Reflections on the Construction of the Full-English Course "Engineering Ethics"

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Abstract: "Engineering Ethics" is a basic engineering course for majors such as automation. It plays an important role in broadening students' global vision and cultivating their professional ethics awareness. How to effectively teach the course contents in English within limited class hours, while stimulating students' interest in learning and improving their practical ability and professional quality is an important issue that needs to be solved urgently.

In order to effectively carry out the full-English teaching of "Engineering Ethics", the teaching strategy needs to be optimized from multiple dimensions such as course design, implementation of teaching methods, and assessment and evaluation. First, the course starts with basic ethical concepts and gradually expands to ethical issues in actual engineering, helping students think about how to make responsible ethical decisions in the context of globalization. Secondly, in terms of teaching methods, a variety of teaching methods are used to stimulate students' interest and promote students' in-depth thinking on ethical issues. Finally, assessments focus on a comprehensive evaluation of students' learning outcomes, including their understanding of ethical decision-making and language skills. This approach effectively tests knowledge retention while fostering critical thinking and expression related to ethical issues, better cultivating students' global outlook and sensitivity to professional ethics.

An analysis of the achievement of learning objectives from the course taught in full-English at a university demonstrates that the above teaching method has achieved good teaching results.

Keywords: Engineering ethics; Full-English teaching; Achievement of learning objectives

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1. Importance of Full- English Teaching for "Engineering Ethics"

"Engineering Ethics" is a basic engineering course for automation, measurement & control and other related majors in colleges and universities in China. The construction of full-English courses is not only a means to improve students' abilities, but also an important way to enhance the international reputation of colleges and universities[1-2]. With the advancement of engineering education certification applications and the increase in students' diversified needs for learning, the construction of full-English "Engineering Ethics" course has become imperative, which is specifically reflected in the following aspects:

(1) International certification standards met. International engineering education certification systems such as ABET have clear requirements for ethics courses. Full-English courses can help students understand internationally accepted ethical norms and standards, and provide important knowledge reserves for future engineering careers.

(2) Students' global perspectives broadened. Engineering ethics courses need to explore complex cross-cultural and cross-border issues. Full-English teaching can introduce global cases, such as the Boeing 737 MAX incident, so that students can have a deeper understanding of ethical decision-making in different cultural contexts.

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(3) Students' professional ethics awareness enhanced. The work of engineers has a significant impact on society and the environment. By studying international literature and classic cases, students can more comprehensively understand the value of engineering ethics in actual work, thereby enhancing their sense of social responsibility.

(4) Global applicability. Ethical issues have commonalities in different cultural and technological contexts. Full-English teaching can help students master these common contents and prepare for international academic exchanges [3].

2. Implementation of Full-English Teaching for "Engineering Ethics"

Full-English teaching of "Engineering Ethics" can be comprehensively planned from the aspects of course design, teaching implementation and assessment methods to ensure that students can not only master engineering ethics knowledge but also improve their language skills.

(1) Course planning and contents design

The course aims to help students establish an awareness of engineering ethics and master the ability to deal with ethical issues in engineering practice [4-5]. At the same time, it guides students to become familiar with international ethical standards for engineers and improves their ability to read literature, write reports and communicate in English.

Based on the original Chinese textbook, the course adds self-edited English lecture notes and supplements real engineering cases such as the ethical challenges of artificial intelligence, combining theory with practice.

The course contents can be divided into multiple independent modules to facilitate teaching in a step-by-step manner, such as: Fundamental Theories in Engineering Ethics, Professional Conduct for Engineers, Analysis of Ethical Dilemmas, Ethics in Emerging Technologies, etc.

(2) Diversification of teaching methods

The course flexibly uses a variety of teaching methods, including:

Lecture method: core knowledge is delivered through full-English lectures, and multimedia is used to assist teaching.

Discussion and debate: classroom discussions based on real situations are conducted to cultivate students' critical thinking and language expression skills.

Flipped classroom: Let students learn relevant knowledge before class and deepen their understanding through interaction in class.

At the same time, the course invites corporate engineers to give lectures in English to provide students with a real international perspective.

(3) Assessment and evaluation

The course‘s assessment is mainly aimed at assessing the achievement of students' ability training goals, with the examination of students' mastery of each knowledge point and application ability as important contents, and focuses on process evaluation. The assessment is not limited to the final grade, but also needs to focus on the progress of students in the learning process, especially the improvement of language ability and depth of thinking.

3. Example Analysis

The following is an analysis of the teaching effect of a class in the fall semester of 2024-2025 at a certain

university. The "Engineering Ethics" course in this class has a total of 16 class hours.

The course focuses on the cultivation of students' language skills, recommends free teaching resources such as English learning aids to students, and encourages students to read relevant English literature, such as classic research or current affairs reports in the field of engineering ethics. In the early teaching stage, combined with the actual situation, students are flexibly allowed to communicate in a combination of Chinese and English. Key contents of the course teaching materials are also annotated in Chinese, and the transition to full-English learning is gradually made in later stage.

The course simultaneously establishes online courses on the Chaoxing platform, providing students with learning materials including international case libraries, ethics literature and videos.

There are 38 persons in the class, with high overall attendance rate and good learning atmosphere. The course has a total of 2 course objectives as follows:

Course objective 1: ability to analyze and evaluate the relationship between engineering and society, namely being able to make reasonable analysis based on the relevant background knowledge of automation majors, evaluate the impact of professional engineering practices and complex engineering problem solutions on society, health, safety, law and culture, and understand the responsibilities that should be assumed.

Course objective 2: quality of complying with professional norms, namely having humanities and social science literacy, social responsibility, and being able to understand and comply with engineering professional ethics and norms in automation engineering practice and fulfill responsibilities.

The assessment method includes regular assessment and final assessment. Regular assessment is mainly 40% of homework/tests, and final assessment is mainly 60% of course reports. Regular assessment and final assessment include assessment of students' English writing and expression skills.

The expected value of the course objectives and overall course objective achievement is 0.8 and 0.88, respectively. Bar chart of course objectives evaluation is shown in Fig.1, and line chart of each course objective evaluation is shown in Fig.2.

It can be seen that the students have a good grasp of both course objective 1 and 2. Among them, only one student's course objective 1 achievement evaluation value was lower than the expected value of 0.8, accounting for 2.6% of the total number of students in the class. All students' achievement of course objective 2 are higher than expected value. In the next academic year, it is planned to strengthen the construction of online course teaching resources of course objective 1, and further follow up on the above student's learning situation through extracurricular tutoring and Q&A, and provide feedback in a timely manner through statistical teaching data.

After the course, a questionnaire survey was conducted on the students in the class. The questionnaire contents included whether online learning resources (such as videos, case databases) were useful, whether the course improved the understanding of the subject, and whether the course helped improve academic English proficiency. Nearly 70% of the students gave positive comments on the above questions, indicating that the full-English teaching of "Engineering Ethics" in this class has achieved good results. Through the questionnaire survey, we learned about the students' experience and expectations of the course, and provided useful feedback and suggestions for further improving the course contents and teaching methods.

4. Conclusion

This paper first analyzes the necessity of full- English teaching for "Engineering Ethics" from the aspects of understanding international certification standards, broadening global vision, and enhancing professional ethics awareness. Then, it explores the implementation of full-English "Engineering Ethics" from the aspects of

course design, teaching implementation and assessment methods. Finally, it evaluates the learning objectives of "Engineering Ethics" course at a certain university, and conducts corresponding questionnaire survey.

Full-English teaching should be continuously improved in combination with specific teaching practices, and there is still a long way to go in exploring full-English teaching. At present, full-English teaching pays more attention to cultural inclusiveness, that is, incorporating multicultural elements into full-English teaching to enhance students' global awareness. Full-English teaching will continue to be an important part of the global education system.

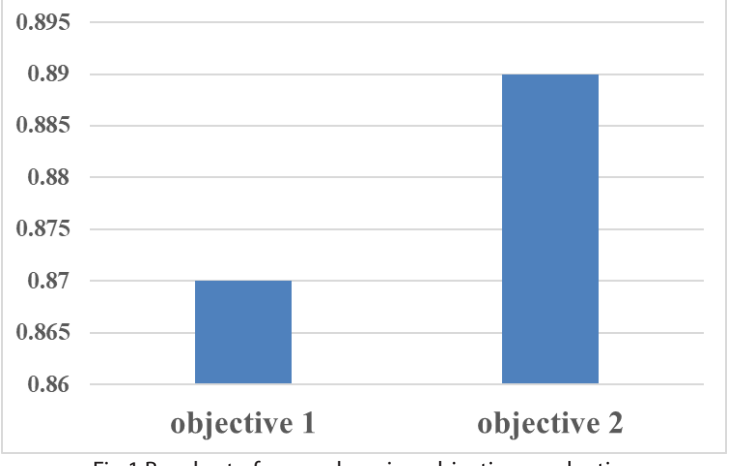

Fig.1 Bar chart of course learning objectives evaluation

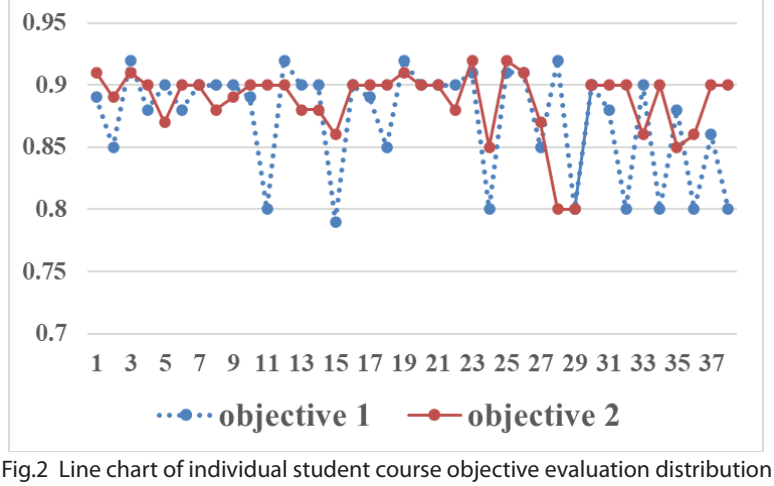

Fig.2 Line chart of individual student course objective evaluation distribution

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