



Research and Practice on the Cultivation of Talents in Applied Environmental Design Combining “Art” and “Engineering”

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Abstract. The cultivation of talents in applied environment design combining “art” and “engineering” is an important step to explore the educational model of innovative applied high-quality talents. With the combination of art and engineering technology, it is necessary to meet the development of the times and cultivate artistic talents to compound talents. From the aspects of training objectives, professional setting, management system, teaching mode, teaching content and courses, teaching resources, research and development of assessment and evaluation technology, teacher training, etc., it is suggested to carry out all-round docking with cooperative enterprises, such as docking with post ability and professional needs. Meanwhile, a practical and feasible path for the cultivation of talents in applied environmental design is explored.

Keywords: Combination of “art” and “engineering” · Environmental design · Applied type · Talent cultivation

1 Introduction

From smart home to intelligent building, the new requirements of industrial transformation, upgrading and optimization point out the reform direction of higher engineering education. Engineering technology should be effectively combined with art. Taking this opportunity, it is urgent to explore a practical way and cultivate application-oriented design talents to meet the development of the times. To cultivate applied environmental design talents based on the combination of “art” and “engineering” is an important step in exploring the educational mode of innovative applied high-quality talents. In addition, it is suggested to carry out specific measures to improve the educational effectiveness in the field of applied environmental design in combination with “art” and “engineering”, which can drive the development of disciplines, enhance the characteristic advantages of environmental design, and promote the scientific research and teaching level. At the same time, it is feasible to strengthen foreign exchanges, assume more social responsibilities, enhance the function of colleges and universities in serving regional economy, and promote the vigorous development of architectural decoration.

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2 Research Status

In China, the major of environmental design started late, emphasizing theory and neglecting practice in teaching. Besides, the ability of school-enterprise collaborative education and transformation ability of innovative technology are not strong. At present, many courses have become interdisciplinary subjects, such as urban planning, ergonomics, environmental ecology, materials science, etc. Besides, environmental design is an important technical support for new engineering.

In foreign countries, environmental design emphasizes the combination of science, art and technology, focuses on practice and innovation, and adopts an open integration mode of industry and education.

In the context of new engineering, the relevant external dynamic mechanism has been preliminarily formed, whether the training of applied talents of environmental design in local colleges and universities is effective needs timely and accurate inspection and feedback from market enterprises. In particular, the key to construct undergraduate application-oriented talent training mechanism and form school-running characteristics in private colleges and universities is to carry out effective cooperation between schools and enterprises and enhance professional competitiveness.

3 Exploration on the Cultivation of High-Level Applied Talents of Art Design in Combination with the “Art” and “Engineering”

The department of environmental design in Neusoft University (Guangdong) has analyzed the shortcomings and limitations of the traditional talent training mode in the practice of art talent training for many years. Through a large number of social, industry and university research in China and foreign countries, the environmental design specialty has been set up scientifically on the basis of the excellent tradition. Since its establishment, this major has made it clear that the goal is to cultivate high-level application-oriented art and design talents in the combination of “art and engineering”. At the same time, this major has built a compound innovative talent training system with art as the leading, engineering technology as the background and action orientation as the core. Then, the unique talent training mode has been formed, which integrates art design and engineering practice, promotes each other, integrates knowledge, ability and quality. Therefore, a practical way to cultivate innovative design talents who meet the development of the times in combination with art and engineering is explored. Under the strategy of ecological sustainable development in the new century, the demands and requirements of domestic enterprises and industries for interdisciplinary and compound design talents in combination with art and engineering are constantly improving. Against the background of new engineering construction, it is suggested to pay attention to the new situation and the requirements of the self-development of environmental design specialty. Colleges and universities should highlight the leading role and important position of action-oriented teaching method in talent training, promote the department to train students according to the current professional qualification or enterprise standards, and establish an innovative training mode of environmental art talents in combination with “art and engineering”.

4 Construction Elements of Innovative and Applied Talent Training Mode Based on the Combination of “Art and Engineering”

This “combination of art and engineering” is an innovation of talent training system, which advocates the combination of traditional art classroom and environmental protection engineering technology classroom, and realizes the innovation of the talent training mode of environmental design with the close combination of art and art and engineering in domestic application-oriented colleges and universities. In addition, it determines the necessity of innovation in the training program of professionals in environmental design, the composition of teaching staff, curriculum and design, teaching methods and so on.

First of all, it is suggested to cultivate high-level application-oriented talents of art design combining with and engineering, with the concept first. Meanwhile, it is necessary to put forward the environmental design concept of ecological sustainable development as the guiding ideology of practical teaching. Besides, it is feasible to pay attention to the concept of sustainable development and ecological concept, and cultivate the application ability of environmental protection technology.

Secondly, it is required to revise the teaching plan and outline of environmental design, integrate the traditional art courses around the design, combine the basic modeling ability of art with the courses of process production and environmental protection materials technology, carry out comprehensive training on art design topics and technology application courses, and build a high-quality environmental art major through professional training modes such as “double-certificate teaching mode”, post-centered curriculum, three-dimensional assessment and evaluation mode and graduation thesis defenses.

At the same time, the construction of action-oriented curriculum system based on work process is a systematic project, which needs to be based on the combination of “art and engineering” and “double-qualified” teaching team to develop and organize the implementation, as well as the corresponding teaching methods [1]. Finally, it is required to organically organize and mobilize teachers of other environmental ecology and engineering technology to intervene in the teaching mode of design course. A team of art teachers, engineering teachers, industry experts and technical backbone has been established to ensure that courses of practical skills are mainly taught and guided by highly-skilled teachers.

5 Embodiment of the Characteristics of Environmental Design Specialty in Combination with Art and Engineering

5.1 Implementing Practical Teaching of Environmental Protection Concept and Focusing on Sustainable Development

To cultivate high-level application-oriented art and design talents in combination with “art and engineering”, it is suggested to put the concept first, and the environmental protection design concept of ecological sustainable development should be taken as the guiding ideology of practical teaching. With the help of modern science and technology and the improvement of living consumption level, people have higher requirements for

the quality of their own living environment. The road of sustainable development has become the common choice of all human society. Professional teachers must keep up with the pace of the development of the times, take this strategic thought as the guiding ideology of professional practice, take the project as the carrier and action as the means, help students establish the environmental concept of ecological sustainable development in teaching, and guide students to take environmental sustainable development as the design concept throughout the whole design process. For example, students should fully realize that interior design is not only the design of style and appreciation, but also the environmental design of “health” [2]. In addition, it is necessary to take geographical advantages of university adjacent to the capital city of Guangzhou. Students are required to participate in and complete a series of works, such as social investigation, base environment analysis, functional layout, spatial planning, morphological design, detailed treatment and applicable technology selection. Then, students can realize the impact of the design and construction of artificial environment on the overall ecological environment system, learn how to minimize resource consumption and environmental damage, obtain the maximum function and environmental benefits, and understand the significance and value of 3R principle (reducing, reusing, recycling) to environmental design. Meanwhile, it is suggested to cultivate students’ awareness and ability to use “waste” resources [3].

5.2 Action-Oriented Talent Training System

Professional courses emphasize the practicalness of teaching content. In essence, they induce and strengthen students’ achievement motivation through “design tasks”. Taking a real design project from an enterprise as a learning bridge, it is not the “task” that drives students to complete the task, but the learners themselves. Students should participate in the engineering design projects accepted by teachers, apply the theoretical knowledge learned in the classroom to the actual design, and learn in practice [4].

The advantages of IT school and advanced teaching means such as multimedia are used in the on-campus training teaching to simulate the working environment to improve the intuition and authenticity of teaching and stimulate students’ interest in learning. In the course, practical projects are introduced into the classroom. Through the practical operation of some projects with low difficulty and strong professionalism, students can have a further understanding of the process, method, construction technology and engineering regulations of environmental art design. At the same time, students are trained to analyze problems independently. As for difficult projects, students can be divided into groups. Students can complete by collective division of labor, so as to cultivate team spirit. Besides, students can understand the shortcomings of their professional knowledge, clarify the direction of efforts, and finally achieve the goal of combining theory and practice through practical operation [4].

In the off-campus training course, professional instructors are arranged to lead the team and organize students to carry out social welfare services, such as setting up stalls in the newly-delivered community, providing residents with decoration design consulting services and design plane schemes free of charge, and entering the construction site to personally feel the construction process. In this process, students would have the opportunity to contact with the actual environment, relatively new equipment and processes,

keep pace with the rapid development of the industry, and get rich practical experience and guidance from front-line workers. Through practice, students' will is honed and their psychological function is enhanced, so that they can not only work independently, but also participate in group creative activities [4].

5.3 “1321” Teaching System is the Backing for Introducing Practical Teaching Design

On the basis of comprehensively learning from and absorbing the action-oriented ideas and experience of domestic and foreign universities and enterprises, the “1321 teaching mode” (i.e. one year is divided into three semesters, including two semesters of theoretical study and one semester of practical training). The production of environmental design engineering enterprises is affected by the seasonal climate. The construction period is mainly in spring, summer and autumn, especially the period from June to September is the best time. During this period, the enterprise has a large amount of production tasks, a wide range of construction work and a large number of posts, which is the best period for students to work and practice [5]. Therefore, the semester of practical training starting from August of each academic year accelerates the renewal of the teaching practice content of the environmental art specialty. Neusoft University has formed a relatively mature teaching system after ten years of practice and exploration. Teachers and students have learned valuable experience in the whole process of the enterprise project. Students have enhanced their interest and purpose of learning. The effect is very obvious, which has been widely praised by the society.

6 Reflecting the High-Quality Construction of Environmental Art Specialty with the Profession-Post Docking

6.1 Establishing Curriculum System and Structure Centered on Post

The outstanding feature of action-oriented curriculum system is action-oriented. Learning for action is the goal and learning through action is a teaching process. Action is learning, which is “learning through action and doing in learning process”. What can be used? It is suggested to train with doing things in the process of completing tasks. What should we do? It is suggested to do what students do in their future career and directly solve what they do in their future career. As the action-oriented curriculum is set, students can regain new knowledge and skills and achieve sustainable development in the event of changes in working relationships and careers [1]. Based on the action-oriented and innovative teaching concept of “art and engineering” of environmental design specialty, the teaching and research team of environmental design takes students' professional practice ability as the basic guiding ideology of curriculum setting, and divides the curriculum groups, such as landscape design, public space design and home space design. Universities should actively cooperate with enterprises. Through the investigation, discussion and analysis of the work process of posts (groups) of environmental art and design specialty, universities can get the typical work tasks, summarize them into action fields according to the typical work tasks, and then convert the action fields into the curriculum categories of students' core learning, so as to build two curriculum systems, including professional basic courses and practical skill courses.

6.2 The Curriculum Offering Should Be in Line with the Market Demand, and the Categories of Professional Extended Courses Should Be Refined

Universities must compare and analyze the job market, conduct in-depth enterprise research and visits to brother colleges and universities, analyze reliable information, collect the report on the flow of environmental design talents made by the talent exchange information department, evaluate the demand trend of development for talents, and then make a decision on the curriculum. According to the results of market research, the interior design of environmental design specialty takes the post ability as the core, determines the work posts according to the occupations such as living space, decoration design, exhibition design and commercial decoration engineering construction, and refines the categories of professional extended courses. Therefore, there are five thematic directions (residential space, villa design, exhibition space, office space and catering space). The basic theoretical courses “fundamentals of fine arts”, “composition design” and “decorative materials and crafts” have been modified, deleted or re-integrated into comprehensive design courses such as “residential space design” and “villa space design”. “Exhibition space design”, “office space design”, “interior design of tourism architecture” and “comprehensive design of space” are based on the specialty of senior students, strengthening the learning of a certain skill, cultivating students’ various abilities from the perspective of market demand, and emphasizing students’ software operation, practical ability and comprehensive knowledge application. The reform of curriculum offering and training direction has achieved phased results.

The teaching content of basic courses is professional. In the limited professional learning time, basic courses are taught closely around the professional training objectives. The cultivation of one or more abilities is supported with one or more courses. For example, the basic contents of courses such as “fundamentals of fine arts” and “introduction to environmental art” must include two parts: theory and artistic creation. It is to use theoretical knowledge to serve artistic creation. Teachers should reasonably use traditional teaching methods for basic teaching. The “basic art course” aims to directly lead students quickly enter the perspective study required by the environmental design specialty. Then, students can replace the basic sketch training with the line draft training of effect drawing, and replace the basic color training with the mark pen and color effect drawing performance skill training.

The professional training courses focus on the proficiency and craftsmanship of students in mastering a certain skill, and the close combination of theory and practice is conducive to the close combination of the professional course and the development frontier of construction technology. Emphasizing the combination of engineering technology and artistic aesthetics is to pay due attention to the education of environmental science (agronomy, botany, ecology, etc.) and engineering technology (materials, architecture, structural construction, etc.). It is suggested to take advantage of the good development of building materials enterprises in the Pearl River Delta and the leading national engineering technologies such as decorative materials and structures, and guide students to try and explore new structures, new environmental protection materials and new technologies. From basic courses to professional courses, universities should really effectively combine professional theory with practical operation, strengthen the cultivation of applied

talents in higher vocational colleges, and emphasize the professional characteristics of the combination of “art and engineering”.

6.3 Building a Three-Dimensional Assessment and Evaluation Model

As an important part of teaching design, the way of curriculum assessment and evaluation plays a guiding role. The teaching and research team of environmental design of Neusoft University also reformed the assessment and evaluation methods of environmental design courses reasonably, established a multi-dimensional assessment and evaluation system, and achieved remarkable results, ensured the profession of talent training mode, and achieved the real integration of “art and engineering”.

The project tries to create a set of multi-dimensional professional assessment and evaluation system with innovative ideas and strategies of environmental design for art design in colleges and universities.

6.3.1 Establishing a Multi-dimensional Assessment and Evaluation System

Course assessment directly reflects teachers’ teaching and students’ completion. A course should formulate different assessment standards, such as traditional theoretical assessment module, on-site technology assessment module, etc. In this way, it is conducive to the mutual integration between art courses and engineering technology courses and the communication between teachers and students. Meanwhile, students’ works can get more suggestions and comments in the evaluation. Students can clarify their shortcomings in the communication with classmates, teachers and experts and learn from each other. Then, the evaluation is objective, fair and transparent.

Specific implementation is as follows.

First, the course teacher presides over the assessment, and many teachers from other specialties participate in the assessment and evaluation. The participation of more than one teacher from other specialties in the assessment and evaluation of this major is conducive to obtaining interpretation of students’ works from more perspectives. At the same time, it can effectively weaken the impact of teachers’ personal subjective factors on the assessment and evaluation, make the overall evaluation tend to be objective and enhance the fairness of results.

It is suggested to carry out self-evaluation, teachers’ comments and students’ mutual evaluation. Students are required to elaborate on their own works and accept questions from others. Teachers comment on the students’ works and defense, pointing out the advantages and disadvantages and the direction of efforts. After all students complete the self-assessment and teachers make comments, the real-name voting of the two-vote system will be implemented, and the votes will be counted on the spot, and the corresponding scores will be obtained according to the voting results.

Through the evaluation of their own design works by students and teachers, students find the “key” to improve their own creation and inject new perspectives and vitality into future creation and appreciation of others’ works. In addition, when students learn to reflect on what they care about, their sense of self-respect and self-confidence are also improved.

It is suggested to face expert assessment from enterprises or brother colleges sincerely. The professional assessment of off-campus enterprises is a project full of innovation and characteristics. Teachers and industrial experts from brother colleges and universities ask students to independently complete environmental design or design operation according to the requirements and materials on the spot without any plan. This is not only the assessment and evaluation of students' learning results, but also the examination of the teaching situation of the whole course, so as to promote the benign improvement of teaching. For example, the department of environmental design has invited off-campus enterprise experts such as the chief designer of Pubang Garden Co., Ltd., the designer of Guangzhou Yuexiu Design Institute and the main designer of Foshan Interior Decoration Company to carry out the professional assessment on students. After the explanation and instruction of experts outside the school, the students who participated in the assessment said they had benefited a lot and mastered their career development coordinates more clearly. The affirmation of enterprise experts on professional talent training mode has also greatly encouraged teachers' teaching enthusiasm.

It is feasible to participate in professional competitions and assess students through competitions. Universities can evaluate students' works from a wider range, such as in the whole country or the whole province. Students participating in professional competitions can clearly know what position their design level is in the whole country or the whole province. In this way, universities can promote students' enthusiasm for learning, enterprises can also understand students, and students gradually integrate with the market.

6.3.2 Paying Attention to the Design Process and Steps and Carrying Out Phased Assessment and Evaluation

It is necessary to pay attention to the design process, divide this process into several stages for examination and evaluation, and promote students to form a good habit of design thinking. Universities should integrate evaluation and teaching activities, evaluation and specific design activities, and pay more attention to give play to and improve data collection ability, analysis ability, imagination, creativity, communication and cooperation ability and initiative of students in the design process.

Phased assessment and evaluation also prompt teachers to go deep into the whole process of students' design. In this process, teachers are required to observe the creative process through one-to-one dialogue, obtain the real situation of students' learning, and give them encouragement and guidance in time. Meanwhile, students are frequently asked to explain the sketch making, repeated modification, reflection and perception of their own works and others' works in the process of creative activities, and evaluate their own works from the perspective of process. Teaching is expected to become a new and vibrant process, which gives students confidence and encouragement [6].

6.3.3 Paying Attention to the Comprehensive Evaluation of Students' Overall Development

The curriculum of environmental design not only focuses on students' mastery of design knowledge and skills and the development level of overall visual design ability, but also

emphasizes students' development of cultural cultivation and humanistic qualities such as emotion, attitude and values through the study of design. Based on the actual situation, teachers can formulate scientific and operable assessment and evaluation standards for environmental design and life, emotion, culture, science and other aspects, and carry out the overall assessment and evaluation of students.

The research content of assessment system is original and practical, and belongs to the hot research content of teaching reform in applied universities. It promotes major construction, curriculum reform and teacher construction, which is worthy of popularization and reference by colleges and universities.

7 Conclusion

With the combination of art and engineering technology, a practical way to cultivate applied design talents who meet the development of the times is explored. Universities should transform the training of artistic talents to the training of compound talents, which can drive the construction of the training mechanism of applied undergraduate talents in local colleges and universities, realize the rational allocation of resources and optimize the construction of teaching team. At the same time, it can drive the development of disciplines, enhance the characteristics and advantages of environmental design, promote the improvement of scientific research and teaching level, strengthen foreign exchanges and assume more social responsibilities. Also, it can play an exemplary role in China's environmental design, play a positive role in alleviating the shortage of environmental design talents, improve the regional economic function of colleges and universities, and promote the vigorous development of domestic architectural decoration industry.

In short, the cultivation of applied environmental design talents with the combination of "art" and "engineering" is an important step to explore the education mode of high-quality innovative applied talents. The combination of engineering technology and art is not a simple combination, but a dialectical unity of arts and sciences. Through continuous practice and exploration, the success and failure will be valuable experiences, and the formed teaching theory will become clearer and become the cornerstone of future success. It is feasible to promote the renewal of design concepts, use the beauty of modern science and technology, and prosper environmental design education and culture in China.

Authors' Contributions. This paper is independently completed by Yaqin Lei.

References

1. Yang, ZhengJun. 2009. Consideration about the establishment of action-oriented talents cultivation program for higher technical and vocational institutions. *Shanxi Architecture* (in Chinese).
2. Zhang, Jian, Yang Zheng, and Yanhui Sui. 2011. Study on Reform in Education of Environmental Art Design under Global Climate Change. In *Proceedings of Conference on Creative Education (CCE 2011)*, 08 April 2011 (in Chinese).
3. Ye, Wang. 2019. Research on the Teaching Reform of Environmental Art Design Based on the Concept of Ecological Sustainable Development. *Chinese Adult Education* (in Chinese).

4. Liu, Lili. 2011. Environmental Art Design Innovation Teaching Mode of Thinking. *Legend. Selected Biographical Literature (Theoretical Research)* (in Chinese).
5. Tao, Honglin. 2009. Innovation and Practice of Talent Training Mode of 'School - enterprise Cooperation, Work - study Alternation and Double Certificate Integration' for Civil Engineering Specialty in Higher Vocational Colleges. *Chinese University Teaching* (in Chinese).
6. Construction scheme of the evaluation system of building decoration teaching. 2019. <https://wenku.baidu.com/view/360a33f04531b90d6c85ec3a87c24028915f85a3.html> (in Chinese).

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