Construction of the Practice System of Landscape Architecture Major Based on "Multi–dimensional Integration"

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Abstract During the critical transformation period of landscape architecture major after the adjustment of disciplinary structure and the changes in market demand, private colleges and universities, as important places for cultivating local talents, have pain points such as uneven quality of teachers and students and weak innovation and practice. The practice system with "multi-dimensional Integration" integrates four dimensions: interdisciplinary integration, spatial and temporal intersection, historical inheritance, and behavioral activity, deepens the disciplinary connotation, and integrates the three elements of nature, humanity, and technology, aiming to provide a new path for private colleges and universities to cultivate application-oriented and compound talents with innovative capabilities. In terms of optimizing talent cultivation and adapting to industry changes, this system provides thinking and reference for landscape architecture major, helping the major reshape its core competitiveness and promoting educational innovation and industry development.

Keywords Landscape architecture, Practice system, "Multi-dimensional integration" model, Talent cultivation, Teaching reform

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After the golden development period of successfully applying for the first-level discipline and then the downgrading of the first-level discipline and the painful process of abolishing the academic doctoral and master's degrees in 2021, landscape architecture major is now at a critical juncture of historical transformation[1]. Due to the adjustment of the first-level discipline structure, the phased contraction of academic postgraduate training, coupled with the changes in market demand brought about by the transformation of the real estate industry, the development of professional talent cultivation is facing an unprecedented challenge of staff reduction and huge psychological pressure on teachers and students[2]. As a core major supporting new urbanization, rural revitalization, the creation of a healthy urban living environment, and ecological civilization construction, the interdisciplinary nature of landscape architecture is becoming increasingly important-its knowledge system naturally integrates multiple dimensions such as architectural planning, ecological technology, information technology, and humanities and social sciences. This trinity integration characteristic of "nature-humanity-technology" is precisely the strategic fulcrum for the major to break through the predicament of discipline downgrading, and the significant impact of industry downturn. Against this backdrop, building a professional talent cultivation practice development system with "multi-dimensional integration" has become an important solution. It aims to conduct in-depth practical integration through four dimensions: disciplinary intersection, spatial and temporal intersection, historical inheritance, and behavioral activities, and establish a knowledge application framework for dynamic talent cultivation adapting to industry changes.

As the main force in local talent cultivation, private colleges and universities shoulder a special mission in the education of landscape architecture. However, common problems such as uneven quality of talent cultivation and weak innovation and practice among graduates need to be urgently addressed[3]. The strong practical nature and interdisciplinary genes of landscape architecture major provide an ideal carrier for its exploration of practical education reform[4]. The traditional model of "one-way output by teachers" has been unable to meet the demands of cultivating compound abilities, and it is urgent to build a progressive innovation practice ecosystem of "learning innovation-communication innovation-self-service innovation". Under the guidance of teachers' innovative and entrepreneurial concepts, students achieve ability leaps in real scenarios, ultimately forming an innovative chain of mutual empowerment between teachers and students. This model can not only enhance students' ability to solve complex problems, but also promote the academic transformation of teachers and the deepening of industry-education integration.

Based on the transformation of disciplines and the development demands of private education, a construction plan for an educational practice system based on "multi-dimensional integration" was proposed. In terms of disciplines, the curriculum system is restructured based on the ternary theory of "nature-humanities-technology", and the cross-integration of fields such as ecological restoration, smart landscapes, and cultural inheritance was strengthened. In terms of mechanism, "interdisciplinary technology, smart tool technology, and environmental behavior technology" are integrated to conduct project-based teaching and smooth out the cycle chain of "enterprises, universities, and research institutions". In terms of resources, a dynamic practical network of school-enterprise collaboration should be constructed to address the resource bottleneck of private colleges and universities[5]. This study aims to explore the multi-dimensional intrinsic connections of landscape architecture major, provide path references for private colleges and universities to cultivate compound talents with innovation and entrepreneurship capabilities, and help the major reshape its core competitiveness in the process of industry transformation.

1 Development trends of prac–tical teaching research

"OPEN KNOWLEDGE MAPS" was

used to statistically analyze over 120 teaching and research contents related to the innovation and entrepreneurship system of undergraduate education in landscape architecture in the past five years and then create a word frequency map (Fig.1). It can be seen that in the field of "innovation and entrepreneurship" practical education in landscape architecture in the past five years, keywords such as

virtual reality technology, online education platforms and immersive learning environments have frequently appeared. This is in line with the current teaching situation where digital tools have become the core carriers of practical teaching[6]. Concepts such as interdisciplinary collaboration, environmental awareness cultivation, and expanded learning models also account for a considerable proportion, indicating that the undergraduate education system is shifting from applied skills training to the cultivation of compound abilities. This is in line with the current situation where private colleges and universities are cultivating compound talents with full-chain innovative thinking through the collaboration of enterprises, universities and research institutions, ecological ethics infiltration, and project-based learning. In terms of regional culture, landscape heritage education and cultural analysis are the focus, while research on the inheritance of indigenous culture and the intelligent modernization transformation of traditional construction is relatively marginalized[7-9].

There are still deficiencies in the current research on innovation and entrepreneurship education in private undergraduate programs of landscape architecture. At the level of interdisciplinary integration, although there is cooperation with other disciplines in the dimension of interdisciplinary knowledge integration, the teaching model of interdisciplinary knowledge integration is not mature enough. It mostly borrows methods from other disciplines to solve problems in this major, making it difficult to achieve deep integration. In terms of the intersection of time and space, research in the field of integrating the enlightenment of traditional construction wisdom with the education of modern technology is relatively weak, and the establishment of the spatial and temporal translation mechanism of historical context is not yet perfect. In terms of historical inheritance, the teaching cognition level of regional cultural genes is insufficient, and the exploration of modern expression paths of teaching methods is inadequate; the historical manifestations are mostly superficial, with insufficient connotation

and inspiration. From the perspective of behavioral activities, there is a lack of research on the dynamic correlation between user behavior data and spatial design in practical education, and the response mechanism of practical links to the evolution of behavioral patterns is absent, which affects the implementation and feasibility of practical innovation.

2　Support from national policies

2.1 Positioning and requirements for development during the "14th Five-Year Plan" period

2.1.1 An important part of a high-quality education system. During the "14th Five-Year Plan" period, the state emphasizes that practical education should be oriented towards high quality. As a key part of private education, practical education should pay more attention to cultivating students' practical ability, innovative spirit and comprehensive quality to meet the demand for high-quality talents.

2.1.2 Highlighting the function of practical education. It is needed to strengthen practical teaching links and increase students' opportunities to participate in actual projects, such as school-enterprise cooperation and the integration of enterprises, universities and research institutions, so as to enable students to enhance their professional skills and the ability to solve practical problems and achieve the close combination of theory and practice[10].

2.1.3 Interdisciplinary integration orientation. The intersection and integration among different disciplines should be encouraged, and disciplinary boundaries should be broken down in practical education to cultivate students' interdisciplinary thinking and the ability to comprehensively apply knowledge to adapt to complex social issues and industry demands[11].

2.2 Development opportunities for future construction during the "15th Five-Year Plan" period

2.2.1 Technological integration and innovation. Under the development of digital technology, technologies such as virtual reality (VR), augmented reality (AR) and artificial intelligence (AI) have become the barometers of industry development. The practical education of landscape architecture will deeply integrate GIS, 3D reconstruction, and various virtual reality technologies to enhance teaching effectiveness and students' practical abilities, providing students with a richer and more efficient learning experience and cultivate innovative landscape architecture talents with digital skills for society.

2.2.2 Demand for sustainable development. "The concept of sustainable development" has been closely related to the practical construction and talent cultivation of landscape architecture since its proposal, and will continue to run through the entire process of practical education of landscape architecture in the future[12]. The content of practical education will place greater emphasis on knowledge related to ecological
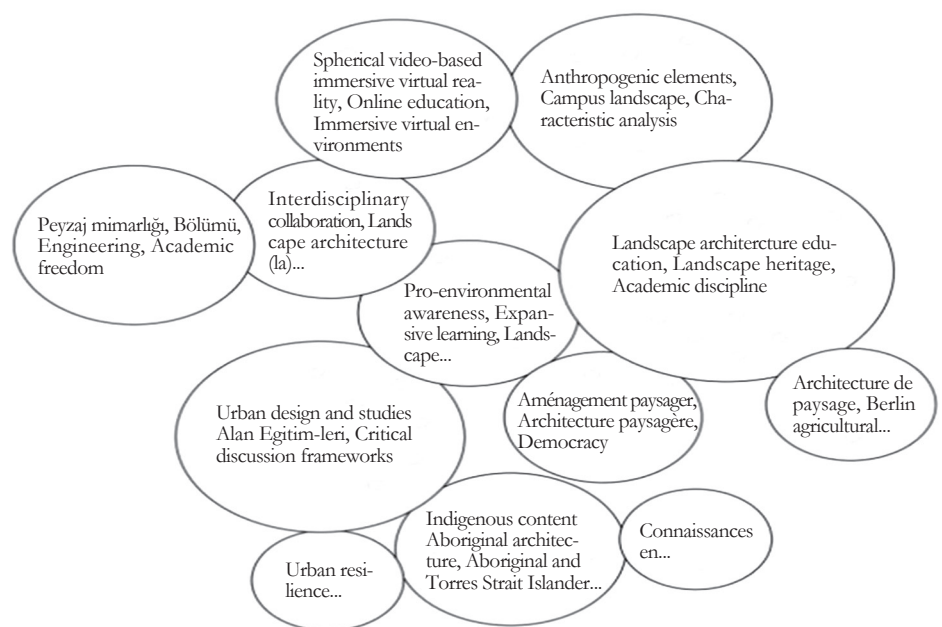

Fig.1　Hotspots of research on landscape architecture practical education in the past five years

restoration, energy conservation and emission reduction, and people's well-being, and students are encouraged to innovate and explore low-carbon, environmentally friendly and health-preserving landscape architecture design models. Landscape architects are contributed in the important historical stage of responding to global climate change, and thus play a greater role in the field of sustainable development.

2.2.3 International cooperation and exchange. An international perspective has become an important direction for innovation and entrepreneurship education in landscape architecture. To enhance its industry status and cultivate high-quality talents, private education will also join the platform of cooperation with international advanced educational institutions during the "15th Five-Year Plan" period. It will introduce international advanced landscape concepts, promote exchanges and mutual learning, discuss technical methods and teaching models, encourage students to participate in international project practices and international-level subject competitions, enhance students' international competitiveness, and promote the international development of the private system of landscape architecture[13-14].

3　Construction of a practical system under the "multi–dimen–sional integration"

As shown in Fig.2, the practical system constructed under the "multi-dimensional integration" refers to the practice of talent cultivation carried out under four dimensions: interdisciplinary integration, spatial and temporal intersection, historical inheritance, and behavioral activity. It aims to solve the problems such as insufficient cognitive level of talents, insufficient regional understanding, and insufficient broadening of horizons during the cultivation of talents in private undergraduate programs, and cultivate application-oriented local talents with initiative, recognizability, creativity.

3.1　Interdisciplinary integration

Interdisciplinary integration has a long history. In 1900, Harvard University in the United States initiated professional courses related to landscape planning and design, in which Frederick Law Olmsted Jr. participated. Later, they developed into a teaching system related to landscape architecture, thus pioneering modern landscape architecture education. In the 1980s, due to its interdisciplinary, design-oriented, interesting, practical and collaborative nature, it made considerable progress in its birthplace, the United States, and was introduced to Germany,

Japan, France and other countries, gradually becoming localized. This has laid the foundation for the practical aspect of landscape architecture major, namely being highly interdisciplinary. As landscape architecture industry has developed, the dimensions of interdisciplinary integration have continuously expanded horizontally, and it is now closely related to more than 20 disciplines such as environmental science, ecology, geography, history, forestry, agriculture, architecture, urban and rural planning, and economics. As a result, the research methods of other disciplines are often used to solve the problems in landscape architecture, and some studies are relatively one-sided; the urgent needs of the current industry and talent cultivation in landscape architecture are not met. In the future, in terms of talent cultivation, it is not only necessary to strengthen deep interdisciplinary integration, but also to take teachers as the center to constantly explore the essence of interdisciplinary integration, deepen the connotation construction of disciplines in landscape architecture, and drive in-depth application and innovation transformation.

3.2　Spatial and temporal intersection

To optimize the practical education system, a three-dimensional framework of "technology empowerment-scene simulation-intelligent linkage" needs to be constructed. Under the impact of AI technology, future teaching will only become more data-driven, forward-looking and intelligent. For instance, Soochow University has relied on digital twin, AR and VR technologies to build an immersive teaching system, dynamically simulated typical scenes such as the seasonal changes of Jiangnan gardens, and constructed a visual cognitive model of the spatial and temporal evolution of landscape to carry out teaching practices. In the practical session, students are guided to build a "time and space laboratory" platform, and real projects such as the regeneration of industrial heritage sites and the renewal of historical districts are set up. They are required to complete the full-cycle scheme design from historical origin to future prediction. Besides, it is needed to simultaneously build a spatial temporal case library for course projects, integrate classic and cutting-edge cases such as the evolution of representative waterfront space and climate-adaptive landscape, and combine big data prediction technology to cultivate students' intervention capabilities in long-term processes such as urban expansion and ecological changes, and promote the transformation of professional cognition from static design to dynamic governance.

3.3　Historical inheritance

The proposal of historical inheritance requires the construction of a talent practice education and training chain of "decoding of cultural context-inheritance of skills-contemporary translation". Under the influence of the background of cultural confidence, landscape architects should also deeply explore practical cases that are regional, historical and cultural. In teaching, it is needed to add the analysis and practice of classic cases of traditional gardens, guide students to internalize and understand the design concepts, layout techniques and cultural connotations of traditional gardens. Students are encouraged to participate in the protection and restoration projects of traditional gardens through internships and practical training, and their professional skills and cultural literacy are enhanced through hands-on operations. Meanwhile, cooperation with cultural heritage protection institutions is strengthened to provide students with more practical opportunities and resource support. In the future, it is still necessary to pay attention to the dissemination of traditional garden culture or regional garden culture, cultivate landscape architecture talents with forward-looking vision, and enhance the dissemination influence of landscape architecture culture.

3.4　Behavioral activity

The construction of behavioral activity requires the establishment of a practical system of "data driving-empirical design-social collaboration". During teaching, devices such as electroencephalogram (EEG), eye trackers, and physiological devices are introduced, and a quantitative analysis model of "spatial-behavior-emotion" is established. VR technology and physiological acquisition technology are utilized to conduct practical body-sensing experiences, record physical condition data, and evaluate the spatial usage preferences of different groups of people. Based on the concept of creating a healthy environment, students' ability to balance professional ideals and social reality among diverse interests is cultivated, truly practicing the professional ethics of "designing for the people and creating a healthy living environment".

4　Conclusions

The construction of the practice system for the landscape architecture major with "multi-dimensional integration" was studied, and under the dual background of disciplinary transformation and the development of private education, a four-dimensional collaborative practice system framework of "interdisciplinary inte-
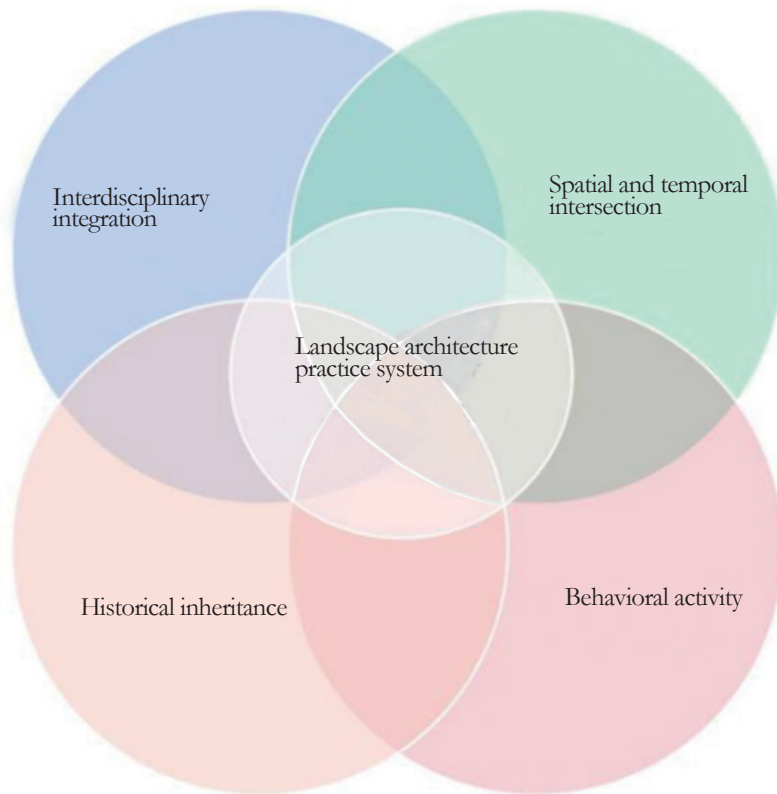
Fig.2 Practical system constructed under the "multi–dimensional integration"

gration-spatial and temporal intersection-historical inheritance-behavioral activity" was constructed, and a practice model driven by interdisciplinary integration, seized by spatial and temporal intersection, rooted in historical inheritance, and guided by behavioral activity was created. This system integrates the three elements of nature, culture and technology to implement the technological integration and innovation under the guidance of national policies, providing a feasible reference path for the practical cultivation of talents in the landscape architecture major of private colleges and universities in solving resource bottlenecks and cultivating compound talents.

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