

Exploration and practice of project-based blended teaching mode based on OBE-CDIO concepts- example of “Project Planning and Control”

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Abstract. At present, there is a discrepancy between the overall goal of cultivating applied talents in the context of new engineering disciplines and the social demand, which leads to the problems of unimpressive student learning outcomes and low employment rate caused by the single traditional teaching mode. Based on the the educational philosophy of OBE (Outcome based education) and CDIO (Conceive--Design-Implement-Operate), this paper took the course of “Project Planning and Control” in Henan University of Economics and Law as an example, and adopted the blended course mode of combining project task-driven and round table seminar to carry out the teaching reform of the course, which has the The design of four modular teaching contents, the construction of teaching method(70% of concentrated lectures and 30% of immersion seminars) and evaluation system were finally completed. so that students could improve their professionalism and practical application ability in real work tasks and professional scenarios, and complete the initial exploration of the comprehensive education path of "policy, position, course, competition and certificate".

1 Introduction

With the rapid development of engineering and technology fields under the background of new engineering disciplines, how to cultivate the engineering thinking and the ability to solve practical problems of school students and realize the transformation from theory to practice is an important task for the cultivation of compound, innovative and applied talents in engineering management, and also a great challenge for the educational and teaching reform of financial colleges and universities.

“Project Planning and Control” is a theoretical and practical course. Some scholars integrated project cases into the classroom in order to achieve effective unification of classroom theory and engineering practice^[1-2]. This type of teaching is known as project-based teaching, which is based on the theory of ‘action orientation’, and certain teaching contents are intentionally designed into a single project for case study or simulation^[3-4]. Junge et al.^[5] believe that allowing students to participate in project production at an early stage can enhance the autonomy of project-based teaching, and in the classroom can be from the transmission of knowledge to the infiltration of values to achieve the goal of talent cultivation^[6]. In recent years, the research of project-based teaching mode has developed rapidly, but it is mainly concentrated in pure engineering majors, mostly used in practical training

courses. Financial colleges and universities to economics, management, law and other heavy, and engineering directly related to the management class majors, the project teaching application is less, only the research is mainly in the concept of interpretation and case presentation^[7-8]. Therefore, based on the teaching concept of "student-centered and result-oriented", how to organically integrate the project cases into the teaching content and teaching methods, create a classroom of "Project Planning and Control" that integrates traditional lectures and open discussions, so that students can quickly integrate the professional theoretical knowledge and effectively improve their practical ability of analyzing and solving complex project problems will be one of the directions worth exploring and researching in the teaching reform of this course. The practical ability to analyze and solve complex project problems will be one of the directions worth exploring and researching in the teaching reform of this course.

The project-based blended curriculum model is based on the guidance of the outcome-oriented education concept, with students as the main body and teachers as the leading course model, integrating teaching, learning and doing. Firstly, in accordance with the work needs of engineering management positions from the perspective of professional competence, typical real engineering projects are introduced to design modularised task-driven course content, and each module is set up with several real enterprise management work scenarios, which supports different professional qualities and practical

abilities. Then, in the task implementation, each student can experience the important value of professional skills and practical ability in the work scenarios through round-table immersion seminars. Compared with the traditional course teaching, the use of task-driven, modularized course system divided by difficulty points accurately grasps the coordinated relationship between the theoretical and instrumental aspects of the project planning and control courses, and the scenario simulation of the round-table immersion teaching method ensures that the students from the input of knowledge (traditional classroom teacher teaching) to the output (round-table classroom free seminar) of the two lines of integration of the course content, and truly achieve the purpose of learning to apply and live to use. The purpose of learning is to use what we have learned. However, some scholars have focused on the professional knowledge and interviewing experience required for the certificate in their courses, but most of them have focused on the professional training classroom, and the application to the undergraduate classroom has not yet been researched.

2 Analysis of the current teaching situation

Henan University of Economics and Law, as one of the backbone colleges and universities with key support for construction in Henan Province, has attached great importance to the programme since the first batch of undergraduates enrolled in the Engineering Management-IPMP (International Project Manager Professional Certification) programme in 2020, from the school to the colleges, and has actively benchmarked against the requirements of the IPMP qualification, and identified it as one of the core courses supporting the programme for the first time in 2021. Since the first cohort of students enrolled on the Engineering Management programme, the University and colleges have placed a strong emphasis on the programme, actively benchmarking against the requirements of the IPMP qualification and identifying the Project Planning and Control course as one of the core courses supporting the programme for the first time in 2021. So far, the course has been offered over 2 semesters and the main teaching issues are as follows:

(1) Theoretical content of the course is too much and practical engineering content is too little

The current "project planning and control" course design basically focuses on the "schedule—resources—cost—quality" planning and control of the principles, processes and methods of tools to develop the knowledge structure, a total of six chapters, the concept of abstract and more theoretical knowledge, resulting in a more narrow 34 hours of teaching. Although the teaching content of the project as the background, the project case study and practical operation, but less, the lack of teaching content and engineering practice of the link, resulting in students can not be construction project planning and control of various aspects of engineering practice tasks and theoretical knowledge.

(2) A single mean of teaching in a teacher-centred classroom cannot meet the needs of students' practical ability development

The classroom is basically a teacher lecture PPT as the main, students passively accept knowledge, teachers and students have less interaction with students. As of June 2024, Zhengdong Campus has 86 smart classrooms, including standard, advanced and extended classrooms. Formally, it collects video, audio, multimedia and other technologies, and is set up with seedling and round table classrooms, which can provide teachers and students with rich learning resources and tools, but it has not yet been fully used in the teaching of this course.

(3) One way course grading system

The assessment and grading of this course is based on a combination of the usual grade (30%) and the final grade (70%). Although the final exam contains a variety of questions, it is mainly concerned with concepts, principle analysis and the application of the key line method, which mainly assesses students' mastery of theoretical knowledge and focuses on memorisation and comprehension skills. This tends to cause students to blitz before the exam and forget after the exam. From the industry's point of view, the assessment results do not match the skills required for the position and do not reflect the importance of the practical skills of project planning and control.

3 Exploration of classroom practice based on the concept of OBE-CDIO

3.1 The need to integrate the concepts of OBE-CDIO

The OBE (Outcome based education) educational concept, also known as outcome-oriented education, is a student-centred, reverse-thinking approach to the construction of the curriculum system concept^[9]. The emergence of digitalisation and intelligence in the context of new engineering makes all industries face the adjustment and innovation, and gives birth to the substantial transformation of management style, and practical literacy based on professional positions becomes the universal basic ability of technical management talents. CDIO stands for "Conceive, Design, Implement, and Operate". It coincides with the four stages of feasibility study, design, implementation and control of the whole process of project management^[10]. The CDIO concept can play a role of organic integration and linkage between the course content, highlighting the student-oriented, so that students take the initiative to actively and positively participate in the course content.

Paul Grace, Chairman of the American Project Management Professional Qualifications Board, believes that in today's society, everything is a project and everything will become a project^[11]. Modern enterprises have entered the new project management era, the project management boundary is increasingly going to generalisation, diversification, to the project group, the management of project benefits. The new industrial thinking, data thinking, management thinking will affect

the management of the whole project. The enterprise management positions in the context of the new era, in particular, require students to have communication and coordination skills, data analysis skills, decision-making and implementation skills, process control skills, etc., and the cultivation of these skills must be the carrier of the project's full life cycle management process, so that students spontaneously and practically in the organic link between the course of the way of learning to achieve.

3.2 The main elements of the "roundtable immersion" teaching methodology

3.2.1 Building an ecological open classroom

Tolstoy has a famous saying: "Successful teaching requires not coercion, but the stimulation of students' interest in learning". "Roundtable teaching is precisely an interactive and authority-free communication environment that can encourage students to actively participate in the open classroom to change the way they think about learning^[12]. Some studies have shown that compared with the traditional seedling classroom arranged in columns, the round-table layout of students sitting around the table has a wider range of activities and is more convenient for face-to-face communication and discussion between teachers and students. The "round table" classroom pays more attention to the individual differences of students, the teacher's guidance, outside the question and answer, most of the time by the students in the practice of active, personal participation. This allows each student to fully develop his or her own insights and ability to apply knowledge based on the acquisition of subject knowledge.

3.2.2 Shifting metaphysical thinking and teaching at a relaxed pace

The essence of round-table lectures is to motivate students to rely on themselves, independent learning, cooperative learning, and exploratory learning, and to form a genuine intrinsic motivation for learning. Teachers use a certain form of organisation to transform a full classroom into a student-centred seminar and cooperative classroom, breaking the disadvantages of metaphysics. Teachers go from the podium to the students, listen to students' opinions and suggestions, so that students think actively, speak boldly, and build self-confidence. Teachers as a guide, timely organization of students on a topic for discussion, in the process of forming their own views to enhance the students' sense of cooperation, communication and coordination skills, sense of collective honor, etc., to change the students' previous passive acceptance of the learning way of thinking, the real classroom to achieve the cultivation of students' skills and personal development.

The practice of round-table classroom will reduce the time of one-way lecturing by teachers. Therefore, before the round-table immersion classroom, first of all, we must divide the traditional classroom teaching knowledge and round-table seminar topic content, each

stage of the round-table seminar time for a reasonable control, to ensure that the first half of the course is full seminar and debate, and the second half of the sedate show and summary. Not only can let each student participate in it, but also on the course of the key points for targeted analysis and training, and in the process of timely guidance to the students to answer questions, to avoid the formation of the wrong way of thinking.

4 Practical path of "project-based hybrid" teaching mode

4.1 Complementary integration of knowledge systems between the OBE orientation and the teaching concept of industry-teaching integration

Based on the standards of industry positions for employing people, accurately locate the goals of talent cultivation, take the learning output as the guide, and construct the teaching content that integrates the course module and "project + task" based on the main line of engineering management personnel's work tasks and work content. Taking the project planning and control course as an example, study the relationship between practical links and theoretical knowledge in the whole process of project management life cycle represented by scenario-based tasks, and reconstruct the teaching content into "three phases (plan preparation, process control, feedback and change)", "four modules (schedule, resources, cost, quality)", and form a "project + task" teaching content that can be used for the training of engineering managers. Quality, forming a clear hierarchical knowledge framework in line with actual production. The reconstructed teaching content follows the whole process of real project management and follows the "frontier", taking into account the fact that the linear knowledge production mode from "basic research" to "market application" has been replaced by the new "training demand for engineering talents" and "international vocational training". In addition, it follows the "cutting edge" and takes into account the fact that the linear knowledge production mode from "basic research" to "market application" is replaced by the non-linear innovation mode, such as the demand for new engineering talents cultivation and international professional qualification certificates, and the real-time updating and integration of the latest national policies, industry demands, management rules and skills, and the teaching process fully realizes the close connection of "position-course", tracks and expands the students' knowledge system, and builds the fusion and complement mechanism of the knowledge growth system. Students can deepen their learning in multiple aspects and perspectives through "recognising needs-imitating scenarios-tracking changes-practicing and applying", and gradually grow from beginner to expert in project management.

4.2 Promotion of “Policy-Position-Course Competition-Certificate” project teaching

The organic integration of the five links of “policy, position, course, competition and certification” should be based on the functional positioning of their respective roles, with multi-party synergy and close cooperation to form a benign dynamic closed loop. With regard to “policy”, in the objective of talent cultivation, we should follow the development trend of new engineering science and emphasize the positioning of cross-cutting and innovative talents.. Based on the real projects of enterprises, we implement the curriculum teaching, effectively combining the close cooperation between universities, industries, enterprises, organizations and other subjects to promote the multi-party synergy of "position-course competition certificate". Colleges and universities promote the design of curriculum system, content reconstruction, teaching method scenario, as well as the incubation of competition team, skill certificate training and other aspects of colleagues, to realize the deep integration of "policy, position, course, competition and certificate", to guide the course with the policy, to set the course with the position, to match the excellent course, to verify the course with the certificate, and to educate people with the course(See Figure 1).

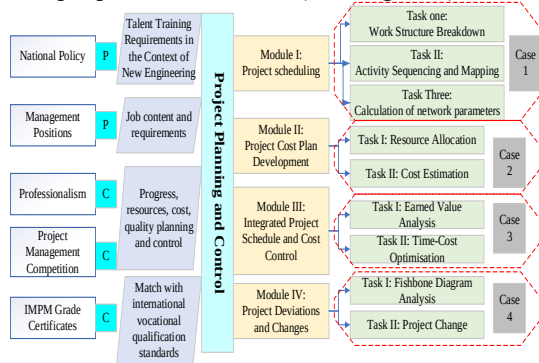


Fig. 1. Modularization of the course knowledge system under the pathway of certificate and position course competition and certificate education

4.3 Coupling traditional centralized lectures with roundtable immersion teaching models

From teacher-centered to student-centered, establish a teaching mode consisting of traditional indoctrination lectures and open discussions, based on the course content of the four modules of project schedule planning, duration optimization, resource arrangement, cost control, combined with the background of the real project cases, according to the three stages of the “pre-course research-in-class training-position-course thinking” teaching organization. In addition to building a professional knowledge framework for students, it also cultivates their practical ability and innovation ability. Teachers, as task publishers and feedback collectors, take on the tasks of designing project tasks and organising seminars. Firstly, the students are grouped according to the project tasks, and they carry out practical training on Project, the engineering management software, complete the task of independent research before class, and carry

out the knowledge and skill requirement analysis and data collection. In class, they adopt problem-based learning exploration and analysis -centralised question, and answe-intra and inter-group debates and demonstration of results, and they master the setting of work package time parameters, the adjustment of idle time difference, the optimisation of work schedule, the balanced arrangement of path and resource demand, the balanced arrangement of work package, and the optimisation of work time. During the course, students will master the management skills of setting the time parameters of work packages, adjusting the time difference of free time, optimising the work schedule, arranging the balance of resource demand, analysing the cost variance, and so on. At the end of the course, through a combination of teacher comment and peer evaluation, students are encouraged to review and reflect on the experiences and lessons learnt within and between groups to improve their overall application skills.. Taking the "Project Planning and Control" course as an example, 30% ~ 40% of the teaching time is devoted to practicing round-table immersion teaching and centralized teaching of professional knowledge, organically combined to carry out "teacher-led, student-oriented" project-based teaching coupling mode, see Figure 2.

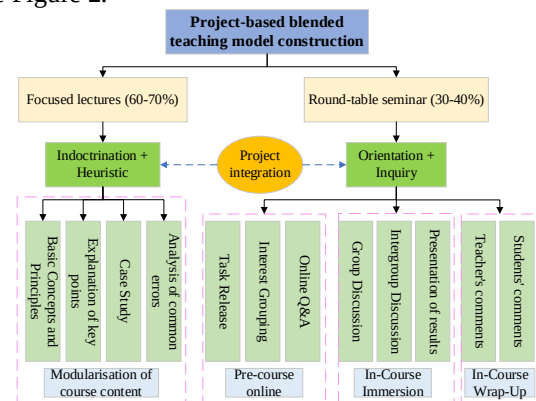


Fig. 2. Project-based blended learning model

4.4 Establishing a scientific and feasible diversified process evaluation system based on competence orientation

Focusing on the new era of educating people with the mission of "high-quality and high-level technical and professional talents, skilled craftsmen and great national craftsmen", we introduce the process evaluation strategy and establish an evaluation system based on process and practice evaluation, which covers the comprehensive capabilities of students' professional knowledge, practical ability and innovation. During the implementation of round-table teaching, the teacher conducts a summative assessment of the students' individual and group knowledge and skill improvement against the learning objectives set at the beginning. At the end of the round table discussion, each group is asked to carry out an intra-group summary and an inter-group evaluation. At the same time, targeted advice and guidance is given in the light of individual student

variability. Taking the assessment method of the "Project Planning and Control" course as an example, it relies on the engineering management software project platform, learning channel and other implementations to track the frequency and depth of students' learning of the tasks released before class. Based on learning outcomes and the new concept of comprehensive development and differentiated evaluation of students, using a combination of peer evaluation and teacher evaluation, we provide timely evaluation feedback on the training process, such as half-round table discussion, inter-group discernment and mid-class presentation of results. After the class, they will submit self-evaluation reports and give certain rewards in combination with the course points, so as to cultivate their craftsmanship of excellence and the management concept of continuous improvement. Construct a comprehensive evaluation system of "knowledge (40%) + process practice (40%) + self-assessment summary (20%)". See Figure 3.

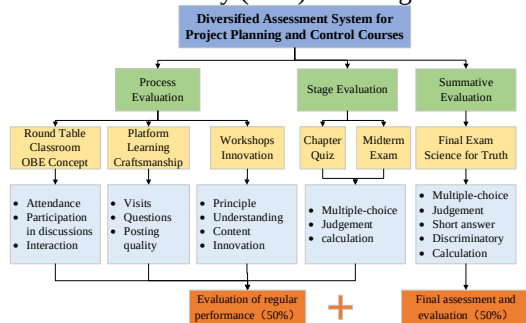


Fig. 3. Diversified assessment system for courses

5 Conclusions

Based on the analysis of the teaching problems of the course of "Project Planning and Control", through the introduction of the project hybrid teaching mode of the OBE-ODIC concept, the reform and innovation of its teaching content, teaching method and assessment system, The course content was divided into modules of progress, resource, cost and quality management to form a hierarchical knowledge framework that matches the production reality. And then real projects were used throughout the learning stage from freshman to senior year to promote the comprehensive education. The programme used a combination of traditional central lectures and round-table immersion seminars for pre-course study, in-course training and position-course reflection to cultivate students' practical and innovative abilities. This course model is a bridge between teaching theory and teaching practice, and its practical exploration and reform provides a reference for the cultivation of engineering management professionals in the context of new engineering disciplines.

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