

Research on the Construction of a Curriculum System for Vocational Undergraduate Landscape Architecture Programs Based on Sustainable Career Development

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Abstract: *As a higher-level type of vocational education system, vocational undergraduate education must take students' sustainable career development as its fundamental goal, achieving an organic integration of technical skills training and innovative potential development. Based on vocational action competence theory and career development theory, this study proposes four principles for curriculum system construction: value orientation (aligning with industry demands), competence orientation (focusing on vocational action competence), dynamic orientation (combining whole-work-process with individualised pathways), and data-driven orientation (promoting smart transformation). Taking the "Landscape Architecture Engineering" major as an example, the study systematically elaborates a practical pathway featuring typical products as carriers, work-process-systematised curricula as the core, and interdisciplinary integration as support, and constructs a "Product-Curriculum-Competence" matrix, providing an operational reference framework for vocational undergraduate curriculum reform.*

Keywords: Vocational undergraduate education, Sustainable career development, Curriculum system, Vocational action competence, Landscape architecture engineering.

1. Introduction

In 2021, China's Ministry of Education promulgated the "Measures for the Administration of the Establishment of Undergraduate-Level Vocational Education Majors (Trial)", explicitly stating that vocational undergraduate education aims to cultivate high-level technical and skilled talents who possess both "vocational attributes" and "higher education attributes". Such talents are expected not only to be competent in frontline technical and skilled positions, but also to possess creative abilities such as technological innovation, product development, and complex problem-solving. This objective poses a fundamental challenge to the traditional curriculum system centred on job-specific skills training. Concurrently, the new round of technological revolution and industrial transformation is accelerating, with new business forms and models emerging constantly. Occupational boundaries are becoming increasingly blurred, and the knowledge renewal cycle has shortened significantly. A single-skills-based "employment preparation" education model can no longer cope with the changing times. Therefore, the vocational undergraduate curriculum system must transcend the short-sighted logic of "initial employment" and shift towards a systematic restructuring centred on students' sustainable career development.

Sustainable career development emphasises that individuals, in a dynamically changing occupational world, can continuously update their knowledge structures, expand their competence boundaries, maintain professional competitiveness, and gain a sense of meaning. This is not only an inherent need for individual development but also an essential requirement for high-quality economic development. However, current vocational undergraduate curriculum systems generally suffer from weak theoretical foundations,

disconnection from industry needs, and a lack of progressive competence design, urgently requiring theoretical guidance and empirical exploration. As a newly established educational form, vocational undergraduate education cannot simply transplant the disciplinary logic of general undergraduate education, nor should it directly adopt the job-skill logic of junior college vocational education. It must achieve systematic breakthroughs in talent cultivation models (Yang Xinbin, 2022). Based on vocational action competence theory and integrating career development theory, this study focuses on the "Landscape Architecture Engineering" major and attempts to construct a curriculum system framework oriented towards sustainable development, aiming to provide a reference for similar majors.

2. Sustainable Career Development as the Intrinsic Requirement of the Vocational Orientation of Vocational Undergraduate Programs

Vocational undergraduate education combines both "vocationality" and "higher education characteristics". Its training objectives determine that the curriculum system must take vocational activities as its logical starting point and individual long-term career growth as its value orientation. Sustainable career development refers to the process in which individuals, throughout their entire careers, continuously improve their abilities and competencies through ongoing learning, proactive adaptation, and meaning construction, so as to adapt to technological changes and market demands, and to achieve a deep alignment between career goals and personal potential (Super, 1980; Krumboltz, 2009). This process depends not only on external educational support but also on individual intrinsic agency and action competence.

2.1 Individual Agency and the Acquisition of Meaning as Keys to Sustainable Career Development

Individual agency refers to the ability of individuals to actively choose, plan, and adjust their own development paths in their careers, with internal factors such as career interests, values, and aspirations playing a dominant role in career decision-making (Lent et al., 1994). Individuals with strong agency can keenly perceive environmental changes, actively seek learning opportunities, break through fixed mindsets, and transform external challenges into growth opportunities. However, agency alone is insufficient to sustain development; individuals must also continuously gain a sense of meaning in their career activities. When job tasks match personal interests and potentials, work itself can stimulate intrinsic motivation, forming a positive feedback loop of “interest–engagement–competence–meaning” (Ryan & Deci, 2000). The curriculum system should not only emphasise skills training but also provide students with diverse exploratory spaces to help them discover their interests, leverage their strengths, and activate internal development drivers.

2.2 Enhancing Vocational Action Competence as the Core of Sustainable Career Development

Roth’s four-dimensional model of vocational competence (professional competence, methodological competence, social competence, and self-competence) is widely recognised (Zhao Zhiqun, 2013). Vocational action competence is the overall quality of comprehensively applying these four dimensions to effectively solve complex problems in authentic work situations. The synergy of these four dimensions enables individuals to be competent in current positions while adapting to occupational changes, constituting the core competence for sustainable development. The cultivation of vocational action competence should be comprehensively advanced at three levels: knowledge, ability, and disposition.

At the knowledge level, vocational knowledge addresses “how to operate”, while technical knowledge answers “why it is so” and “how to improve” (Ma Jun & Zhao Miaoyi, 2022). Vocational undergraduate education should strengthen learning in technical theory and methodology, constructing a three-dimensional knowledge system comprising factual, conceptual, and metacognitive knowledge. At the ability level, the whole work process encompasses planning, execution, monitoring, evaluation, and other stages. Systematised curricula should extract typical work tasks based on job analysis, enabling students to acquire procedural and strategic knowledge through complete project experiences. At the disposition level, open teaching forms such as project seminars and hands-on operations should be adopted to

cultivate problem-solving, teamwork, and self-management skills, gradually forming professional identity and responsibility awareness.

3. Research Methods

This study employs three methods in combination. Literature review: Systematic searches were conducted in CNKI, Web of Science, Scopus, and other databases for literature on vocational undergraduate curriculum development and vocational action competence cultivation, to sort out theoretical lineages. Industry survey: From September 2024 to March 2025, semi-structured interviews and questionnaires were administered to 32 managers and project leaders from 15 landscape architecture enterprises in the Pearl River Delta region (covering design institutes, construction companies, maintenance firms, and smart landscape technology enterprises). The survey focused on talent competence demands, digital transformation requirements, and graduates’ competence gaps, providing empirical evidence for product selection and competence level classification. Case study: The Landscape Architecture Engineering major at Shenzhen Polytechnic University was selected as a typical case to explore the curriculum system construction pathway.

4. Principles for Constructing a Vocational Undergraduate Curriculum System Oriented towards Sustainable Career Development

Based on the above theoretical analysis and research methods, this study proposes that the construction of a vocational undergraduate curriculum system should follow four major principles, forming a synergistic mechanism of “goal anchoring → competence mainline → dynamic adaptation → data closed-loop” (Figure 1). The value orientation principle provides directional anchoring for the curriculum system, ensuring training objectives align with industry demands. The competence orientation principle establishes the core mainline of the curriculum system, taking vocational action competence as the consistent training target throughout. The dynamic orientation principle introduces individualised development pathways on top of a common foundation, responding to students’ interest differences and market changes. The data-driven orientation principle provides precise support for the implementation of the preceding three principles, enabling continuous curriculum optimisation through data feedback. Together, the four principles constitute a complete closed loop from goal setting to pathway implementation to dynamic adjustment.

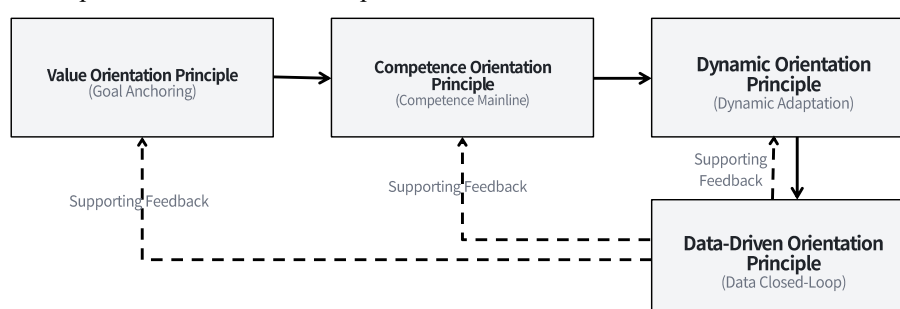


Figure 1: Schematic diagram of the synergistic mechanism of the four principles

4.1 Value Orientation Principle: Industry Demands as the Value Anchor of the Curriculum System

Vocational undergraduate education must be rooted in the industrial chain and serve regional economic development. Human capital theory (Becker, 1964) indicates that the return on educational investment depends on the degree of match between the competences cultivated and the demands of the labour market. Therefore, curriculum design should fully investigate industry development trends, technological iteration speeds, and changes in talent specifications, ensuring close alignment between training objectives and occupational competence standards. Through school-enterprise joint curriculum committees, talent cultivation plans should be jointly formulated, and new technologies, new processes, and new industry standards should be integrated into teaching content in a timely manner.

4.2 Competence Orientation Principle: Vocational Action Competence as the Core Objective of the Curriculum System

The curriculum system must take the cultivation of vocational action competence as its main thread, ensuring not only that graduates can achieve “high-quality employment”—that is, quickly becoming competent in initial positions—but also laying the foundation for their “sustainable advancement”. This means that the curriculum must balance specialised skills training with comprehensive competence cultivation, emphasising a balance between theoretical depth and skill breadth, ensuring that students possess cross-position transferability and innovative capabilities.

4.3 Dynamic Orientation Principle: Combining Whole-Work-Process Courses with Directional Courses

Career adaptability theory (Savickas, 2005) points out that individuals need four adaptive resources in career development: concern, control, curiosity, and confidence. Accordingly, the curriculum system should, through whole-work-process courses, allow students to experience the complete business chain, stimulating career curiosity and establishing career concern through rotational practice. Simultaneously, flexible directional elective courses (e.g., smart landscaping, ecological restoration, landscape operations) should be offered, allowing students to choose specialisation directions based on their own strengths and career plans, thereby cultivating career control and confidence, and achieving a “common foundation + individualised development” dynamic adaptation.

4.4 Data-Driven Orientation Principle: Empowering Curriculum Evaluation and Management through Smart Means

With the help of big data and learning analytics technologies, precision in curriculum implementation, evaluation, and management can be achieved. Evaluation methods should shift from experience-based judgement to data-supported assessment, from summative evaluation to process-oriented, multi-dimensional monitoring. A dynamic portfolio of student competence development should be established to provide scientific evidence for personalised learning

recommendations and teaching improvement (Wang Maoli & Qing Zhongquan, 2023).

5. Optimisation Pathways for the Vocational Undergraduate Curriculum System Oriented towards Sustainable Career Development—A Case Study of “Landscape Architecture Engineering”

5.1 Positioning of Talent Cultivation Objectives

The 20th National Congress of the CPC set the modernisation goal of “harmonious coexistence between humanity and nature”. The annual investment in landscaping remains above 160 billion RMB, and the industry is shifting from incremental expansion to stock quality improvement, with smart and digital technologies becoming new growth points. The talent cultivation objective of this major is positioned as: cultivating on-site engineers who possess systematic professional knowledge, proficient technical skills, strong practical innovation capabilities, and career transferability, oriented towards the full life cycle of landscape architecture (design–construction–operation–maintenance). This manifests in two types of compound talents: integrated design-construction talents, combining conceptual creativity with engineering implementation; and integrated operation-maintenance talents, using digital tools such as IoT, GIS, and BIM for smart operation and maintenance. Both types require a solid professional foundation and continuous learning ability.

5.2 Developing Work-Process-Systematised Courses with Products as Carriers

Taking typical products as carriers, a progressive project-based curriculum system is constructed following the rule “from simple to complex, from single to compound”, enabling students to acquire complete action competence through the process of completing authentic products. Work-process-systematised courses emphasise organising teaching content with typical work processes as the logical thread (Jiang Dayuan, 2017). Product selection follows four criteria: typicality, progression, completeness, and market relevance. Based on survey results from 15 enterprises, the research team employed thematic coding to analyse data from 32 interviewees, extracting 124 initial codes, which were grouped into 16 candidate categories. After joint deliberation with four industry experts, four representative products were finally selected, and a “Product–Curriculum–Competence” matrix was constructed as shown in Table 1. The progression logic of the four products is: L1 focuses on single skills, L2 on process integration, L3 on cross-specialty coordination, and L4 on digital innovation.

Each product corresponds to a semester-long intensive practical course, with enterprises providing real projects and students completing the entire process from needs analysis to construction evaluation in groups. Taking Flower Show Design & Construction as an example, students must complete scheme bidding, material procurement, on-site construction, and maintenance within limited budget and time, thereby identifying personal interests and strengths through deep experience. Figure 2 shows the progressive pathway from L1

to L4 in a stair-step diagram, along with the corresponding typical products and courses.

Table 1: Matrix of Typical Products and Competence Development for Landscape Architecture Engineering

Product (Project)	Application Scenario	Corresponding Learning-Area Courses	Key Vocational Action Competence (Level)	Competence Progression
Landscape Installation Design & Fabrication	Public space art intervention	Installation Art Design, Materials & Construction, Model Making	Creative conception, formal expression, spatial construction (L1)	Foundational → Single skill
Flower Show Design & Construction	Guangdong-Hong Kong-Macao Greater Bay Area Flower Show	Flower Application Design, Construction Organisation, Budget Control	Scheme design, construction management, teamwork (L2)	Integrated → Project management
Urban Micro-Garden Creation	Old community renewal	Site surveying, plant configuration, hardscape construction	Site investigation, multi-specialty coordination, technical problem-solving (L3)	Systemic → Cross-specialty collaboration
Community Park Smart Management Database Construction	Smart city management	IoT Fundamentals, GIS Application, Data Analysis	Data collection, platform operation and maintenance, intelligent decision-making (L4)	Advanced → Digital innovation



Figure 2: Stair-step diagram of the progressive advancement of vocational action competence levels based on typical products

5.3 Developing Learning-Area Courses and Restructuring the Curriculum System

1) Development of Learning-Area Course Modules

Drawing on the German “learning area” concept, the linear structure of “basic courses–specialised courses–extension courses” is broken down, and theoretical knowledge is integrated around the competences required by typical products (Jiang Dayuan, 2003). To support “Landscape Installation Design & Fabrication”, a “Basic Spatial Modelling Competence” module is developed, integrating courses such as Design Composition, Engineering Drawing, Computer-Aided Design, and Materials & Technology. Around the project “Design and Build an Interactive Insect Hotel”, knowledge support is provided according to project progress, with the teaching team jointly formulating syllabi and standardising assessment criteria.

2) Restructuring Course Objectives through Competence Progression

Course objectives are arranged in four tiers: “foundational cognition – specialised skills – comprehensive application – innovative practice”. Lower years emphasise principles and basic skills (L1–L2), while upper years focus on interdisciplinary integration and innovation (L3–L4). Table 2

shows an example of module objective breakdown using “Flower Show Design & Construction”.

Table 2: Objective Breakdown for the “Flower Show Design & Construction” Learning-Area Module

Competence Dimension	Specific Objectives	Assessment Method	Corresponding Courses
Professional Competence	Independently complete flower show scheme design, with construction drawing and budgeting capabilities	Scheme review + construction drawing quality assessment	Flower Application Design, Engineering Drawing
Methodological Competence	Formulate reasonable construction organisation plans, effectively control schedule and costs	Construction organisation plan defence	Construction Organisation & Management
Social Competence	Communicate effectively within teams, coordinate with suppliers and client needs	Peer evaluation + supervisor observation	Project Management & Communication
Self-Competence	Reflect on design decisions during the project process, actively seek improvement	Personal reflection report	Integrated across all module courses

3) Offering Directional Elective Course Modules

Three directional modules are offered: Smart Landscaping (IoT, GIS, big data visualisation), corresponding to L4; Ecological Restoration (ecosystem restoration, sponge cities,

native plant communities), focusing on L3–L4; and Landscape Operations (asset management, public space operation, investment and financing), emphasising management capabilities. Students are required to complete at least one module (12–15 credits) from the 3rd to the 5th semester and undertake comprehensive practice in real projects.

4) Establishing Data-Driven Dynamic Evaluation Mechanisms

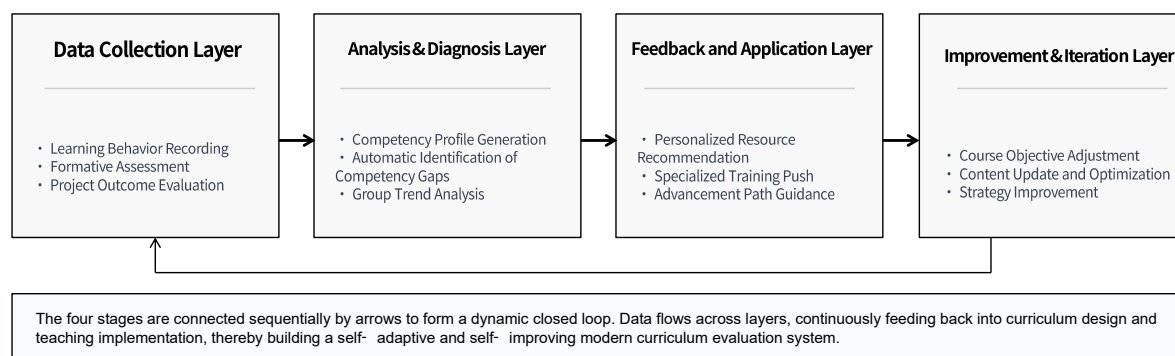


Figure 3: Schematic diagram of the data-driven curriculum evaluation closed-loop

5.4 Promoting Comprehensive Competence Development through Interdisciplinary Learning

1) Constructing a General Education Support System

Relying on student societies, workshops, and innovation and entrepreneurship competitions, students are encouraged to engage in autonomous innovative practice activities. Interdisciplinary elective courses covering ecological ethics, data analysis, project management, communication and expression, etc., are offered to help students broaden their knowledge horizons and stimulate interest potential. Professional instructors guide students in cross-domain projects, such as “Smart Park Interactive Installation Design”, integrating computer programming, sensor technology, and environmental design to cultivate composite thinking. Through integrating general and professional education, a tripartite competence structure of “scientific literacy + humanistic grounding + professional skills” is formed (Xu Dexiu & Ding Zhiyin, 2022).

2) Strengthening Value Orientation and Ethical Education

In the era of globalisation characterised by multicultural integration and technological change, landscape architecture engineering professionals need not only technical capabilities but also value judgement and ethical decision-making competence. Issues such as ecological civilisation construction, sustainable development ethics, and social responsibility should be integrated into professional courses. For example, students are guided to discuss real dilemmas such as “data privacy and ethical boundaries in smart landscape management” and “multi-stakeholder coordination in ecological restoration projects”. Through case analyses, role-playing, and thematic debates, students’ critical thinking and ethical decision-making skills are cultivated. Simultaneously, ecological red-line awareness, public participation concepts, and principles of fairness and justice are introduced into practical projects, enabling students to simultaneously establish professional values during skills

A four-stage closed-loop of “collection–analysis–feedback–improvement” is constructed (Figure 3): the collection layer records learning behaviours and process evaluations through the teaching platform; the analysis layer assesses achievement levels for each competence dimension and identifies individual weaknesses; the feedback layer pushes personalised resources and advancement recommendations; the improvement layer aggregates group data to identify common weak links and drives continuous curriculum optimisation.

training, laying an ideological foundation for lifelong career development.

3) Broadening International Perspectives and Comparative Learning

Drawing on the dual-track model of “project workshops + corporate internships” from German Universities of Applied Sciences, the community service model of design–build courses in US universities, and the “teaching factory” concept from Singapore’s Nanyang Polytechnic, international case comparisons and cross-border project collaborations are embedded in the curriculum. Through participation in international horticultural competitions, joint workshops, and other activities, students’ cross-cultural communication skills and technical literacy aligned with international standards are cultivated.

6. Concluding Remarks

Based on vocational action competence theory and integrating career development theory, this study reveals the internal mechanism by which “individual agency – sense of meaning – vocational action competence” synergistically drives sustainable development, and proposes four-dimensional construction principles of “value, competence, dynamics, and data”, enriching the theoretical framework for vocational undergraduate curriculum development. Taking the “Landscape Architecture Engineering” major as a case, the study constructs a “Product–Curriculum–Competence” matrix and a curriculum system framework, validating the feasibility of a reform pathway featuring typical products as carriers, work-process-systematised curricula as the core, and directional modules and interdisciplinary integration as support. Future work will expand the survey scope to test the generalisability of the framework, conduct quasi-experimental studies to obtain causal evidence, explore AI-assisted personalised learning pathway recommendations, and establish a graduate career development tracking database to continuously verify the actual contribution of the curriculum

system to students' sustainable development.

Fund Projects

1) 2025 Shenzhen Polytechnic University Teaching Research Project: Research on the Construction of Standard System with SZPU Characteristics—Taking the Development of Arborist Certification as an Example (Project No. 7025310501);

2) 2026 Shenzhen Polytechnic University School-Enterprise Joint R&D Centre Project: SZPU-Lvyuanfang Urban Plant Health Management Technology R&D Centre (Project No. 602631009PQ);

3) 2025 Shenzhen Polytechnic University Teaching Research Project: Exploration of the Practical Teaching Model of the "Engineering Elite Skills Training" Course Based on Talent Cultivation for Landscape Skills Competitions (Project No. 7025310617).

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