

Exploring the Construction and Characteristic Development of First-class Undergraduate Majors in Engineering Management - Education Sector

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Abstract: The construction of first-class undergraduate majors in engineering management is an important component of the construction of double first-class universities and an important support for cultivating first-class talents. In order to comprehensively revitalize undergraduate education, it is necessary to explore the connotation of first-class undergraduate majors, sort out the advantageous resources of the university, establish the construction contents of undergraduate majors from various aspects such as talent cultivation, professional orientation, sustainable development of majors, curriculum system, faculty team and teaching conditions, and formulate characteristic development ideas in combination with social demands and professional advantages.

Keywords: Engineering management; First-class profession; Characteristic development

Introduction

The engineering management profession is a product of reform and opening up and the gradual establishment and improvement of the market economy system. With the diversification of market interest subjects and the continuous promotion of reform and opening up, problems such as excessive project investment, misallocation of resources and declining economic benefits have become increasingly prominent; especially with the continuous promotion of the Belt and Road national strategy, more energy and power projects have gone abroad, requiring the engineering management of the new era to be dedicated to solving the management problems of energy and power projects in different environments. These problems have put forward higher requirements for engineering management talents, and also put forward new requirements for engineering management education. On the basis of analyzing the educational characteristics of our undergraduate engineering management majors, this paper analyzes the future planning of the construction and development of first-class undergraduate majors, so as to lay the foundation for the sustainable development and talent cultivation of engineering management majors in the new era.

1. The current state of development of the engineering management profession

The engineering management profession in China can be traced back to the early 1960s, when a group of engineering economy experts who studied in the former Soviet Union in the 1950s and engineering economy experts who studied in Britain and the United States before the 1950s opened the discipline of technical economy in China, which mainly studied the economic analysis of projects and technical activities, such as project evaluation and feasibility analysis.

In 1979, 11 institutions in China, including Xi'an Jiaotong University, launched management engineering programmes.

In 1980, Huazhong Institute of Technology started to recruit undergraduate students in materials management engineering.

In 1981, Harbin University of Architecture enrolled in construction management engineering, followed by real estate business management and international engineering management.

After four revisions in 1963, 1989, 1993 and 1998, China's undergraduate majors have been integrated into engineering management, including construction management engineering, capital construction management engineering, management engineering (direction of construction management engineering), real estate management, foreign-related construction engineering creation and management, and international engineering management, which formally became a major under the first-level discipline of management science and engineering in 1998^[1].

Engineering management majors are widely employed in construction units, construction enterprises, real estate companies, supervision companies, project management companies, engineering consulting and other departments to engage in construction, budgeting, supervision, technical management, information, safety, quality testing and other work^[2]. In recent years, with the rapid development of the national economy, the demand for engineering management professionals in various industries has increased drastically^[3]. However, the development history of engineering management majors varies among colleges and universities, so there are certain differences in professional settings, faculty settings and research directions.

The major of Engineering Management of North China University of Electric Power was established in 1983, and was selected as one of the national first-class undergraduate majors in 2020, and ranked 16th in China in the 2021 Soft Science Ranking of Chinese Universities. The major adheres to the cultivation objectives of “electric power characteristics, engineering practice, scientific research and innovation”, and cultivates high-quality composite talents with “knowledge of both technology and economics, management and law”.

2. Engineering Management Specialty Analysis

2.1 Industry Features

Engineering management is an emerging cross-composite discipline of engineering technology and management, which cultivates complex senior management talents with basic knowledge of management, economics and civil engineering technology and mastering theories, methods and means of modern management science. Modern engineering project management generally has the following characteristics: the project involves a wide range of areas and is technically difficult; it requires multi-disciplinary integration; there are many participating units and requires cross-territory collaboration; high quality requirements and tight schedules; complex information communication and wide social influence. This profession was established in the early 1980s after the reform and opening up, in response to the needs of socialist construction. In recent years, with the development of global integration, especially after China’s accession to the WTO, international engineering project management has become a hot spot. According to the relevant national regulations, engineering management requires students to have basic knowledge of civil engineering technology and management, economy and law related to engineering management; students of this major are required to study mainly the basic theories, methods and technical knowledge of civil engineering in engineering management. Generally speaking, engineering management is mainly construction project management, and most of the engineering management majors in China’s universities are set up according to this requirement.

2.2 School Features

As a first-class professional university for the electric power industry, North China University of Electric Power (NUEP) has seized the opportunity to build a “large electric power” system based on superior disciplines, with emerging energy disciplines as the focus and arts and science disciplines as the support, in the face of the world’s energy development trend led by innovative energy and renewable energy. “The university has been able to maintain its advantages in the field of energy and electricity. On the basis of the dominant disciplines such as electricity and power, the university accelerates the development of disciplines such as environment, nuclear energy, hydropower, wind energy, solar energy and bio-energy, actively develops disciplines such as economics, management, law, mathematics, physics and other arts and science disciplines, pays attention to the combination of mechanical, electronic, material, control information and arts and science disciplines with energy and power disciplines, through mutual penetration and cross-fertilization, so that the connotation of each discipline forms its own characteristics and together The university has built up a system of disciplines and specialties that highlights the characteristics of “Big Electricity”.

The university pays attention to the characteristics of talent cultivation of “emphasis on practice and strong ability” and builds the “four modes” of “basic experimental teaching, on-campus practical teaching, simulation practical teaching and off-campus engineering practical teaching”. The “Four Modes” engineering teaching mode is built to lay a solid foundation for the overall development of students. Among them, the on-campus practical teaching module mainly consists of “experimental simulation” and “practical simulation”, the former highlighting the application of simulation in experimental teaching, and the latter simulating a practical environment close to reality, allowing students to conduct comprehensive practical training.

2.3 Course Features

The basic courses of Engineering Management in North China Electric Power University include six basic courses, namely Principles of Management, Microeconomics, Engineering Statistics, Engineering Operations Research, Engineering Economics and Engineering Drawing. Through the core foundation courses, students can master the important professional theoretical foundation of management, economics, statistics and operation research at the same time. The core courses can be further subdivided into four series of courses:

- ① civil engineering series courses;
- ② engineering cost and management series courses;
- ③ engineering management software series courses;
- ④ power industry special series courses.

The civil engineering series courses enable students of engineering management to master the necessary basic knowledge of civil engineering and lay a solid professional foundation for engaging in engineering management-related work; the engineering cost and management series courses, as the core professional courses of engineering cost and management series, play an important role in cultivating students’ vocational skills and enhancing their competitiveness in employment; the engineering management software series courses can exercise students’ ability to solve practical problems by using professional software. The series of courses on engineering management software can train students to use professional software to solve practical problems and lay a good foundation for their future work; and the series of courses on the characteristics of the electric power industry are designed to cultivate high-level engineers in the electric power industry and give students a unique competitive advantage in the electric power industry.

3. Exploring the construction and development of first-class undergraduate majors

With the continuous development of socialism with Chinese characteristics in the new era and the continuous improvement of social and economic levels, the construction of first-class undergraduate majors and the cultivation of first-class professional talents have increasingly become the focus of high-quality development of universities. At present, there are problems in the development of engineering management majors, such as the lack of distinctive professional characteristics, unreasonable curriculum system,

unfrontier curriculum content and imperfect practical training platform. In order to better complete the construction of first-class undergraduate majors, innovate talent cultivation mode, make the course content, cultivation mode and teaching means meet the requirements of “Power Engineering Management Composite Talent Cultivation Plan”, engineering management majors need to take the characteristic development road with the needs of the times.

3.1 Design of an engineering management training programme oriented to the needs of energy and electricity

In the process of constructing first-class undergraduate majors, it is necessary to highlight the characteristics, explore the inherent needs of cultivating outstanding engineers, future scientists and industry leaders around energy and power science and engineering, formulate the cultivation objectives of first-class engineering management majors, construct the curriculum system corresponding to them and form the cultivation program of first-class engineering management majors. The specific contents are as follows: 1) extensively investigate the current situation and successful experiences of the development of engineering management majors in famous universities at home and abroad; 2) explore the specific needs of energy and power science and engineering for engineering management; 3) analyze the factors and paths influencing the cultivation of first-class talents in engineering management; 4) clarify the cultivation objectives, construct the curriculum system and form a cultivation program for first-class engineering management majors with the characteristics of our university.

3.2 Course content revised to highlight energy and power features

Based on the realistic needs of the country and the industry, facing the field of electric power engineering management, according to the role and characteristics of each course in personnel training, engineering standards, specifications and cases with strong electric power characteristics and cutting-edge advantages are enriched into the teaching contents of corresponding courses, so as to realize the in-depth integration of basic theory and cutting-edge technology, general education and innovative application, universal knowledge and industry characteristics. Specifically, we collect and analyse the common knowledge points of the teaching contents of each course, explore the frontier theories and technical methods of each course, and then collect and collate the case materials accumulated in energy and power engineering research projects, so as to finally complete the revision of the teaching contents of courses with outstanding energy and power characteristics.

3.3 Reforming the cultivation mode of talents with characteristics of power engineering management

Adhering to the objective of “student-oriented, promoting students’ all-round development and personality development”, the university carries out comprehensive reform of the cultivation mode of talents with characteristics of electric power engineering management, focusing on the construction direction of first-class disciplines of energy and power science and engineering. Through the revision of curriculum teaching contents and the establishment of electric power characteristic teaching materials system, the construction of virtual simulation practice training system through VR technology and Internet technology, the improvement of practical operation ability of engineering management students based on the construction of electric power engineering practical training platform, and the realization of remote linkage training mode through the cooperation between schools and enterprises with the help of advanced communication technology. Establish the cultivation mode of electric power engineering management talents with organic integration of multiple methods.

3.4 Building a teaching team based on a multidisciplinary and collaborative matrix organisation structure

Based on the national excellent teaching team of engineering project management, the university will further strengthen the construction of teachers’ team. According to the construction idea of “self-cultivation, internal selection and external introduction”, the team will focus on improving the quality of the teaching team, optimize the structure, drive teaching by scientific research, encourage teachers to go deep into enterprises and grassroots, and shorten the distance between theory and power production practice; in order to cultivate compound talents of engineering management majors, break the barriers between disciplines, and strive to build a team with a strong sense of reform, reasonable structure and advanced teaching quality. In order to cultivate composite talents of engineering management majors and break the barriers between disciplines, we strive to build a teaching team based on matrix combination structure under the collaboration mode of cross-department and cross-discipline, which loves undergraduate teaching, has a strong sense of reform, reasonable structure, high teaching quality, advanced teaching concepts and clear teaching reform goals. In order to achieve this goal, firstly, it is necessary to analyze and summarize information about the education background, research direction and engineering practice experience of the existing teaching team, update the concept of professional construction and enhance professional quality through teacher training and exchange and learning, so as to meet the competence requirements of the members of the teaching team for first-class majors; subsequently, it is necessary to construct the matrix organization structure of the teaching team of first-class majors in engineering management, and at the same time carry out the internal management system of the teaching team. The construction of the internal management system of the teaching team was carried out at the same time to avoid the problem of multiple leaders that might be caused by the matrix organization structure.

3.5 Building a practical teaching platform with energy and power characteristics

In order to guarantee the smooth promotion of teaching reform, improve the quality of education and teaching, and achieve the sustainable and healthy development of first-class engineering management majors, it is necessary to study how to construct the quality assurance system of this major through methods such as engineering certification and quality supervision system. For example, in the whole process of cultivating talents with characteristics of electric power engineering management, build a method of monitoring and attributing timely responsibility for the quality of higher education; carry out the adjustment and optimization of cultivation programs of undergraduate courses and teaching practices of Chinese engineering management majors firmly in accordance with China’s engineering education accreditation standards and relevant international accreditation standards. In terms of disciplines, strive to complete the professional accreditation work, including the international accreditation assessment work, and strive to obtain the

relevant international accreditation certificate, and do a good job of subsequent professional construction based on the accreditation opinions.

4. Concluding remarks

Under the guidance of the Ministry of Education encouraging classification development and characteristic construction, relying on the advantageous resources of the construction of the first-class discipline group of “energy and power science and engineering” of North China Electric Power University, we have made preliminary exploration and planning for the characteristic development direction of engineering management majors in our university, and will continue to follow the national undergraduate education concept and the new needs of the industry in the future to make dynamic adjustments to the construction direction of this major. In the future, we will continue to follow the national undergraduate education concept and new demands of the industry to make dynamic adjustments to the direction of construction of this major. The engineering management major of North China University of Electric Power will, on the basis of solidifying the essence of the major, give full play to the characteristics of the university’s large electric power, realize the role of demonstration leader in the field of engineering management in the electric power industry, cultivate composite top talents in the field of electric power engineering management, and provide strong support for the smooth realization of the low-carbon transformation of China’s energy engineering and the goal of double carbon.

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