills of architectural design alone, without integration with related disciplines such as structural engineering and environmental science. As a result, interdisciplinary teaching remains a mere formality, and it becomes impossible to cultivate versatile talents.

### **3.4. Incomplete project evaluation system and difficulty in comprehensive assessment of students' competencies**

Teaching evaluation is crucial for the effective implementation of architectural design courses. However, the current evaluation methods are far from reasonable. They mainly focus on evaluating students' learning outcomes, while seriously neglecting their performance during the project process and their overall competencies. The insufficient attention paid to process-oriented evaluation leads to a failure to objectively reflect the development of students' comprehensive abilities, which is not conducive to the optimization of courses. To a large extent, this hinders the further improvement of teaching quality.

## **4. Paths for teaching reform in architectural design empowered by generative artificial intelligence**

### **4.1. Constructing a dual-track integrated curriculum system of "AI + tradition" to balance technological empowerment and humanistic care**

The architectural design major needs to adjust its original curriculum to comprehensively improve teaching effectiveness and establish a curriculum system that integrates artificial intelligence technology with traditional courses.

In terms of basic theory, courses such as Artificial Intelligence and Architectural Design and Principles of Algorithmic Design should be added to help students master core technical principles, including Generative Adversarial Networks (GAN) and parametric modeling. At the tool application level, courses related to AI-Assisted Design Workflows and BIM + AI Collaborative Design should be developed, enabling students to receive training in tools such as Tripo3D and MidJourney. Such training enhances students' ability to rapidly generate conceptual schemes and optimize construction drawings.

Meanwhile, humanistic care should be strengthened in architectural design courses. In the course Design Ethics and Critical Thinking, students should be organized to analyze the compliance and cultural adaptability of AI-generated schemes, further cultivating their ethical awareness in technological decision-making. For example, AI-generated future urban design activities can be organized in the course. After students complete their designs, analyses should be conducted on the lighting efficiency of vertical farms and the privacy protection of community shared spaces in their schemes. Through evaluation, the feasibility of students' designs is judged, and targeted revision suggestions are provided. The construction of the above curriculum system truly achieves a balance between technological empowerment and humanistic care<sup>[2]</sup>.

### **4.2. Building a virtual-real integrated training platform to break through bottlenecks in spatial imagination and practical ability**

Traditional architectural design teaching mainly relies on 2D drawings and physical models, which fail to effectively

cultivate students' spatial imagination and thus affect the accuracy of their designs. Generative artificial intelligence technology can construct a training environment for the entire virtual construction process. Through VR technology, it provides students with simulated construction scenarios, allowing them to observe details such as structural joints and pipeline layouts via professional equipment. Simultaneously, the application of a BIM + AI early warning system enables real-time simulation of construction progress and potential risks, facilitating the early prediction of construction delay points. For instance, in architectural construction courses, generative AI can convert 2D drawings into analyzable 3D models, allowing students to examine sectional views and observe the sequence of steel bar binding, significantly improving their mastery of construction knowledge. In course learning using the training platform, a combination of artificial intelligence technology and manual drafting should be implemented. Students generate preliminary schemes with generative AI and then refine details through manual drawing, effectively avoiding the homogenization of schemes caused by over-reliance on software and endowing designs with personal style. For example, in historical building restoration courses, students use generative AI to generate preliminary restoration schemes, and then manually draw the mortise-and-tenon structures of traditional bracket sets (dougong) to ensure compliance with the restoration principles of the *Venice Charter*. Finally, the training platform should integrate global resource cases to provide students with cross-cultural design parameters. The establishment of a virtual-real integrated platform helps verify the feasibility of students' design schemes, enables them to deeply understand the engineering logic behind technology, enhances their spatial imagination and practical operational abilities, and facilitates a comprehensive breakthrough from creativity to technology and practical application<sup>[3]</sup>.

### **4.3. Implementing a “project-based + interdisciplinary” teaching model to cultivate compound innovative talents**

Traditional teaching focuses on knowledge imparting, while the application of generative AI in architectural design transforms classrooms into a problem-solving model. First, integrating real projects into the curriculum teaching. Currently, school-enterprise cooperation has become an inevitable trend in higher education. Therefore, universities should collaborate with enterprises related to architectural design to introduce real projects for students, which is more conducive to improving their practical abilities. By participating in real projects, students apply professional knowledge to solve problems, cultivating more compound talents for the architectural industry. For example, universities can cooperate with real estate companies to develop zero-carbon community projects. Students can use AI to simulate the impact of different window-wall ratios on energy consumption and optimize schemes combined with photovoltaic panel layouts. The designed schemes need to be truly adopted by enterprises and put into construction. In such projects, the technical feasibility is analyzed, construction is carried out, and finally, the scheme is promoted. This helps students understand the operational logic of the industry and enhances their competitiveness in the future job market. Second, promoting interdisciplinary team collaboration. Interdisciplinary teamwork is more conducive to cultivating students' innovative thinking. Students majoring in architectural design, computer science, and other design-related disciplines can collaborate to form teams and complete relevant projects<sup>[4]</sup>. For example, students from different majors can jointly complete an intelligent building project: computer science students develop energy consumption monitoring algorithms, design students optimize spatial layouts, and engineering management students formulate construction plans. Third, establishing a mechanism combining dynamic assessment and personalized learning. The AI system tracks students' learning progress, provides personalized learning resources and tasks, effectively addresses their learning weaknesses, and promotes the progress of every student.

### **4.4. Establishing a three-dimensional evaluation system of “technology-humanity-ethics” to ensure the sustainability of teaching reform**

Teaching evaluation plays a crucial role in architectural design education. The application of generative AI in the major requires a reconstruction of the evaluation mechanism. First, knowledge mastery. Relying on an AI question bank, it automatically assesses students' mastery of basic knowledge and skills, such as AI fundamental theories and proficiency in

parametric modeling tools. Second, design innovation. Based on a global case library, it judges the originality of students' works and analyzes the uniqueness and rationality of their schemes. Third, ethical reflection. It evaluates the cultural adaptability and compliance of barrier-free design in students' proposed schemes. For example, in the "Urban Design" course, after students complete their scheme designs, teachers can use AI to analyze data such as sunlight simulation results and pedestrian flow density heatmaps, conduct detailed data analysis, and perform a comprehensive evaluation of students based on multi-dimensional design content. In addition, a "process-based feedback" mechanism should be introduced into the evaluation system. Traditional evaluation is mostly outcome-based, focusing on students' final test scores while ignoring their learning process, leading to one-sided evaluation results. The application of generative AI enables real-time tracking of students' design progress, evaluates the entire learning process, and provides improvement suggestions. For instance, generative AI can analyze students' design schemes, identify issues such as imbalanced facade proportions and chaotic functional zoning, and automatically provide reference data from similar cases of Zaha Hadid Architects, promoting students' reflection and iteration. This helps focus on solving students' existing problems and improving their abilities<sup>[5]</sup>.

## 5. Conclusion

In summary, the application of generative artificial intelligence technology in the architectural design major is an inevitable trend for professional development and plays a vital role in improving the quality of education. In the future, it is necessary to continue exploring the paths of teaching reform in the architectural design major empowered by generative artificial intelligence, so as to comprehensively promote curriculum reform and innovation.

## Disclosure statement

The author declares no conflict of interest.

## References

- [1] Xiao XR, 2025, Reconstruction and Practice of BIM Technology Training System for Architectural Design Majors in Higher Vocational Colleges under Digital Transformation. *Modern Vocational Education*, 2025(22): 149–152.
- [2] Wang R, 2024, Teaching Design and Implementation of Comprehensive Training Projects for the Architectural Engineering Technology Major. *Modern Vocational Education*, 2024(34): 157–160.
- [3] Deng L, Jiang JK, Rong YL, 2025, Research and Practice on the Reform of Talent Training Mode for Architectural Design Major under the Background of Industry Transformation and Development. *Vocational Education Research*, 2025(10): 68–77.
- [4] Li C, 2025, Construction of High-Quality Classrooms for Architectural Interior Design Major in the Digital Era. *Journal of Hunan Industry Polytechnic*, 25(4): 108–113.
- [5] Hu SS, Jiang L, Liu J, et al., 2025, Exploration on the Teaching Mode of Digital and Task-Driven Green and Low-Carbon Architectural Design Course. *Science & Technology Vision*, 15(19): 106–109.

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