Advances in Social Science, Education and Humanities Research, volume 345

International Conference on Advanced Education and Social Science Research (ICAESSR 2019)

Research on the Teaching Reform of the NEET-oriented Engineering Training

Xiaoqin Liu [1,a],
[1] Engineering Training Center, Wuhan University of Science and Technology
Wuhan, Hubei Province, China

Chengsong Liu [2,b],*
[2] School of Materials and Metallurgy, Wuhan University of Science and Technology
Wuhan, Hubei Province, China

***Abstract*—Under the guidance of NEET training objectives, engineering training integrates emerging disciplines, basic disciplines and supporting disciplines by integrating existing teaching resources of materials, machinery, information technology and other related disciplines. Different learning routes are set to ensure the systematic and logical teaching of interdisciplinary teaching, and to guide students' future learning activities. While students' engineering thinking and scientific thinking is cultivated, higher requirements for teachers are required.**

Keywords—engineering training; interdisciplinary integration; engineering thinking; teaching reform

I. INTRODUCTION

Since February 2017, the Ministry of Education of China has successively issued the Notice on the Research and Practice of New Engineering and the Notice on Promoting the Research and Practice of New Engineering. The representative of the Massachusetts Institute of Technology (MIT) listened to the report of China's Education Ministry in May 2017 and conducted an in-depth study on the construction of new engineering in China [1-3]. In August of the same year, MIT launched the new round of engineering education reform named New Engineering Education Transformation (NEET) program, which represents the latest development direction of engineering education in the United States.

Guided by NEET training objectives, combined with the national conditions of China's new engineering construction, our school engineering training center upgrades traditional disciplines and cross-integrates different disciplines by integrating existing teaching resources of materials, machinery, information technology and other related disciplines. Under the premise of student-centeredness, reform the existing engineering training teaching mode, and train students to think and solve problems in a proper way when they face various unknown and complicated problems in engineering practice.

II. THE CONNOTATION OF THE NEET PLAN

According to the charter of the NEET program, MIT's focus on implementing new engineering reforms will focus on the learning style and learning content of students, reflecting the student-centered educational philosophy. Professor Fengxiang Xiao from Tianjin University studied the formal content and internal logic of the MIT NEET program, indicating that the NEET program is to make MIT's engineering talents face the future industry to cultivate future industrial and social development. Leading engineering talents are the goal. The NEET program believes that the development direction of engineering education is a new machine and a new engineering system for the future. Engineering education should be student-centered, lay the foundation for students to become engineering talents, and emphasize the development of students' thinking mode.

The New Engineering Education Transformation (NEET) program aims to restructure engineering education at the Massachusetts Institute of Technology. NEET is an interdisciplinary work that focuses on comprehensive and project-centered learning to develop the necessary skills, knowledge and quality of young engineers as entrepreneurs, innovators and discoverers, and instill NEET thinking to make them meet the enormous challenges brought by the 21st century.

MIT believes that new engineering should be student-centered and the individual needs and professional interests of students should be respected. Through engineering education, more and more flexible career choices are provided for engineering professionals. More and more flexible career choices are covering from engineering Makers to Discoverers, that is a wide field of engineering careers. Manufacturer refers to engineering An engineer who practices work and continues to innovate in engineering practice activities. The responsibilities assumed include conception, design, implementation, operation, and so on. The manufacturer is practice oriented [4-5]. Discoverer refers to engaged in engineering science research. The engineering researcher of the work, whose duties include inquiry Engineering activity rules, expanding engineering science knowledge, etc. The discoverer is Cognitive orientation. The reason for this division is related to the nature of the project closely. The project not only contains engineering practice activities, but also Engineering science knowledge. The engineering practice activities are practical orientation corresponding to the manufacturer. The engineering science knowledge is cognitive orientation corresponding to the discoverer.

The engineering practice activities and engineering science knowledge are not between The relationship of binary division, but interconnected, interacted, and interacted with each other. So manufacturers and discoverers simply represent work Two dimensions of the profession, the manufacturer and the discoverer can each other Towards and promote each other. It is also possible to convert each other under certain conditions.

For A talent development program that enables students to become producers or discoverers, MIT emphasizes that students should be center in engineering education activities. Based on the basic engineering science knowledge, such as engineering basic knowledge of science, basic paradigm of engineering practice, etc. Based on the basic elements of the project, according to their own duties Industry interest, students can develop career development plans, choose different engineering studies Content and be prepared in accordance with the career path of the manufacturer or discoverer.

III. THE NEET PROGRAM-ORIENTED ENGINEERING TRAINING TEACHING REFORM

The NEET program is a teaching reform carried out by MIT on the basis of examining the construction of new engineering in China. It has many similarities with the construction of new engineering. It emphasizes the goal of cultivating engineering talents for the future industry. The change in the main teaching methods of NEET is reflected in the participation of students in interdisciplinary projects, which coincides with the interdisciplinary construction in China's teaching reform. Based on the teaching achievements of new engineering construction and interdisciplinary construction, our school engineering training center has carried out a series of new teaching reforms guided by the NEET program.

A. Strengthen interdisciplinary integration and establish a multi-path, personalized and logical teaching system

In order to adapt to the development needs of new industries, making full use of other disciplines within the university as external network resources is of great significance to the interdisciplinary cooperation of universities. Compared with other departments, the Engineering Training Center, as a base for engineering learning and practice for all students, has unique advantages in achieving interdisciplinary research and strengthening interdisciplinary integration.

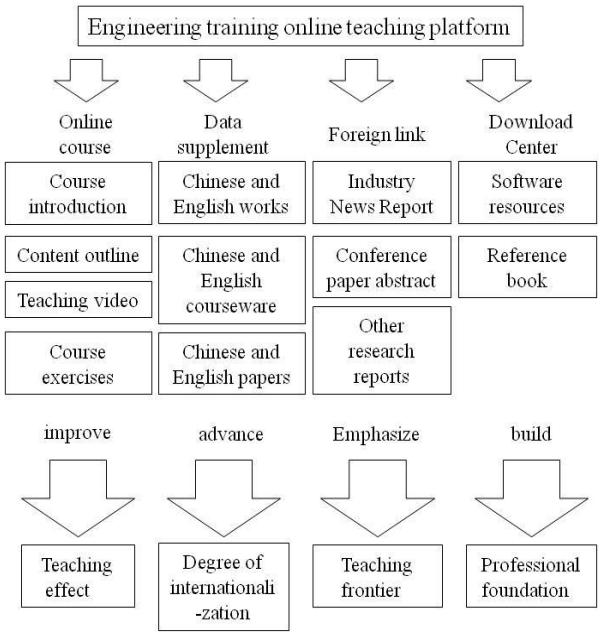

Fig. 1 The engineering training online teaching platform

Using the micro-course platform as shown in Fig.1, the professional knowledge of each isolated subject is cross-integrated to form a logical teaching resource library. Students' professional level and professional interest are judged before the class. Students can choose more suitable according to the judgment results. Online learning paths and learning content.

In the course of training, the basic majors such as machinery, materials and metallurgy are used as the entrance, and the computer, information, automation, management and other majors are supported to establish a clustering network that is gathered and guided by emerging disciplines. The students are guided to develop in new industries such as intelligent design and production, information management, information security, decision analysis, etc., and the impression that students hold the old-fashioned stereotypes held by metalworking internships is broken.

Based on the module teaching method, after mastering the basic engineering science knowledge in the first module, students select different engineering training contents according to their professional interests in the subsequent modules, which are mainly divided into engineering manufacturing and engineering discovery. The engineering manufacturing is mainly to train students in the picture, drawing and manufacturing processing skills, while the engineering discovery is mainly to train students to find problems and solve problems.

B. Optimize teaching methods and cultivate students' multi-directional thinking

A single teaching method is not suitable for multi-directional teaching content. Engineering involves two dimensions, engineering manufacturing and engineering discovery. Different career orientations have different connotation requirements for engineering talents, but the two are not binary-separated, but interact, promote each other, and even convert under certain conditions. Therefore, it is necessary to prepare a variety of teaching methods. It reflects the difference between manufacturing and discovery, and can guarantee the integration between the two.

The new engineering department pays more attention to the cultivation of students' thinking styles. MIT proposes that new engineering people should have eleven ways of thinking: manufacturing, discovery, interpersonal skills, individual skills and attitudes, creative thinking, systematic thinking, critical and cognitive thinking, analytical thinking, computational thinking, experimental thinking and humanistic thinking. The development of these eleven modes of thinking runs through the entire teaching activities, and the teaching content, teaching methods and evaluation and evaluation are guided by this.

IV. THE BENEFITS OF THE NEET PROGRAM-ORIENTED ENGINEERING TRAINING

Through the research and practice of this project, it will play the following roles in improving teaching quality and cultivating engineering talents.

The construction and implementation of the NEET-oriented engineering training and teaching system is in line with the

current trend of interdisciplinary construction. NEET determines that the development direction of engineering education is a new machine and a new engineering system for the future. Compared with traditional machines and engineering systems, the new machines and new engineering systems show a high degree of integration, that is, new machines and new engineering systems transcend the isolation of traditional engineering disciplines, for machinery, information, molecules, biology, construction, energy. For students of different disciplines, the existing training platform is used as a carrier to cross-integrate emerging disciplines, basic disciplines and supporting disciplines, build a convergence network guided by emerging disciplines, and set different learning routes to ensure interdisciplinary integration.

The NEET-oriented engineering training is student-centered and giving students more flexible engineering training content options. The more flexible engineering training content refers to engineering practice or engineering science research. The reason for this division is closely related to the nature of the project. The project includes not only engineering practice activities, but also engineering science knowledge. Engineering training is a school-wide curriculum. At the beginning of the university, helping students to identify more interesting and suitable career orientations is of great guiding significance for future learning activities.

The NEET program clarifies that the focus of engineering education is to emphasize the development of students' way of thinking. The new industry is paying more and more attention to the performance of engineering talents in terms of learning ability and thinking mode. The original engineering education centering on student knowledge acquisition and cognitive ability training will be challenged. How to build a curriculum system for engineering teachers to raise students from simple technology development to a higher level is a problem that needs special attention in engineering education reform.

V. Characteristics and Innovations of This Research

Guided by the NEET program, combined with China's new engineering construction and interdisciplinary cooperation, for students with different professional and professional interests, the teaching content and teaching methods of engineering training are improved. Convergence network is built to achieve diversification, logic and personalization of teaching content. According to the two directions of engineering training, namely manufacturing and discovery, a more reasonable teaching method is designed.

NEET plans to focus on the cultivation of engineering talents. The focus of teaching is more on the development of students' thinking mode. Emphasis is placed on engineering practice, through more attention to students' learning interests, learning styles and learning content. students' engineering thinking, scientific thinking and humanistic thinking is cultivated, so as to become the engineering talents of rationality and rationality that can lead the development of future engineering industry.

Through the research and implementation of this project, not only will the students who have participated in the engineering training practice teaching activities of the engineering majors of our school benefit, but the theoretical research results can also be used as an important reference for the teaching reform of other engineering majors in our school.

VI. Conclusion

Guided by the NEET program, combined with the construction of new engineering and interdisciplinary cooperation in China, the teaching content and teaching methods of engineering training are improved to realize the diversification, logic and individualization of teaching content. The focus is transferred from the previous knowledge towards the cultivation of students' thinking mode. Through more attention is put on the students' interest in learning, learning methods and learning content, the students' engineering thinking, scientific thinking and humanistic thinking are cultivated.

China and MIT proposed the idea of new engineering construction in the same period, and MIT collected global engineering teaching during the period of education reform and came to China to have a deep understanding the concept and construction situation of China's new engineering. This shows that the formation of China and MIT New Engineering reforms are closely related. The new engineering reform, start engineering education from emphasizing engineering Practice the "practice paradigm" to emphasize the student-oriented "educational paradigm", upholding its consistent courage to innovate and the MIT spirit of daring reform. To lead the global higher engineering teaching, the new direction of education development can use this new construction of engineering, put forward and practice new engineering structure embodying China's characteristics.

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