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Teaching Reform and Practice of Science and Technology Paper Writing Course Under the Background of Engineering Education Certification

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Abstract

Based on the basic concept of engineering education professional certification student center, achievement orientation, continuous improvement, in view of the current situation of poor writing ability of undergraduate scientific and technological thesis, weak scientific research consciousness, combined with the graduation requirements from the syllabus, course content, teaching methods, assessment methods and other aspects of the reform. The reform has played a beneficial help to improve students' subjective initiative in learning, cultivate teamwork spirit, and vacation to the understanding of scientific and technological papers and writing ability. The results can also provide a useful reference for the curriculum teaching reform under the background of other engineering education professional certification.

Keywords: engineering education professional certification, science and technology paper writing, teaching reform and practice

1. Introduction

Since China officially joined the Washington Agreement in 2016, engineering education professional certification has become an important institutional guarantee for engineering personnel training and education quality in China (Huang, Z.-K., He, X.-X., Liu, Y.-T., et al., 2022). The major of Mechanical Design, Manufacturing and Automation of Sichuan University of Science & Engineering began the reform of engineering education professional certification in 2019, and officially passed in 2021. As one of the few courses in this major that inspire students' scientific research thinking ability and expression ability of scientific research, science and technological paper writing course carried out a series of teaching reform and practice.

At present, Chinese college students tend to have less contact with scientific research in undergraduate students, and their ability of summarizing, innovating, expressing and writing of scientific and technological achievements is poor (Wang, Y.-Q., 2019). Therefore, in recent years, many universities opened the "science and technology paper writing" course to improve the writing ability of science and technology literature. However, there are still many problems with the course: 1) The content of the course is simple, mainly for the paper writing process, but for a series of problems closely related to scientific paper writing, such as research topic selection, literature search, submitted journal selection, paper submission skills almost not involved; 2) textbooks are universal textbooks, can not reflect the characteristics of different majors (Zhang, F.-F. , 2016); 3) The teaching method is too single, most teaching methods are through teacher's explanation and students' passive learning, this is not conducive to the interaction between teachers and students, nor is it conducive to playing students' subjective

initiative in learning; 4) The evaluation method lacks the intermediate control means, and it is difficult to fully understand the students' learning situation and comprehensive ability. To sum up, it is of great practical significance to carry out curriculum reform combined with the requirements of engineering education professional certification.

2. Curriculum Reform and Practice

2.1 Change the Teaching Concept

Under the background of engineering education professional certification, teachers should break the traditional teaching concept, establish a new teaching idea that the teaching concept should be student- centered, achievement-oriented, and continuous improvement as the mechanism, in other words, established the teaching concept of Outcome Based Education (OBE).

2.2 The Reform of the Syllabus

Engineering education professional certification puts forward 12 graduation requirements in the talent training plan. According to the characteristics of the science and technology paper writing course, the syllabus of the course has been reformed, which could support two graduation requirements: (9) Individual and team and (10) Communication, and corresponding to two secondary index points: 9-2,10-1, as shown in Table 1:

Table 1. Course objectives and corresponding graduation requirements

Course objectives	Graduation requirements	Secondary index points for graduation requirements
1	9: Individual and team	9-1: Have a good sense of teamwork, and be able to work independently or jointly in the team;
2	10: Communication	10-2: Understand the development trends in the field of mechanical design and manufacturing, be able to clearly state and express their views on the complex engineering issues of mechanical design and manufacturing, and communicate with the industry peers and the public;

The course objective 1 is: To understand the development status and trends in the professional research field through teamwork, and to form the review results of the professional research field through collaboration.

The course objective 2 is: Be proficient in using literature retrieval tools to obtain relevant materials needed for learning and research; master scientific and technological paper writing skills, and have preliminary scientific and technological paper writing ability;

2.3 The Reform of the Curriculum Content

The traditional science and technology paper writing materials mainly explain the writing techniques of each component of science and technology paper, which is difficult to let students have a comprehensive and systematic understanding of science and technology work.

Therefore, in the reform of curriculum content, first of all, we should combine the characteristics of the major, knowledge and cases, and explain the scientific research work from the topic selection, project approval, research methods and means, article writing skills, the selection of journals and the whole cycle of publication, so as to enhance students' comprehensive understanding of science and technology work. Secondly, it should be combined with other problems related to the course, such as graduation thesis, or combined with excellent papers in the professional field. These contents are closely related to students 'undergraduate study, they can improve students' interest in learning and drive the enthusiasm of students. Thirdly, in the teaching process, the importance of the team strength in science and technology work should be emphasized, and students' teamwork awareness and ability should be enhanced through appropriate learning tasks, so that students can understand the importance of teamwork and the necessity of scientific research communication.

2.4 The Reform of the Teaching Methods

The traditional teaching method is mainly "teaching", and teachers are the center of the subject, while students often passively accept the knowledge (Han, C.-Y., Xie, Y.-H., Xie, D.-D., & Liu, H., 2021). Under the guidance of the concept of engineering education professional certification, this course combines the graduation requirements, and reforms the practical link and "flipped classroom" link in addition to normal classroom teaching:

(1) Teamwork and practice reform. Firstly, students were divided into small groups, and then each group determined the direction of their desired research field by themselves. Then, students should reviewed the status of research in that direction by groups, wrote a review paper and submit it before the start of the " Classroom flipped " session. At last, the teacher reviewed the article and returned to the group, allowing the group to discuss and submit it again.

(2) "Classroom flipped" reform. Each group organized PPT for the written review articles, selected representatives to report to other students in the form of academic reports in class, and other groups asked questions and made academic discussions on the group.

2.5 The Reform of the Assessment Methods

Curriculum assessment is an important means to evaluate students' mastery of the course. However, the traditional assessment method is mainly based on the final paper (Gao, X., Zhang, B.-J., 2016), supplemented by homework or attendance, which is not conducive to the comprehensive evaluation of students. In this course, according to the requirements of the course objectives, the personal achievement assessment and team achievement assessment are combined, and the process assessment and the final assessment are combined (Jiang, X.-W., & Liu, F., 2021), so that the personal and team ability, communication ability and scientific and technological thesis writing ability into the comprehensive assessment category, in order to achieve the support of the graduation requirements index points details are as follows:

1) Team review and article assessment. It was noted in subsection 2.4 that students submitted 2 review articles in small groups before and after the " Classroom flipped " session. This assessment accounted for 30% of the total score, among which the first and second submissions accounted for 30% and 70% of the score, respectively.

2) The " Classroom flipped" assessment. After the report of each group, the report quality of the group will be scored by teachers and other groups, with teachers and students each scoring 50% of the total score and 40% of the total score.

3) After the end of the course, each student will choose one research direction and write review articles in this direction in strict accordance with the scientific and technological paper format. This assessment accounts for 30% of the total score.

3. Effect of the Reform and the Major Existing Problems

After the course, 103 students were surveyed to understand the effect of the curriculum reform and the existing problems. The results showed that in the survey "Do you think the course can cultivate the sense of teamwork and improve the ability to work independently or jointly in the team", 96% of the students chose "Yes", and in the survey of "Do you think the course understands the trends of the professional field and enhances academic communication and writing skills", 86% of students chose "Yes", indicating that the course had a good classroom effect.

However, there are still some problems in the course. In the survey of "what opinions and suggestions on the teaching situation of this course", some students reported "The hours of the class are too short", "unable to understand the content of scientific and technological papers", "the time of the academic report are too short" and other problems. It can be seen that although the current curriculum reform has achieved some results, there is still a long way to achieve continuous improvement, and need further reform and exploration.

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