Educational Objectives Formulation Based on Major Accreditation of Engineering Education

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Abstract. Based on the accreditation of engineering education, combined with the basic concept of student-centered, outcome-based and continuous improvement of educational quality, in the present study, the basic principles of formulation of educational objectives, as well as their evaluation and continuous improvement were discussed. A reference for the construction of engineering specialty and the accreditation of engineering education.

Introduction

A system of engineering education accreditation headed by "Washington Accord" has been formed in the world. Engineering accreditation, as an important way to promote engineering education reform as well is extensively developed in China \cite{1}. In 2018, the Ministry of Education issued the National Standards for Teaching Quality of Undergraduate Majors in General Colleges and Universities. The formulation of the standard follows three principles: student-centered, product oriented and continuous improvement, which is fully consistent with the core concept of engineering education accreditation: student-centered, outcome-based and continuous improvement.

The inevitable way to promote the construction of new engineering and the implementation of the standard is to promote the action of colleges and universities, so that colleges and universities can revise the talent training program according to the standard, and cultivate diversified and high-quality talents. The first step of the action is to make the objectives of professional education. And the following courses, teaching organization and evaluation methods are all based on the set educational objectives. Therefore, how to establish an education objective that not only highlights the characteristics of disciplines and specialties, reflects the industry requirements, but also conforms to the trend of the emerging engineering construction era and social needs is a key issue for every engineering major.

Overview of Engineering Education Accreditation

Accreditation of engineering education is a specialized certification for engineering majors of higher education institutions by specialized certification institutions. It is an international system of engineering education quality assurance, and also an important basis for international mutual recognition of engineer qualification \cite{2}. It has three core concepts: student-centered, outcome-based and continuous improvement, which represent a new education concept. Although the concept of student-centered education has been presented for a long time, it’s the first time that the engineering education accreditation makes the concept of "student-centered" education have a clear and reasonable theoretical framework. Outcome-based emphasizes the transformation of educational concept from "input" to "output", and the focus of teaching and learning from "knowledge" to "ability". The outcome-based training program will greatly overcome many shortcomings, such as vague educational objectives, the lack of comprehensive knowledge structure.
and one-sided ability cultivation. The core concept of continuous improvement emphasizes the establishment of a management system that can be continuously improved. Effective evaluation feedback mechanisms include graduate tracking feedback system, teaching quality monitoring system, social evaluation system, teacher development, equipment management, maintenance and update system, etc.

In China, the goal of engineering education accreditation is to build the quality monitoring system of China's engineering education, promote the reform of China's engineering education, and further improve the quality of engineering education; establish the engineering education accreditation system linked with the engineer system, promote the connection between engineering education and the business sector, enhance the adaptability of engineering education personnel training to industrial development; and promote China's engineering education international recognition of education to enhance international competitiveness [3].

The Leading Role of Educational Objectives

Generally, the educational objective refers to the degree of achievement of the established goal by the trained person, indicating the structure, composition, stage and specific value of the educational content, which is the guidance of the educational teaching practice and the standard of the educational teaching evaluation activity. Education objectives based on the engineering education accreditation emphasizes the overall description of the professional achievements of graduates who have graduated for three to five years. It requires that the achievements achieved by graduates must be related to the vision and educational purpose of universities and colleges, and can show professional functions and characteristics, and meet the trend of the times and social needs.

![Diagram of the leading role of educational objectives.](image)

The accreditation standards of engineering education mainly include education objectives, students, teachers, course composition, teaching achievements and evaluation, equipment and space, administrative support and funds, field certification standards, and continuous improvement results, etc. The accreditation standards are set around the education objectives as the core and primary indicators. Fig. 1 shows the leading role of education objectives. The education objective is the goal of training students and the direction of learning. It is also the basic base for making the core competence that students should have when they graduate. The setting of professional curriculum system, the organization and implementation of teaching process, the evaluation of teaching effectiveness, and the allocation and investment of teaching resources are all centered around the education objective, serving the objective. Equipment and space, administrative support and funds are the external guarantee elements for the establishment of engineering education. It provides guarantee for the achievement of education objectives. All the above links should be continuously improved around the education objectives and the requirements of graduates' core competence to ensure the achievement of the education objectives [4].
The Principles of Educational Objectives Formulation

The principles of educational objectives formulation based on major accreditation of engineering education embodies the core concepts of student-centered, outcome-based and continuous improvement. Moreover, it reflects the characteristics of disciplines, specialties and industry needs, and conforms to the trend of the times. Fig. 2 shows the principles to be followed for the establishment of education objectives based on the engineering education accreditation. As follows:

![Diagram]

Figure 2. The principles of educational objectives formulation.

**Student-Centered**

For a long time, whether it is the formulation of education objectives and graduates’ core competence requirements, or the construction of curriculum system, and other education and teaching links, too much emphasis is placed on the knowledge and skill attributes of disciplines and majors, which are embodied in the teacher centered, students are completely in a passive learning state, and even the emergence of the teacher-centered curriculum. Based on the core concept of student-centered, the education objectives of engineering education major accreditation emphasize that education is not only the acquisition of students' professional knowledge and skills, but also the self-improvement of students, including international vision, scientific ethics, teamwork, innovation awareness and lifelong learning ability.

**Outcome-Based**

The core of outcome-based education is to design education objectives from the final achievement, match teaching activities with educational objectives, and evaluate and measure the matching degree. It emphasizes the ability standard. Education provides students with the ability to adapt to the life and work of the future society, such as the ability to self-study, analyze and solve problems, practice, cooperation and communication [5]. Every student can achieve success in learning. In the process of teaching, it is not necessary to adopt the same method. Moreover, successful learning will further promote students' desire for success through learning, in order to further promote students' learning.

**Highlight the Characteristics of Subjects and Majors**

In the division of education field, engineering education belongs to applied education. The talents trained through engineering education are suitable for the application-oriented profession. The applied education requires students to master major knowledge and pay more attention to the cultivation of students' comprehensive application of knowledge and the ability to solve practical problems. The establishment of education objectives of engineering major should highlight the characteristics of subjects and majors, make students fully understand the current situation and prospects of the development of the major, and make students more firmly master major knowledge.
and skills. It emphasizes the study of basic theoretical knowledge and the cultivation of practical ability [6].

**Meet Industry Requirements**

Colleges and universities should take the initiative to expand social resources and feedback the professional requirements of industries and enterprises to engineering education personnel training. Therefore, engineering education can better reflect the actual situation of the current engineering technology, meet the needs of the current industry enterprises, and form the interaction of relevant interest groups. The educational objectives formulation reflects the needs of the industry, which helps to promote the effective integration of engineering education and enterprises, enhance the satisfaction of social employers, and promote the combination of production and learning, school enterprise cooperation.

**Serve to Expectations of the Colleges and Universities**

The expectations of the colleges and universities are the development state they expect to achieve in the future. The expectations can inspire and guide school members to pursue the goal of promoting the development of students and the school. Furthermore, it can stimulate the self-surpass consciousness and ability of school members and make them give full play to their value. Educational objectives formulation should be combined with the development expectation of the college and university, and the three complement each other.

**Conform to the Trend of the Times**

Productivity and production relations are the economic basis for making educational objectives. The educational objectives formulation must be adapted to the development of productivity and production relations in a certain society. Engineering education is closely related to the current level of social, economic, scientific and technological development. The characteristics of its specialty emphasize that education should be closely related to the actual social and economic development, meet the social needs, and effectively solve the problems in the current social development. Education serves the society, and the development of education can directly affect the development of society. Therefore, the educational objectives formulation should reflect the current and future social skills needs of engineering professionals, conform to the trend of social development, and meet the social needs [7].

**The Process of Education Objectives Formulation**

Combined with the above principles and the practice and thinking of Fujian Normal University Optoelectronic Information Science and Engineering major participating in engineering education accreditation, the formulation process of education objectives based on engineering education accreditation is proposed as shown in Fig. 3. Some suggestions are as follows:

1. The teaching committee preliminarily determines the education objectives of the major according to the education expectations and objectives of the colleges and universities, characteristics of subjects and majors, industrial prospects and industry needs, as well as the requirements of engineering education accreditation standards.

2. The initial educational objectives shall be submitted to the faculty (major) meeting for discussion and suggestions for revision to improve the educational objectives.

3. Hold a professional advisory committee to review the educational objectives of the major, put forward opinions or suggestions, and further improve the educational objectives; experts of the professional advisory committee need industry representatives, alumni (graduates) representatives and business owners (employers) representatives each accounting for one third.

4. Hold the faculty meeting again to discuss and approve the education objectives.

5. Conduct a questionnaire survey on alumni (graduates) and employers, and investigate the rationality, importance and achievement degree of the education objectives. The survey results will
be an important basis for the continuous improvement of the follow-up professional education objectives.

Figure 3. The process of Education objectives formulation.

Assessment Mechanism of Education Objective Achievement

After establishing the educational objectives based on the engineering education accreditation, it is necessary to establish and use the effective educational objectives and educational achievement testing mechanism to test the achievement of the educational objectives, and constantly improve the educational objectives, in order to continuously improve the quality of education. The latest accreditation standard (2016-2017) of the engineering technology program states: "the program must frequently use appropriate and documented procedures to assess and evaluate the achievement of educational objectives. The results of these evaluations must be systematically used as input to continuous improvement projects. Other available information can also be used to assist in continuous improvement of the program, and the evaluation results are systematically used as input for continuous improvement [8]. Fig. 4 is a schematic diagram of the assessment mechanism for the achievement degree of education objectives. Through the combination of internal and external loop evaluation, we can evaluate the achievement degree of education objectives, form measures of continuous improvement and a dynamic cycle mechanism. Among them, the internal loop assessment mainly includes the teaching supervision mechanism of the University and the college, the investigation of the teaching effect and satisfaction of the course, the production of the graduate questionnaire survey, etc. the external loop assessment mainly includes the professional advisory committee, the interview and questionnaire survey of the enterprise owner, the interview and questionnaire survey of the students from the same Department, the questionnaire survey, etc.

Figure 4. Assessment mechanism of education objective achievement.

Summary

Based on the background of the emerging engineering construction era, this paper discusses the educational objectives formulation based on major accreditation of engineering education. Combined with the practice and thinking of the engineering education accreditation of the
Optoelectronic engineering major in Fujian Normal University, this paper puts forward the principles, processes and achievement assess mechanism of the education objective formulation, and makes continuous improvement, so as to provide reference for the construction of the engineering major and the engineering education accreditation.

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