

The Exploration of OBE-oriented “Artificial Intelligence + Design” Teaching Practice - Taking the Commercial Space Design Course for Environmental Design Major as an Example

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Abstract:

With the increasing integration of artificial intelligence technology and design disciplines, the traditional commercial space design curriculum system is facing the challenges of rapid technological iteration and lagging teaching content. This research is based on the concept of Outcome-Oriented Education (OBE) and combines artificial intelligence technology to build an “OBE-AID” (Outcome-Based Education-Artificial Intelligence Design) teaching model, aiming at solving the problem of the disconnect between technology and creativity in traditional design education. Practical verification is carried out in commercial space design courses through innovative methods such as curriculum reorganization driven by artificial intelligence technology, collaborative teaching with dual-teacher classrooms, and project-based learning that combines virtual and reality. The research results show that students have significantly improved their application of artificial intelligence tools, enhanced their innovation level, gradually formed systematic “artificial intelligence + design” thinking, and built a solid professional foundation. This research provides a theoretical framework and practical path for the digital transformation of design education, and provides important theoretical guidance for cultivating composite design talents who adapt to the intelligent era.

Keywords:

OBE Education Concept, Artificial Intelligence, Technological Design, Commercial Space Design, Case-Based Teaching

1. Introduction

With the rapid development of artificial intelligence technology, it is deeply integrated with the design discipline, gradually reshaping the traditional design education. The essence of design discipline is innovation, and innovation needs the support and assistance of new technology [1]. Artificial intelligence technology

provides new technical tools, such as generative design, parametric modeling, virtual reality (VR) and augmented reality (AR), which deeply affects the thinking and creative process of modern space design. It brings unprecedented opportunities and challenges to environmental design specialty. With the introduction of artificial intelligence technology, the design efficiency has been improved, and the boundaries of creativity have been expanded. The traditional curriculum system can no longer meet the needs of the current industry, especially in the field of commercial space design, the demand for intelligence and data-driven is increasing, and the traditional education model has failed to adapt to this change in time. The concept of Outcome-Based Education (OBE) provides a theoretical framework for solving this problem. This concept emphasizes close contact with the needs of the industry, reverse design of the curriculum system, and pays attention to the improvement of students' ability. The three principles of OBE-goal focus, student-centered and dynamic adaptation-are highly compatible with the needs of design education in the era of artificial intelligence. It aims to cultivate design talents who master cutting-edge technology and have innovative thinking. OBE application is reflected in two aspects: first, it is clear about the "technology+design" ability index to solve the disconnection between technology and creativity; The second is to integrate the artificial intelligence tool chain through project-based learning, so as to realize the transformation from knowledge to ability. In this study, the OBE teaching mode of "artificial intelligence+design" is constructed in theory, which provides a new perspective for design education. On the practical level, this study takes the commercial space design course as a pilot, and puts forward a set of replicable curriculum reform scheme, which solves the problem of disconnection between technology application and creativity cultivation by reconstructing teaching objectives, optimizing teaching process and innovating evaluation system. The research results provide reference for similar colleges and universities, and provide enlightenment for design education to adapt to the trend of intelligence. Based on the OBE concept, this paper puts forward the teaching mode of "artificial intelligence+design", and discusses the replicable reform scheme with the help of the case of commercial space design course, aiming at optimizing the teaching objectives, process and evaluation system, promoting the organic integration of artificial intelligence technology application and creative cultivation, and providing a practical path for the digital transformation of design education.

2. Theoretical Framework: the Fusion Logic of OBE and Intelligent Design

2.1. The core connotation of OBE concept

"Outcome-based Education" (OBE) is translated as "outcome-oriented education" or "output-based education" [2]. The core of this advanced educational concept contains three basic principles: First, the principle of "reverse design of goals" emphasizes that based on the needs of the industry, clarifying the expected learning outcomes, and reversely constructing the curriculum system and teaching content based on these outcomes. Secondly, the "student-centered" principle advocates using students' ability improvement as a criterion rather than simply relying on the transfer of knowledge. Finally, there is the "continuous improvement" mechanism, which continuously optimizes the teaching process through dynamic evaluation and feedback [3]. It is of great significance in global professional mutual recognition and education reform [4]. In the field of design education, the adaptability of the OBE

concept is particularly prominent: on the one hand, the design discipline itself focuses on practice and is highly consistent with the ability orientation emphasized by OBE. On the other hand, the rapid changes in the design industry require flexible adjustment of the education system. It is the dynamic adjustment capabilities advocated by OBE that can meet this need. Especially in the teaching of commercial space design, OBE helps to effectively combine the application of intelligent technology with the cultivation of design innovation capabilities.

2.2. Educational empowerment of artificial intelligence technology

Artificial intelligence technology has opened up a new development path for design education, especially in the field of commercial space design, which has shown great potential and practical application value. Parametric generation technology makes the iteration and optimization of design scheme more efficient, while virtual reality (VR) simulation technology provides a brand-new means for intuitive inspection of space experience. Big data analysis provides a more accurate scientific basis for business positioning and passenger flow prediction. These breakthroughs in artificial intelligence technology gave birth to the framework of “artificial intelligence+design”, which mainly includes two dimensions: one is the dimension of technical literacy, such as the application ability of artificial intelligence tools and the ability of data analysis. The second is the thinking dimension of space design, such as creative generation and aesthetic judgment. The cross-integration of the two not only promotes the development of the design field, but also marks a profound change in the ability standard of design talents.

2.3. Theoretical basis for integration model

The integration of OBE concept and artificial intelligence design is based on a solid theoretical foundation. Constructivist learning theory emphasizes that students actively construct knowledge system in real situations, which is highly consistent with the project-based learning mode advocated by OBE concept and the simulation environment provided by AI technology. Technology-enhanced learning (TEL) theory further illustrates the important role of intelligent tools in optimizing the education process, especially in realizing personalized learning path and improving teaching efficiency. These theories have laid a theoretical foundation for the integration of OBE concept and intelligent design, and provided a solid theoretical basis for building a new teaching model.

The construction of this theoretical framework not only clarifies the internal relationship between OBE concept and intelligent design education, but also reveals the feasibility and necessity of their integration. Future research will further develop the “OBE-AID” teaching mode on the basis of this framework, and carry out empirical verification through the course of commercial space design.

3. The Construction of OBE-AID Teaching Model

Under the background of the deep integration of artificial intelligence and design education, this study innovatively proposed the OBE-AID (Outcome-based education-artificial intelligence design) teaching mode. This model takes the results-oriented education (OBE) as the core concept, and combines the systematic integration of artificial intelligence technology, aiming at creating a brand-new teaching framework for environmental design specialty. This model provides an operational and practical scheme for the reform of commercial space design course.

3.1. Design framework of commercial space design course mode

OBE-AID teaching mode is based on three-dimensional system structure, forming a closed-loop teaching system. At the target level, combined with the latest demand of commercial design industry, through the investigation of six design enterprises, the three core competencies required by commercial space designers in the intelligent era are defined: AI technology application, data-driven design thinking and intelligent space innovation ability. These goals keep up with the development of the times, define specific skills requirements, such as “parametric design tool use” and “VR/AR technology application”, and incorporate them into the evaluation criteria to ensure that the teaching objectives are closely connected with the needs of the industry. At the process level, the iterative process of “problem-technology-scheme” is innovatively put forward, which is divided into three stages: (1) Students obtain the design requirements of real business design cases through the school-enterprise cooperation platform. (2) Then, guide students to use AI and parametric platform to deduce the scheme. (3) In the scheme formation stage, the organic combination of technology application and design creativity is emphasized. Taking the commercial space design project as an example, students analyze the site status and basic data, determine the proportion of functional layout, generate conceptual schemes, verify the space experience by using modern VR technology, complete the complete design process of “data-creativity-verification”, and improve the multi-dimensional development of design ability. At the evaluation level, the model breaks the traditional single evaluation mode and constructs a multi-dimensional and dynamic evaluation system, covering process evaluation, AI algorithm scoring and industry expert review, which verifies the actual value of design results from the practical point of view and ensures the objectivity and accuracy of capability achievement.

3.2. Key innovation points

The core innovations of the OBE-AID teaching model are reflected in three aspects: (1) The course structure has been systematically adjusted based on AI workflow, and has successfully integrated advanced technologies such as parametric design, VR simulation and big data analysis, forming a technology-driven teaching chain. The newly designed course revolves around the design workflow, and the content is divided into four step-by-step modules: the commercial space design data collection and analysis module (20 hours), focusing on cultivating students’ ability to process big data. Commercial space design scheme AI drawing intelligent generation module (20 class hours) helps students master the practical application of AI tools. Virtual verification module (8 hours) to improve students’ ability in technology integration. And a comprehensive practice module (24 hours) to enhance students’ practical experience through practical projects. Through this course reconstruction, technical learning and design practice are organically combined to ensure that students can skillfully use AI tools to draw design drawings at the end of the semester. (2) The course adopts a “dual-teacher classroom” model, which is taught jointly by college teachers and AI engineers. This teaching method not only ensures the depth of design theory, but also enhances the practicality of technology applications. (3) The teaching model also develops project-based learning (VRP) that combines virtual and practical. Students will conduct AI-assisted design experiments in a virtual environment and verify them through actual commercial projects, thereby achieving the combination of academic research and practical applications.

3.3. The characteristics and value of OBE-AID teaching mode

The OBE-AID teaching model has three distinctive characteristics: (1) The goal orientation is clear, and all teaching links are designed around ability development indicators. (2) The teaching model emphasizes technological integration. Artificial intelligence tools are not only used as auxiliary tools, but become an important part of core teaching content. (3) Diversify the evaluation system and establish a sound quality monitoring mechanism. Practice has shown that this teaching model effectively solves the problems of “superficial application of intelligent technology” and “formalization of school-enterprise cooperation” that are common in design education. The innovative value of this teaching model is reflected in three main levels: at the theoretical level, a three-dimensional integration framework of “goal-process-evaluation” is proposed, which provides new ideas for the development of the theoretical system of design education. At the practical level, the teaching model develops an implementation path that can be replicated and promoted, and takes multiple measures to create a “dual-qualified” teacher team [5]. For example, the “dual-teacher classroom” collaboration mechanism and the VRP teaching model can be effectively applied in different environments. At the application level, the teaching model cultivates compound talents with both design capabilities and artificial intelligence technology, and graduates are highly praised among employers.

4. Teaching Practice Case of Commercial Space Design Course

4.1. New curriculum reform design

Based on the course of Commercial Space Design for the third year of environmental design major in Guangzhou Huashang College, this study systematically implemented the OBE-AID teaching mode. This course has a total of 72 hours, including 24 hours of basic theory courses and 48 hours of project practice courses. The teaching content is divided into four stages according to the order from shallow to deep: familiarity with theory and framework, practical cases and applications, problem investigation and positioning, prototype realization and verification. In the early stage of teaching reform, the research team conducted a three-month investigation, focusing on two aspects: (1) By interviewing four well-known design institutions, the team summarized and refined six core competencies required for intelligent commercial space design. (2) The research team conducted a competency baseline test on 16 students who participated in the course. The results show that only a few students have the ability to operate basic artificial intelligence tools. According to these survey data, the curriculum team made structural adjustments to the syllabus. Traditional courses usually follow the linear order of “theory-investigation-scheme-expression”, while the reformed OBE-AID course adopts the spiral structure of “technical module+design project”, and the learning and design process of artificial intelligence technology are closely combined and run through every stage. In addition, the course also invites researchers in related fields to participate in classroom counseling to help students turn their ideas into specific design schemes, thus effectively improving their practical ability in the application of artificial intelligence.

4.2. Teaching achievement

In the course of commercial space design, students choose their own topics according to actual problems, and the core is to examine their problem-solving ability

and scheme implementation ability, rather than the theory-based assessment method in traditional computer science. Although there is no fixed standard for the scope and creative form of the project, each group of students is given individual guidance to explore how to use artificial intelligence technology to improve the performance effect of commercial space design. The course also emphasizes teamwork and encourages interdisciplinary cooperation. Through the four-stage teaching, students have created many works around the theme of “artificial intelligence+commercial space design” and tried to promote and demonstrate the results. The teaching practice results of commercial space renderings generation are as follows:

In the course of commercial space design, the application of artificial intelligence technology mainly focuses on the generation of commercial space design renderings, and has achieved remarkable results in the teaching practice. The teaching content in this stage is combined with practical cases, which not only deepens students’ understanding of the theoretical framework, but also effectively improves students’ practical ability in making AI renderings. In the course practice, students import hand-drawn scheme renderings into official website, a senior architect, to make AI renderings. The specific operation process is as follows: First, enter official website, the senior architect, click Login and enter the operation interface, and select the AI drawing function. Click Upload in the “Profile Basemap” option. Upload the hand-drawn drawings of commercial space design locally, and select the corresponding refined building model. Then, debug the creative description, AI expansion and retouching prompts, set the page parameters, click Start Creation, and pull the rendering command left and right to render the renderings. If the effect does not meet the expected requirements, students can use the “re-description” function to modify and refine the prompt words and parameter settings. For local modification, students can select and lasso a specific area of the image through the “local redrawing” function, generate a new description command, add local redrawing prompts, adjust the area to be modified, and click “Start Creation” again to re-render, and finally generate a rendering effect diagram of commercial space design (Figure 1). In the aspect of knowledge application, students have mastered the AI rendering technology in OBE-AID teaching mode and effectively combined it with commercial space design creativity. By importing hand drawing into AI drawing software, students can quickly transition from hand drawing to the generation of commercial space design renderings, and fully demonstrate the innovative concept of “artificial intelligence+design”.

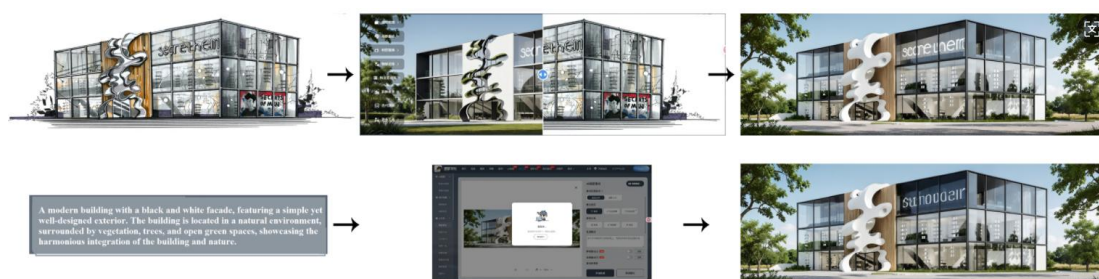


Figure 1. Commercial space hand-drawn solution AI rendering rendering.

Image source: Lin Zezhen, Ling Jin

In the case of “AI-aided commercial space design renderings”, students first use hand-drawn commercial space design scheme to complete the scheme design, and then use official website software, a senior architect, to draw renderings, and further

optimize the design effect by adjusting the settings. In the process of drawing renderings, students found that the speed of drawing renderings was slow. After optimization and adjustment, the efficiency of drawing renderings was improved by 60%. Another innovative case is “generative AI-aided conceptual design”. The course introduces AI software tools, and students use AI software and other tools to complete five rounds of scheme iteration within two weeks. The data shows that students who use AI software tools are five times higher than traditional methods in program output, and the average creative score is increased by 23%. These cases fully demonstrate the huge application potential of AI software technology in commercial space design. With the aid of AI software technology, students have not only significantly improved their learning efficiency, but also reached a new height in the quality of design and creation. Through AI software technology, students can accurately identify potential problems in design, and quickly adjust and optimize them, so as to achieve higher design output in a limited time (Figure 2).

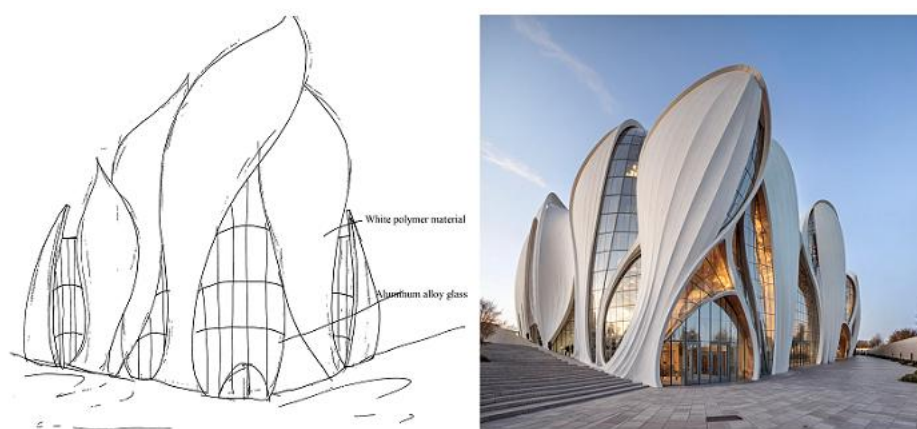


Figure 2. Student Cai Mengfan's design team “Qingyu Tea Stream Natural Growth — The scheme of tea culture flagship store in Tianhe South Street of Guangzhou under the new retail concept”.

Image source: Cai Mengfan, Chen Chuanghui

4.3. The Evaluation of implementation effect

The evaluation method of this course adopts the student course report link, and students complete the final homework through PPT work report and physical prototype function operation. In the reporting process, students need to highlight the concept and creativity of the work “artificial intelligence+commercial space design”. And combined with the market and business model. The jury consists of students, teachers, designers and technicians from the design company of the course co-founder. The evaluation criteria include innovation (40%), technical realization (45%) and market commercialization (15%). During the course presentation, students can not only improve their ability of expression and elaboration, but also get professional advice from the field of commercial space design, thus avoiding the idea from being divorced from practical application or being too idealistic. In the reporting and communication session, the enterprise tutor puts forward suggestions on the revision of students' works: First, the accuracy of the generation of commercial space design renderings is the key. Secondly, the auxiliary role of generative AI software in conceptual design needs to pay attention to the application of AI intelligent technology in practical operation. Through the course report, some students' works are highly praised by the enterprise, and the feedback of the evaluation results serves as

the basis for the continuous improvement of teaching [6], and the enterprise intends to provide support and deepen the design in the subsequent stage.

After a semester of teaching practice, the quantitative evaluation results show that the application rate of AI software technology in students' works has increased from 12% in the initial stage to 82%. In terms of innovation, the average score of off-campus evaluation rose from 70 points (100 points) to 82 points. Qualitative analysis also shows positive results. Enterprise tutors affirmed students' performance in the aspect of "balance between technical thinking and design thinking". The high-frequency words appearing in students' experimental summary reports include efficiency improvement, creativity stimulation and interdisciplinary thinking. These feedbacks effectively verify the remarkable effect of OBE-AID teaching mode in cultivating new design talents.

5. Conclusions

Aiming at the needs of the transformation of design education in the era of artificial intelligence, this study innovatively constructs OBE-AID teaching mode, and provides a systematic solution for the reform of commercial space design course. This teaching model has achieved breakthrough through a three-dimensional framework: at the target level, it has created a capability index system oriented to industry demand. At the process level, the iterative process of "problem-technology-scheme" is designed. At the evaluation level, establish a dynamic and pluralistic evaluation system. The innovation of teaching mode includes module reorganization based on AI workflow, "double-teacher classroom" cooperation mechanism, and project-based learning mode combining virtual and reality. Through the verification of teaching practice, the research results show that the model can significantly improve students' application ability of AI software technology (proficiency is as high as 82%) and design innovation level (expert score is increased by 12 points), and effectively solve the problem of disconnection between AI software technology and creative cultivation. Further analysis shows that the application of AI software model improves students' industrial adaptability by 40%, and the actual landing rate of the scheme has also increased. Future research will explore the application and evaluation mechanism of AI software technology in the course system of commercial space design, and establish a more adaptable education platform. Generally speaking, the teaching mode proposed in this study is reproducible, which provides valuable paradigm reference for the digital transformation of practical disciplines and has far-reaching significance for cultivating compound design talents that meet the needs of the intelligent era.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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