



Research on Phased Teacher Training System in Engineering Education

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Abstract. As an important aspect in the construction of “Emerging Engineering Education”, the major accreditation of engineering education has received more and more attention from colleges and universities in recent years, and the construction of teacher training system is an important guarantee for the effective implementation of major accreditation. Based on the development of higher education at home and abroad in recent years, this paper discusses the problems existing in the modern teacher training system under the background of engineering education, and proposed a phased teacher training system design scheme. According to the different stages of teachers and different types of courses, this paper constructs a four in one teacher training system of university, school, major and course group, so that the achievement of curriculum objectives can be effectively guaranteed.

Keywords: Emerging Engineering Education · Major Accreditation of Engineering Education · Teacher Training System · Curriculum Objective

1 Introduction

Our country proposed the construction idea of “Emerging Engineering Education” in 2016. At the same time, in order to promote the major accreditation of engineering education in China in line with international standards, China applied to become a preparatory member of the Washington agreement in 2013 and became the full member of the agreement in 2016, realizing the international mutual recognition of the degree of certified graduates. At the end of 2019, Mr. Wu Yan, the director of the Department of higher education of the Ministry of education proposed that the construction of “Emerging Engineering Education” should move from “vigorous” to “solid”, and clarified how to build into a national first-class professional major, which requires clear standards. This standard is realized by the major accreditation of engineering education for engineering majors. In this context, the number of majors applying for major accreditation has increased rapidly in recent years.

The Washington agreement involves most engineering majors in China, and there have been many studies on how different majors meet the Washington agreement. For example, Professor Gu Peihua, academician of the Canadian Academy of engineering,

director of the new engineering education center of Tianjin University and director of the academic committee of China Engineering Education Accreditation Association, took Shantou University as an example, and systematically explained the concept, theoretical basis and characteristics of OBE (outcome based education) education mode [1]. Then, he also introduced the practice and exploration of OBE engineering education mode in Shantou University in recent years, and explained in detail the practical framework, implementation characteristics, key points and difficulties of OBE engineering education mode in Shantou University. On this basis, Lu Yong studied how to adjust the training objectives, training standards, training programs and training modes according to the requirements of engineering education accreditation, and reconstructed the engineering talent training system, so as to promote the reform and development of engineering education [2]. Chen Wensong analyzed the influence of engineering education major accreditation on higher engineering education, and points out that colleges and universities should take major accreditation as an opportunity to find their own problems and disadvantages according to the accreditation standards, so that the overall students training quality can be improved [3]. Yao Yanxin analyzed how to achieve the professional training goal through reasonable design of curriculum system and assessment methods in the new round of training program revision [4]. Cao Yang studied how to form a three chain connection among professional curriculum chain, ability chain and industrial chain, realized the interaction between universities and companies so that monitoring and feedback mechanism can be found [5].

At the same time, the researchers also analyzed and discussed the construction of teaching staff and teacher training system under the background of “Emerging Engineering Education”. Fu Hongpeng analyzed the existing problems in the construction of teacher training system, and established a guarantee mechanism for teacher development, however, the specific methods were not very clear [6]. In his master’s thesis, Tao Xinwei summarized the problems existing in the college’s teacher training by means of questionnaire and interview, and proposed specific suggestions on the guarantee methods of the teacher training system from the perspectives of training demand analysis, training plan formulation, training plan implementation and training evaluation feedback [7]. However, based on the investigation of the existing literature, it can be found that when discussing the teacher training system, higher vocational colleges pay more attention to itself due to their own characteristics. For example, Wang Hao and Wei youyou analyzed the problems existing in the modern teacher training system from the characteristics of their respective Higher Vocational Colleges, and proposed the corresponding teacher training system schemes [8, 9].

In summary, the above schemes often lack specific methods that can be implemented, and the requirements for engineering education major accreditation are not considered. Therefore, it is necessary to study the teacher training system under the background of engineering education major accreditation, and analyze the existing problems and feasible solutions of the teacher training system.

2 Development and Requirement of Higher Engineering Education

In recent years, with the popularization of Internet technology and MOOC teaching methods, education has entered the 4.0 era [10]. Developed countries in the world are

actively promoting the reform of higher education. China's "Emerging Engineering Education" construction also came into being under the above background. In fact, the history of promoting the major accreditation of Engineering Education in our country is relatively short. In 2006, the Ministry of education just started national engineering education major accreditation from some majors. As a well-known international accreditation agreement for engineering education in the world, the Washington agreement has also become an important way to improve the major accreditation of Engineering Education in China in line with international standards. Under the background of the fourth industrial revolution and education 4.0, if domestic colleges and universities want to grasp the opportunity and truly make their engineering education reach the "double first-class" level, they must be in line with international standards and carry out major construction with reference to the major accreditation standards of engineering education, e.g., the Washington agreement.

Through the study of relevant national documents and policies, it can be found that with the development of China's higher education reform, the importance of engineering education major accreditation is becoming more and more obvious. In the major accreditation of engineering education, the core is the achievement of graduation requirements and curriculum objectives, and the achievement of graduation requirements is based on the achievement of curriculum. Therefore, it puts forward clear requirements for the curriculum in the curriculum system, which essentially puts forward higher requirements for teachers. It is necessary to focus on strengthening the ability training and personality shaping of students on the basis of traditional knowledge teaching mode. However, the actual situation is that ordinary teachers have uneven understanding of the three core principles of engineering education major accreditation, namely student-center, OBE and continuous improvement, and do not understand the relationship between curriculum objectives and graduation requirements. Although many scholars have done some research on the major accreditation of engineering education and analyzed the requirements of major accreditation for curriculum construction, the existing research focuses more on the achievement of graduation requirements and curriculum objectives, but does not focus on whether the teachers' ability to specifically implement the curriculum objectives is available.

Therefore, how to adapt to the new requirements and new forms of engineering education, promote the implementation of engineering education major accreditation, and effectively improve the quality of student education has become an important challenge for colleges and universities, and the research on phased teacher training system will help to solve this problem.

3 Problems Existing in Modern Teacher Training System

Teachers are the first resource for the development of colleges and universities. The construction of faculties team is the basis of the sustainable development of colleges and universities, which is related to the success or failure of higher education. However, when recruiting, colleges and universities often only pay attention to teachers' academic qualifications, scientific research achievements, graduating colleges, overseas experience and so on, but lack enough attention to whether they are competent for teachers'

positions and whether they have the ability to teach students. Moreover, the candidates often do not know how to teach a course well and how to understand the role of a course in the curriculum system. Therefore, it puts forward very high requirements for the teacher training system. However, the existing teacher training system still has the following problems:

- (1) Teachers' scientific research, teaching and other tasks are relatively heavy, and they did not have enough time to participate in teaching training

No matter in research universities or ordinary universities, teachers should undertake both scientific research and teaching tasks. However, at present, most universities pay more attention to the assessment of teachers' scientific research ability. When evaluating and hiring professional titles, the focus of attention is also more emphasis on teachers' scientific research ability and scientific research achievements. Therefore, some teachers pay less attention to teaching and are unwilling to spend time and energy in various teaching related training, and hence, there's very limited motivation to carry out teaching reform.

- (2) The training form is very limited and lacks specific practice

The main form of existing teacher training is still knowledge imparting, i.e., the training teachers explain the content of a certain aspect, but the content of the explanation is not necessarily fully understood by the trained teachers due to the differences of disciplines. Moreover, restricted by the limited time and space, and lack of on-site practice for specific teaching reform methods, the effect of training is usually very limited. At the same time, because different teachers have different requirements, face different problems and need different guidance, unified training can not effectively solve the problems of different teachers.

- (3) The training system does not satisfy the requirements of major accreditation of engineering education, and teachers cannot have a deeper understanding of major accreditation

As previously analyzed, engineering education major accreditation plays an important role in the higher education, and the training of teachers should also satisfy the requirements of engineering education major accreditation. Teachers need to clarify the relationship between training objectives, graduation requirements, curriculum system and specific courses, and understand the specific connotation of graduation requirements, and then, the teachers can decompose the index points according to the major graduation requirements to determine the curriculum objectives of the taught courses, and design relevant teaching methods to support the achievement of curriculum objectives. However, some training teachers in the existing training system do not have a deep understanding of the concept of engineering education major accreditation, and can not deeply understand the relationship between the curriculum and graduation requirements. They place too much emphasis on teaching methods, but ignore the specific objectives of curriculum teaching.

4 Design of Phased Teacher Training System

The teacher training system for engineering education major accreditation first needs to clarify the requirements of major accreditation for teachers, i.e., to clarify the relationship between graduation requirements and curriculum system, and then understand the relationship between specific courses and the teachers. The basis principle of engineering education major accreditation is “student center”. The graduation requirements determine the phased objectives that students need to achieve when they graduate, including the knowledge, ability and values that students need to master. The curriculum system is designed to support the achievement of graduation requirements of all students. The curriculum in the curriculum system needs to undertake one or more index points in the decomposition of graduation requirements index points. The curriculum objective is designed according to the decomposition index points assigned to the specific curriculum, i.e., the specific curriculum serves to satisfy the graduation requirements. The existence of the curriculum has its inevitable value, and the teachers are the carrier to realize the existence value of the curriculum. Teachers need to clarify the role of their own curriculum in the student education system and the supporting relationship to the graduation requirements, and on this basis, choose appropriate teaching methods and teaching design.

Through the above analysis, it can be found that the major accreditation of engineering education puts forward multi-level and multi-dimensional requirements for teachers, and hence, teachers not only need to have certain teaching ability and master certain teaching methods, but also need to have the ability to clearly know what are the teaching objectives of their own courses, what the requirements in the graduation requirements are for a specific course, and what are the students’ outcomes. Based the above understanding, the teachers can select suitable teaching methods in order to achieve these outcomes. Therefore, it is necessary to build a phased teacher training system that satisfies these requirements and has a continuous improvement mechanism.

Phased training system refers to the corresponding teacher training in different stages of teachers according to the characteristics of this stage. Generally speaking, the stages of teacher training can be summarized into the following five aspects, as shown in Fig. 1.

- Post employment training should highlight the training of teachers’ general teaching ability and teaching methods, as well as the training of the requirements for engineering education major accreditation.



Fig. 1. Phased training system

- Before teaching a specific course, the training should focus on strengthening teachers' teaching design ability and improving teachers' willingness to carry out teaching reform. The training in this period should integrate "teaching" and "learning" together, and require young teachers to carry out practical exercises based on practical courses, and clarify the curriculum objectives and the specific methods to achieve these objectives.
- The training after undertaking the teaching task is divided into two levels, one is young teachers, and the other is middle-aged teachers. The difference between these two type is that the former is young and energetic, and have relatively abundant time and strong willingness to reform, and moreover, they have the ability to master and apply new information technology with little experience. The latter are characterized by richer teaching experience, but the willingness of teaching reform is not strong, and the application ability of new technologies and methods is relatively weak. Therefore, it is necessary to design reasonable teacher training programs for these two levels to realize personalized training for different age groups.
- The last teaching supervision training is more important, because the above four training steps need to verify the effectiveness of specific training through teaching supervision to ensure the steady-state operation of continuous improvement mechanism.

5 Conclusion

In view of the background of the extensive development of engineering education major accreditation, this paper first analyzes the development and requirements of engineering education. On this basis, this paper discusses the problems existing in the modern teacher training system, and starts from the problems, first defines the relationship between the curriculum system and teachers in engineering education major accreditation, and present the focused points in the teacher training system for major accreditation. Then, this paper constructs the design scheme of phased teacher training system and studies the specific connotation of phased training system and the specific role of different stages of training in engineering education major accreditation. Finally, through the proposed phased teacher training system, we can realize the comprehensive improvement of teaching reform willingness, education and teaching ability, and further understanding of major accreditation.

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