

Exploring the Teaching Reform of Industry-Education Integration in Engineering Ethics and Project Management Course

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Abstract: Engineering ethics and project management are the most extendable courses in the quality course group, which is the characteristic core curriculum system of measurement and control technology and instrument specialty. This course is divided into two parts: engineering ethics and engineering project management. In view of the society's increasing emphasis on engineering ethics and the key role of engineering project management in solving complex engineering problems, the traditional purely theoretical teaching method is no longer suitable for the new teaching needs in the contemporary context. Therefore, in order to improve the teaching quality and the students' learning effect of the extensible and open knowledge, the major of measurement and control technology and instrument of Changzhou Institute of Technology invited the technical directors of representative enterprises in the industry such as Changzhou Promise Management Consulting Co., Ltd. to analyze the classroom cases of relevant knowledge, so as to realize the teaching reform of industry education integration of joint teaching between schools and enterprises. Bring the latest industrial status and development trend of measurement and control technology and instrument technology into classroom teaching, effectively improve teaching quality, and deeply cultivate students' engineering ethics and project management awareness.

Keywords: Engineering ethics and project management, Integration of production and education, Reform in education.

1. Introduction

Measurement and control technology and instrument is a traditional undergraduate major in instrumentation. Since Zhejiang University and Tianjin University first set up precision mechanical instrument and optical instrument specialties in 1952, after several reforms, reorganization and mergers, we have seen the traces of measurement and control technology and instrument specialties in colleges and universities across the country [1]. The core curriculum system of measurement and control technology and instrument specialty of our school is oriented to the complex engineering problem of enterprise production process (product) quality control and improvement and quality system establishment. Through the study of quality management, quality control and other knowledge, students can master quality tools, and use these information to bring into the environment of engineering ethics and project management to learn new and expanding knowledge. As the end of the core curriculum system, the effect of theoretical teaching and case presentation by enterprise experts of the engineering ethics and project management course will directly affect the students' understanding of complex engineering problems. Based on this, this paper will discuss the teaching practice of engineering ethics and project management from the aspects of theoretical teaching ability training and the reform of integration of production and teaching.

2. Teaching Practice of Integration of Production and Education

2.1. Course objective setting

Course objective 1: Be able to describe the basic concepts

in engineering ethics and project management, environmental values and ethical principles in engineering activities, evaluate the risks of engineering projects, propose reasonable and feasible engineering risk prevention methods, carry out full life cycle assessment of enterprise production process, and lay a certain foundation for subsequent project demonstration and project management analysis.

Course objective 2: understand the ecological environment, public health, social security, humanistic care, etc. of the project, establish a high sense of social responsibility, correct values, and a strong sense of ethics, be able to examine the connotation and tasks of project management in solving complex engineering problems in automatic detection, modern quality management and related fields, and consciously fulfill the professional ethics of engineers [2].

Course objective 3: understand the importance of engineering management and economic decision-making in complex engineering problems in engineering practice, especially in the field of automatic detection and modern quality management, complete the dynamic engineering project management process, establish the interdependence and mutual restriction between the three objectives of project progress, quality and cost, and analyze the feasibility, risk, investment decision-making and business evaluation of the project.

Course objective 4: Be able to analyze and design the project management of automatic detection and modern quality management engineering projects from the aspects of the lowest project life cycle cost, reducing resource consumption, improving efficiency, optimizing resource allocation, etc., clarify the nature and structure of the engineering project quality control system, and establish the idea of engineering project quality management.

2.2. Main contents of the course

2.2.1. Project Introduction

Through discussing the case of Dujiangyan Water Conservancy Project, the characteristics and basic process of engineering activities are mastered, and the historical development period and characteristics of the project are summarized. Citibank Building case in Moke video of Xi'an Jiaotong University is cited to discuss engineering thinking and decision-making, and further explore how the risk-based thinking in the above courses can be applied to engineering problems. Master the basic logic and methods of engineering system analysis, and understand that computer prediction, modeling, optimization and simulation tools can be used to realize the cognition of engineering problems. Quote the documentary "Qinghai Tibet Railway" to discuss the engineering concept and engineering concept, and define the engineering concept of the new era.

2.2.2. Moral framework of engineering ethics

Based on this discipline, this paper discusses the organic combination of traditional engineering and humanities, and brainstorms the historical background of the rise of engineering ethics. To understand the development process and phased significance of engineering ethics in China, and to clarify the nature of engineering requires engineering talents with engineering ethics literacy; It is clear that the improvement of engineering technicians' ethical quality requires strengthening engineering ethics education. Cite the case of tramcar paradox in Moke video of Communication University of China, discuss the application of utilitarianism, deontology and other ethical ideas, and master the main ideas of engineering ethics. Finally, citing the case of Ford Pinto, using the learned engineering ethics ideas, discuss the ethical dilemma and ethical choices.

2.2.3. Professional ethics of engineers

The case of Engineer's Caution is cited to discuss the characteristics of engineering ethics in different periods. Combined with historical events, understand the development stage of China's engineering ethics and its turning events. Understand the professional ethics of engineers.

3. Engineering ethics dilemma and solutions

Cite the case of Wenzhou bullet train accident, grasp the causes of the ethical dilemma of the project, and discuss the collectivization of the responsible subject, the conflict between roles and obligations, the conflict of interests and the choice of values. Explore the way out of the dilemma of engineering ethics, clarify the reasons and starting points for advocating public participation and technical evaluation, clearly find the way out of the dilemma of engineering ethics from the perspective of engineering ethics education, and summarize the cases. Cite the case of toxic gas leakage in Bhopal, India, and master the solutions to the ethical dilemma of the project, including the method of dispute analysis, line drawing analysis and flow chart analysis. After the theory teaching, the virtual case of engineering ethics is tested in class.

4. Internal and External Social Responsibility of the Project

The case of long-lived vaccine is cited to explore the professional characteristics of engineers from the historical

development stage of engineers. Cite the explosion case of Tianjin hazardous chemical warehouse, master the elements of internal social responsibility, and define the engineer and internal social responsibility. Quote the case of the Ethiopian Airlines crash to clarify the professional quality of engineers, including mastering profound professional knowledge, extensive relevant knowledge, and adhering to professional ethics and norms. Citing the case of Xi'an Metro cable, this paper discusses the ethical decision-making of engineers, and clarifies the differences between engineering decision-making and management decision-making from the perspectives of different functions and different ways of thinking. Put forward virtual cases and discuss in groups.

5. Introduction to Project Management

Master the difference between the project and the engineering project, and clarify the different characteristics. Understand the concept of project management and the stakeholders of the project. Grasp the new concept of project management and define the management methods, including the whole life cycle, lean construction and contracting mode. Master the essence of the whole process management. Define the concept of project scope management and master the elements included in the project scope management process. Understand the meaning of structural decomposition of engineering projects, and give class cases for group discussion. Define the concept of project scope control and understand the requirements of project scope control.

6. Project Life Cycle and Organizational Management

Master the concept of the whole life cycle of the project, and define the four stages in the project life cycle. Take engineering construction projects as an example to distinguish the life cycle of construction projects in China's construction industry. Master the contracting mode of engineering projects, and be able to draw schematic diagrams of various modes and distinguish their characteristics. Understand the project management mode, and define the constituent elements and the application of each mode. Master the concept of project organization structure, understand the constituent factors of the organization structure and the common organization forms in the project.

7. Project Progress Management

Master the concept and main tasks of project schedule management. Specify the presentation method of project schedule, including logical relationship, bar chart and network chart of work activities. Understand the comparison method between actual progress and planned progress, including bar chart comparison method, S curve comparison method, banana curve comparison method, forward line comparison method and list comparison method. Master the generation and development of network plan, the characteristics of network plan, and the drawing method of network diagram. Specify the time parameter calculation method, and be able to determine the key path in the given complex network diagram [3]. From the perspective of system engineering discipline, focus on the optimization method of project schedule, including the optimization of construction period, the tradeoff between construction period and cost, and the tradeoff between resources and construction

period.

8. Project Quality Management

Master the concepts of project management and quality control in combination with the knowledge learned in the previous course Modern Quality Management. Master the quality characteristics and influencing factors of the project. Distinguish between process quality management and project quality management, and understand the project quality control system. This paper reviews the application of mathematical statistics methods in engineering quality management, including quality improvement tools such as layered method, fishbone diagram, pareto diagram method, histogram method, etc.

8.1. Teaching practice summary

The teaching process increases the number of case studies. This course introduces a total of 20 case videos (excluding text cases), requiring students to analyze and discuss through video introduction and master the knowledge points learned in the class. For example, by discussing the Challenger case, analyze and clarify the elements of internal social responsibility of engineers. On the other hand, from the perspective of assessment, students are only interested in the stories that occur in the cases when they carry out logical analysis of cases under the guidance of teachers, but the situation of completing logical analysis questions independently during the assessment is poor, especially the subjective analysis is not in place. They randomly find answers in textbooks. Only some students can accurately carry out correct logical analysis according to the engineer's normative knowledge in engineering ethics. In particular, the overall length of the case description involved in the topic is long, and some students can not even correctly understand the topic. Later, it is proposed to use the assessment method of the course "Engineering Ethics" of Xi'an Jiaotong University, shoot a short film of engineering ethics education by students in groups, and replace the group discussion on engineering ethics through the details of the cases in the self prepared short film, which can play a role in strengthening ability training.

8.2. Teaching Practice of Enterprise Tutors

As a teaching reform course of integration of production and education, the General Manager of Changzhou Promise Management Consulting Co., Ltd. and the technical directors of the 99th alumni of the University School of Economics and Management and other industry representative enterprises were invited to give courses. The class hours taught by enterprise experts accounted for 15% of the total course hours. Especially in the course of engineering ethics, the students responded warmly to the cases occurred in the actual factory and interacted frequently.



Figure 1. General Manager of Changzhou Promise Management Consulting Co., Ltd. Enterprise experts give lectures in class

8.3. Application of Ideological and Political Elements in Curriculum

The main ideas of engineering ethics fully reflect the application of relevant basic principles of Marxism, such as the dialectical relationship in the tram paradox case; Considering the environmental factors and combining the concept of the whole life cycle of the project, the concept and application of the life cycle of the system engineering scientific research problem will be publicized to enhance national self-confidence, self-esteem and pride [4]; From the perspective of project schedule optimization, cultivate students' interdisciplinary thinking, use measurement and control technology to plan the development blueprint of engineering project management theory and application, face the world's leading edge of science and technology, face the main battlefield of economy, face the major needs of the country, face the people's life and health, and constantly march towards the breadth and depth of science and technology [5]; Cite a large number of practical cases, master the scientific methods of engineering ethics and project management, clearly step out of the school gate, go to the society, and become qualified builders and successors of the socialist cause.

9. Conclusion

In this paper, through the practice of teaching the course of engineering ethics and project management with the combination of production and teaching, with the help of the combination of enterprise experts and school theory, the reform has been carried out from the two aspects of curriculum objectives and the establishment of curriculum system, which has trained students' ability to analyze complex engineering problems, made students master the idea of engineering ethics and engineering project management methods, and considered the internal and external responsibilities of engineers, Strengthen the concept of sustainable development of the industry.

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