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Research on the Reconstruction Path of Environmental Design Courses in Local Colleges and Universities in the Context of New Liberal Arts

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Abstract: *Under the background of the construction of new liberal arts, environmental design majors are facing the transformation needs of interdisciplinary integration, technological empowerment and social demand docking. Local colleges and universities are in urgent need of reconstructing the curriculum system due to the problems of solidified curriculum structure, superficial application of technology, lack of regional culture inheritance and insufficient collaboration between industry and education. Taking the construction of interdisciplinary curriculum group as the core, it is proposed to integrate the knowledge of art, science and technology and humanities, develop regional culture course modules, deepen the mechanism of industry-education integration, and build a practical platform combining virtual and real and a digital teaching ecology. Through the iteration of teachers, the synergy of multiple subjects and the dynamic evaluation system and other safeguards, we promote the transformation of the environmental design major to the direction of "art + science and technology + humanities" composite, cultivate composite talents with innovation ability, cultural consciousness and social responsibility, and help local universities to connect with the strategy of the new liberal arts and the needs of the industry frontiers.*

Keywords: *New Liberal Arts; Local Colleges and Universities; Environmental Design; Curriculum Reconstruction*

1. Introduction

The construction of new liberal arts is an important strategy of the state to promote the reform of higher education, aiming to cultivate complex talents who can adapt to the complex problems of the new era through interdisciplinary integration, technology empowerment and social needs. The Ministry of Education's Declaration on the Construction of New Liberal Arts emphasizes that liberal arts education needs to break through disciplinary barriers [1], strengthen digitalization, internationalization and innovation, and build a new curriculum system that is "cross-disciplinary, technology-driven, and culture-led". As an intersection of art, architecture and engineering technology, environmental design majors need to reconstruct their curriculum system to respond to the call for new liberal arts and to solve the problems of disciplinary fragmentation, technological lag and lack of culture in traditional teaching. The construction of new liberal arts emphasizes interdisciplinary integration, innovation and the ability to solve practical problems, which requires environmental design majors to break through the traditional liberal arts boundaries and build an open and synergistic curriculum system. Due to limited resources, theoretical curricula and insufficient practical teaching, local universities need to realize transformation through curriculum integration and reconstruction.

2. Theoretical Foundations of Environmental Design Curriculum Reconstruction in the Context of the New Liberal Arts

2.1 Core Concepts and Characteristics of the New Liberal Arts

The rise of the new liberal arts is a profound change in higher education to meet the development needs of the new era. Its core connotation is mainly reflected in the following three aspects:

The first is interdisciplinary integration. The new liberal arts emphasize breaking down the barriers between traditional disciplines and realizing the cross and penetration of knowledge in different subject

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areas. Under this trend of integration, environmental design courses are no longer limited to the single category of art and design, but widely absorb the knowledge of architecture, landscape design, urban planning, environmental protection, sociology, psychology and other related disciplines. This multidisciplinary crossover not only promotes the synergistic development between disciplines, but also provides students with a broader vision of knowledge and diversified thinking perspectives, and cultivates their ability to scrutinize and solve problems from a multi-dimensional perspective.

Secondly, it is technology-driven. With the rapid development of science and technology, New Liberal Arts focuses on integrating cutting-edge technology into teaching content and methods to enhance the efficiency and quality of teaching. In the environmental design course, through the application of modern technology, students can carry out design simulation and scheme optimization more intuitively, improve design accuracy and efficiency, and also better cope with the complex technical challenges in actual projects.

Finally, it is social demand-oriented. New Liberal Arts is closely related to the actual needs of social development and focuses on cultivating high-quality talents with the ability to solve complex social problems. For environmental design, the curriculum needs to closely focus on the current needs of society in environmental protection, urban renewal, cultural heritage, community building, etc., and cultivate students' sense of social responsibility and practical ability. Through the cooperation with industries, enterprises and government departments, the practical teaching of real projects is carried out, so that students can participate in solving actual social and environmental problems during their school years, and provide strong talent support for the development of the society.

2.2 Transformative Trends in the Environmental Design Discipline

In the context of the new era, the discipline of environmental design is undergoing a profound transformation. From the traditional single art design field, it is gradually developing towards the composite direction of “art + science and technology + humanities”. On the one hand, art is always the cornerstone of environmental design, which gives design a sense of beauty and creativity. Through art learning and practice, students can cultivate unique aesthetic vision and creative expression ability, injecting soul and charm into design works. On the other hand, the integration of technology has brought new tools and means to environmental design, greatly expanding the possibilities and efficiency of design. The digital design technology enables designers to build models and make proposals more accurately; the virtual reality technology enables students to preview and experience design proposals in a virtual environment, and make real-time modifications and optimization; the augmented reality technology provides a new interactive way for design display and communication; the application of building information modeling technology makes the whole life cycle management of design, construction and operation possible, which It improves the overall efficiency and quality of the project.

The addition of humanities and social sciences makes environmental design pay more attention to human needs and cultural heritage, and improves the depth and breadth of design. Environmental design is not only the molding of material space, but also the embodiment of human lifestyle and cultural values. Through the study of sociology, psychology, anthropology, history and other humanities and social sciences knowledge, students are able to more deeply understand the needs and behavioral patterns of different groups of people, and design works that are more humane and have cultural connotations.[2] For example, when designing community environments, it is important to consider not only the aesthetics and functionality of the space, but also to pay attention to the needs of community residents' interactions, cultural identity and social equity, so as to create a harmonious, livable and culturally distinctive community environment.

The necessity of sustainable development is also becoming more and more prominent. The concept of sustainable development requires environmental design to meet current needs without compromising the carrying capacity of the natural environment, and to realize the coordinated development of economy, society and environment. In the curriculum, ecology, environmental science, sustainable building materials, energy utilization and other aspects are added to cultivate students' ecological awareness and sustainable development ability. Through study and practice, students will be able to master green design methods and strategies, such as ecological restoration technology, low-carbon building design, rainwater recycling, etc., contributing to the construction of a resource-saving and environment-friendly society.

The integration of regional culture, on the other hand, is to highlight the uniqueness and cultural connotation of the design and avoid homogenization of the design. Each region has its own unique geographical environment, historical background, cultural traditions and lifestyle, all of which provide

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rich materials and inspiration for environmental design. By combining regional cultural elements with modern design concepts, it is possible to create environmental design works with local characteristics and in line with the trend of the times. For example, when designing for the protection and renewal of ancient towns, it is necessary to retain the traditional architectural features and historical and cultural values, but also to integrate modern living needs and functional facilities to create new spaces that are both historically flavorful and vibrant. This transformational trend not only injects new vitality into the development of the environmental design discipline, but also provides more professional and innovative solutions for sustainable social development.

3. Existing Problems of Environmental Design Programs in Local Colleges and Universities

3.1 The single structure of the curriculum restricts the cultivation of complex capabilities

The traditional curriculum system has long relied excessively on the framework of art and design disciplines, failing to effectively integrate engineering technology and environmental science knowledge. This single curriculum structure seriously limits the cultivation of students' comprehensive ability, making them incapable of facing complex and diverse design tasks. Specifically, engineering courses such as building construction and mechanics of materials and environmental courses such as ecological restoration and sustainable design have been marginalized for a long time, showing the characteristics of fragmentation and fragmentation. The barriers between disciplines lead to students' difficulties in establishing systematic thinking, and when facing comprehensive design tasks such as renovation of existing buildings and ecological landscape planning, there are often technical logic faults and obstacles to the integration of interdisciplinary knowledge. This situation directly affects the career adaptability of graduates in emerging fields such as green building and smart city, making it difficult for them to adapt and grow quickly in the rapidly developing industry environment.

3.2 The application of technological tools remains at the superficial level

The practice of digital technology in teaching is still limited to the stage of visualization of design results, virtual reality is mostly used for spatial roaming demonstration, and artificial intelligence only assists in the generation of effect diagrams. This phenomenon of technology application staying at the superficial level restricts the enhancement of students' design innovation ability. Parametric design, climate simulation analysis and other in-depth technical tools have not been integrated into the whole process of design, and the application of generative AI in the pre-data analysis and program projection has not yet formed a mature teaching mode. The limitations of technological cognition lead teachers and students to position digital tools simply as a means of efficiency enhancement rather than a driving force for change in design thinking. This perception hinders the development of design innovation capabilities in cutting-edge fields such as smart communities and digital twins, making teaching disconnected from actual needs.

3.3 Absence of mechanisms for the transmission of regional cultural genes

The problem of homogenization of course content is prominent, the teaching casebook is overly dependent on international classic projects, and the transformation of local cultural resources is obviously insufficient.[3] Local traditional architectural techniques, ecological wisdom and other characteristic materials are not included in the curriculum system, and the students' design programs often fall into the shallow expression of cultural symbols collage, lacking in-depth interpretation of the regional cultural lineage and the ability of creative transformation. This lack of cultural self-awareness makes it difficult for graduates to balance modern functional needs and cultural heritage mission when participating in projects such as renewal of historic districts and revitalization of rural landscapes. Students are often unable to organically combine regional culture with modern design concepts, resulting in design programs that lack cultural depth and uniqueness.

3.4 Industry collaborative education mechanism is not yet coherent

School-enterprise cooperation mostly stays in shallow interactions such as program reports and graduation internships, and the introduction of real projects and the whole process of practice are obviously insufficient. Practical teaching is still dominated by simulation projects, which fails to meet the emerging needs of the industry such as intelligent park design and ageing space transformation. Talent

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training standards lag behind the industry's technology iteration speed, resulting in graduates needing to go through a long job adaptation period, and there is a significant ability gap in BIM co-design, sustainable assessment and other occupational core skills. This situation makes graduates need a longer time to adapt to the job requirements in the actual work, which affects the career development and employment competitiveness of students.

4. Core Strategies for Curriculum Reconstruction in the Environmental Design Program

4.1 Construction of interdisciplinary course clusters

The first task of curriculum reconstruction for environmental design is to break down the disciplinary barriers and build a systematic basic course module. Through the establishment of "Design+Architecture+Environmental Science" general education course module, the core knowledge system of spatial aesthetics, architectural principles, ecological cycle system and so on are organically integrated. The courses cover interdisciplinary contents such as the history of architectural design, human environment science, ecological restoration technology, etc., forming a systematic cognitive framework of "human-environment-society". For example, the analysis of energy-saving technologies in environmental science is integrated into the course of building construction, and the social attributes of space are explored from the perspective of sociology in the teaching of the history of design, so as to lay the foundation for students' interdisciplinary thinking. In order to expand the boundaries of design thinking, it is also necessary to introduce cutting-edge interdisciplinary courses such as environmental psychology, landscape ecology and urban sociology. Environmental psychology courses guide students to analyze the real needs of space users through behavioral pattern research; landscape ecology cultivates ecological restoration and sustainable design capabilities through ecosystem simulation experiments; urban sociology courses combine field survey methods to let students understand the production mechanism of social space. Cutting-edge courses such as climate-adaptive design and digital twin technology can be added to ensure that the teaching content is synchronized with the development of the industry. In addition, technology-enabled courses need to be systematically developed. AI-assisted design courses are added to teach students to use generative design algorithms for creative iteration; in BIM technology application courses, the whole process from modeling to construction simulation is taught to strengthen digital collaborative design capabilities. Using VR/AR technology to build an immersive design platform, students can experience design elements such as light and shadow changes and human flow lines in real time in the virtual space, and optimize the scheme through dynamic interaction. 3D printing technology courses can also be introduced to realize the whole chain of practice from digital models to physical prototypes. [4]

4.2 Regional culture and in situ curriculum development

First of all, the integration of non-heritage culture into design practice requires the construction of a systematic curriculum [5]. For example, the development of "non-heritage symbols extraction and innovative design" related courses, with local traditional architecture mortise and tenon structure, folk paper-cutting art, traditional patterns, etc. as the research carrier, to establish a digital cultural gene pool. Through semiotics deconstruction, parametric modeling, application of new materials and other teaching links, the creative transformation of cultural heritage is realized. For example, Su embroidery patterns are transformed into modern landscape paving patterns, and elements of Huizhou architectural horse-head wall are integrated into modern building façade design, so as to enhance students' understanding of local culture and their ability of innovative application. Secondly, we cooperate with local governments to implement localized design projects, and build a closed teaching loop of "real problem-design research-implementation on the ground". In the field of rural revitalization, we carry out the design for the protection and revitalization of ancient villages, and let students participate in the regeneration of rural landscapes and the transformation of farm houses; in the field of urban regeneration, we work with communities to carry out the design of micro-space transformation, such as the construction of pocket parks in old districts, and the design of community cultural corridors. Each project sets up a research report, multiple rounds of program selection, construction drawing, construction supervision and other full-process practice links to strengthen the sense of social responsibility and the ability to design on the ground.

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4.3 Integration of industry and education and dynamic evaluation system

It will establish an in-depth industry-teaching integration model and build a curriculum development committee with enterprises. Introducing industry instructors to participate in curriculum design, setting up the "enterprise case analysis" module to improve professionalism by analyzing the technical difficulties, cost control, user needs and other real problems in actual projects. Set up the "full-cycle project simulation" course, in which students complete the complete process from conceptual design to construction drawings in teams, and the enterprise tutors carry out stage-by-stage evaluation. Drawing on the model of Dalian University of Technology's "school-enterprise joint laboratory", we have jointly built a BIM technology center, a virtual reality design studio and other practical training platforms.[6] At the same time, we will build a three-dimensional dynamic assessment system of "homework evaluation + project evaluation + competition evaluation". Assignment evaluation focuses on the design process records, through the evolution of sketches, model iteration, design logs and other process materials assessment; project evaluation introduces the participation of enterprise tutors and community representatives, scoring from the practicality, innovativeness, and landedness of multi-dimensional scoring; competition evaluation encourages students to participate in various disciplinary competitions, and the results of the competitions are used as the basis for credit recognition. In addition, a dynamic feedback mechanism is established to continuously optimize the design ability through the defense of stage results and industry expert review meetings.

4.4 Values-based guidance

Values guidance is integrated into the whole teaching process of professional courses. For example, in the "Frontier of Design" course, the topic of ecological civilization is set up, and green design standards and carbon neutral paths are analyzed through case studies; in the "Landscape Design" course, the concept of sponge city is combined to explore the design strategy of harmonious coexistence between human beings and nature.[7] Through social research in design projects, students are guided to pay attention to the needs of disadvantaged groups, such as ageing community design and barrier-free space design for people with disabilities, so as to cultivate a sense of social care. At the same time, build a career literacy training matrix. Offer a series of lectures on craftsmanship, invite non-genetic inheritors to tell the story of craftsmanship in traditional crafts; organize workshops for industry masters to pass on the essence of design through actual projects with apprentices. Establishing a professional code of ethics course module, covering design ethics and intellectual property protection. By participating in the construction supervision of actual projects, students can understand the professional requirements of detail control and quality management, and shape a rigorous and responsible professional attitude.

5. Pathways and safeguards for the implementation of curriculum restructuring

5.1 Interdisciplinary faculty Iterative upgrading

A collaborative training mechanism of "academic mentors + industry mentors" will be established to promote the transformation of teachers' competence structure. Through the establishment of interdisciplinary teaching and research teams, teachers are encouraged to actively participate in joint projects between schools and enterprises to continuously expand their academic vision and practical skills. Teachers are regularly sent to well-known design organizations for technical training to enhance their ability to master the latest technologies and methods. To build a "teaching-research-practice" three-in-one assessment system, and to incorporate the practical achievements of teachers in hosting horizontal projects and guiding students in competitions into the indicators of title evaluation, so as to motivate teachers to continuously improve the level of practical teaching. A certification program for teaching ability of new technologies will be carried out in cooperation with industry associations to systematically improve the teaching transformation ability of teachers in the fields of BIM collaborative design and AI generative creation, so as to ensure that the teachers' team can adapt to the fast-developing industry needs.

5.2 Collaborative Nurturing Mechanism Construction

Deepen the mode of talent coeducation between schools and enterprises, and establish "dual-teacher mentor workstations" with local design enterprises to promote the organic combination of theory and practice. First-line designers with more than 10 years of project experience will be hired as co-leaders of the courses to jointly develop cutting-edge courses and ensure that the course content is closely integrated

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with the development of the industry's cutting-edge. Establish a dynamic updating mechanism for the "enterprise expert pool", and introduce practitioners in emerging fields to participate in the curriculum and graduation design guidance every year, so as to ensure that the teaching content is synchronized with the technological development of the industry, and to enable students to come into contact with the latest industry trends and technologies.

5.3 Practice Platform Building for Virtual and Real Integration

To create a "three-level" practical teaching carrier: the basic level builds disciplinary training bases, optimizes related facilities and experimental equipment, and provides a good environment for students to carry out basic practical operations; the application level undertakes real projects such as revitalization of traditional villages and micro-renewal of communities in conjunction with the local government, so as to allow students to participate in the design and implementation of actual projects; and the innovation level carries out forward-looking experiments such as digital twins and low-carbon architecture to cultivate students' innovative ability and scientific research. The innovation layer carries out forward-looking experiments such as digital twins and low-carbon buildings to cultivate students' innovative ability and scientific research literacy. A "project pool-resource library-exhibition of results" mechanism will be established, and key local projects will be selected every year to be transformed into teaching cases, forming a closed-loop system of "design intervention-social feedback-curriculum optimization", so as to form a benign interaction between teaching and practice.

5.4 Digital teaching ecosystem construction

The development of the "cloud chain" teaching resource platform integrates three core modules: virtual simulation experimental system, including building energy simulation, landscape growth prediction and other interactive scenarios, providing a rich virtual experimental environment; industry dynamics database, real-time updating of green building standards, materials and technical parameters, to ensure that students have access to the latest industry information; Intelligent evaluation AI assists homework correction and design logic diagnosis, improving the efficiency and accuracy of teaching evaluation. Implement the hybrid teaching mode of "online knowledge construction + offline project practice", build a catechism group covering cutting-edge courses such as "AI Generative Design" and "Digital Protection of Local Cultural Heritage", and develop three-dimensional resources of "microcourses, training packages, and case studies" to realize on-demand calling of teaching resources, and to ensure that students have access to the latest industry information. It realizes on-demand calling of teaching resources and full traceability of learning trajectory, and enhances students' independent learning and practical ability.

6. Conclusions

The construction of new liberal arts provides an opportunity for the transformation of environmental design majors in local universities, and also puts forward systematic reconstruction requirements for their curriculum system. By analyzing the trend of disciplinary transformation and existing problems, the four-in-one curriculum reconstruction path of interdisciplinary integration, technology empowerment, cultural heritage and industry-teaching synergy has been clarified, and the core of which lies in realizing the in-depth coupling of regional characteristics and industry needs. The reconstruction of the curriculum system needs to break through the traditional disciplinary barriers, relying on digital technology to innovate the teaching mode and build a dynamic and open ecology of education. In the future, local colleges and universities should further strengthen the collaboration mechanism between schools and enterprises, promote the iteration of faculty capacity and integration of teaching resources, and highlight the value of the discipline in serving the regional development and inheriting cultural heritage. The results of the study provide a theoretical framework and practical reference for the innovation of environmental design education, but the long-term effectiveness of curriculum restructuring still needs to be tested through continuous teaching feedback and industry suitability, in order to realize the benign interaction between talent cultivation and social development.

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