Course of Engineering Project Management for Automatic Engineering

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Abstract

For the new requirements of engineering certification, a modular teaching plan of engineering project management is proposed that is also combined with the professional features of vehicle engineering. Specifically, the teaching objectives of this course are established by engineering certification. Meanwhile, the course content is modularized and adopted different teaching method, such as lecture, interactive module, heuristic teaching method, etc. The improvement plan of course fully focuses on student-centered and output-oriented principle which strengthens the initiative of students to master basic theory knowledge. And it is helpful for students to have the ability to meet the engineering certification standards.

Keywords: module, project management, automatic engineering, engineering certification

1. Introduction

With the popularization and application of engineering project management in the enterprises, society's demand for talents with engineering project management knowledge and skills is also increasing. Engineering project management has become one of the mandatory courses for many colleges and universities to export talent[1]. So the practical ability of engineering project management is not only one of the necessary skills for technical talents under market demand, but also emphasizes the application of knowledge, which is an important link in engineering technology talents' practical ability training[2]. Especially，in the graduation requirements of the vehicle engineering major, it is clearly stated that students need to have project management capabilities, which is to understand and master engineering management principles and economic decision-making methods, and can be applied in a multi-disciplinary environment.

Project management is a comprehensive course that integrates engineering, management, technology, economics, laws and regulations, as well as theory and practice. It not only involves professional content such as engineering technology, personnel management, cost analysis, and risk avoidance, but also is closely related to national policies and regulations [3]. For different majors, project management should have different training programs. For the enterprise management major, it focuses on theoretical research[4]. And for the vehicle engineering major, it focuses on solving practical problems. However, these differences are not well reflected in the college's training program now. So in the teaching process of vehicle engineering project management courses, it need to pay attention on how to effectively improve the teaching efficiency and teaching quality and how to promote the good connection between students' professional qualities and the needs of vehicle companies. In this process, teachers need to establish a curriculum teaching program with professional characteristics.

2. Teaching Objectives

The teaching objectives of this course are as follows:

a. Students have a sense of social responsibility and engineering professional ethics.

b. Students have the economic management knowledge required for engineering work.

c. Students have the management technology and skills related to the practice of mechanical engineering projects, and have a certain sense of innovation.

d. Students understand the relevant policies, policies, laws and regulations of the automotive industry, and correctly understand the impact of automotive engineering on society.

e. Students have engineering-related organizational management capabilities, communication and expression capabilities and team spirit.

Through the study of this course, the following effects would be achieved.

a. Students understand the knowledge structure, capabilities and responsibilities of project management engineers, learn the domestic and international background and development trends of engineering project management, and make out the interrelationship between engineering project management and related disciplines and relevant theoretical knowledge.

b. Students understand the organization, process and bidding management of projects.

c. Students master the basic methods of investment control, schedule control and quality control in project management.

d. Students understand relevant laws and regulations, combine practical issues, and have the initial ability to engage in project management.

e. Students have certain organizational management, communication and expression, innovation and teamwork awareness.

Due to the orientation, teaching objectives and learning effects of the course, the teaching content and related resources are improved. Accordingly, based on the analysis and summary of teaching lessons, a variety of teaching methods should be used.

3. Contents Pattern Blocked

To desalinate inherent concept, course content carry out modular teaching based on course orientation and needs analysis. The project management knowledge system is divided into three major modules which are basic theory, case module, and application in background field. The block of basic theory includes project management overview, project organization, integration management, time management, quality control, cost management, human resource management, risk management, and purchasing management. Case module involves role play in project management, automotive product development, work breakdown structure, critical path, project risk identification, and project stakeholder analysis. The application in background field contents logistics project management, automobile project management, and mechanical R&D project management.

4. Diversified Teaching Methods

Due to the influence of traditional education and teaching concepts, teachers now basically use textbooks as the main materials when teaching engineering project management, and describe the theory knowledge by word in slam-teaching method. Because of the limitation of teaching concepts and sections, teachers pay too much attention to the theoretical knowledge and ignore the importance of practical teaching. This situation has greatly negative impacts on the overall development of students' engineering quality.[5] Similarly, according to the principle of modular design, the teaching method is divided into four parts: lecture module, interactive module and assessment module.

4.1 lecture module

Teachers not only expand the scope of knowledge for students in the course, but also keep close to the professional knowledge. The content of the lecture should be state of the art technology, and not limited to textbooks. Teachers should initially determine the key contents of the course, teaching schedule and assessment mode.

4.2 Interactive module

Interactive sections in teaching could increase the students' participation and decrease the anxiety. Questions or group discussions [6] are good way to enhance students' ability of analysis and summarization in a cheerful atmosphere. In the process of discussion or questioning, comparing the teacher's ideas, students could improve the ideas and form a rigorous thinking.

In this module, multiple teaching method could be adopted such as heuristic and role-playing which could consolidate and improve subsequent effects of learning from the experience.

To make the interaction effective, the module grouping method is needed which is shown in Fig 1.

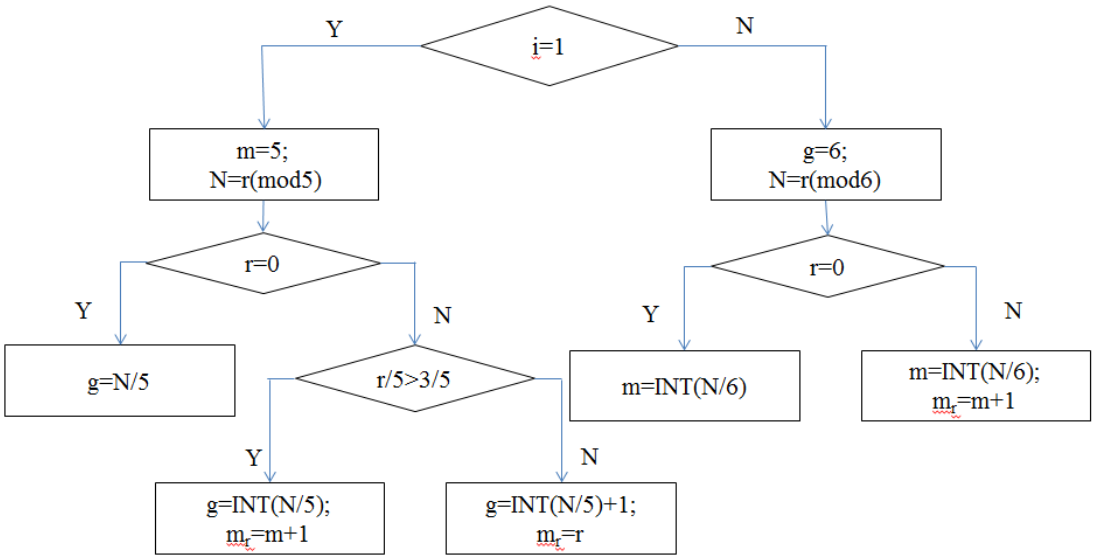

Fig.1 Grouping Method

Where i is serial number of teaching program, and $N \in [30,40]$ is the number of total students.

Respectively, g and m represent the number of groups and members in each group. m_r is the number of members in the special group.

Heuristic teaching method

According to the course content, two inspiration methods of discussion and question are adopted respectively. Heuristic method of discussion is to guide students to actively participate in classroom teaching activities on the basis of preview and students play the main role through discussion. For example, teachers release thinking questions before class and organize students to discuss in class in order to discover problems and solve problems. Heuristic method of questioning is that teachers ask students some questions about the key points and difficulties of the course content in class which is helpful for students to digest and consolidate the course content.

The teaching method of role-playing

The teaching method of role-playing is immersive learning which emphasizes students' direct participation and experiential teaching. To introduce the construction project into the school classroom simplify and transparent the complex and abstract management knowledge and theories. The students experience the whole process of engineering project management, and practice the project management theory. The whole class is divided into 6 project teams and the grouping method is shown in Figure 1 (i=1). Each team is responsible for one position as Table 1.

Table 1 Positions and Responsibility

Position	Responsibility
project manager	business and project planning
operation manager	operations and records
engineering manager	personnel and equipment
accounting manager	reports
procurement manager	raw material procurement and negotiation
assistant manager	project plan control

Through actual project management, everyone is immersed in a simulated engineering project to learn and communicate. In the process, lots of contents are involved, such as cost accounting and analysis, schedule planning, resource needs planning, construction organization design, materials management, etc. Compared with the traditional model, the teaching effect is good since students could get the preliminary application of the theoretical knowledge in engineering project management. Through the analysis of exchanges with students, students have high interest.

4.3 Assessment module

At present, the evaluation method used is still closed-book examination in most colleges and universities in China, and the content of the papers is basically theoretical knowledge that needs to be memorized.

Teachers will use this test as a basis to develop corresponding evaluation. This backward evaluation method has great limitations. In order to get good scores, students have to memorize various theories and formulas. This kind of assessment method has no way to reflect the true level of students, nor can it conduct a comprehensive assessment of students' practical ability, and the assessment results do not meet objective demands for teaching effects of this course.

In order to effectively improve students' practical ability and complete the part of engineering quality training, the teachers must emphasis on students' practical ability training and strengthen extracurricular design training.

The task-driven teaching method is adopted for the practical application to simulate a real project. When teaching related content of the project integration management in the course, the students are divided into small groups, see Fig 1 (i=2), and the project assignments which consistent with the classroom content are assigned. In order to have better understanding of the knowledge, students are responsible for a project from beginning to end, discuss and communicate with each other in group. They simulate each member of the project work and complete the formulation of project charter and project management plans. In the course of teaching, the teacher first briefly explains the knowledge involved, and according to the needs of the task, informs the students to look up relevant materials and complete the tasks. The task of each member is the assessment and training, and the requirements for students are high. First, they need to learn the relevant basic knowledge. Meanwhile the most likely problem in the team to complete the tasks is that one person does the whole project, and the others are little more than nameplates. Due to an ambiguous team's division of labor, it is easy to make the inappropriate evaluation in the assessment. In order to eliminate team members to shirk each other's tasks, the division of labor record sheet is introduced to clarify the difficulty coefficient of each member, and then score points is according to the completion situation.

5. Conclusion

Based on the background of engineering certification, the curriculum reform of Engineering Project Management still needs to optimize the teaching mode to improve the theoretical level of students and train students' ability of project construction management. Teachers are supervisors, emphasizing the student-centered open teaching ideology with output-based education which is to encourage students to think independently. In view of the modular curriculum content, appropriate teaching methods are adopted to improve students' ability of independent learning, knowledge application, teamwork and economic decision-making which meet the requirements of engineering certification training, and provide practical and feasible methods for transporting internationally-used technical personnel of project management.

Acknowledgements

The authors would like to thank the references for giving valuable comments and suggestions, which make us possible to improve the paper. Research is supported by Shanghai University of Engineering and Technology high-level & first-class undergraduate construction leading planned project--mechanical professional group construction.

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