ISSN 2522-6398 Vol. 8, Issue 7: 133-138, DOI: 10.25236/FER.2025.080719

Research on the Teaching Practice Path of Landscape Design-Build Workshop under Artificial Intelligence: A Case Study of Future Garden in Shenzhen Bougainvillea Flower Show

Ye Xue[1,a], **Xu Dexiu**[1,b,*]

[1]*School of Construction Engineering, Shenzhen Polytechnic University, Shenzhen, China*
[a]*yexue@szpu.edu.cn*, [b]*475062955@qq.com*
[*]*Corresponding author*

Abstract: *This paper focuses on the teaching reform of the "design-build" workshop for higher vocational landscape architecture programs. Combining practical project cases such as the Future Garden of the Shenzhen Bougainvillea Flower Show, it explores the application paths of artificial intelligence (AI) technology in design scheme generation, full-process optimization of construction, and innovation in teaching models. By analyzing questionnaire data, it reveals the teaching effectiveness and existing pain points of traditional design-build workshops, and proposes a teaching and research system integrating "AI + design-build". The aim is to improve students' intelligent design capabilities, interdisciplinary collaboration skills, and project implementation efficiency, providing a new paradigm for cultivating high-level technical talents in landscape architecture.*

Keywords: *Artificial Intelligence (AI), Landscape Design-Build Workshop, Teaching Practice, Vocational Education Reform*

1. Introduction

1.1 Research Background

Driven by both contemporary urban and rural construction and ecological civilization development, the landscape design industry is undergoing a transformation from "blueprint design" to "full-cycle implementation". This places higher demands on practitioners' comprehensive abilities - not only requiring solid design theories and aesthetic literacy but also the ability to transform creativity into physical spaces, interdisciplinary collaboration skills, and mastery of emerging technologies. However, the traditional landscape education model that "emphasizes theoretical teaching over practical transformation" is still prevalent. Students' design schemes learned in classrooms often fail to be implemented due to being disconnected from construction technologies, material properties, and site constraints[1], leading to a disconnect between "design" and "build", and this contradiction is particularly prominent in complex project practices.

The landscape "design-build" workshop, as an important teaching carrier connecting theory and practice, has gradually highlighted its value in recent teaching reforms. By allowing students to deeply participate in the entire process from scheme conception to on-site construction, the workshop effectively makes up for the shortcomings of traditional teaching. As shown in the questionnaire data, 86.42% of students believe that such workshops significantly improve the implementation ability of design schemes, and 69.14% of participants have transformed classroom knowledge into practical achievements in real scenarios through competitions such as the Shenzhen Bougainvillea Flower Show. This data intuitively confirms the core role of practical teaching in skill cultivation and provides empirical support for the innovation of landscape education models.

Meanwhile, technological innovations represented by artificial intelligence are profoundly reshaping various industries, and the landscape design field is no exception. The application of technologies such as parametric design, AI-assisted scheme generation, intelligent site analysis, and digital twin simulation[2] has not only changed the creative logic of design but also put forward "technology + design" compound requirements for practitioners' knowledge structures. Internationally, top universities such as

Technical University of Munich in Germany and University of Pennsylvania in the United States have taken the lead in integrating artificial intelligence and parametric technologies into landscape design-build workshops. They optimize spatial layouts through algorithms and simulate plant growth cycles with digital tools, achieving dual breakthroughs in design efficiency and innovation dimensions. In contrast, in China, with the advancement of concepts such as "smart cities" and "sponge cities", the industry's demand for "AI + landscape" compound talents has shown explosive growth. However, the gap between the lag of technical education in traditional teaching and the advancement of industry practices is gradually widening. Most workshops still remain at the level of manual model making and traditional construction technology teaching, with insufficient integration of artificial intelligence technologies, making it difficult to meet the new demands of the times for talent cultivation.

In this context, the Future Garden of the Shenzhen Bougainvillea Flower Show, as a benchmark project integrating "cutting-edge, practical, and public-oriented" features, provides a unique practical scenario for exploring the integration of artificial intelligence and landscape "design-build" workshops. The project not only requires participants to use AI technologies to solve problems such as ecological adaptation and pedestrian flow optimization in complex sites but also needs to realize interdisciplinary team collaboration and physical construction through the workshop model. This dual attribute of "technology empowerment + practical implementation" not only responds to the trend of international landscape education's technical integration but also provides a reference path for breaking the bottleneck of domestic traditional teaching models. Therefore, in-depth research on its underlying teaching practice has important theoretical and practical significance.

1.2 Research Significance

Theoretical significance: This study constructs an AI-empowered teaching framework for landscape "design-build" workshops, providing theoretical support for the reform of higher vocational landscape education. Current research on technology-empowered teaching in the landscape education field mostly stays at the macro level, lacking a systematic theoretical construction of AI technology application in the entire "design-build" process. By analyzing the mechanism of AI in scheme generation, site simulation, construction optimization, and other links in the workshop, this study fills the theoretical gap in the deep integration of technology and teaching. Meanwhile, focusing on the "practice-oriented" characteristics of higher vocational education, it explores talent cultivation theories in line with the laws of vocational education, providing a new perspective for interdisciplinary integration research in the field of vocational education and enriching the modern landscape education theory system.

Practical significance: It addresses issues such as "limited equipment and site" (59.26%) and "insufficient project sources" (53.09%) in traditional design-build workshops. It breaks through site restrictions through AI virtual simulation and alleviates project shortages by connecting to resource libraries. With projects like the Future Garden of the Shenzhen Bougainvillea Flower Show as carriers, it optimizes teaching processes, improving project accuracy and efficiency while enhancing students' technical application and project execution capabilities, achieving dual improvement in teaching and industry practice, and providing replicable experiences for similar institutions or projects.

2. Current Teaching Situation of Landscape Design-Build Workshops and Potential of AI Integration

2.1 Analysis of Traditional Teaching Situation Based on Questionnaire

According to the questionnaire feedback, the teaching effectiveness of traditional landscape "design-build" workshops shows obvious polarization. In terms of soft skills training, 82.72% of students believe that the workshop has significantly improved their team communication skills, which is closely related to the workshop's emphasis on the group collaboration model. At the same time, 51.85% of participants feel its positive help for career development, indicating that the workshop plays a certain role in connecting campuses and industries. However, in terms of hard skills improvement, the improvement rate of "application of materials and construction technologies" is only 53.09%, which is not only significantly lower than that of team collaboration skills but also exposes the shortcomings of traditional teaching in technical operation and innovation training - students' mastery of physical material properties and construction logic is still at a basic level, making it difficult to meet the technical innovation needs of complex projects.

In terms of pain points, the limitations of traditional design-build workshops are concentrated in the

ISSN 2522-6398 Vol. 8, Issue 7: 133-138, DOI: 10.25236/FER.2025.080719

dual constraints of practical conditions and efficiency. On the one hand, the physical limitations of equipment and sites directly restrict the development of complex projects. Students have difficulty accessing large-scale construction equipment or diverse site scenarios, resulting in insufficient breadth and depth of practical experience. On the other hand, traditional design schemes rely on manual modification and repeated polishing, with low iteration efficiency. When facing the high demands for innovation and timeliness in competitions such as the Shenzhen Bougainvillea Flower Show, they often fall into a passive position due to delayed scheme adjustments and insufficient technical implementation capabilities, making it difficult to produce works that are both creative and implementable. This situation of "acceptable soft skills but weak hard skills" and "limited practical conditions and insufficient innovation response" highlights the gap between the traditional teaching model and the industry's demand for compound technical talents.

2.2 Application Scenarios of AI in the Design and Construction of Future Garden in Shenzhen Bougainvillea Flower Show

In the entire process of landscape design and construction, artificial intelligence technology provides innovative solutions for various links through precise and intelligent intervention, and has shown significant value especially in projects such as the Future Garden of the Shenzhen Bougainvillea Flower Show.

In the design stage, the core role of AI is to break away from traditional experience dependence and realize the integration of scientific decision-making and creative generation. In the site analysis link, AI can obtain multi-dimensional data through methods such as drone aerial photography, and generate visual analysis reports after algorithm modeling to accurately identify site advantages and limitations. In terms of scheme generation, style transfer technology based on deep learning has become a creative tool: by inputting design cases of classic flower shows at home and abroad, AI can extract style features and combine them with site data to quickly generate multiple sets of flower configuration schemes in line with the "Future Garden" theme. Designers only need to optimize and adjust on this basis, which not only improves the diversity of schemes but also shortens the creative incubation cycle.

In the construction stage, AI intervention focuses on improving construction efficiency and risk management. In the construction simulation link, AI combines BIM technology with schedule management algorithms to build a virtual construction scenario, dynamically deducing material transportation routes, construction process connections, and manpower allocation, and predicting possible delays or conflicts in advance. Taking the construction of the temporary exhibition garden of the Shenzhen Bougainvillea Flower Show as an example, AI can simulate the impact of extreme weather on the construction progress and automatically generate alternative construction schemes to ensure the project is completed on schedule. In terms of material optimization, the AI system intelligently recommends low-cost and degradable alternative materials by integrating the environmental protection material database and project budget parameters, and predicts the durability of materials in combination with the flower growth cycle, taking into account ecology and practicality while controlling costs, thus solving the problem of "blindness in material selection" in traditional construction.

In the evaluation stage, AI realizes the quantification and dynamic optimization of the scheme implementation effect. By integrating data on audience behavior during the Shenzhen Bougainvillea Flower Show (such as stay time and photo hotspots), flower growth status monitoring data (such as survival rate and flowering period), and expert review opinions, AI constructs a multi-dimensional scoring model to comprehensively evaluate the aesthetic effect, ecological benefits, and public experience of the design scheme. For example, for a flower installation in the "Future Garden", AI can analyze the emotional tendency of keywords in audience feedback and combine plant growth data collected by sensors to generate optimization suggestions[3], providing data support for the design and construction of subsequent similar projects and forming a closed-loop improvement mechanism of "design-build-evaluation".

3. Construction of Teaching Path for AI-empowered Landscape Design-Build Workshop

3.1 Curriculum System Reconstruction: Integration of AI Tools into the Entire "Design-Build" Process

The reconstruction of the curriculum system needs to break the separation between traditional courses and technical applications, and deeply embed AI tools into the teaching links of the entire "design-build"

ISSN 2522-6398 Vol. 8, Issue 7: 133-138, DOI: 10.25236/FER.2025.080719

process. In the course "Landscape Plant Landscaping", the newly added "AI Design Module" can carry out teaching around generative AI tools such as Stable Diffusion: students learn to use AI to quickly generate multiple sets of plant configuration schemes by inputting keywords such as "Bougainvillea Flower Show + Future Garden + Ecological Theme"[4], and then manually screen and optimize the schemes in combination with plant growth habits and site lighting data. This not only improves the efficiency of scheme creation but also strengthens the design thinking of "AI assistance rather than replacement". The course "Garden Design and Construction" focuses on introducing parametric modeling teaching of Revit + AI plug-ins. Students need to master the use of AI plug-ins to automatically generate structural node models that meet construction specifications, and realize real-time synchronization between design schemes and bill of quantities through data linkage, solving the problem of "disconnection between design drawings and construction implementation" in traditional teaching.

The practical project design takes the Shenzhen Bougainvillea Flower Show as the core carrier to build a closed-loop training system of "AI preliminary scheme → manual optimization → intelligent construction simulation → physical construction". In the scheme stage, students need to use the AI tools learned in the course to complete site analysis and preliminary scheme design, such as generating 3 sets of exhibition garden layouts with different styles through AI; in the optimization stage, they adjust the plant collocation and material costs of the scheme with the guidance of teachers; in the construction simulation stage, they use AI construction software to conduct virtual construction deduction of the scheme to predict construction difficulties; finally, they implement the scheme through physical construction, enabling students to master the application logic of AI tools in different stages in the complete process and realize the coordinated improvement of "design creativity" and "technical implementation" capabilities.

3.2 Innovation in Teaching Model: "AI Collaboration + Virtual-Real Integration"

The teaching model of "AI collaboration + virtual-real integration" aims to break through the time and space constraints and collaboration barriers of traditional practical teaching. In the virtual simulation preview link, relying on the digital twin of the Shenzhen Bougainvillea Flower Show site built by AI, students can enter the 1:1 restored virtual site environment in advance: by simulating the transportation routes of different materials (such as environmental protection boards and flower pots), they can optimize the construction movement line design; they can even simulate the site drainage under extreme weather to adjust the exhibition garden's terrain slope in advance. This preview model not only reduces reliance on physical sites (alleviating 59.26% of site restrictions) but also enables students to avoid more than 80% of conventional construction errors before physical construction.

Intelligent team collaboration strengthens the communication efficiency across groups through the AI collaboration platform: the scheme mutual evaluation system based on natural language processing technology can automatically extract key information such as "innovation points" and "feasibility issues" in each group's schemes and generate structured evaluation reports, avoiding information omission in traditional oral mutual evaluation; at the same time, the platform can summarize the progress data of each group in real-time. When a group lags behind in the "AI scheme generation" link, the system will automatically push similar excellent cases for reference, responding to 82.72% of students' demand for improving team collaboration capabilities.

The dynamic evaluation and feedback mechanism focuses on the accuracy of process evaluation: the AI system tracks students' modification traces in scheme iteration (such as the number of adjustments to schemes generated by Stable Diffusion and the parametric modification logic of Revit models) and decisions on cost and ecological balance in material selection in real-time, and generates visual capability maps. For example, if students over-rely on AI output in the stage of "AI preliminary scheme → manual optimization", the system will prompt "it is necessary to strengthen manual verification of the matching degree between plant growth cycles and schemes", and then combine teachers' guidance on the depth of technical application to form a personalized improvement plan of "AI data feedback + teachers' experience guidance".

3.3 Upgrading Industry-Education Integration: School-Enterprise Collaborative Development of AI Practice Platform

The upgrading of industry-education integration needs to focus on "real scene training + technical resource complementarity" and solve the resource limitations of traditional models through school-enterprise collaboration. The "AI-Construction" training system developed jointly with landscape

ISSN 2522-6398 Vol. 8, Issue 7: 133-138, DOI: 10.25236/FER.2025.080719

enterprises can deeply integrate the historical data resources of the Shenzhen Bougainvillea Flower Show: the system not only includes award-winning schemes and construction difficulties in the past 10 years but also can simulate site conditions in different years through AI algorithms. Students can choose the "simulated competition" mode in the system, receiving assessments according to real project standards throughout the process from scheme design to construction implementation, ensuring that the training content is seamlessly connected with industry needs.

The introduction of enterprise technical forces effectively makes up for the technical shortcomings of in-school teachers: inviting AI engineers from landscape enterprises to participate in workshop guidance, providing practical guidance on technical details such as "optimization of parametric modeling efficiency of Revit + AI plug-ins" and "setting of risk warning thresholds in AI construction simulation", changing the limitation that 1-2 teachers in the traditional model could hardly cover multiple technical links. In addition, enterprises can provide authorization for the latest AI design tools and open their internal "material-cost" database, allowing students to use resources synchronized with the industry in training and strengthening the practicality of technical application.

4. Conclusions and Prospects

The "AI + design-build" teaching model proposed in this paper, with the Future Garden of the Shenzhen Bougainvillea Flower Show as the practical carrier, has verified its significant effectiveness in talent cultivation through real projects: in terms of innovation capability, among the schemes generated with the assistance of AI tools by students, 2 sets of schemes were shortlisted for the final evaluation of the exhibition competition, confirming the role of AI in stimulating design creativity; in terms of project implementation efficiency, the scheme iteration cycle was shortened compared with the traditional model, and the material loss rate was reduced, effectively meeting the dual requirements of competition projects for "high innovation" and "high implementability". This teaching model, which is centered on technology empowerment and takes real projects as the link, provides a feasible sample for higher vocational landscape education to open up the connection chain of "theory-practice-industry".

Future research can extend to deeper technical integration and systematic construction. On the one hand, explore the in-depth integration of generative AI and landscape plant growth simulation: by training AI models based on plant physiology, realize the linkage from design scheme generation to plant growth cycle prediction. For example, in the scheme design of the Shenzhen Bougainvillea Flower Show, after inputting flower varieties and site climate parameters, AI can not only generate visual schemes but also simulate the changes in plant growth forms in the next 6 months, helping students predict the dynamic evolution of landscape effects in advance and solving the contradiction between "static design" and "dynamic plant growth". On the other hand, efforts need to be made to build a full-process closed loop of "intelligent design - digital twin - physical construction": using generative AI to output preliminary design schemes, relying on digital twin technology to build virtual scenarios including material performance, construction processes, and plant growth, and implementing physical projects after multiple rounds of virtual construction optimization, forming an iterative mechanism of "virtual trial and error - physical correction". This closed-loop system can not only further reduce the trial-and-error cost of physical construction but also enable students to master the full-chain technical logic from digital models to physical spaces, ultimately forming a replicable and promotable practical paradigm for higher vocational landscape education, providing a complete reference framework from technical tools to teaching concepts for teaching reforms in similar institutions, and promoting landscape vocational education to upgrade towards "technology-driven, virtual-real integration, and industry-education collaboration".

Acknowledgements

This article is sponsored by the 2023 Guangdong Higher Vocational Education Teaching Reform Research and Practice Project (No. 2023JG504).

References

[1] Chen J., Meng G., Yan H.. Integration of Technology and Design: A Ten-Year Review of Teaching Reform by the Construction Technology and Design Team of Tongji University (2010—2020)[J]. Time + Architecture, 2020,(03):45-49.

ISSN 2522-6398 Vol. 8, Issue 7: 133-138, DOI: 10.25236/FER.2025.080719

[2] CHEN R, LUO X M, HE Y H, ZHAO J. Research on the Adaptability of Generative Algorithm in Generative Landscape Design[J]. Landscape Architecture, 2024, 31(9): 12-23.
[3] ZHONG Y, LIU Y X, YE Y. Measurement of the Public Activity Richness of Urban Park Based on Large Language Models and Social Media Data: A Case Study of Shanghai[J]. Landscape Architecture, 2024, 31(9): 34-41.
[4] FENG L, YU C W, SUN Y T, ZHAO J. Generative Design of Plantscape Based on Generative Adversarial Network: A Case Study of the Generation of Flower Border Plan[J]. Landscape Architecture, 2024, 31(9): 59-68.