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Research on the Teaching Mode of Master of Engineering Management based on CDIO

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Abstract

Based on the concept of CDIO Engineering Education, this paper systematically discusses the problems existing in the current master's course teaching of engineering management specialty, and constructs the master's course teaching mode of Engineering Management Specialty Based on the concept of CDIO by analyzing the core characteristics of CDIO mode and the requirements of MEM course teaching, aiming to realize the organic unity of knowledge transfer and practical innovation, effectively improve the teaching effect of the master's course of engineering management specialty, and effectively respond to the talent demand change of the construction industry under the evolution trend of the era of knowledge economy.

Keywords

CDIO; MEM; Curriculum System; Teaching Mode.

1. Introduction

CDIO is a new engineering education concept and implementation system. CDIO stands for conceive, design, implementation and operation. It takes the life cycle from product development to product operation as the carrier, allowing students to learn engineering in an active, practical and organic way. It is the concentrated generalization and abstract expression of "learning by doing" and "project-based education and learning".

The master of Engineering Management (MEM) education aims to cultivate professional talents in the field of engineering management to meet the urgent needs of economic and social development for high-level engineering management talents. Engineering courses are highly technical, comprehensive and practical. However, at present, many colleges and universities have been following the academic oriented training mode. There are intergenerational differences between teaching content and social needs. The curriculum system is fragmented, and the basic theory and application modules are lack of organic connection. At the level of knowledge construction, students are generally faced with the dilemma of weak inter disciplinary integration ability and lack of systematic cognitive framework.

Based on the concept of CDIO Engineering Education and the background of the transformation and upgrading of the construction industry, this study systematically discusses the reform and innovation path of the master of engineering management course teaching. By analyzing the core characteristics of CDIO mode and the existing teaching implementation contradiction of engineering courses, combined with the compound ability requirements of the new construction mode for high-level engineering management talents, this paper constructs the teaching mode of Engineering Management Master course integrating CDIO concept. The research aims to achieve the organic unity of knowledge transfer and practical innovation, cultivate compound engineering management talents with systematic knowledge architecture, engineering practice ability and continuous innovation literacy, and effectively respond to the

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talent demand change of the construction industry under the evolution trend of the knowledge economy era.

2. Analysis of MEM Course Teaching Status

(1) The curriculum is not close enough to the needs of the industry

The curriculum of MEM engineering in some colleges and universities failed to closely combine the industry dynamics and the requirements of vocational qualification examination, and the teaching content lagged behind the industry development and market demand. The professional curriculum system focuses on theory, and the integration of work and management is not deep enough. Some colleges and universities follow the traditional academic master's curriculum framework, and do not adjust the teaching content according to the characteristics of engineering management applied talents, which is difficult to meet the needs of systematic management and training of complex engineering projects.

(2) The shortage of teachers and practical teaching

Most MEM teachers lack front-line engineering background, and it is difficult to combine theoretical knowledge with actual cases in teaching. The course teaching is still mainly based on theoretical explanation. In addition, the number of practice teaching bases in many colleges and universities is insufficient, and the construction of teaching bases is lagging behind. Due to the lack of real scene support for engineering and technology courses, the cultivation of students' practical ability and problem-solving ability is limited, which further affects the effect of engineering practice teaching.

(3) Students' work study contradiction and lack of learning motivation

Most of the master students of engineering management major are in-service staff and need to give consideration to work and learning, resulting in classroom participation and homework quality not being guaranteed. At the same time, the lack of close integration between the future development of the industry and engineering practice in teaching, students' vague cognition of the future career path, will also cause students' lack of learning motivation.

(4) Insufficient resource investment and school enterprise cooperation

Many colleges and universities lack investment in teaching resources such as simulation laboratory and engineering management software, which affects students' mastery of modern engineering skills such as BIM Technology and project management tools. In addition, the construction of the internship base is not perfect, and the depth of enterprise tutors' participation in teaching is limited. Although some colleges and universities cooperate with construction enterprises, most of them stay at the level of visiting. It is difficult for students to contact the core management process, and the school enterprise collaboration mechanism cannot be effectively implemented.

3. MEM Course Design based on CDIO Concept

(1) Full life cycle engineering view

CDIO takes the whole process of product/system conception → design → implementation → operation as the carrier to build a complete cognitive chain of "market demand analysis - technical solution development - Product iteration optimization - business value realization", and cultivate students' systematic engineering thinking.

(2) Ability oriented education logic

CDIO breaks through the traditional mode of "stacking subject knowledge", and realizes the three-dimensional coupling development of technical ability, collaboration ability and innovation ability through the spiral cycle of "learning by doing" and "learning by innovation". The CDIO education model is driven and oriented by the needs of the forefront of the industry,

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focusing on the dynamic fit between the curriculum system and the pace of industrial innovation. Therefore, it is necessary to establish a normalized industry monitoring mechanism, capture the trend of market change, continuously optimize the teaching structure and teaching mode, and ensure the effective coordination between talent training and professional practice.

(3) Real situation immersion mechanism

CDIO mainly simulates the real scene of the industry (such as project bidding, risk management, cost control), and Through the combination of virtual simulation platform and physical engineering projects, the ability to solve complex engineering problems is strengthened. CDIO advocates the project driven teaching method, adopts the project driven teaching mode, and embeds knowledge acquisition into the whole process practice of the project. That is, let students learn and master knowledge by participating in specific engineering projects.

(4) Integrated teaching plan

CDIO framework requires colleges and universities to build a systematic teaching plan, and effectively integrate personal professional skills development, team cooperation ability improvement and complex engineering system construction ability into the training plan through the linkage of curriculum module design and practice platform. This requires engineering courses to break the barriers of traditional disciplines, achieve interdisciplinary integration, and form a complete knowledge system and ability structure. At the same time, the integrated teaching plan should also focus on cultivating students' systematic thinking and comprehensive application ability, so that they can make correct decisions and judgments in the complex and changeable engineering environment.

4. Implementation Path of MEM Course Teaching Mode based on CDIO

(1) Optimizing the curriculum system

Establish the reverse design thinking of "industry demand capability matrix curriculum module", regularly invite industry associations and experts in relevant fields of construction enterprises to participate in the revision of MEM talent training plan, and integrate the latest standards and requirements of the construction industry (such as BIM Technology, intelligent construction, etc.) into the curriculum system. The modular course design is adopted, and the module of "basic theory+industry frontier+management tools" is divided. The corresponding direction is set according to the characteristics of the school and the development of the industry. The course content covers the needs of emerging industries such as intelligent manufacturing, BIM Technology, and the Internet of things. Set up interdisciplinary courses, such as "technical economics+project management" and "system engineering+data analysis", to strengthen the cultivation of collaborative ability between engineering technology and management. Increase the proportion of case teaching, use the enterprise real project case library, and improve the practical ability.

(2) Building a "double qualified" teaching staff

Introduce the enterprise mentoring system, and employ senior executives or technical experts with engineering management experience as joint mentors And course design, thesis guidance. Teachers are regularly assigned to take temporary posts in enterprises to strengthen the accumulation of experience in front-line projects, and teachers are encouraged to participate in horizontal subject research and convert scientific research achievements into teaching cases.

(3) Innovative teaching mode

In view of the contradiction between students' work and study, the mode of "weekend centralized teaching+online asynchronous learning" can be adopted to provide the mechanism of course recording and broadcasting and flexible assignment submission. Support fragmented learning by developing MOOC platform and micro class resources. In view of the lack of learning

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motivation, we can promote project driven learning, enhance the sense of learning value through real projects, and stimulate the internal drive of learning by opening career development oriented courses and inviting alumni to share industry trends and transformation experience.

(4) Design project driven learning

Taking the real project of the enterprise as the background, the students complete the whole process task from conception to operation in groups to ensure that the project is feasible and challenging, and carry out the project implementation according to the plan, including data collection, data analysis, etc. after completing the project, the students display and share the results. For example, to design the cost optimization scheme of a construction project, students are required to consider the key points of cost control at different stages of the project from the perspective of the whole life cycle, covering scheme design, technical analysis, cost calculation, implementation path and operation and maintenance strategy.

(5) Implementing case teaching and role playing

Case teaching is a teaching mode with students as the main body and teachers as the guide. It emphasizes learning in real or simulated situations, so that students can combine theoretical knowledge with practice. For example, in the teaching of project cost management course, you can choose representative, practical and cases, which should cover all aspects of project cost management, such as investment decision, design budget, construction drawing budget, project settlement, etc., and let students group to simulate different roles such as the construction unit, construction unit, consulting unit to make decision analysis on project cost at the corresponding construction stage.

(6) Carry out school enterprise collaborative training

Using the two different educational environments and resources of schools and enterprises, the teaching effect of the course is improved by the organic combination of classroom teaching and students' participation in practice. The school can cooperate with enterprises to build a training base, establish a "school enterprise joint laboratory", introduce enterprise resources to support teaching, and provide students with practical opportunities in practical engineering scenarios. The school can also jointly develop training projects with enterprises, integrate the actual needs of enterprises into the training teaching, and let students participate in the core process management of enterprises, so that students can better understand the industry dynamics and market demand.

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