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Original Paper

Exploration on the Teaching Reform of "Aging Design" Course for Civil Engineering Specialty under the Background of Aging

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Abstract

The degree of aging in China continues to deepen, and the demand for old residential renovation and old-age facilities construction has surged. The aging project has become the focus of urban and rural construction. As a carrier for the cultivation of construction talents, the existing courses of civil engineering lack systematic teaching content suitable for aging, and the supply of talents is out of line with the needs of the industry. Based on the development of aging society and the actual needs of engineering, this paper analyzes the existing shortcomings from the curriculum system, teaching content, practice platform and teaching staff, constructs the integrated reform system of theory, practice and curriculum ideology and politics, and puts forward the optimization path of reconstructing curriculum, innovating teaching, expanding practice and integrating ideology and politics. The research shows that promoting the reform of aging-appropriate teaching can improve the training mode of civil engineering talents, cultivate compound engineering talents with both professional ability and humanistic care, and continuously transport professional strength for urban and rural aging-appropriate construction.

Keywords

Population aging, Aging design, Curriculum reform, Teaching exploration

1. Introduction

The world is generally facing the problem of population aging. At the end of 2025, the population over 60 years old in China exceeded 323 million, and the gap of aging engineering talents is prominent. At present, civil engineering teaching focuses on traditional engineering content, lacks systematic teaching content suitable for aging, and the supply of talents is difficult to meet the needs of the industry. Promoting the reform of the curriculum system is a necessary measure for the civil engineering

specialty to adapt to the construction of an aging society.

Combined with the current situation of domestic aging development and the first-line teaching situation, this paper sorts out all kinds of problems exposed in the teaching of aging design at this stage, and gives the reform ideas and implementation methods that can be implemented, hoping to provide some reference for the civil engineering specialty to meet the needs of aging society construction and cultivate relevant technical talents.

2. The Necessity of Integrating Aging Design into the Teaching of Civil Engineering Specialty

2.1 The Rigid Demand of Population Aging for the Construction of Aging Environment

The degree of aging in China continues to deepen, the elderly population is large, the growth rate is fast, and the trend of aging is obvious. The physical function of the elderly is special, and they have different needs for living, public space and travel environment. Architectural design, construction and renovation should take into account their physiological and psychological characteristics.

A large number of old residential areas built in the early years are lack of supporting facilities, such as elevators, anti-skid floors, handrails and other facilities suitable for the elderly; at the same time, all kinds of new old-age supporting buildings continue to expand, and there are special design standards in structure and function layout. The new and old two types of projects have spawned a large number of aging construction needs, which is a realistic social demand that civil engineering education needs to face directly.

2.2 The Ability Requirements of Aging Construction for Civil Engineering Professionals

The aging project spans many fields such as planning, structure, electromechanical and construction, and has high requirements for the comprehensive quality of civil engineering practitioners. Practitioners should not only master the relevant theories of physiological behavior characteristics and space use of the elderly, but also be able to skillfully use all kinds of aging norms. They should also have the ability to evaluate the safety of old buildings, compile renovation plans and coordinate construction, and have the cooperative thinking of cross-professional cooperation. However, at present, most civil engineering courses in colleges and universities still focus on traditional structure, construction and management, and lack targeted teaching modules suitable for the elderly. The teaching generally focuses on technical theory and ignores the special needs of the elderly. There are problems of emphasizing technology over humanities, re-building over transformation, and emphasizing general use over special projects. Therefore, the students trained are difficult to adapt to the engineering employment needs of the aging society.

2.3 The Direction Guidance of new Engineering Construction to the Reform of Civil Engineering Specialty

The construction of “new engineering” aims to promote the renewal of engineering training system, better connect industry and people’s livelihood, and enhance the ability to serve the national strategy. Civil engineering reform also needs to follow this direction. At present, intelligent construction, BIM

application, green building and other technical contents are added to the professional courses, which means responding to the practical problems emerging in social development. Population aging is a prominent social situation in China, which should become an important direction of teaching reform in civil engineering.

In recent years, some colleges and universities have promoted the reform of aging teaching in architecture, environmental design and other majors. Some studies have proposed that the theory and design courses of architectural specialty should be appropriately integrated into the concept of aging, and guide students to pay attention to the needs of the aging society. The architecture major of Chongqing University adds the subject of aging architecture in the multi-disciplinary joint graduation design to broaden the teaching dimension. The architecture major of Yanshan University uses the old community renovation project to train students' complete design thinking from site research and judgment, resource coordination to space remodeling. The practical results of similar majors fully show that it is necessary and feasible to introduce aging-related content into the teaching of civil engineering.

3. The Main Problems Existing in the Teaching of Aging Design Course for Civil Engineering Specialty Are Discussed

3.1 The Systematic Lack of Suitable Aging Content in the Curriculum System

At present, in the curriculum system of civil engineering specialty in most colleges and universities in China, there is always a lack of systematic teaching content suitable for aging, which is also a prominent problem in the current professional teaching. It is the lack of this systematic teaching content that makes civil engineering students almost unable to contact the relevant theory and practice of aging engineering during school. It also makes students have problems such as insufficient professional knowledge reserve and lack of engineering judgment ability in the face of practical projects such as elevator installation in old residential areas, aging and renewal of existing residential buildings, and new construction of old-age facilities.

3.2 The Disconnection between Teaching Content and the Actual Needs of Aging Construction

In the few courses that offer appropriate aging-related content, there is also a problem that is clearly out of touch with reality. Most of the course teaching stays at the level of basic concept introduction, and lacks in-depth explanation of professional technical details. Taking the teaching of barrier-free design as an example, the classroom only briefly introduces the infrastructure such as ramps and protective handrails, and does not refine the core contents such as construction technology, material selection specifications and structural bearing capacity checking. At the same time, the update of course content is lagging behind, which cannot adapt to the update rhythm of industry norms and technology. In recent years, the state has successively issued laws, regulations and technical standards such as the "Barrier-free Environment Construction Law" "Architectural Design Standards for Elderly Care Facilities", but these contents have not been fully integrated into classroom teaching.

The existing research points out that the current aging curriculum has problems such as incomplete

knowledge system, insufficient teaching depth, and lack of practical links, which cannot meet the actual needs of the industry. This judgment is also applicable to the teaching of aging design for civil engineering majors.

3.3 Weaknesses and Deficiencies in Practical Teaching

Aging design is a highly practical engineering content. Students need to master the corresponding practical ability through field research, case analysis, program practice and other diversified links. However, from the current practical teaching situation of civil engineering specialty, the training content related to aging is obviously insufficient. The topics of all kinds of curriculum design are mostly around office buildings, teaching buildings, ordinary residential buildings and other conventional buildings. The design topics for old-age facilities and old buildings suitable for aging and renewal are very scarce. In the process of cognition practice and production practice, students ' practice scenes are mostly new large-scale projects, and there are few opportunities to contact the site of aging renovation of existing buildings. In the graduation design, students who choose aging-related topics are even fewer.

The blank of practical teaching not only makes students unable to deeply understand and master the theoretical knowledge of aging design, but also hinders the transformation of theoretical knowledge to engineering practical ability. Due to the lack of real or simulated aging engineering training scenarios, it is difficult for students to cultivate comprehensive ability to solve such practical engineering problems.

3.4 The Lack of Professional Ability of Teachers for Aging

The professional level of teachers is the core support for the implementation of the curriculum reform for the elderly. However, at this stage, most of the civil engineering teachers are deeply engaged in traditional research directions such as structure, rock and soil, and engineering management, and lack the accumulation of research on the design for the elderly. They have not systematically studied the norms of old-age buildings and the renovation technology of old houses, and also lack the special exploration of the law of behavior activities of the elderly, which makes it difficult for teachers to teach the content of the elderly in a complete and in-depth way in the classroom. The lack of professional ability of teachers for aging has also become a key factor hindering the continuous advancement of the teaching reform of civil engineering.

4. The Path of Teaching Reform of Aging Design Course for Civil Engineering Specialty

4.1 Reconstructing the Curriculum System: Layered Embedding of Aging Content

In order to effectively promote the teaching reform related to aging design, the core and most important work is to optimize and reconstruct the existing curriculum system as a whole and systematically. Based on this, this paper proposes a three-tier progressive curriculum system optimization scheme of “general education infiltration-professional integration-special strengthening”.

The lower grades rely on the basic courses such as “Housing Architecture” of “Introduction to Civil

Engineering" to add special topics, and explain the background of aging society and the significance of aging construction in combination with engineering cases, so as to establish students' awareness of people's livelihood service as soon as possible. In the professional learning stage, practical contents such as barrier-free structure, old construction and engineering control are added to the core courses of concrete structure, building construction and engineering management, and the key points of aging are embedded in the professional backbone knowledge. Colleges and universities can also set up relevant elective courses or micro-specialties in combination with their own resources. Colleges and universities with sufficient conditions can create a characteristic development direction and support the transformation of civil engineering specialty to healthy, livable and intelligent construction.

4.2 Updating Teaching Content: Docking Standard and Engineering Practice

The update of teaching content is the core of curriculum reform. The teaching of aging design for civil engineering specialty should focus on the simultaneous promotion of norms, cases and cutting-edge technologies.

In classroom teaching, we must first benchmark the current industry regulations and technical standards, and integrate the core provisions of the "Barrier-free Environment Construction Law" and the "General Specification for Pension Facilities and Barrier-free" into the teaching content, so as to help students establish standardized and rigorous design ideas for aging. Secondly, the real projects such as old and new old-age buildings and old residential renovations are transformed into teaching cases, the design ideas of high-quality projects are disassembled, and the frequent engineering problems on site are sorted out, so that students can intuitively grasp the practical difficulties. In addition, cutting-edge technologies such as BIM, assembly decoration and intelligent construction are introduced simultaneously. Modeling and scheme optimization are carried out in combination with renovation projects. Virtual simulation is used to simulate the movement and visual impairment of the elderly, so that students can feel the impact of space environment on the use experience of the elderly and deepen the cognition of humanistic design.

4.3 Innovative Teaching Methods: Multiple Means to Improve the Teaching Effect

The innovation of teaching methods is an important guarantee to improve the teaching effect of aging design. A variety of teaching methods should be used to stimulate students' learning initiative and participation.

With the help of transformation cases, the classroom guides students to comprehensively consider safety, function and cost, and exercise their engineering thinking ability. Relying on real old-age care and old-age reform projects for practical training, students can participate in the whole process of research, scheme and drawing design, and accumulate practical experience. Organize students to visit communities and pension places for field interviews, intuitively grasp the real living needs of the elderly, and understand the livelihood significance of aging design. At the same time, the integration of competition and teaching is promoted, and students are encouraged to participate in the competition of aging and intelligent construction, so as to stimulate the sense of innovation and improve the

comprehensive practical ability in an all-round way.

4.4 Strengthening Practice Teaching: Building a Multi-level Practice System

Practical teaching is the key link to cultivate students' ability of aging design. Colleges and universities can build a hierarchical progressive practical education system, integrate teaching modules such as curriculum design, internal and external practice training, graduation design and extracurricular social practice, and form a coherent and complete engineering ability training system.

As a basic practice link, curriculum design can add topics such as aging renovation of old houses, so that students can complete the investigation, scheme and drawing training. The school jointly builds a training base with enterprises and pension institutions, and relies on the real community reconstruction project to arrange students to participate in the survey, program adjustment and on-site construction cooperation. The focus of graduation design is set in the direction of old reform, old-age community, barrier-free facilities, etc., to guide students to carry out special design. It can also organize students to go into the community to carry out social practice such as voluntary consultation and simple survey, which not only tests the application level of professional knowledge, but also establishes the sense of responsibility to serve the people's livelihood.

4.5 Integrating Curriculum Ideological and Political Education: Value Guidance and Professional Education go Hand in Hand

The aging design course has its own advantages of ideological and political education. Based on the living needs of the elderly, it creates a livable and suitable environment for the elderly. It not only practices the core idea of people-oriented engineering, but also implements the value concept of harmony and friendliness.

Curriculum ideological and political education can be divided into three layers to complete value guidance: first, combined with industry data, policies and engineering cases, let students see the current situation of aging society, take the initiative to shoulder the responsibility of serving people's livelihood and responding to the national aging strategy; secondly, cultivate the consciousness of humanistic care, remind students not only to pay attention to structural safety and cost economy, but also to consider the actual use experience from the perspective of the elderly. Finally, the craftsman spirit and professional bottom line are shaped. In the process of carefully completing the design of suitable aging transformation and following up the construction landing, students can truly understand the humanistic temperature and social value behind the engineering technology.

5. Conclusion

The reform of aging teaching has a long cycle and a complex system. Each school should advance step by step according to its own conditions. Education authorities and industry associations can introduce teaching standards, curriculum guidelines and supporting textbooks to provide support for the reform. Colleges, competent departments and industries should work together to make the training of civil engineering talents meet the needs of the construction of an aging society, continuously transport

professional talents suitable for the construction of an aging society, and lay a solid foundation for the realization of a sense of security for the elderly.