

Reform of Cultivation Mode of Innovation Practice Ability of Mining Engineering Major Under the Belt and Road —Take Wuhan University of Science and Technology as an Example

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Abstract: Mineral resources development is an important part of the Belt and Road strategy. As a result, mining engineering students shoulder the important mission of mining development. To achieve it, it's necessary to determine the cultivation objectives of mining engineering major, and deal with the relationship among cultivation objective, school positioning and positioning of cultivation of professional talent and social economic development, and implement the reform of the cultivation mode of innovation practice ability of the mining engineering major, which is to promote course teaching, practical teaching and the second classroom of three dimensional reform, build four platforms including student association, social practice, discipline competition and innovation base, and enhances the five abilities of learning ability, thinking ability, practical ability, research ability and innovation ability.

1. Introduction

The mining industry will be integrated and further developed with informationization, intelligentization and internationalization on the basis of mechanization and automation under the Belt and Road. With changes of economy and society, development of science and technology and innovation of engineering practice, new and higher requirements on the cultivation of mining engineering major become a necessity, it's also necessary to improve the innovative practice ability of mining engineering students. At present, the adaptability of talents cultivation, curriculum system, teaching content and industry development and progress of mining engineering need to be strengthened. The synergy of experiments, internships and practice links need to be improved. The intensity of going out and inviting in still need to be improved [1-3].

Compared with other majors, the mining engineering major has higher requirements on students' knowledge structure and ability due to its characteristics of practicality and engineering. Based on this, it is of great theoretical and practical significance to carry out the reform of the innovation practice ability cultivation mode of mining engineering major, because the reform can improve and optimize the professional knowledge structure and systematically enhance the innovation ability, and cultivate high-quality innovation talents of mining engineering major.

2. Cultivation objective

The cultivation of mining engineering major should adapt to the needs of national economic and technological development. First, the students of mining engineering major should have a good sense of communication and cooperation, a good humanistic quality and a certain international vision. Second, the students should master adequate natural science knowledge, professional skills and research methods. Third, the students should thoroughly understand the basic principles of mining of solid mineral deposits. Fourth, the students should have technical management and

technical design capabilities to be engaged in planning, production operation and management, engineering design and construction, technical research and development in metal non-metallic mineral mining, mine safety and other related fields. Fifth, the students should be high-quality applied talents with comprehensive development of moral, intellectual, physical, aesthetic and labor, reasonable knowledge structure, strong social adaptability, practical ability and innovative entrepreneurship.

3. Three relationships that should be handled in the cultivation objective

3.1 Deal with the relationship between cultivation objective and school location

Wuhan University of Science and Technology is characterized by iron and steel metallurgy, with engineering as the mainstay, combining science and engineering, coordinating development of disciplines such as engineering, science, management, medicine, literature, economics and law, and actively developing emerging disciplines and interdisciplinary disciplines. The cultivation objective of mining engineering major should combine the conditions and characteristics of the university, and be located at the need of the development of regional economy and characteristic industries. To cultivate high-quality applied talents with solid foundation, sharp thinking, strong adaptability, high comprehensive quality, professional ethics, innovation and entrepreneurship spirit and international vision to adapt to the transformation and upgrading requirements of China's mining industry.

3.2 Deal with the relationship between cultivation objective and talent cultivation location

The objectives of mining engineering cultivation cover the requirements of humanities literacy, professional knowledge, professional skills, innovation ability, teamwork ability and lifelong learning ability. Graduates of this major should have engineering ethics and social responsibility, and be able to adapt to the long-term development requirements of the industry. The students should also be able to be engaged in scientific research, technology research and development, process innovation, engineering organization management in planning, production operation and management, engineering design and construction, technology research and development in mining engineering and related fields. The formulation of cultivation objectives should be closely related to the cultivation of professional talents. After five years of engineering practice and self-improvement after graduation, the students of mining engineering major can become the backbones, industry experts and entrepreneurs of production, technology or management in enterprises.

3.3 Deal with the relationship between cultivation objective and social economy development

The formulation of talent cultivation goals should be oriented to the needs of regional social economy development. The State Council issued the Vision and Action for Promoting the Construction of the Silk Road Economic Belt and the 21st Century Maritime Silk Road in 2015, which listed the exploration and development of mineral resources as a key point of cooperation, which provided new opportunities for China's mining development. As an important part of the Belt and Road strategy, mining development cooperation plays an important role in the construction of the Belt and Road. The National Mineral Resources Planning (2016-2020) pointed out that it is necessary to speed up the green development of the mining industry, vigorously promote the conservation and comprehensive utilization of mineral resources. So, higher requirements for mining engineering major are put forward. In order to accelerate industrial upgrading and rapid development, high-quality, professional and international high-quality mining engineering talents have become an urgent need for industry and local economic development.

4. Reform content

The reform relies on the teaching research project of higher institutions in Hubei province, combined with the international and domestic economic and social situation. According to the development needs of the metallurgical mining industry, the reform follows the principles of higher education reform and the regular of cultivation of innovative talents. The reform takes the mining

engineering major of Wuhan University of Science and Technology as the research object, the reform of the cultivation mode of innovation practice ability of mining engineering major was implemented, and has made active attempts and useful explorations to effectively improve the quality of mining engineering talents. The structure of the cultivation mode of innovation practice ability of mining engineering major is illustrated in figure 1.

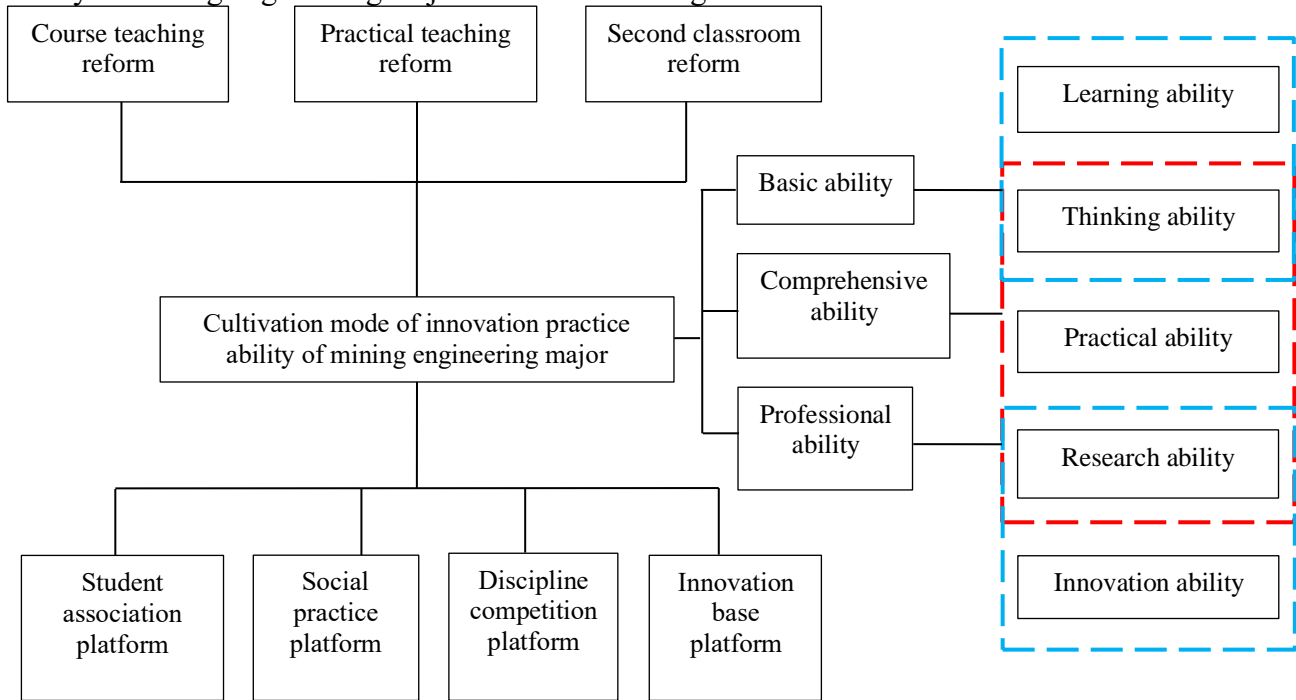


Fig.1 Structure diagram of the cultivation mode of innovation practice ability of mining engineering major

The mining engineering discipline of Wuhan University of Science and Technology, has a long history, and was founded in 1973. The school has a doctoral program in the first-level discipline of mining engineering and a post-doctoral mobile station in mining engineering, and two undergraduate majors in mining engineering and mineral processing engineering. Since 2010, the reform has taken the lead in conducting pilot research in the professional mining engineering major of mining engineering. Subsequently, the mode was applied in 41 classes of mining engineering major and mineral processing engineering major among 1438 students.

4.1 Three dimensional reform

4.1.1 Course teaching reform

The goal of reform is to cultivate students' spatial thinking ability in mining engineering major. First, through the integration of multiple knowledge, a new theoretical system of "mining +" theory curriculum is formed. Second, through the complement of theory and practice each other, theoretical teaching and practical teaching segmentation practical teaching system is constructed. Third, through the progressive of spatial cognition, the cultivation of spatial thinking runs through the whole process of university education.

4.1.2 Practical teaching reform

The goal of reform is to cultivate the ability of solving complex engineering problems in mineral processing engineering students. The practical teaching of three levels (basic level, comprehensive level and innovation level) and five modules (internship module, experimental teaching module, graduation design and curriculum design module, technology innovative modules and quality development modules) is implemented, the structure of practical teaching is optimized. By connecting production practice, strengthening experimental teaching, focusing on engineering practice, the practice of teaching system can be completed.

4.1.3 Second classroom reform

The goal of reform is to improve the ability of scientific and technological innovation of mining engineering students. First, the entrepreneurial cognition education as a guide is explored. Second, a

new method of cultivating innovative talents based on innovation and practice education is established. Third, the system with the lead of scientific research teams and innovative quality management is established. Fourth, the synergy system of the second classroom platform with professional guidance, project traction, team construction and institutionalized guarantee as the implementation method is constructed.

4.2 Four platforms

4.2.1 Student association platform

Student association platform relies on the professional background, resource associations and security associations are established. The school cooperates with enterprises to achieve a win-win school-enterprise joint model and establishes a community tutor system to strengthen guidance for the associations. Combining with World Earth Day, World Environment Day, and Safe Production Month, the school carries out public activities to make popularization of professional knowledge and publicity and education activities on mining environmental protection and mining safety, and then to promote ideas such as green mining.

4.2.2 Social practice platform

Social practice platform should take the practice team as the main body, relying on professional knowledge, and taking social needs as the guide. The school sets up a social practice base, and carries out long-term social practice activities with clear themes to realize the social operation project operation, forming a united, open, mutually beneficial and win-win practice personality education bureau to promote knowledge acquisition and ability training.

4.2.3 Discipline competition platform

The team model of instructor and postgraduates (doctoral) students and high-level undergraduate and low-level undergraduate of four-level linkage echelon based discipline competition is explored and constructed, and ensure the relative fixation of the instructors, the relatively complete structure of the discipline competition team to achieve knowledge enhancement and capacity improvement.

4.2.4 Innovation base platform

Innovation base platform relies on the university students' science and technology innovation fund project, the construction of science and technology innovation base is strengthened. A two-way selection mechanism for the instructor and student team is established, and concentrates on the four aspects of project declaration, process guidance, conclusion review and results display to achieve knowledge utilization and the purpose of cultivation in the ability to sublimate.

4.3 Five abilities

The key to the cultivation of innovative talents is the cultivation of students' abilities. The cultivation of abilities emphasizes the mastery of knowledge, the improvement of knowledge structure, and finally the application of knowledge. Cultivation mode of innovation practice ability of mining engineering major under the Belt and Road is able to make the development, improvement and consolidation of students' learning ability, thinking ability, practical ability, research ability and innovation ability.

4.3.1 Learning ability

Learning ability is a prerequisite for other abilities. First, according to the characteristics of mining engineering students, doctors and professors into the classroom are carried out, which introduce professional frontier technology, enhance students' learning enthusiasm. Second, the arouse intelligence lecture hall and peer education are carried out, which enhance students' learning relevance. Third, lessons of modern mining and metallurgy history, and steel metallurgy introduction are added, which broaden students' knowledge. Finally, independent learning, online learning, extracurricular learning and other links are set up, which promote the transition of instrumental knowledge to skilled knowledge, and systematically improve students' information retrieval, summarization, application and other learning abilities.

4.3.2 Thinking ability

Thinking ability is the deepen of learning ability and the support of other abilities. With mastering the existing knowledge, the school should need to cultivate students' problem awareness and

enhance students' thinking. The school also should use heuristic, seminar, inquiry and other teaching methods to strengthen students' reverse thinking, dialectical thinking and systematic thinking and improve students' ability to discover problems and identify and discriminate.

4.3.3 Practical ability

Practical cultivation is the basic way to transform knowledge into ability. After building the thinking ability, the school should need to strengthen the cultivation of students' practical ability. By adjusting the credits of practice links, increasing the number of hours of practical teaching, optimizing the structure and content of geological internships, understanding internships, production internships and graduation internships, extensively carrying out mining safety knowledge contests and mining engineering student practice competitions. Only in this way, cultivation skills knowledge can be transformed into engineering skills and students' practical ability of cultivation such as hands-on participation, communication and solidarity and cooperation are strengthened.

4.3.4 Research ability

After the theory is tested by practice, it is necessary to excavate the essence, sum up the law, and sublimate the connotation. Therefore, the cultivation of research ability is indispensable. First, the quality enhancement project for talent cultivation is implemented. Second, the project library of science and technology innovation fund for college students is established. Third, the undergraduate tutor system is implemented and the laboratory is open. Fourth, the mechanism of guiding students' innovation activities and graduation design based on the research projects is established. These measures can make students think in learning, practice in thinking and explore in practice, and transform engineering skills into engineering practice, so as to achieve the purpose of improving research ability.

4.3.5 Innovation ability

Innovative ability is a new ability to integrate innovation consciousness, innovative thinking and innovative literacy after learning ability, thinking ability, practical ability and research ability. In every link and every process of the cultivation of mining engineering talents should run through the sense of innovation. The innovative thinking in learning and practice should be emphasized, and the cultivation literacy in evaluation and assessment should be highlighted. Thus, the students of the innovative ability can be trained and cultivated, and complete the sublimation of students' engineering ability to innovation ability.

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