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The tutor team construction in the "honeycomb model" of professional degrees training for postgraduate

Li SUN[1], Yansheng SONG[1], Wei WANG[2], Qiao JIN[1]

1. School of Civil Engineering, Shenyang Jianzhu University, Shenyang 110168, China
2. Department of Quality Evaluation and Supervision, Shenyang Jianzhu University, Shenyang 110168, China

Abstract: This paper analyzes the current situation of professional degree graduate education in China, summarizes the main problems existing in the construction of tutor team at the present stage, and constructs the "honeycomb model" of civil engineering master's degree graduate training. The "honeycomb model" replaces the double mentors with the mentor team, and takes the cultivation of practical innovation ability as the goal. Demand-oriented, it establishes substantive connections between the multiple agents represented by the mentor team members. In addition, the "honeycomb model" promotes the mutual promotion and integration of multiple entities through cost-effectiveness, and realizes the sustainable development of multiple entities through win-win cooperation. Finally, the model relies on the project matrix operation mode to promote the construction of tutor team and realize the unification of academic and professional graduate training.

Key words: tutor team; honeycomb model; professional degree; postgraduate training; civil engineering

1 Introduction

In 2022, the added value of China's construction industry accounted for 6.89% of GDP, and it is one of the pillar industries of the national economy. The number of construction enterprises is 143,600, and the enterprise personnel is 51.84,402 million [1]. The number of enterprises increases, the number of employees decreases, and the industry competition intensifies. Green building, prefabricated building, intelligent construction and intelligent supervision have become the development direction of the future construction industry. Talent has become the key to enhancing the core competitiveness of enterprises, promoting industrial transformation and upgrading, and promoting the high-quality development of the construction industry. Civil engineering is a scientific, technical and practical subject field. The training of high-level composite professional degree postgraduates will provide strong support for China's construction industry to accelerate the transformation from "construction" to "intelligent manufacturing" and from "intelligence" to "intelligent use".

A professional degree is a type of degree as opposed to an academic degree. Its education is characterized by a close combination of academia and profession. Its purpose is to cultivate a professional (or occupation) field of solid basic theory and broad professional knowledge, with a strong ability to solve practical problems, and can undertake professional technology or management work, with good professional quality of high-level applied professionals [2].

In March 1990, the 9th Meeting of the Academic Degrees Committee of the State Council deliberated and adopted the

Several Opinions on the Establishment and Trial Operation of the Master of Business Administration Degree. Since 1991, the professional degree education system has been implemented, and the professional degree graduate education in our country has started since then. In March 2009, *Several Opinions of the Ministry of Education on the Training of Full-Time Master's Professional Degree Graduates* pointed out that the full-time master's professional degree graduate education is the need of the reform and development of degree and graduate education, and the training goal of China's master's graduate students will be changed from training academic talents to training application-oriented talents. In October 2020, the Academic Degrees Committee of the State Council and the Ministry of Education issued the *Professional Degree Graduate Education Development Program (2020-2025)*, which pointed out that the enrollment scale of China's professional master's degree graduate students will be expanded to about two-thirds of the total enrollment scale of master's graduate students in 2025, with the goal of cultivating high-level applied talents to proactively adapt to major national development strategies, industrial transformation and upgrading, and major needs for current and future talents. Up to now, China's graduate education disciplines have reached 14 categories, 117 first-level disciplines, 31 professional master's degree categories, with all categories offering professional degrees. Professional graduate education has entered a new era [3][4][5]. At the same time, the training mode of professional degree postgraduates and the construction of tutor teams also face new problems that need to be solved urgently.

2 Analysis of the current situation of professional postgraduate education tutor team

Education statistics released by the Ministry of Education show that from 2009 to 2022, the total number of postgraduate students in China increased from 449,000 to 1,103,500, with an increase of 145.77 percent, and an average annual increase of 11.21 percent. The number of graduate students enrolled in professional degrees will reach nearly 700,000 in 2022, nearly 10 times the number in 2009 [6][7].

For more than 30 years since the development of professional degree and master's education, each graduate training institution has carried out its own characteristic reform and practice by referring to the graduate training mode and management mechanism at home and abroad. The content of its reform practice is to highlight the characteristics of the industry, clarify the training objectives, and optimize the curriculum in accordance with the professional needs. In addition, the integration of production and education should be carried out to strengthen practical teaching, emphasize application orientation and enrich the forms of academic theses, establish and improve the dual tutorial system inside and outside the school, and improve the reasonable teaching and research evaluation system. The above achievements have accumulated rich experience for the sustainable development of professional master's degree education, and also reflected many problems in the relevant links of the current training mode [8-17]. Among them, the problems of single structure, heavy form and light substance in the construction of tutor team are particularly prominent.

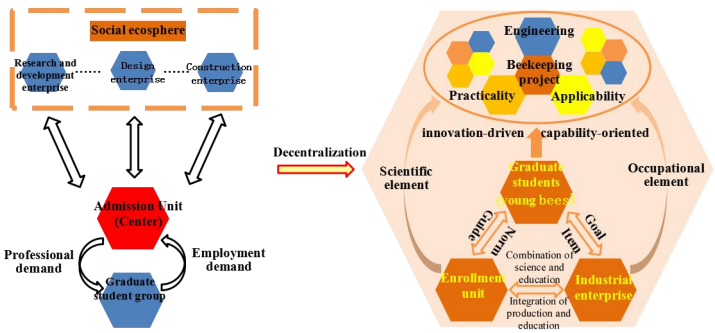
The most prominent problem in the training process of professional degree postgraduates is that the existing academic tutor team has a single structure, which is not fully competent for the training of application-oriented high-level specialized talents. Among the existing graduate training institutions, ordinary undergraduate schools are still in the main position. According to the 2021 education statistics released by the Ministry of Education, there are 827 graduate training institutions nationwide, of which 594 are regular undergraduate schools, accounting for 71.83%; There are 648,976 graduate students enrolled in professional degree programs, of which 646,136 are enrolled in regular undergraduate programs, accounting for 99.56%. The "double tutor" system has been implemented in the training of professional degree postgraduates, which mainly focuses on the guidance of on-campus tutors, with off-campus tutors participating in the guidance of practice process, project research, courses and papers, etc. At present, however, they only hire off-campus technical personnel from industries and enterprises to teach some short course hours, or part of professional courses, or

carry out academic lectures irregularly. The degree of substantive participation of external tutors in graduate training is not high. The main reasons lie in:

(1) There are "congenital deficiencies" in the construction of teachers in training institutions that started with academic graduate training. The teaching structure of ordinary undergraduate schools is relatively simple, and the academic teachers who "leave the school and enter the school" are in majority, while the application-oriented teachers with practical engineering background and industry experience are less. In addition, the teachers have a solid theoretical foundation, rich academic achievements, pay more attention to macro frontier issues, and most of the problems in the field of practice and application stay at the level of horizontal subject cooperation research, and the curriculum content is outdated, forward-looking and career-oriented, and cannot be connected with the vocational qualification system.

(2) External tutors have limited sources and less selectivity. The number of engineering and technical personnel in industrial enterprises is increasing year by year but tends to be stable. The number of "experts, scholars and professionals with rich experience in the field of practice" is far from meeting the needs of the training of professional degree postgraduates in terms of the number of tutors and academic attainments, which leads to the practice of graduate training becoming a mere formality. The technical content of the practice is not high, and the practice time is "shrinking" in disguise.

(3) The two mentors have different personnel affiliations and different benefit driving factors. The school tutor is the first person responsible for the training of professional degree graduates, and the quality of student training has strict and clear requirements in its unit evaluation system. However, the off-campus tutors are part-time in nature, and the training units have fewer assessment indicators and insufficient binding force. In addition, the salary of teachers outside the school is not attractive, and the driving factors of interest are few and not strong. Moreover, the work of the unit of the off-campus tutor is heavy, and the part-time guidance of professional degree postgraduates is often weakened, or even marginalized, and the participation degree is not high, naturally, can not produce "win-win" results.



traditional "chain" honeycomb

Fig. 1. Comparison of two graduate training modes

(4) The concrete implementation of the "double tutor" system is out of step with the original design intention. At present, the training process of professional degree postgraduates is still the main body of the enrollment unit, and the on-campus tutors are fully responsible for it. Off-campus practice and off-campus tutor guidance only stay in the form level, the connotation level has not yet realized the substantive organic combination of on-campus training and off-campus practice. Therefore, the content of practical and applied teaching will not be normal and timely. The topic selection of the dissertation completed by students deviates from the development of the industry and the needs of enterprises, and it is difficult to achieve scientific and technological research and achievement transformation.

3 Honeycomb theory and honeycomb model

The behavior of bee populations reflects the collective wisdom of survival, from unconscious to conscious, and the ability to unleash the potential of individuals at the grassroots level when there is no command from the top [18]. The practicality, accuracy and aesthetics of honeycomb structure are the result of survival of the fittest, maintenance of dominance and long-term evolution of core elements such as genes in the process of biological evolution.

The basic characteristics of the honeycomb model are demand-oriented, low-consumption and high-efficiency, and leap-forward development. There is no mandatory central control in the organizational structure, the sub-units are closely connected, and the influence between points forms a causal relationship through the network. The honeycomb theory also has reference significance for the innovation of training mode of professional degree postgraduates. Based on the honeycomb theory, the ecological circle for the cultivation of civil engineering degree graduates is established (Fig.1), which changes the traditional training mode of one dominant, closed and decentralized enrollment unit, and realizes decentralization, secondary autonomy and high connectivity. Honeycomb model aims to cultivate the practical innovation ability of professional degree graduates, implement it with an open mind, drive the integration of production and education with the social and economic benefits contained in scientific and technological innovation, and achieve multi-subject cooperation and win-win.

4 The construction and operation of mentor team in "honeycomb mode"

4.1 Replace two mentors with a team of mentors

In the "honeycomb" training model, professional degree students are trained by a team of supervisors, whose team members come from multiple subjects and disciplinary backgrounds involving multiple fields related to civil engineering. The tutors of the enrollment units are mainly teachers of major research directions, and teachers of basic sciences, as well as teachers in basic sciences, humanities and social sciences. Other members are mainly domestic and foreign scholars in related fields, as well as technical personnel in charge of construction enterprises. The team takes projects or tasks as the carrier to achieve cross-integration of knowledge, expand the source of teachers and forms of cooperation. The main functions of the mentor team are reflected in the following two main aspects. On the one hand, in terms of daily management, we will collectively discuss, formulate and improve the professional training program to adapt to the social and industrial requirements of the training of professional degree postgraduates, and participate in professional education, vocational education and engineering practice in combination with the tutor's personal research or professional expertise, and collectively participate in the assessment links such as proposal, mid-term assessment, pre-defense and defense. On the other hand, during the implementation of the project or task, the graduate students are specifically guided to carry out research work. During this period, the graduate students are responsible for the project and accept the assessment of the project team [19].

4.2 Establish a physical connection between multiple agents based on demand

At present, the participants and structure of scientific and technological innovation show the characteristics of multi-agent collaboration. As a construction enterprise, in order to develop to the high-end of the industry, it is inevitable to seek breakthroughs in the core technology field and increase investment to achieve the continuous pursuit of advanced technology. China's professional degree graduate education has entered a new stage of development. Training high-level applied talents to provide strong talent support for the transformation and upgrading of the construction industry and innovative development is a new demand for professional degree graduate training institutions, which guide multi-subject initiative, all-round and effective scientific and technological innovation activities. The traditional research-oriented segmentation management has been expanded to project-oriented matrix operation. With the help of project carriers, innovation-driven graduate students (bees) move autonomously among the "honeycombs".

4.3 To promote the integration and interaction between multi-agents in a cost-effective manner

Improving the ability of independent innovation and building an innovation-oriented country are the core of the national development strategy. Independent innovation, especially the independent innovation of enterprises, requires a large investment in human resources, material resources and financial resources, and has a high risk. From the perspective of professional degree graduate training, the traditional training institutions based on universities and research institutes cannot achieve large-scale capital investment like enterprises. In this case, along with the mutual needs of multiple subjects behind the tutor team members, the flow of graduate students (bees) among various "honeycombs" will inevitably lead to the initiative of multiple subjects to seek resource sharing and technology flow, so as to achieve multiple investment in graduate training, thereby reducing the input cost of individual subject talent training and technology development, and achieving maximum benefits. This is extremely beneficial to the development of enterprises, especially small and medium-sized enterprises.

4.4 Achieve sustainable development of multiple entities through win-win cooperation

Collaborative innovation is the most efficient allocation of resources. The number of graduate students enrolled in professional degrees is increasing year by year, the number and level of academic groups of training institutions are constantly improving, and the links between multiple subjects behind the members of the tutor team are becoming closer and closer. The honeycomb model is demand-oriented and cost-efficient, so that each component of the graduate training ecosystem operates autonomously and efficiently, providing timely and accurate feedback on information.. Enterprises have the highest market acuity, and can put forward technological innovation goals, provide practice platforms and professional needs around industry development and market demand, attract individual bees and bee colonies, and make a big honeycomb. Relying on the basic advantages of disciplines, enrollment units make full use of the resources of other subjects to increase the number of individual bees, do more to increase the number of large bee colonies, and jointly train professional degree graduates to achieve multi-subject sustainable development.

4.5 Project as the carrier to achieve the academic and professional unity of graduate training

Honeycomb model draws on the matrix organizational structure in management, and links the research direction of training institutions (universities, scientific research institutes) with the production or technical research projects of construction enterprises in vertical and horizontal forms with the project as the carrier. On the basis of learning subject knowledge, the training of professional degree postgraduates is completed through specific practice links to enrich professional practice content, strengthen practical teaching guidance, and strengthen the practical background of dissertation topic selection. In each stage of postgraduate training, vocational education should be gradually strengthened to improve their academic level and innovative ability. During the implementation phase of the project, deep cooperation and collaborative innovation will be promoted in practice by means of post and apprenticeship, so as to effectively improve the training quality of graduate students and realize the unification of academic and professional training of professional degree graduate students.

5 Conclusion

The "honeycomb model" of civil engineering master's degree training has changed the training model of one dominant, closed and decentralized enrollment unit, and has realized decentralization. This model aims at cultivating the practical ability of graduate students and replaces the double tutors with the tutor team to establish a physical connection between the multiple agents represented by the members of the mentor team and guided by needs. It promotes the mutual promotion and integration between multiple entities through cost-effectiveness, and realizes the sustainable development of multiple entities through win-win cooperation. "Honeycomb mode" relies on the project matrix to effectively implement and

promote the construction and operation of the tutor team, which is conducive to the unification of academic and professional postgraduate training.

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Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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