



Analysis of Engineering Ethics Education Teaching Based on BOPPPS Teaching Model

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Abstract. This paper explores and studies the cultivation of engineering ethics knowledge for civil engineering students, and explores the introduction of engineering ethics knowledge in teaching practice according to the current teaching status of professional courses. Guided teaching combined with ethical theory and engineering application background cases, based on the BOPPPS teaching model, oriented by educational goals and student-centered, using a variety of teaching methods, such as audio multimedia teaching tools, online and offline mixed teaching mode, Course ideological and political teaching, etc. Cultivating engineering ethics is to cultivate students' good professional ethics and character, improve students' sensitivity to morality and ethical judgment, enable students to have a certain understanding of engineering ethics knowledge, and enhance ethical awareness and identify ethics in the process of professional course learning. It also promotes the ideological and political education of the curriculum to a certain extent.

Keyword: BOPPPS · educational reform · engineering ethics

1 Introduction

The development of civil engineering technology has greatly improved people's ability to resist natural disasters, such as the development of seismic technology, which has greatly improved people's resistance to earthquake disasters. Civil engineering technology improves public health and social welfare, shopping and leisure conditions, etc. Civil engineering also promotes harmonious social development, urban open spaces, sustainable mixed housing communities, affordable housing, etc., making cities inclusive, just, safe, vibrant and prosperous. However, the development of civil engineering also raises many ethical issues. This paper expounds the common engineering ethics problems in modern society, based on the BOPPPS teaching model, it analyzes the education of college students' engineering ethics training.

2 Main Ethical Issues

2.1 Safety Ethics Issues

According to the statistics of the Ministry of Housing and Urban-Rural Development, in 2014, there were 522 house collapse accidents and urban engineering safety accidents in

China, resulting in 648 deaths. The safety situation is very serious. By type, there were 276 high-altitude accidents, 71 collapse accidents, 63 collision accidents with objects, 50 hoisting accidents, and 62 mechanical injuries, vehicle injuries, electric shocks, poisoning, suffocation and other accidents [1]. Relevant analysis and research have shown that the gaps in laws, regulations and standards, insufficient government safety supervision and capacity, inadequate implementation of corporate safety responsibility systems, turbulence in the construction market, and low and backward industrial technology levels have caused these accidents.

2.2 Environmental Ethics Issues

According to the data of the National Bureau of Statistics, in 2014, my country's cement industry produced 2.48 billion tons of cement, with a capacity utilization rate of 65%, or 1.8 tons per capita. Data from the National Bureau of Statistics also shows that in the 10 years from 2005 to 2014, 28.89 billion square meters of various types of houses were built in my country. Such a scale and speed of construction can be said to be unprecedented in the world, but the scale and speed of house demolition in China during the same period is also unprecedented. Relevant research shows that the average lifespan of demolished houses in Chongqing is about 38 years, and the average lifespan of brick-concrete structures in Zhengzhou is 28.45 years. In addition, many buildings in China have been demolished after construction or even before construction, so it is often called "the country that produces the most construction waste in the world".

2.3 Other Ethical Issues

In addition to the two aspects of safety and the environment, engineering ethics also faces various conflicts and incomprehensions such as the engineer's culture, values and professional ethics. As for the first one, such as urban renewal and construction projects, it is often encountered in the demolition and reconstruction of historical and cultural streets, and there will be disputes on the value of demolition, protection and economic development, traditional culture and modern fashion. Another example is the CCTV headquarters building. The project budget has increased from 5 billion yuan to 20 billion yuan, and its safety and energy efficiency issues have attracted attention from all walks of life. The public dubbed it "big pants", and in November 2014, it was even voted as the worst building to be demolished by the editors and reporters of the British "Financial Times". Tall Building Award".

3 Ethical Theories Involved

3.1 The Theory of Utilitarianism

Utilitarianism is an ethical theory that takes actual interests, efficacy and other substantive content as the basis of moral value. It is human nature to be selfish and selfish. It regards human interests as the basis of behavior, the root of morality, the criterion of legislation, and the measure of value for weighing everything. Utilitarians adjust the relationship

between individuals and others, and between individuals and society according to the principle that what can satisfy people's interests or make people happy is moral, otherwise it is immoral.

3.2 Moral Ethics

“The Tao is born, the virtue is the animal, the object is shaped, and the utensil is formed.” “That is why all things respect the Tao and value the virtue.” The Tao is respected, the virtue is precious, and the life is not the life. It is always natural. “—Laozi, spontaneously adjust the relationship between people, so that individuals can impose necessary constraints on their own behavior. “Virtue is not alone, there must be neighbors”—Confucius, the most important thing in morality is “ren”, That is “loyalty and forgiveness”, and the heart is full of sincerity and tolerance when dealing with people [1].

3.3 Social Responsibility Ethics

Corporate social responsibility mainly means that enterprises should not regard earning money as their only appeal and purpose, but should also place social interests on the same level while obtaining economic benefits. It includes: consumer rights, employee benefits, Returns of economic stakeholders, industry development, environmental pollution, social and public interests, etc. Take responsibility for the quality and safety of the products provided; take responsibility for the promotion of social development; take responsibility for the welfare and safety of employees of your own enterprise.

3.4 Debt Ethics Theory

The moral theory represented by Kant is characterized in that the rules of action determine whether to realize or not, and only the rules that do not produce contradictions can be generalized and realized. So, “practice movements under conditions that others do too.” Acting, like her, is about demonstrating the value of human reason. When things are done according to the rules of reason, it is moral and shows the value of reason. This is one of the purposes. Hence, “my purpose is to treat people as people, not tools”; if things are just “conventional”, that is wise not moral, and exceptions will arise. It may or may not be implemented, only “beyond the rules” can be called the noble and great value of reason, and automatic obedience to the rules makes action inevitable.

4 Teaching Practice

Engineering ethics should be taken as the curriculum perspective of all professional basic courses and core courses. In short, engineering ethics courses can be taught in the form of a combination of independent education and subject penetration [4]. Specifically, self-education refers to the establishment of specialized engineering ethics basic courses, and subject penetration refers to professional basic courses or professional core courses, combining relevant engineering ethics content in the teaching process. Based

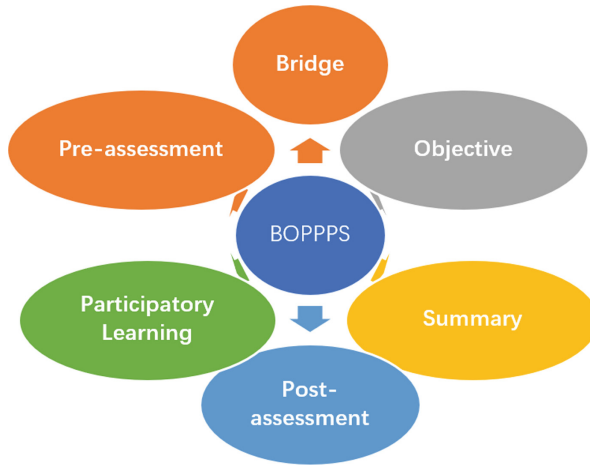


Fig. 1. BOPPPS Teaching Model

on the engineering ethics system of professional basic courses and professional core courses, the core of the system should include engineering ethics content that matches the curriculum content. Among them, the purpose of the basic courses of engineering ethics is to deepen students' understanding of the principles and standards of engineering ethics, and the focus of engineering ethics is engineering ethics. Designed to improve students' understanding of future management skills (Fig. 1).

4.1 Case Teaching

Case teaching involves discussing and analyzing cases, researching and evaluating original solutions to case problems, thinking and planning, and using cases as the subject of analytical research in the classroom. Make improvements in the original case situation, or put forward new ideas and models in new situations, and compare and exchange learning methods. Case teaching not only creates an engineering practice situation for students to enhance their interest in learning, but also allows them to experience the complex situations and difficult choices they face. Engineering practitioners develop not only an understanding of engineering ethics issues, but also the ability to manage engineering ethics and engineering ethics. In addition to basic engineering ethics courses, engineering ethics cases need to be instilled in professional courses as part of engineering ethics education [3].

4.2 Research Study

Inquiry-based learning mainly includes problem-based learning and project-based learning. In short, under the guidance of teachers, students actively discover, analyze and solve problems through a variety of flexible and diverse research-based learning methods to achieve knowledge learning [5]. In the process of achieving learning objectives in terms of capacity building and quality training, students' inquiry-based learning is

actively involved in learning and an atmosphere of group work. Students will develop a unique understanding of learning methods and progress, a deeper understanding of various engineering ethics issues, and an understanding of engineering ethics. Students can also better develop teamwork, communication and other solutions in the process, and the ability of collaborative group learning of complex issues of engineering ethics can effectively improve the learning effect in the process of teacher-student interaction and student-student interaction. At the same time, the unique inquiry-based learning mechanism can ensure the effective realization of future-oriented engineering ethics teaching goals.

4.3 Combining Theory and Practice

Pure theoretical research not only increases the time it takes students to understand and acquire knowledge, but also makes it difficult to internalize what is learned. By combining with practice, the theory is tested and applied, so that students not only understand and acquire the essence and essence of knowledge, but also richly internalize it in their own life. The combination of theory and practice, not only to teach theoretical knowledge in the classroom, but also to explain specific practical or practical problems, and introduce them into the process of engineering practice, so that students can solve ethical problems and engineering ethics problems in engineering, which is helpful for Learn about its principles and standards. Theory and practical education are alternately carried out, allowing students to discover the essence of engineering ethics principles and theories in practical activities.

5 Teacher Team Building

Engineering ethics training cannot only be supplemented by the establishment of special courses, but must integrate engineering ethics related content into professional basic courses and professional core courses on the basis of engineering ethics major. Form a training based on one professional course and linked with multiple basic courses. It can be seen that the teaching of engineering ethics not only needs teachers who can teach the basic courses of engineering ethics, but also need teachers who can combine the teaching of professional disciplines with the teaching of engineering ethics in the teaching of engineering professional courses.

For teachers who teach basic engineering courses, the training focuses on how to carry out engineering ethics education in combination with the content of expert courses. Students understand their own relevant engineering ethics standards and deepen their understanding of engineering ethics through classroom teaching. Improve the ability to deal with engineering ethics issues to achieve goals that echo professional curriculum knowledge.

The researchers believe that engineering ethics requires a mixed educational team of philosophical and engineering experts. Teachers with different backgrounds such as ethics and engineering need to communicate regularly, break the boundaries of disciplinary thinking, and discuss with each other the teaching viewpoints and teaching methods of engineering ethics.

6 Conclusion

In recent years, the social problems caused by engineering practice have become increasingly prominent and have an increasing impact. One of the important reasons is the weakness and lack of training in engineering ethics. In the context of large-scale projects in modern China, engineers as professionals, due to the unique professionalism, knowledge and seriousness of the consequences of the project, as an engineer in a professional role, should put the safety, health and well-being of the public first, which should be It is the basic principle of engineering ethics. In order to improve engineers' awareness of social responsibility, it is necessary to change the traditional engineering concept, that is, to seek the maximization of technical benefits from the engineering professional ethics that are loyal to employers. It is necessary to actively supervise moral education. In the process of rapid industrialization, there have been many production safety accidents and chemical plant explosion accidents. Accident liability reviews often ignore soft factors such as professional ethics and social responsibility, and focus on core factors such as safety standards and management systems.

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References

1. Li, H. (2021). Research on the key mechanism of engineering ethics education. Zhejiang University.
2. Li, W. Y., Zhou, Y., & Song, Y. G. (2021). Research on the integration of curriculum ideology and politics into the curriculum of "Engineering Ethics and Engineering Cognition." *Teacher*, 24, 86–87.
3. Shi, H. C., Feng, L., Wang, Z. M., Wang, L., & Tang, J. (2021). Ideological and political construction of environmental ethics curriculum under the background of new engineering. *Education and Teaching Forum*, 34, 1–5.
4. Wang, S. H., Zhao, S. A., & Yuan, G. L. (2022). Case analysis of hybrid interactive teaching based on BOPPPS. *Electronic Technology*, 51(03), 206–207.
5. Xu, X. L. (2021). Analysis of engineering ethics education in engineering teaching. *Higher Education Journal*, 7(36), 89–92.
6. Zhang, J. L., Wang, W., & Ge, Y. (2021). Research on engineering ethics awareness and craftsman spirit cultivation of new engineering talents. *Public Standardization*, 18, 128–130.

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