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Exploring the teaching reform practices of industry-education integration in modern quality management courses

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Abstract: Modern quality management is one of the most extended courses in the quality course cluster, the core curriculum of the specialties of measurement and control technology and instrumentation. The course is divided into two main parts: the ISO 9000 standard and the ISO 9001 standard. In view of the growing importance of quality management systems in society and the key role that quality management plays in solving complex engineering problems, the traditional purely theoretical teaching methods are no longer suitable for the new demands of teaching in the contemporary context. Therefore, in order to improve the quality of teaching and the students' learning effect of this extended and open knowledge, Changzhou Institute of Technology invited technical supervisors from representative enterprises in the industry, such as Changzhou Wuji Management Consulting Company Limited, to conduct classroom case studies on relevant knowledge and to realize the reform of industry-education integration through joint teaching by the university and enterprises. The latest industrial status and development trend of measurement and control technology and instrumentation technology are brought into the classroom teaching, effectively improving the teaching quality and deeply cultivating students' awareness of modern quality management.

Keywords: Modern quality management; Integration of industry and education; Teaching reform.

1. Introduction

Measurement and control technology and instrumentation is a traditional undergraduate major in instrumentation. Since 1952, when precision mechanical instrumentation and optical instrumentation were first established at Zhejiang University and Tianjin University, the major has undergone several reforms, reorganizations and mergers, and can be found in all universities across China. The core curriculum of our measurement and control technology and instrumentation programmer is oriented towards the complex engineering problem of quality control and improvement of production processes (products) and the establishment of quality systems in enterprises. Students learn about modern quality management, gain a proper understanding of the latest versions of the ISO 9000 and ISO 9001 standards and master the key points of establishing and operating a quality management system. As the beginning of the core curriculum, the effectiveness of the theoretical teaching and case presentations by experts from companies will have a direct impact on the students' understanding of complex engineering issues. Based on this, this paper will discuss the teaching practice of the modern quality management course from two aspects: theoretical teaching capability training and industry-education integration reform.

2. Teaching practice in industry-education integration

2.1. Curriculum Objectives Setting

Course Objective 1: Students are required to be able to describe the basic concepts in modern quality management, to understand the basic concepts, content, development overview and development trend of quality engineering, and to master the model of the four stages of quality management and the characteristics of each stage, so as to lay a certain foundation for the subsequent study of quality management systems, etc.

Course Objective 2: Students are required to understand the concepts, characteristics and basic ideas of Total Quality Management (TQM), to be able to examine the core perspectives, working basis, implementation processes, and tools used in TQM in solving complex engineering problems in automated testing and modern quality management and its related fields, to be able to articulate the seven principles of quality management, and to be able to use these principles in the analysis of production site problems.

Course Objective 3: Students are required to be able to understand the importance of engineering management and economic decision-making in complex engineering problems in engineering practice, especially in the field of automated testing and modern quality management, to be able to recapitulate the development of the ISO 9000 standard and its relationship to other core standards, and to master the basic concepts, general principles and risk thinking of quality management systems.

Course Objective 4: Students are required to be able to analyze and design automatic testing and modern quality management engineering projects from the content of the ISO 9001:2015 standard, to clarify the nature and structure of the quality control system for engineering projects, to establish the idea of quality management for engineering projects and to be able to identify the requirements of the standard and apply them to specific quality management.

Course Objective 5: Students are required to master the general idea of building a quality management system and summarize the basic methods of preparing quality management system documents and their contents, be able to

apply the basic methods to prepare quality management system documents, be able to describe the preparatory work required for a quality management system audit, be able to carry out specific quality management system audits based on quality management system audit implementation procedures and methods, and be familiar with the systems related to quality certification and accreditation and the relevant organizations at home and abroad that provide certification and accreditation.

2.2. Main content of the course

2.2.1. Introduction

The course identifies the differences in the field of systems engineering in which quality management is embedded and enables students to recognize the basic logic and methods of systems analysis and the use of computer-based prediction, modelling, optimization and simulation tools to achieve an understanding of complex engineering problems. Through discussion of the Sanlu tainted milk powder case, students will understand the importance of quality management for enterprises and the concepts of quality, process and product. This course introduces the characteristics and basic processes of engineering activities, summarizes the historical development period of engineering and its characteristics, citing the national gold course of China Metrology University. This course introduces the quality issues arising from engineering activities and summarizes the concepts related to quality management. A model of the four stages of quality management and the characteristics of each stage are discussed to further explore how quality management can be applied to complex engineering problems.

2.2.2. Total Quality Management

From the foundation of the discipline, students explore the organic integration of traditional engineering and humanities disciplines and use this to brainstorm the historical background of the emergence of Total Quality Management (TQM), which leads to the concept of TQM and the development of TQM theory in China and its significance in stages. The case study of the Ritz-Carlton Hotel is used to clarify the basic ideas and core concepts of TQM and apply them to quality management in enterprises. The working procedures of Total Quality Management are cited in a micro-lesson to explore the differences in what Total Quality Management covers in terms of design, manufacturing, support, service, use and post-use treatment. The working methods of on-site quality management are identified and applied to the automatic quality control of manufacturing processes. Theoretical teaching is followed by an in-class test on virtual cases of quality management.

2.2.3. Basic principles of quality management

The latest version of ISO 9000 is taught directly and the seven principles of quality management are identified, including customer focus, leadership, full participation, process approach, improvement, evidence-based decision-making and relationship management.

2.2.4. Quality Management of ISO 9000

Introducing the Mooc launched by this professional department, its introduction to the ISO9000 series of standards, focusing on the core standards of which is a scientific summary of the practical experience of quality management in many economically developed countries in the world, with generality and guidance. The implementation of the ISO9000 family of standards can promote the improvement and perfection of an organization's quality management level and product quality, promote international economic trade, eliminate technical barriers to trade and improve an organization's management level, product and service quality all play a good role. This clarifies the organizational significance of the ISO9000 family of standards, the development history of the standards, the content covered and its relationship with other standards, and the mastery of 13 aspects of quality management system terms and definitions.

2.2.5. Understanding and application of the ISO9001:2015 standard

Virtual case studies are presented and discussed in classroom groups for reflection. An exploration of the content of the ISO 9001:2015 standard, particularly exploring the specific requirements of the standard's provisions, with brainstorming and group discussions. Identify that the core idea of the ISO 9001:2015 standard is the PDCA cycle and introduce the overall structure of the standard as designed according to the principles of the PDCA cycle. This standard identifies the organization and internal and external environment, customer requirements, needs and expectations of mutual parties as inputs to the construction and operation of the quality management system, specifies customer satisfaction, the results of the quality management system, products and services as outputs to the operation of the quality management system, and provides feedback to the operation of the quality management system in the overall cycle. Quality management decision making is explored to clarify the differences between engineering decisions and management decisions from the perspective of different functions and different ways of thinking. Theoretical teaching is followed by an accompanying test on virtual cases of quality management.

2.2.6. Establishment and audit of quality management systems

It is important to establish and improve the quality management system and to maintain its effective operation to improve the quality of the company's products and services. It is clear that a quality management system is a dynamic system that evolves gradually with practice through cyclical improvement. The general idea of building a quality management system is introduced, the basic methods of preparing a quality management system document and its contents are summarized, and the basic methods can be applied to prepare a quality management system document. Introduction to the preparatory work required for a quality management system audit, interspersed with a brainstorming group discussion on the current needs of companies for quality management positions. A specific quality management system audit is carried out based on the quality management system audit implementation procedures and methods. An introduction to micro-lessons on quality certification and accreditation systems and the relevant national and international organizations that provide certification and accreditation.

2.3. Summary of teaching practice

This course introduces 5 micro-lessons and 35 case studies, which require students to analyze and discuss and master the points learned in the class through video and case presentations. For example, by exploring the food safety case, students are required to analyze and clarify the importance of quality management to the business. On the other hand, from

an assessment point of view, students were taught by the teacher to carry out logical analysis of the cases, but were only interested in the story of what happened in the cases and were poor at completing the logical analysis questions independently during the assessment, especially when subjective analysis was not in place and answers were found haphazardly in textbooks. Only some students could accurately carry out a correct logical analysis in accordance with the ISO 9001 standard. Especially when the questions involved case descriptions of overall length, some students could not even understand the questions correctly. The teachers planned to follow up by increasing the number of group discussions and accompanying tests, which could have the effect of strengthening the competency training.

2.4. Teaching practice of corporate instructors

As an industry-education integration course, we have invited the general manager of Changzhou Wuji Management Consulting Co., Ltd. and the alumni of the School of Economics, Management and Entrepreneurship 99 to teach the course. Especially in the part of quality management system audit, students responded enthusiastically and interacted frequently with the cases that happened in actual factories.

2.5. The applied representation of the ideological elements of the curriculum

The main ideas of modern quality management fully represent the application of relevant basic principles of Marxism, such as the dialectical relationship in virtual cases, which enhance national self-confidence, self-respect and pride[4]; the concept and application of quality management tools for system engineering scientific research problems are proclaimed to cultivate students' cross-disciplinary thinking, and the development blueprint of engineering project management theory and application is planned by using measurement and control technology, facing the frontier of world science and technology, the oriented to the main battlefield of economy, oriented to the major needs of the country, oriented to people's life and health, constantly marching to the breadth and depth of science and technology[5]; a large number of practical cases are quoted in the teaching, so that students can master the scientific methods of quality management and step out of school with clear goals and go to society, becoming qualified builders and successors of the socialist cause.

3. Summary

In this paper, we have carried out the practice of industry-education integration lectures through the modern management course. With the help of the combination of enterprise experts and in-school theories, we have reformed the course objectives and the establishment of the course system in two aspects, which has cultivated students' ability to analyze complex engineering problems, enabled them to master the idea of engineering ethics and engineering project management methods, considered the internal and external responsibilities of engineers in society, and strengthened the concept of sustainability in the industry.

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