Teaching exploration of green building innovation practice course for Construction Engineering Management Major under the background of "carbon peaking and carbon neutrality goals"-- Taking the construction engineering management major of Shanghai Urban Construction Vocational College as an example

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Abstract. With Chinese President Xi's commitment to "carbon peak and carbon neutrality" to the international community at the 75th United Nations General Assembly, the teaching of practical courses of construction engineering management has faced major challenges. In view of the current problems that the setting of practice course content and evaluation indicators in the training program of construction engineering cannot effectively deal with the " carbon peaking and carbon neutrality goals ", this paper puts forward reform strategies of curriculum teaching methods such as the "four stage, full cycle progressive green building practical ability training system", and the "multi module practical" green building core teaching system, and the "online + offline" integrated teaching mode exploration, and diversified curriculum evaluation mechanism, etc. This paper also makes appropriate adjustments from the aspects of professional practice teaching content setting, teaching methods and evaluation mechanism, so as to meet the new requirements of "carbon peaking and carbon neutrality goals" for construction engineering management majors.

Keywords: carbon peaking and carbon neutrality goals; Construction Engineering Management; green building; teaching reform.

1. Introduction

With Chinese President Xi's commitment to "carbon peak and carbon neutrality" to the international community at the 75th United Nations General Assembly, the teaching of practical courses of construction engineering management has faced major challenges. At present, the setting of practical course content and evaluation indicators in the training program of construction engineering can not effectively guide students to understand the aspects of Construction Engineering Management in essence, so as to make a positive contribution to the realization of the " carbon peaking and carbon neutrality goals ". Therefore, it is necessary to make appropriate adjustments in the setting of professional practical teaching content, teaching methods and evaluation mechanism to meet the latest requirements.

2. Analysis on the current situation of practical curriculum and evaluation mechanism of Architectural Specialty under the background of " carbon peaking and carbon neutrality goals "

2.1 Proposal of " carbon peaking and carbon neutrality goals "

On September 22, 2020, President Xi announced at the general debate of the 75th United Nations General Assembly that China would strive to achieve carbon peak by 2030 and carbon neutrality by 2060. Subsequently, in March 2021, the fourth session of the 13th National People's Congress adopted the 14th five year plan for the national economic and social development of the people's Republic of China and the outline of long-term goals for 2035, formulated an action plan to peak carbon emissions by 2030, and put forward specific measures to achieve carbon neutrality by 2060. So far, carbon emission analysis has been started in the fields of power / heat, industry, transportation, agriculture

and so on, and carbon emission reduction measures have been put forward and preliminary practice has been carried out. Of course, this also includes the field of construction engineering.

2.2 Analysis on the current situation of practical curriculum and evaluation mechanism of Construction Engineering Management major

At present, the practical courses in the training program of construction engineering management are mainly through embedding the "green building" module in the relevant courses such as *introduction to housing construction and BIM application*, *building and decoration materials*, *architectural design and BIM application*, as well as junior students' on-the-job internship to participate in environmental pollution control facilities (such as sewage treatment plants), introduction to the operation process and explanation of common problems in the process of productive operation, enable students to achieve the set curriculum goals.

Taking the practical course "*architectural design and BIM application*" of construction engineering management as an example, by embedding relevant laws and regulations, technical measures, engineering cases, green building evaluation methods, etc., this course mainly enables students to clarify the professional orientation, professional value orientation and professional responsibility of architectural designers, and to be familiar with the technical measures, laws and regulations, standards and specifications of green and low-carbon buildings in architectural design, as well as to understand the internal relationship between professional engineering practice and social sustainable development, and be able to evaluate the impact of green building engineering practice on environmental and social sustainable development. At the same time, it enables students to understand the research direction and development trend of green building issues at China and abroad, pay attention to the frontier of green building issues, understand the bottleneck of green building development, and organically combine social development, discipline development and self-development.

Although the current practical curriculum can basically meet the requirements of the green construction industry for the achievement of students' basic abilities, it does not reflect the substantive connotation of the realization of "construction engineering management" and " carbon peaking and carbon neutrality goals ", that is, students cannot intuitively understand how construction engineering management can make a positive contribution to the achievement of "double carbon goals", which needs to be adjusted.

In addition, at present, the teaching method of the course is traditional offline teaching and the evaluation method is also very conventional. Take the course of "on-the-job internship" as an example; the evaluation of internship is composed of four parts: practice diary, practice report, attendance, and tutor evaluation, which are evaluated by giving different weights to the four parts.

Through years of practice, we believe that this teaching method and evaluation method have limitations. We can only grasp students' understanding of key knowledge points from a macro perspective, but we cannot accurately evaluate students' real mastery. At the same time, the whole practice process cannot effectively mobilize students' subjective initiative and creative thinking, which needs to be improved.

3. Teaching method reform strategy of green building innovation practice course for Construction Engineering Management majors under the background of "carbon peaking and carbon neutrality goals"

3.1 Teaching reform background

In the context of "carbon peaking and carbon neutrality goals", in order to enable students majoring in Construction Engineering Management to have a deeper understanding of the substantive connotation of the realization of the goals of "Construction Engineering Management" and "carbon peaking and carbon neutrality goals", in addition to carrying out practical courses teaching with green

building modules such as green building laws and regulations, interpretation of green building standards, green building materials and green building technology, teaching reform needs to be further refined, as to enable students to have a deeper understanding of the positive contribution of construction engineering to the achievement of the "carbon peaking and carbon neutrality goals".

According to the "14th five year plan" for building energy conservation and green building development plan issued by the Ministry of housing and urban rural development in March 2022, during the "13th five year plan" period, the energy conservation of new residential buildings in cities and towns in severe cold regions reached 75%, and the cumulative construction area of ultra-low and near zero energy consumption is nearly 100million square meters, and the energy-saving transformation area of existing residential buildings is 514 million square meters, and the energy-saving renovation area of public buildings is 185 million square meters, and the renewable energy substitution rate of urban buildings reaches 6%. By the end of 2020, new green buildings in cities and towns nationwide accounted for 77% of the new building in the year, with a cumulative green building area of more than 6.6 billion square meters, a cumulative energy-saving building area of more than 23.8 billion square meters, energy-saving buildings accounting for more than 63% of the civil building area in cities and towns, and newly constructed prefabricated buildings accounted for 20.5% of the new building in cities and towns in the year. The tasks set by the State Council and the goals of the 13th five year plan for building energy conservation and green building development have been successfully completed.

The construction industry is a major energy consumer, but also has great potential for carbon emission reduction. Therefore, through the analysis of carbon emission sources, the analysis and practice of carbon emission reduction measures in the construction industry, actively promote the low-carbon transformation of the construction industry, which is conducive to the realization of the "carbon peaking and carbon neutrality goals". The "14th five year plan" period is the first five years of the new journey of building a modern socialist country in an all-round way. It is a critical period for the implementation of the carbon peak by 2030 and the carbon neutrality goals by 2060. The development of building energy conservation and green buildings is facing greater challenges and important development opportunities.

3.2 teaching reform strategy

3.2.1 four stage, full cycle, progressive green building practical ability training system

Take the teaching system as the carrier and the teaching mode as the means to build the four stages, full cycle progressive green building practical ability training system, as shown in Figure 1. In the first stage, for the group of lower grade students, the first classroom that keeps pace with the times is carried out to promote the absorption of knowledge, and the salon exchange in the second classroom is carried out to inspire learning interest; The second stage is to introduce real scientific research and engineering projects into the classroom and carry out a series of "theory + practice" teaching links for middle and senior students; In the third stage, for the group of senior students, gradually promote the integration of teaching, science and production, and actively expand practical projects to cooperative design institutes and enterprises; In the fourth stage, for the group of graduates, provide graduates with opportunities to contact the front line of green building design, effectively connect teaching, scientific research and engineering practice, and provide a strong guarantee for the cultivation of students' innovative practical ability.

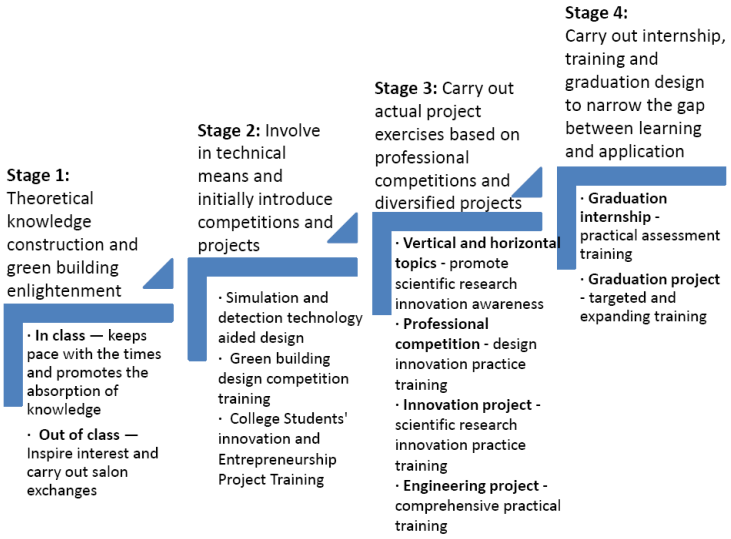

Figure 1 the four stages, full cycle progressive green building practical ability training system

3.2.2 "Multi module practical" green building core teaching system

Take the cultivation of innovative design ability of green buildings as the vital means, serialize the knowledge framework and refine the links of ability cultivation. In the process of ability training, all relevant courses are modularized according to different ability training needs to build a "multi module practical" core teaching system, as shown in Figure 2. "Multi module" means that in the whole teaching system, the key points of knowledge are summarized and integrated into mutually independent module units such as "principle", "technology", "design" and "practice" to some extent, and the professional knowledge points of green building are introduced on the basis of modularization, so as to systematically and solidly implement the key points of green building knowledge and improve the knowledge structure. Among which, "practical" is a diversified teaching system composed of sub modules such as simulated innovation and application, in class and out of class college students' innovation and entrepreneurship practice activities, teachers' vertical and horizontal scientific research topics, green building design competitions and enterprise project practice activities, etc.

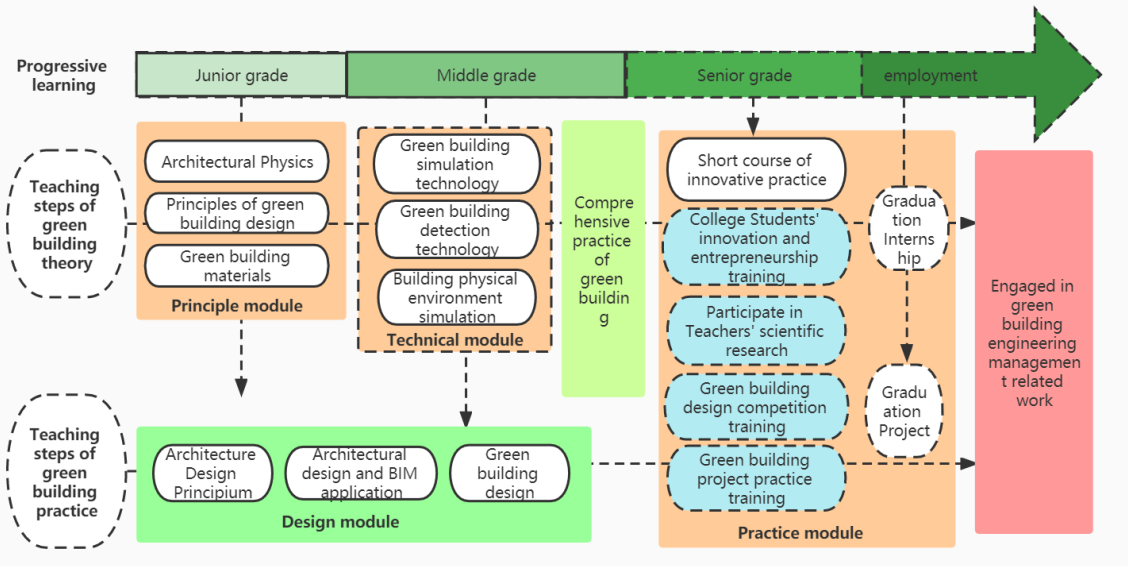

Figure 2 Schematic diagram of "multi module practical" core teaching system of green building

The teaching system should pay attention to the platform construction of innovation training, through the combination of different module courses and the selection of practical tasks, put forward innovative thinking, methods and ability training objectives in class as well as in practical projects,

strengthen students' green building design intention, and then improve the green building design level and innovation ability. The teaching system should also pay attention to the platform construction of practical training, promote by topics, projects, competitions, etc., guide students to study purposefully according to their personal interests and abilities, ensure the development of Diversified Practical Training under the personalized teaching guidance of teachers, and deal with diversity in the time and space of communication, so as to achieve the purpose of layered training.

3.2.3 Exploration of the new teaching mode of "Online + offline" integration

As a practical course, the current teaching objectives are achieved mainly through on-site visits, designers' introduction and offline practice such as architectural project design learning. However, compared with a single offline practice, online practice has the dual advantages of "time and resources", that is, students can use fragmented time to improve their ability, which is also in line with the new habits of contemporary young people. Based on this, practical courses can try to change the traditional teaching mode of using a single offline teaching, and try to use the new mode of "Online + offline" integrated teaching, that is, the teaching of practical courses is still carried out mainly through offline practice, supplemented by a certain amount of "online practice", so that students can truly improve their ability while achieving teaching goals. For example, Shanghai Urban Construction Vocational College has carried out the exploration of "school enterprise association" cloud internship courses for many years. Some excellent resources can be opened to students for free, which provides strong support for the completion of "online practice" content to a certain extent.

"Online + offline" integrated teaching is the development trend in the future. This teaching mode can be fully adopted in the practical courses of Construction Engineering Management major under the background of "carbon peaking and carbon neutrality goals". Through course learning, students' ability can be effectively improved.

3.2.4 Diversified course evaluation mechanism

At present, the evaluation method of practical courses of construction engineering management major in Shanghai urban construction vocational college consists of four parts: practice diary, practice report, attendance and tutor evaluation. The weights of different practical courses are different. Take the evaluating of graduation practice courses for example, the weights of practice diary, practice report, attendance and tutor evaluation are 20%, 50%, 10% and 20% respectively. From the above evaluation methods, it can be seen that the internship report has the largest weight. However, students' creativity and subjective initiative cannot be brought into full play in the process of writing the internship report, which has certain defects.

In view of the above problems, according to the course content setting and the new mode of "Online + offline" integrated teaching, we can try to adopt a diversified evaluation mechanism to strengthen the process evaluation, and that is, the individual evaluation is carried out according to the modularization. Students can continue to learn the subsequent modules only after the previous module meets the evaluation requirements and passes the evaluation; besides, in addition to offline assessment, you can also try the "offline + online" synchronous assessment mode. Offline learning adopts modular assessment, while online learning adopts online assessment. Teachers set corresponding assessment questions according to online practical learning content, and students carry out online assessment immediately after participating in online learning; In addition, students are encouraged to participate in design competitions and college students' innovative training based on the teaching content, and the practical training results can be converted into course evaluation performance based on the project level, which can be used as an additional item of students' course evaluation, so as to encourage students to actively participate in scientific research projects, apply for major innovation projects, participate in green building design competitions, etc., and promote autonomous teaching through performance evaluation.

4. Conclusions

Under the background of "carbon peaking and carbon neutrality goals", it brings great challenges to the practical course teaching of construction engineering management specialty. Only by setting the teaching content reasonably and adopting the corresponding evaluation mechanism, can students correctly understand the substantive connotation of "construction engineering management" and "carbon peaking and carbon neutrality goals". Therefore, we should build a four stage, full cycle progressive green building practical ability training system, take the "multi module practical" green building core teaching system as the starting point, use the "Online + offline" integrated teaching, and combine the offline modular evaluation and online evaluation, the transformation of training results and other diversified evaluation methods, so that students' ability can be further improved while achieving the curriculum teaching objectives. This is in line with the concept of engineering education, which is oriented by students' output and aimed at improving students' comprehensive quality and ability.

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