Study on Graduation Design of the Major of Process Equipment and Control Engineering Under the Vision of Professional Accreditation

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Abstract. The professional accreditation system is an important guarantee to improve the quality of engineering personnel training. It is an important basis for China's higher engineering education to participate in international competition. In order to improve the graduation design quality of the major of process equipment and control engineering, the authors introduced the standards of professional accreditation, analyzed the main problems existed in the graduation design, and put forward some measures to improve the graduation design quality such as optimizing the topics, adopting diversified guidance methods, strengthening supervision and management and so on. The study indicates that the students have more interests to the optimized topics and strong engineering practice and innovation ability.

Introduction

The professional accreditation system is an important guarantee to improve the quality of engineering personnel training. It is the foundation and key to promote the international recognition of China's engineer qualification. And it is of great significance for China to cope with international competition and go to the world in the field of engineering technology.

The Professional Accreditation Standards of CEEAA

In 2012, the China Engineering Education Accreditation Association (CEEAA) was established in China according to the requirements of the Washington Agreement. It is the only legal organization to carry out project education professional certification in China. The professional accreditation standards of CEEAA are composed of the general standards and the professional supplementary standards, show as in table 1 [1].
Table 1. The professional accreditation standards of CEEAA.

| item                | contents                                                                 |
|---------------------|--------------------------------------------------------------------------|
| students            | (1) attract excellent students. (2) guide students in all aspects. (3) track and evaluate students. (4) recognize students' original credits |
| training objectives | (1) There are open training objectives, which are consistent with the orientation of the school, and adapt to the needs of social and economic development. (2) The rationality of cultivation target should be evaluated regularly and the training target should be revised according to the evaluation results. |
| graduation requirements | (1) engineering knowledge. (2) problem analysis. (3) design/develop solutions. (4) research. (5) use modern tools. (6) engineering and society. (7) environment and sustainable development. (8) professional standards. (9) individuals and teams. (10) communication. (11) project management. (12) lifelong learning. |
| continuous improvement | (1) to establish the teaching process quality control mechanism, graduate tracking feedback mechanism and social evaluation mechanism. (2) to demonstrate evaluation used for continuous improvement. |
| curriculum system   | (1) mathematics and natural science courses. (2) engineering foundation courses, professional foundation courses and professional courses. (3) engineering practice and graduation design (thesis). (4) general humanities and social sciences education course. |
| teachers troop      | (1) number of teachers. (2) teachers' ability. (3) teachers have plenty of time and energy. (4) teachers provide guidance to the students. (5) teachers define their responsibilities in the process of teaching quality improvement. |
| support conditions  | (1) classrooms, laboratories and equipment. (2) computer, network and books and data. (3) education funds. (4) teacher team building. (5) schools can provide the infrastructure necessary to meet graduation requirements. (6) the school's teaching management and service standard. |
| supplementary standards | (1) curriculum system. (2) teaching staff. (3) professional conditions. |

The Problems Existed in Graduation Design

Improper Topic

At present, most of the students' design topics are selected by the instructor. According to the results of the questionnaire survey, 81% of the students' topics were directly given by the instructor, and 18.9% of the students' topics were determined through discussion with the instructor. When teachers give topics directly, it is inevitable that they will fail to consider the individual differences of students, and causes the students low interest in design topics. The results of the questionnaire showed that only 35.1% of the students were interested in the design topics [2]. Meanwhile, some teachers used the same old topics over and over again, only slightly modifying the data, and a teacher guided more than one student on almost the same topic [3]. This is a defect in the cultivation of students' practical ability and innovative spirit.

Design Time is not Guaranteed

In the graduation design semester, students are facing the pressure of employment, and some students are also facing the postgraduate entrance examination, which overlaps with the time of graduation project, so students have to put their graduation design into a subordinate position temporarily. Therefore, the supervisor cannot carry out effective management, resulting in the quality of graduation design reduced. According to the survey results, 70% of the students though the design was of average quality [4].

Students Lack of Technical Writing Skills and Awareness of Standards

Students' graduation design consists of two parts: the calculation instruction and the drawing. There are some problems in the drawing that are not standardized, and the instruction lacks the corresponding professional and academic language, so many students have to scramble. Although the school provided a template for the calculation instruction, many students' writing style was still not standard, which was mainly reflected in the citation of articles, the use of punctuation marks,
data analysis, illustration of diagrams and so on. Teachers needed to spend a lot of energy and time to modify the format of the paper, which resulted in a corresponding reduction of time for teachers to train students' ability of analyzing problems and engineering innovation.

**Weak Supervision and Management**

Although the school has formulated the "graduation design guidance manual", which explains the purpose, organization and leadership of the graduation design, the responsibilities of the instructor, and the specification requirements of the thesis, the monitoring mechanism has not been established in the process of graduation design, and there is a lack of effective monitoring measures.

**Introduction of the Process Equipment and Control Engineering in Our School**

The major of process equipment and control engineering in our school was developed on the basis of the major of chemical equipment and machinery which was established by Huainan Chemical Engineering School of the former Ministry of Chemical Industry in 1958 [5]. It started as a 3-year junior college. In 2004, the undergraduate major of process equipment and control engineering was approved. In 2009, the power engineering and engineering thermophysics master degree was authorized. In 2012, the major was selected as a pilot major for comprehensive reform. In 2015, it was approved as the comprehensive reform pilot major of Anhui Province, and in 2016, it was approved as the characteristic major of Anhui Province.

The teaching team of process equipment and control engineering was awarded the university-level teaching team in 2013 and the teaching team of Anhui Province in 2019. The graduates of this major mainly serve the industries of chemical industry, machinery, light industry, petroleum, construction and installation, etc. According to the requirements of professional certification, the authors have carried out reform from the aspects of improving students' interest, improving teachers' quality and strengthening management.

**Measures Taken**

**Optimize the Topics to Improve Students' Interest**

Topic is the source and foundation of graduation design, which directly affects the quality of graduation design. In selecting the topic, the characteristics of the major should be closely combined with engineering practice and production. Usually, topics can be selected according to the following methods. (1) choose the topic based on actual production problems of enterprises; (2) choose the topic based on the characteristics and individual differences of students; (3) choose the topic according to the needs of the society [6].

Usually, there are three types of graduation projects: engineering design, scientific research and innovation. Engineering design-type topics mainly refer to conventional structural design, calculation and verification according to relevant standards based on existing equipment and technical parameters of the plant. This kind of topic is especially suitable for students who go to employment units. Scientific research-type topics are mainly determined by teachers according to their own scientific research. This kind of topic has the certain enlightenment function to the students who continue to study the master's degree. Innovation-type topics mainly come from discipline competition, entrepreneurship competition, innovation team and other team activities. This kind of project requires students to have certain scientific research ability and innovation ability [7].

In practice, the authors gave full consideration to the individual situation of students and selected each topic for each student. For example, for students who were already employed, we chose the engineering design-type topics as their projects, such as design of high pressure reactor, design of floating head heat exchanger, air compressor design, gear pump design, etc. And for the students who continue to study the master's degree, we chose the scientific research-type topics as their projects according to my own scientific research, such as design of the torque self-check planetary reducer, design of hydraulic elevator, design of rice husk conveyor and design of biomass dryer and
so on. For students with innovative consciousness, we chose Innovation-type topics as their projects such as the design of Coriolis powder flowmeter, design of mobile platform based on Mecanum wheel and design of multi-gear pump and so on. These topics enhanced students' interest, mobilized students’ enthusiasm and initiative, and improved the quality of graduation design.

**Adopt Diversified Guidance Methods**

In the process of graduation design, it should be clear that students are the main body of graduation design, and teachers only play a guiding role. The guidance work should vary from person to person, take the diversification guidance mode positively, in order to train the students initiative innovation ability. The way the group does it is. First, according to the situation of students' topic selection, a graduation design guidance group composed of 3 teachers is established, and the three teachers in the guidance group work together. Secondly, establish a QQ or WeChat communication group that includes all the students in the group, so as to facilitate the communication between teachers and students. Thirdly, once a week, each student would report the progress of his/her graduation project, the problems encountered and the methods planned to solve. Fourth, for the students who are looking for jobs and taking the postgraduate entrance exam, they would use QQ, email, WeChat and other communication methods that are not restricted by time and space to communicate and guide them. This combination of online tutoring and face-to-face tutoring can realize the integration and sharing of teachers, information and literature resources, improve students' initiative, exploration and innovation, and achieve the purpose of teaching and learning.

**Strengthen the Training of Technological Writing Ability and Standardization Awareness**

The basic task of the graduation design is to cultivate students' comprehensive use what they have learned the basic theory of basic knowledge and basic skills, analysis solution actual problem ability, help students establish the correct design idea and the rigorous scientific attitude, further improve the level of writing and the ability. Therefore, we strengthened students' understanding of graduation design, emphasized the importance of design documents from the beginning of the design, requiring students to write papers in professional language, draw part drawings and assembly drawings using standard drawings, and write design specifications in strict accordance with templates provided by the school, and conduct regular inspections to correct problems in time.

**Strengthen Supervision and Management**

The school should strengthen the process management of graduation design, and set up a graduation design guidance inspection team. From teacher qualification to topic selection, from students' design process to teachers' guidance process, from document evaluation to graduation defense, and even to grade evaluation, operating rules and assessment system should be established to standardize the operation of graduation design process and further improve the quality of graduation design.

**Conclusion**

Graduation design is the basic training of cultivating engineering undergraduates to conduct scientific research, and it is a key link in university talent training. How to improve the quality of graduation design and ensure the smooth realization of the goal of talent training is a problem that every teacher should think deeply about. This paper puts forward some suggestions and measures in order to improve the quality of graduation design and ensure the realization of talent training goals.

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