

Research on the Course System of Postgraduates with Professional Degrees Constructed by Colleges and Enterprises

Lei Wang, Xuhui Xia, Zelin Zhang*, Xiang Liu, Jianhua Cao

National Experimental Teaching Demonstration Center of Machinery in Wuhan University of Science and Technology, Wuhan, China

*Corresponding Author

Keywords: Schools and enterprises, Professional degree postgraduate, Curriculum system

Abstract: In view of problems of low enthusiasm of enterprises, backward practice teaching mode, lack of practical teaching teachers, and the disconnection between curriculum and practice in the course system for graduate students of professional degree co-constructed by schools and enterprises, this paper takes the promotion of professional competence as orientation, jointly guided by schools and enterprises, builds a practical teaching system of “individualized and modular” engineering, and establishes a “network teaching platform” combining virtual with practical teaching. In order to build a long-term mechanism and enhance the innovative and practical ability of professional degree postgraduates, we should build a “government-industry-university-research” innovation alliance, carry out curriculum evaluation and reform, and so on.

1. Introduction

The Ministry of Education and the Ministry of Human Resources and Social Security jointly issued the “Opinions on Further Promoting the Reform of Professional Degree Postgraduate Training Model” in 2013, which clearly set the goal of the reform as follows: “Taking the vocational needs as the guidance, focusing on the cultivation of practical ability, taking the combination of production and learning as the way to establish a professional degree postgraduate training model with Chinese characteristics that is compatible with the economic and social development [1].” Over the past few years, many domestic universities have carried out relevant research work and established a unique training mode. For example, the “six-oriented” mode of professional degree postgraduate education has been constructed in Shanghai, and the reform of professional degree postgraduate training mode has been pushed forward through the link between professional degree postgraduate education and professional qualifications [2]. On this basis, the models of “school-enterprise joint order, school-enterprise collaboration 3+1+2, 0.5+1+0.5 Learning-Practice integration” are constructed [3]. These models aim at serving the needs of the industry, take training students' professional ability and accomplishment as the basis, build curriculum system around “career development” to form the knowledge system needed for Vocational requirements, adhere to the practical orientation of teaching mode, give orientation to “professionalism” and “applicability” of professional degree postgraduates, and train a large number of national and local economic and social development high-level applied talents.

In 2018, the State Council Academic Degree Committee's Guiding Opinions on Formulating the Training Program for Engineering Master's Degree Postgraduates (Degree Office No. 14) pointed out that the curriculum system of professional degree postgraduates should embody advanced, modular, complex, engineering and innovative, and meet the needs of social diversity and the requirements of students' personalized training. The curriculum should be guided by engineering needs, emphasize the comprehensive cultivation of professional foundation, engineering ability and career development potential, and emphasize the synergistic advantages of online teaching, case teaching and practical teaching [4]. At present, there are still a series of problems in the course of the construction of the curriculum system for the joint training of Postgraduates between schools and enterprises. The atmosphere of pluralistic participation in the construction of the practical

curriculum system has not yet formed. The teaching staff with rich practical experience and high theoretical level in enterprises are uneven. The curriculum resources suitable for the actual production of enterprises are relatively scarce. The strength of promoting practical teaching by means of modern information technology is insufficient. Exploring the new mode of the course of benign interaction and mutual benefit and win-win cooperation between school and enterprise actively, aiming at building characteristic courses through school and enterprise, which can not only train students' basic vocational skills through the design of post ability courses, but also train students' professional quality through the design of basic quality courses in the industry, so as to enhance the professional competence and innovative practical ability of professional degree postgraduates. In addition, it can strengthen the deep integration of industry, education and research between enterprises and schools, so that the co-construction curriculum can really integrate into the local industrial chain and play a role in the enterprise entities of regional economy.

2. Problems in the Course System of School-Enterprise Co-Construction

2.1 Inadequate Multi-Participation

In the course of implementing the curriculum system based on school-enterprise cooperation, enterprises are required to provide manpower for schools to participate in school teaching design, curriculum development, practical teaching, student guidance, and so on. At the same time, enterprises are also required to provide support and cooperation in such aspects as site, equipment and post for students' practice. Accordingly, in order to survive and develop, enterprises themselves aim at pursuing economic benefits, and enterprises will also require reciprocal returns in the process of cooperation. Schools are often difficult to meet the requirements of enterprises, and they are generally not very enthusiastic about school-enterprise cooperation in the construction of practical courses. The lagging or inadequate implementation of the government's policy on the co-construction of postgraduate courses between schools and enterprises, inadequate investment in funds, and the unwillingness of tutors in schools to send postgraduates to enterprises are all factors that restrict the co-construction of the curriculum system between schools and enterprises.

2.2 Lack of Practical Teaching Teachers

Guidelines on the Development of Postgraduate Training Programs for Engineering Master's Degrees (Degree Office No. 14, 2018) indicate that joint school-enterprise courses, case courses and vocational literacy courses can be carried out in training units or enterprises. Teachers can be enterprise engineers or teachers from universities. Enterprises have a large number of employees with rich practical experience. They are familiar with the working process, have rich practical experience and solid skilled technical skills, but lack of theoretical ability. They are relatively inadequate in graduate teaching design, teaching methods, teaching skills, guidance methods and so on. There are some problems, but there is a general lack of practical experience. The expanding scale of professional degree postgraduate training also makes this contradiction more prominent [5].

2.3 The Curriculum is Not Closely Related to Practice

On the one hand, the curriculum design and training process of professional degree postgraduate practical courses offered by many colleges and universities are similar to that of master of engineering. On the other hand, the curriculum is highly theoretical and divorced from practice, and seriously lags behind the needs of economic and social development. The practical needs from work practice can't be integrated into the curriculum content in time, and can't truly reflect the engineering demand orientation of professional degree postgraduate curriculum. It is difficult to achieve the comprehensive training goal of combining professional foundation, engineering ability and career development potential of professional degree postgraduates [6].

2.4 Outdated Methods and Methods of Practical Teaching

At present, in the course of practical teaching, the teaching mode is single, with the teacher as the main lecturer and the teaching content unified. Then the actual demand of professional degree

postgraduate training is individualized, pluralistic and small batch. It is necessary to customize the modular curriculum content for different groups of people to meet the needs of training different application-oriented talents. At the same time, some online courses have been established. However, many curriculum resource platforms have the problems of difficult updating, poor interaction and less use. It is necessary to build a new network learning model to solve the problems of resource construction, resource sharing, resource utilization, resource integration, resource renewal and resource optimization, and to give full play to the initiative of graduate students' network independent learning [7].

3. Major Model of Course Construction by School and Enterprise

There are three modes in the course of school-enterprise co-construction: university-led, enterprise-led and university-enterprise-led [8].

3.1 University-Led

This mode is dominated by University power, and the participation of enterprises is in a subordinate position. Enterprise experts are consulted in the formulation of professional degree postgraduate training system. Enterprise experts are invited to teach or guide the course implementation process. Teaching activities and places are mainly carried out in schools. Teachers in schools are engaged in theoretical teaching. The courses are basic courses of subjects and professional theory courses. The contents of teaching mainly include basic theoretical knowledge and professional theoretical knowledge that students must master. Enterprise technicians are engaged in practical teaching. In the process of teaching, teachers can lead students to enterprises according to the application part of courses. Industry visits related equipment and principle application.

3.2 Enterprise-Oriented

This model is mainly based on enterprise power, with the cooperation and participation of colleges and universities. Course teaching activities and venues are fully carried out in enterprises, and enterprise personnel act as teachers to achieve the guidance and training of students. With the needs of enterprises as the first goal, the curriculum and practical arrangement are all skills to meet the needs of enterprises. Enterprises put forward topics according to production practice. Teachers carry out teaching according to topics. Case teaching or design is carried out through targeted topics. Design demonstration, data search, investigation and research are carried out around the specific requirements of the subject. Through theoretical analysis, simulation modeling, actual production, testing and debugging, and then test and improve in the actual production environment of enterprises until the requirements of enterprises are met. This is the case.

3.3 Co-Dominant

This mode of cooperation between enterprises and universities in a reciprocal manner, training objectives and curriculum settings have been thoroughly agreed upon by both sides, both sides have the right to decide. School-enterprise co-construction curriculum is the main component of curriculum construction, which is jointly participated by universities and enterprises. Enterprise experts and university teachers cooperate with each other to improve the curriculum construction in Colleges and universities. The curriculum development and construction should be based on the full investigation of enterprises and students, convening interviews with enterprise experts, analyzing the job content of talents and job groups needed by enterprises, and identifying posts. Professional knowledge and accomplishment required by the group. In the course of teaching, theory and practice go hand in hand. Students should learn both theoretical knowledge and practical skills. The theoretical course is completed in school, the practical course is completed in enterprises, and the implementation of the course plan is completed by enterprise technicians and school teachers.

By integrating the resources owned by schools and enterprises, cooperating with each other and complementing each other, the model integrates teaching, production, training, technology

development and service functions, and integrates teaching, learning and doing, which is conducive to strengthening school-enterprise cooperation, improving the level of integration of production, learning and research, and realizing the sharing and complementarity of superior resources between schools and enterprises.

4. The Construction Path of School-Enterprise Cooperation Curriculum System

School-enterprise cooperation and co-construction of curriculum is an important support for training high-level application-oriented talents. In order to meet the diversified needs of the society and the requirements of personalized cultivation of students, it is necessary to build a personalized practical teaching system and give full play to the advantages of online teaching and independent learning through the new network learning model.

4.1 Building a “Personalized and Modular” Practical Teaching System

Guided by the demands of engineering, emphasizing the professional basis, engineering ability and career development potential, build “personalized, modular” of professional degree graduate practice teaching system (figure 1), in order to graduate workstation (graduate internship practice base) as the carrier, from product design, development, manufacturing to seek solutions to the correspondency of enterprise technical problems; Considering the individual characteristics of graduate students, the course system that focuses on vocational needs, the course module that focuses on practical links, and the teaching model that focuses on practical guidance are established to tailor the course module for professional degree graduates. With the goal of enhancing the professional development ability of professional degree graduates, we develop a unique training program for each graduate student to highlight professionalism, practicality and professionalism.

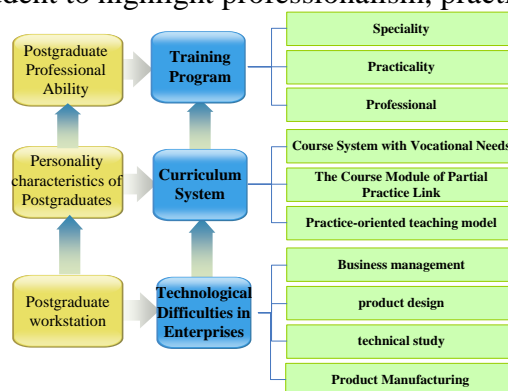


Figure 1 Practical Teaching System for Professional Degree Postgraduates

4.1.1 Perfect the Training Program Combining Theory with Practice

According to the reality of the enterprise needs, enhancing university-enterprise fusion, to build the integrated production and education practice base, student internship with field type, participate in enterprise production and development, to professional demand as the goal, the practical application oriented, with comprehensive qualities and the improvement of application of knowledge and ability as the core, “professional” and “professional”, to adapt to the enterprise actual work needs of specific profession or position, take the initiative to adjust the training plan, highlight the “personalized” train culture characteristic, fully arouse the enthusiasm of enterprises to participate in training program design and the inherent requirement of training objectives and the organic combination of the knowledge structure needed for talent. In terms of course setting, teaching process and requirements of degree thesis, it emphasizes practicality, emphasizes the improvement of professional quality of talents, cultivates students' thinking and ability of insight into problems, design schemes and solving problems, and trains talents oriented for enterprises. Pay attention to the practical training links, arrange students to participate in scientific research projects, especially those cooperating with enterprises, and deepen the specific links of production management and implementation.

4.1.2 Establish a Curriculum System That Meets the Actual Needs of Enterprises and Career Development

Curriculum is the main carrier of professional talent training. Teachers and enterprise experts work together to analyze the curriculum, develop the syllabus, incorporate vocational elements, design teaching links, study teaching programs, and put forward quality standards and assessment methods. The school-enterprise co-construction course can be the core course required by the major, or an experiential, practical and comprehensive course, and it can also be the guidance course for enterprises to survive and develop in the fierce market competition. To cultivate students' vocational ability and the quality as the standard, around the “career development” constructing curriculum system, form the job requirements, the required knowledge system, establish a practical application oriented enterprise course, fit enterprise actual demand and the demand of society to the greatest extent, solve the practical problems of enterprises and social hot issues, according to the practical ability training requirements, use the form of combining theory and practice, building modular curriculum system of enterprise, each module is composed of multiple and enterprise management, design, development, manufacturing and other related work content of sub modules. During the period of engineering practice in enterprises, the graduate students can selectively participate in the teaching practice of each sub-module according to their actual situation and future project needs under the guidance of their tutors, so as to realize the systematic cultivation and improvement of their engineering practice ability, analysis and problem-solving ability, and technological innovation ability of professional degree graduates.

4.1.3 Reform of School-Enterprise Co-Construction Curriculum Teaching Mode

Guided by the working process and taking the knowledge needed in the work as the teaching content, the study task is formulated for the students to cultivate and exercise their innovation ability and practice ability, guide the students to combine theory with practice, and shorten the distance between the students and the enterprise. Carry out the teaching mode reform of “fixed classroom in school + mobile classroom in enterprise + simulation teaching in school and enterprise”. The fixed classroom teaching in school mainly includes series lectures of enterprise mentor group, theory teaching and experiment training of teacher group, practice training and practical guidance of part-time teacher group. Enterprise flows in the classroom on the one hand, teacher credentials the exercise regularly into the enterprise study, study regularly communicate with enterprises and technical personnel, on the other hand, a graduate student with a mission to create positions internship, to participate in the activities of production, etc., will be the real production learning as a carrier of learning situation, grasp the new equipment, new technology, new skills and practice and application of the cutting-edge technology; School-enterprise simulation teaching refers to deepening cooperation with enterprises for the links of complex production system and harsh environment. The teaching process simulates the production and operation process of enterprises, and creates a simulation teaching environment by means of simulation situation and digital simulation.

4.2 Build a “Network Teaching Platform” Combining Virtual with Reality

Building multi-level modular network teaching platform (as shown in figure 2), to achieve “in class and after class”, “mix” all-weather free learning mode dominated by students, rich teaching resources, implementing open teaching, fully embody and meet the personalized needs of graduate students and provide the information resource service, interactive services, practice teaching, the learning process service, teaching evaluation, etc.

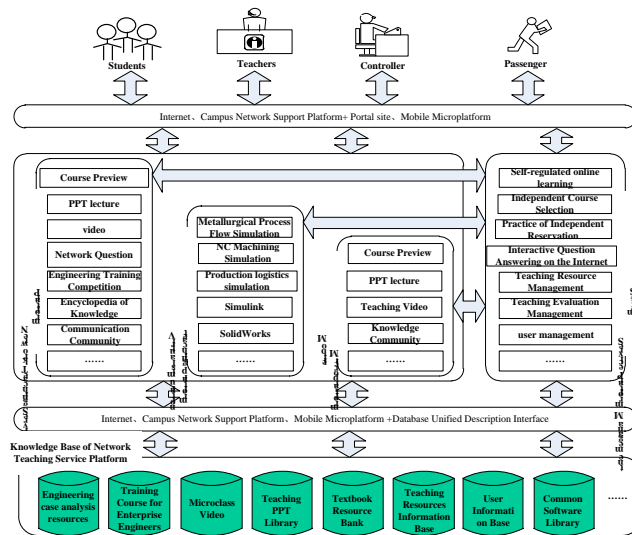


Figure 2 Sketch of “Network Teaching Platform” Which Combines Virtual with Reality

4.2.1 Enrich the System of Practical Teaching Resources

Closely combine with business management, design, development, manufacturing and other work links to establish curriculum resources in line with professional degree graduate students' career development and personality characteristics, including textbook resources, course teaching PPT resources, micro-course video resources, corporate engineer training course video resources, engineering case analysis resources, etc. The forms include animation, micro video, training video, presentation, e-book, virtual training system, real-time learning feedback, etc. According to the requirements of school-enterprise cooperation projects, various resources are closely organized according to the teaching units. Each teaching unit is decomposed into a small and complete entry point, so as to make the focus of each teaching process as small as possible to reflect the practicality of teaching content and task.

4.2.2 Build a Pluralistic and Open Teaching Model

The teacher resources and practice mode are open to the society, and the teacher database, project database and teaching resource database are constructed. Carry out the reform of the teaching mode of “teaching, learning and doing”, and realize the socialization of training, content and assessment. By students, teachers, domain experts to fully participate in the teaching of the course content design, collection of teaching resources, teaching method reform and curriculum assessment scheme designing, university-enterprise cooperation characteristics of blended learning virtual community, the formation of “platform” operation, management and evaluation of normalized according to the feedback of information, in turn, promote the teaching mode, teaching resources, teaching content, teaching environment and teaching evaluation reform.

4.2.3 Realize Independent Learning Mode

Through independent, autonomous choice of online learning course module, independent practice an appointment time, answering questions online communications and a series of learning process, to achieve “in class and after class”, “mix” all-weather free learning mode dominated by students, do knowledge, in-class internalized practice before class, after class, application of actual combat, eventually to promote collaborative learning way real-time interactive teaching process and the production process, passive knowledge receiver into a graduate student from the classroom education virtual community actively explore learners.

5. The Guarantee Mechanism of Course System Constructed by School and Enterprise

The curriculum system of school-enterprise co-construction should strengthen the construction of double-qualified team, strengthen the positive interaction between school teachers and enterprise

experts, ensure the effective implementation of the co-construction curriculum through the multi-linkages of government, enterprises and universities, and strengthen the evaluation and assessment, so as to provide guarantee for the co-construction curriculum.

5.1 Co-Construction of Double Teachers Teaching Team

The essence of school-enterprise cooperative curriculum construction is the deep cooperation between schools and enterprises. Through building a team of full-time and part-time teachers, developing courses jointly, enterprises participate in the whole process of curriculum development and teaching management, thus achieving seamless docking of curriculum content and professional posts. The teaching team of the co-construction course is composed of school teachers and enterprise experts. All full-time teachers have enterprise experience and industry qualifications, and all enterprise experts have the qualifications of trainers or lecturers issued by the enterprise personnel department. The curriculum team should strive for a reasonable allocation of “double-teacher” structure, the proportion of full-time and part-time teachers, knowledge structure and professional and technical positions. The overall arrangement must conform to the “double-teacher” structure. Based on the standard of double-qualified teachers who possess both theoretical and practical teaching abilities, we should really build an excellent team of double-qualified teachers with both excellent theoretical knowledge and strong practical ability, strong teaching ability and high comprehensive quality.

The school dispatches teachers to participate in the production, operation and development of enterprises and arranges teachers to participate in the production, operation and project development of enterprises. Arrange the backbone of enterprises to serve as part-time teachers in schools. Arrange the backbone of enterprise front-line technology to serve as part-time teachers in schools. Enterprises send front-line experts to participate in the construction of guiding courses, learn the concept of teaching reform, advanced teaching methods, and participate in teaching seminars; By means of one-to-one combination, the exchange between schools and enterprises should be strengthened, the comprehensive quality of teachers should be improved, and the advanced technology and business information of enterprises should be applied to teaching in time. In addition to the overall curriculum design from a macro perspective, enterprise experts also need to formulate curriculum standards and evaluation criteria with professional competence. School teachers and business experts also need to revise curriculum standards in time and constantly improve the curriculum content system according to the actual situation of curriculum research and curriculum teaching.

5.2 Build a Practical Innovation Alliance

Adhering to the government-led policy is to promote the construction of the practice base for graduate students in the mode of “government-industry-university” alliance, and to provide effective practice posts, projects and guarantee conditions for graduate students with professional degrees. On the one hand, the government creates conditions for enterprises and universities to build practice bases independently, spontaneously and consciously. At the national level, it is necessary to provide guidance on the strategic planning and operation management of the construction of professional degree postgraduate education practice base, and to provide support in many aspects, such as scientific and technological innovation, talent introduction, tax reduction and exemption. On the other hand, the government should play the role of top-level design in serving local economic development, give full play to the role of government organization and coordination, actively link local enterprises and universities, and build a certain scale of practice base similar to “industrial park” cluster, which can accommodate a number of different disciplines, different levels and different categories of professional degree graduates.

In the alliance of practice bases, the government should take the lead in establishing the mechanism of stakeholder benefit-sharing by insisting on the overall coordination of the government. According to the principle of “complementary advantages, resource sharing, mutual benefit and win-win, collaborative innovation”, a multi-integrated curriculum co-modeling model is constructed to meet the needs of alliance and internal development, such as personnel training,

scientific research, social services and so on. Schools and enterprises need to sign cooperative agreements on curriculum construction, determine the purpose of curriculum construction, clarify the rights and obligations of both sides, and attach operable high-quality curriculum development programs. While schools and enterprises jointly build high-quality courses, they should also have a deep understanding of the course content, describe the necessity and feasibility of building high-quality courses, and clarify the implementation steps, responsible persons and completion time nodes in the course of course construction.

5.3 Comprehensive Evaluation and Assessment of Co-Construction Courses

Under the background of Industry-University-Research Cooperative education, the curriculum constructed by school-enterprise cooperation should have a matching evaluation system and evaluation mechanism. The evaluation should be in line with enterprise standards and social needs, provide impetus for curriculum innovation and reform, establish assessment criteria with comprehensive professional quality as the core, and evaluate the curriculum by combining the evaluation of school teachers and enterprise experts.

Actively carry out the reform of teaching methods and assessment methods, constantly improve the curriculum evaluation system, and ultimately achieve the renewal and improvement of curriculum syllabus, curriculum content, curriculum resources and teaching assessment program, and improve the training quality and teaching effect of applied talents.

Establish a result testing mechanism, apply the known results to teaching practice, test the results of students' ability test through students' feedback, objectively and scientifically evaluate the advantages and disadvantages of the construction and development results, and further improve the construction of high-quality courses.

6. Summary

This paper summarizes that the curriculum system of professional degree postgraduates meets the needs of diversified society and personalized cultivation of students. The curriculum should be guided by engineering needs, emphasize the comprehensive cultivation of professional foundation, engineering ability and career development potential, and pay attention to giving full play to the advantages of online teaching. There are many problems in the course of school-enterprise co-construction, such as insufficient multi-participation, lack of practical teaching teachers, lack of close connection between curriculum and practice, outdated methods of practical teaching, etc. The course system of school-enterprise co-leading construction can realize the sharing and complementarity of school-enterprise superior resources. Through the construction of "individualized and modular" practical teaching system, the establishment of "network teaching platform" combining virtual and practical, the path of school-enterprise cooperative course system construction is followed, the construction of double-teacher team, the construction of "alliance" of practical innovation, and the comprehensive evaluation of cooperative course construction are carried out to ensure the establishment of a long-term mechanism and enhance the innovative practical ability of professional degree postgraduates.

Acknowledgement

This work was supported in part by the Provincial teaching research project of Hubei higher education (No. 2018252, 2018254), and University-level teaching research project of Wuhan University of Science and Technology (No. Yjg201801, 2017X062, 2018Z004).

References

[1] YU Liting, LU Keping. Research on the Program Design of School Enterprise Co Construction under the Background of Cooperative Education of Industry, University and Research --- In Transportation Management Course as an Example. LOGISTICS ENGINEERING AND

MANAGEMENT, 2018(4), 178-180.

[2] BAI Qiuchan, ZHENG Rongjian. On the curriculum of school enterprise co construction in Local Engineering Colleges. *Asia-pacific education*, 2016(32)19.

[3] XU Dong. A Practical Study on the Construction of Key Curriculum Resource Platform by School and Enterprise Based on Blended Learning. *CHINA ADULT EDUCATION*, 2015(9):122-124.

[4] WANG Yingzhe. The Development and Design of the School-enterprise Construction Course under the Modern Apprenticeship System. *The Guide of Science & Education*, 2018(7):32-33,103.

[5] SU Tonghua. The Innovative Experimental Course Construction System of School Enterprise co Construction Mode. *Computer Education*, 2017 (8):173-177.

[6] LI Yangmei, YANG Xiling. Research on the Development of University Enterprise Cooperation Course in Applied University. *KEJI JINGJI SHICHANG*, 2018(3): 160-161.

[7] ZHANG Jiangong, YANG Chen, HUANG Lijuan. On University-Enterprise “Fit-to-purpose” in Terms of Practical Ability of Full-time Master Students of Engineering Based on Enterprise Demand. *Journal of Graduate Education*, 2016(6): 73-79.