Journal of Education and Educational Research
ISSN: 2957-9465 | Vol. 2, No. 2, 2023

Research on the Cultivation System of Innovation Ability of Postgraduates with Master's Degree in Engineering

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Abstract: As the main source of high-quality innovative and application-oriented talents in China, the scientific and rational nature of the training system of master's degree in engineering directly affects the quality of Chinese engineering talents. In order to solve the problems existing in the training objectives, teaching models, curriculum settings, degree awarding and other aspects of the engineering master training system, the paper studies the innovation ability training system and mechanism of the engineering master professional degree graduate students from three aspects: the design of the innovation ability training structure of the Chinese engineering master graduate students, the empirical analysis of the innovation ability quality structure of the engineering master graduate students, and the reform suggestions of the innovation training system of the engineering master graduate students, Clearly define the basic concepts such as the innovation ability quality of the engineering master, analyze the innovation ability training of the engineering master professional degree graduate students by using the big engineering concept and competency theory, and enrich the theoretical basis of the research on the innovation ability quality structure of the engineering master professional degree graduate students.

Keywords: Master of Engineering; Professional degree; Innovation ability; Training mechanism.

1. Introduction

From Comrade Deng Xiaoping's proposal that "science and technology are the first productive forces" to rejuvenating the country through science and education, from the innovation-driven development strategy to the innovation of the new era is the first driving force to lead the development, the innovation-driven is the destiny of the country, the scientific and technological innovation ability is the core support for the development and progress of the country, the key to innovative development is to cultivate innovative talents, and the key to cultivate innovative graduate talents is the innovation ability training system and mechanism.

To innovate in China, it is necessary to vigorously cultivate comprehensive engineering talents with solid scientific foundation, strong engineering practice ability, high comprehensive quality and international competitiveness. In the new era and new engineering, we need not only senior engineers who understand technology, but also innovative talents with innovative thinking, innovative spirit and innovative potential. Such talents should not only realize scientific and technological innovation and promote scientific and technological progress, but also have the sense of "mind the motherland and look at the world" and international vision, And it can gradually grow into a big country craftsman with the comprehensive quality of "being brave to assume responsibility and pursuing excellence" and the awareness of law, engineering ethics and ecological awareness.

There are a lot of documents about the research on the competence structure, training system and training mode reform of engineering masters in the United States, the United Kingdom and other engineering education developed countries. This part of the document mainly summarizes the development process of the training system of engineering masters, analyzes the competence structure of engineering masters and the mature experience and enlightenment of training, and provides more suggestions for the reform of the training system of engineering masters in China. In terms of the research on the cultivation of master of engineering in the United States, it is found that the cultivation system of master of engineering in the United States is based on quality by summarizing the literature. In terms of the research on the training of engineering masters in the UK, many scholars pointed out that the training system of engineering masters has diversified characteristics. In the research of Japanese engineering master training, it is found that its engineering master training system is based on the industry-university-research model by combing the literature.

In 2009, China launched the recruitment and training of full-time professional master's degree candidates, and also included new undergraduate graduates in the enrollment of engineering master's degree candidates. Since then, the training objects of engineering master's education have changed and the training standards have been further improved. After more than 20 years of development, China's engineering master graduate education has established a relatively complete training system. However, with the development of the times, the engineering master graduate education is facing new problems such as "short training orientation, lack of value recognition", "identical curriculum settings, false double tutor system", "lack of practical training, single paper form", specifically in the setting of training objectives, It failed to reflect "high goals, big patterns and strict requirements", and failed to highlight the requirements of engineering ethics, craftsmanship and social responsibility; There is no institutional guarantee in the teaching mode; In the construction of practice base, the actual needs of practice teaching are not met, and the effect of students' practice is difficult to guarantee; In terms of training characteristics, it fails to reflect the engineering, practical and professional nature of engineering master education; In terms of mentoring, the two-mentor system has not been fully implemented, and

the training responsibilities of corporate mentors have been weakened; In terms of school-enterprise joint training, there is a lack of in-depth and continuous cooperation and sharing mechanism; In terms of degree standards, the standard of engineering master degree lacks the inspection and evaluation of the practical ability of engineering master students. These problems highlight the urgency of the reform of the training system for engineering master students. In order to improve the quality of postgraduate training, further serve the needs of "Made in China 2025", the national innovation-driven development strategy, and the construction of a world power in science and technology, it is necessary to carry out research on the system and mechanism for cultivating the innovative ability of graduate students with master's degree of engineering, and improve the innovation training system of master's degree of engineering, which has certain practical significance for deepening the current comprehensive reform of master's education.

2. Research content

As the main source of high-quality innovative and application-oriented talents in China, the cultivation of master's degree in engineering has a direct impact on the quality of engineering talents in China. In order to solve the problems in the training objectives, teaching models, curriculum settings, degree awarding and other aspects of the engineering master training system, this paper studies the innovative training system and mechanism of engineering master graduate students.

(1) This paper analyzes the current situation of the innovation ability training system and mechanism of China's engineering graduate students. 1) In terms of the development process and reform measures of China's engineering master education, the development process includes four stages: the exploration period, the starting period, the stable development period, and the prosperity period of the engineering master education. The reform measures include the establishment of the National Engineering Master Professional Steering Committee, the addition of the engineering field admission system, and the formulation of the engineering master professional degree standards; 2) In terms of the requirements and characteristics of the ability and quality training of China's engineering master, this paper analyzes the development planning, guidance and other policy texts of the relevant engineering education issued by the State Council and the Ministry of Education, and summarizes four characteristics, namely, the emphasis on the application of training objectives, the emphasis on the foundation of curriculum setting, the implementation of the dual-supervisor system, and the emphasis on the combination of production and learning in the training mode; 3) In terms of the main problems existing in the cultivation of the ability and quality of the Master of Engineering, it is summarized that "the cultivation orientation is short, the value recognition is insufficient, the educational attributes and objectives of the Master of Engineering are lack of conceptual support", "the curriculum setting is identical, the double-tutor system is false, the quality of the theory and practice of the Master of Engineering is lack of mechanism guarantee", "the lack of skills and practice, the lack of participation in research and development, the lack of professional competence of the Master of Engineering" and other problems.

(2) Summarize the concepts, theories and thoughts related to the system and mechanism of cultivating the innovative ability of engineering master's degree graduates.

The summary of the concepts, theories and thoughts related to the system and mechanism of cultivating the innovative ability of engineering master students mainly includes: 1) related concepts, such as the concept and composition of ability, the meaning and characteristics of quality; 2) In terms of theoretical basis, the concept of big engineering includes the basic overview and its theoretical composition (big professional quality, comprehensive ability and engineering ethics), and the competency theory involves the definition of competency, the competency structure model (the basic model of competency, the construction method of the model); 3) In terms of engineering education thoughts, including those of the United States, Europe and Japan.

(3) A Study on the Competence and Quality Structure of Innovative Postgraduates of Master of Engineering

The academic circles mainly focus on the basic ability, professional ability and comprehensive ability. Zhang Jiangong and others built an evaluation model and measurement scale for the practical ability of the Master of Engineering based on the needs of enterprises, divided the ability structure into basic practical ability, professional practical ability and comprehensive practical ability, and further clarified that basic practical ability consists of learning ability, communication and cooperation ability, etc; Peng Shuolong and other researchers pointed out that further attention should be paid to the cultivation of information processing and learning ability, engineering communication and application ability. Ma Shihong has constructed the framework of engineering master's practical ability from the perspective of industrial demand, and divided the engineering practical ability into five aspects. Few scholars start with the fundamental issue of "what kind of master of engineering is qualified for master of engineering", which makes their research premise less sufficient.

The ability and quality structure of the innovative postgraduate students of the Master of Engineering mainly includes: 1) the structural design of the innovative ability of the Master of Engineering under the concept of large engineering, including the four major divisions of major engineering fields (industry classification, occupational classification, professional classification, discipline classification), seven major engineering fields and three training objectives; 2) The competency structure design of engineering master based on competency theory includes the establishment basis and competency structure.

(4) A Study on the Cultivation of Innovation Ability and Quality of Engineering Postgraduates

The training goal is the premise of the existence of engineering master's graduate education, and is an important symbol to distinguish other types of graduate education. Yuan Bentao, et al., taking the training of master of mechanical engineering as an example, proposed that the training objectives of master of engineering should be guided by clear post competence and professional qualifications. Li Mengjiao pointed out that the training of engineering master's degree should strengthen the training of practical ability. Some studies have emphasized that the training objectives of the Master of Engineering should highlight professional ability or practical ability, and less attention has been paid to the requirements that the training objectives should cover engineering ethics, craftsmanship spirit, and social responsibility, which are the most important quality to become a qualified Master of Engineering.

The empirical analysis of the quality structure of the innovation ability of the engineering graduate students mainly includes 1) the questionnaire research for the graduate students, including the exploration of the quality structure of the engineering graduate students, and the construction of the structural equation model; 2) The in-depth interview analysis of experts includes the establishment of interview objects, the design of interview outline and the analysis of interview results.

(5) Research on the construction of the supporting conditions for the cultivation of the innovative ability and quality of engineering master students

Tutors play an important role in the process of graduate education, and also affect the ability and quality cultivation of engineering masters. There is a certain particularity in the construction of the tutor team of engineering master's graduate students - double tutor system. The existing literature points out that the two-mentor system has not been fully implemented and the responsibilities of corporate mentors have been weakened. Zhang Xiaoli pointed out that the "double tutor system" of Chinese professional degree graduate students has not fully played its practical role, and the internal and external communication and interaction mechanism is not smooth, and proposed to improve the implementation of the "double tutor system". The cultivation of the ability and quality of engineering master students' needs a relatively special platform. Many scholars focus on the research of "the construction of the joint training base of production, education and research", pointing out that the establishment of the joint training base can make up for the lack of practical ability cultivation of engineering master students and other beneficial aspects, but they pay less attention to how to establish an in-depth and sustainable cooperation and sharing mechanism.

3. Conclusion

Based on the concept of big engineering and competency theory, this study explores the reform of engineering master training, and constructs the training standards for engineering master graduate students, including the requirements of knowledge, quality and ability. According to the training standard of engineering master and the current situation of China's engineering master graduate education, we should make some thoughts from the following aspects: "pay attention to engineering ethics education, strengthen the cultivation of modern craftsman, improve engineering professional quality", "strengthen the supply of knowledge and skills, improve the dual-qualification guidance mechanism, improve engineering practice ability", "target the professional competence demand, encourage the development of research and application, and improve employment and entrepreneurship ability", Make some suggestions. That is, "one initial intention, one main line and two penetrations", adhere to the initial intention of cultivating excellent engineering talents for the country, adhere to the main line of service demand and improving quality, and adhere to the student-oriented and cross-integration throughout the whole process of engineering master training. The main conclusions are as follows:

(1) This paper clearly defines the basic concepts such as the innovation ability quality of the engineering master, analyzes the innovation ability training of the engineering master professional degree graduate students by using the big engineering concept and competency theory, and enriches the theoretical basis of the research on the innovation ability quality structure of the engineering master professional degree graduate students.

(2) Based on the structural equation model, this paper probes into the system and mechanism of cultivating the innovative ability of Chinese master of engineering graduate students, and expands the application of this method in graduate education research.

(3) This thesis can start with the fundamental issue of engineering master education, "what kind of engineering master is qualified".

(4) This paper combs the current situation of the cultivation of the innovative ability quality of China's engineering master graduates, summarizes the system and mechanism of the cultivation of the innovative ability quality of China's engineering master, and summarizes the main problems in the cultivation of the innovative ability quality of China's engineering master.

(5) This paper designs the innovation ability system of Chinese engineering master's degree graduate students, carries out empirical analysis, and puts forward specific methods and institutional suggestions such as "paying attention to the education of engineering ethics, strengthening the cultivation of modern craftsmen, improving the engineering professional quality", "strengthening the supply of knowledge and skills, improving the dual-qualification guidance mechanism, and improving the engineering practical ability", "benchmarking the demand for professional competence, encouraging the development of research and application, and improving the employment and entrepreneurship ability", It provides a reference for deepening the reform of innovation education for Chinese engineering master students.

4. Reform effect and suggestions

(1) Design the system and mechanism structure of innovation ability training for Chinese engineering master students.

1) The ability and quality structure design of master of engineering under the concept of large engineering includes four major divisions of major engineering fields (industry classification, occupation classification, specialty classification and discipline classification), seven major engineering fields and three training objectives; 2) The design of the competency structure of engineering master based on the competency theory includes the establishment basis (the competency characteristics of knowledge, skills and attitudes, the general talent standards for the education and training plan of outstanding engineers, etc.), and the competency structure (two major knowledge requirements, three major quality requirements, and five major capacity requirements).

(2) Carry out empirical analysis on the structure of the mechanism for cultivating the innovative ability of engineering master students.

1) The research of questionnaire survey for graduate students, including the exploration of the ability and quality structure of engineering graduate students (exploratory factor analysis, ability and quality structure measurement), the construction of structural equation model (confirmatory factor analysis and path analysis, the analysis of the relationship between observation variables and latent variables, and the analysis of the relationship between exogenous latent variables), Ordinal regression analysis (parallel line test and model fitting results, parameter

estimation results of Ordinal model); 2) The in-depth interview analysis of experts includes the establishment of interview objects, the design of interview outline and the analysis of interview results.

(3) Put forward reform suggestions for the training system of engineering master's degree. The reform suggestions mainly include "paying attention to the education of engineering ethics, strengthening the cultivation of modern craftsmen, and improving the engineering professional quality", "strengthening the supply of knowledge and skills, improving the guidance mechanism of double teachers, and improving the engineering practice ability", and "benchmarking the professional competence demand, encouraging the development of research and application, and improving the employment and entrepreneurship ability"; The research summary includes research limitations and prospects.

Acknowledgments

The paper supported by Shanxi Province graduate education and teaching reform project "Research on the cultivation of innovative ability of graduate students with master's degree in energy engineering" (No.: 2021YJJG332); The teaching reform and innovation project of Shanxi Province's colleges and universities "Research on the construction of virtual simulation experiment teaching platform system for mining engineering specialty under epidemic prevention and control" (No.: J20221158).

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