

Innovation and practice of teaching mode of Engineering Project Investment and financing course under the background of application-oriented teaching

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ABSTRACT

Under the background of application-oriented teaching reform, as the core course of engineering management specialty, the teaching mode of the Engineering Project Investment and Financing course needs to break through the limitation of traditional theory indoctrination in order to meet the urgent needs of the industry for compound talents. Therefore, this paper will explore the innovative practice strategy of the teaching mode of Engineering Project Investment and financing course, embed the course content in the real case of the industry, and implement the dual tutor teaching mechanism of school-enterprise cooperation, strengthening the combination of virtual simulation and physical projects can help the reform of applied courses and cultivate more compound talents for the engineering field.

KEYWORDS

applied teaching; investment and financing of engineering projects; innovation of teaching mode; school-enterprise collaboration

With the rapid development of infrastructure construction in our country and the diversification of investment and financing modes in the field of engineering management, the ability requirements for practitioners have also shifted from single technical talents to compound talents with the ability of investment and financing analysis, risk management, policy interpretation and so on. Engineering projects are usually divided into operational, quasi-operational and non-operational.

The corresponding investment and financing models are determined based on the different types of projects. Common financing models include PPP (Public-Private Partnership), BOT (Build-Operate-Transfer), TOT (Transfer-Operate-Transfer), TBT (Build-Operate-Build), and PFI (Private Finance Initiative). However, the current teaching of relevant courses in colleges and universities lacks the integration of real project scenarios, and the latest trends in the industry have not been incorporated into the teaching content promptly, resulting in the disconnection between talent training and market demand. The application-oriented teaching reform provides a direction for solving this dilemma. Its core goal is to shorten the transformation path from knowledge learning to ability application through the practical reconstruction of teaching content and the innovation of teaching methods. Therefore, based on the practical needs of application-oriented teaching reform, this paper will explore the innovative teaching mode of Engineering Project Investment and financing courses to help the deep connection between higher education and industrial demand.

1 Teaching objectives of Engineering Project Investment and Financing course under the background of application-oriented teaching

1.1 Mastery of fundamental theoretical knowledge

Under the background of application-oriented teaching, the primary goal of the Engineering Project Investment and Financing course in colleges and universities in China is to help students systematically master the core theoretical knowledge related to engineering project investment and financing. Engineering projects' investment and financing activities involve interdisciplinary contents such as economics, management, finance and engineering. Students need to understand the basic principles, process framework and key concepts of investment and financing and grasp the inherent law of investment and financing activities as a whole. The curriculum needs to strengthen the practical application orientation of theoretical knowledge. Students need to master how to use the cash flow model to evaluate the economic feasibility of the project and how to use risk analysis theory to identify potential problems in the investment and financing process^[1]. In addition, students also need to be guided to understand how theory guides practical decision-making. When teachers explain the capital structure theory, they need to analyze the logic of the impact of different financing methods, such as equity financing and bond financing, on the cost and risk of engineering projects. In this way, students can understand the advantages and disadvantages of different financing methods in practical operation and their application scenarios to select the optimal financing strategy according to the project's characteristics and the enterprise's needs.

1.2 Cultivation of practical ability

Under the guidance of application-oriented teaching, the teaching of the Engineering Project Investment and Financing course needs to cultivate students' practical ability to use theoretical knowledge to solve practical problems. The project investment and financing are divided into several links, including the design of a project financing scheme, the formulation of contract terms, the formulation of risk management and control measures, etc. Students should be able to design a reasonable financing structure according to the characteristics of the project. The use of financial tools to prepare the project capital schedule requires that the course familiarize students with the complete process of investment and financing activities through case deduction and simulation training to master the use of standardized tools. The actual project investment and financing problem is complex. Hence, the content of the project investment and financing course needs to set up contradictory conditions, requiring students to weigh the advantages and disadvantages of different schemes and put forward optimization suggestions to help students get rid of a single theoretical perspective, the formation of practical constraints based on the decision-making thinking ability^[2].

2 Challenges faced by the teaching of Engineering Project Investment and Financing Course

2.1 The course content is divorced from the industry reality

The practical rules and policies in engineering investment and financing are updated rapidly. However, the compilation of teaching materials and the revision of curriculum syllabi in colleges and universities need to go through multiple levels of review, and the cycle is long, making it difficult to reflect on the latest changes in the industry quickly. New tools such as special debt and PPP models have been widely used in infrastructure in recent years, but many textbooks lack these contents. Moreover, the authors of textbooks are mostly academic researchers and lack continuous tracking of front-line practices, so the course content is biased toward classical theories. Engineering Investment and financing involves multidisciplinary knowledge, but most of the courses are still divided into teaching contents according to the boundaries of the disciplines, and the knowledge points such as financial analysis, legal provisions, and risk management are scattered in different chapters. It is difficult for students to understand how these contents are applied in practical projects. Colleges and universities consider the integrity of the discipline's theoretical system when making teaching plans. However, enterprises need students to be able to interpret policy documents and coordinate the interests of multiple parties in order to develop a more reasonable and scientific financing plan. However, the course still focuses on theoretical model derivation and case analysis, resulting in students' understanding of many theories, in the face of real project policy changes, conflicts of interest and other complex issues, will still feel at a loss.

2.2 Lack of practical experience

The entry criteria for university teachers have long been based on academic ability. In the recruitment process, attention is paid to academic background, scientific research results and the number of published papers, and the requirements for employment experience or practical skills are relatively loose. Many teachers are directly employed in universities after obtaining a doctorate. Their knowledge system is based on theoretical research, and they lack experience participating in real engineering investment and financing projects. The project investment and financing is a complex project, and its development process involves multi-party interest coordination, risk allocation and other contents, which can not form intuitive cognition only by literature reading^[3]. Moreover, the evaluation and promotion of teachers in colleges and universities are generally oriented by scientific research results, and teaching tasks and academic papers occupy the main energy. Participation in enterprise practice is not included in the workload, nor can it be transformed into effective resources for professional title evaluation. Policy tools, contract models, and project investment and financing market rules are constantly changing. Still, teachers' daily contact is mostly static resources such as textbooks and academic papers, making it difficult to obtain the latest industry experience. The gap in knowledge updates has led to a growing distance between classroom teaching content and actual operational needs, resulting in students acquiring more theoretical knowledge that is disconnected from real-life scenarios. Their ability to effectively solve real problems is not being improved.

2.3 Difficulty in participating in real projects

In the financing process of real engineering projects, once the details of the financing scheme, the negotiation records of contract terms, and the distribution of benefits are leaked, it will directly affect the economic interests of enterprises. Therefore, enterprises will exchange this information with a professional team to protect trade secrets and guard against risks. As an external participant, even if students enter the practice link through school-enterprise cooperation, they are

also exposed to simplified data after processing or are assigned to peripheral work such as document sorting and data entry, it is difficult to understand the real capital allocation logic and risk assessment methods in the process of project financing. It is also impossible to understand the root cause of the problem and the solution path. In addition, the project investment and financing take months or even years from preliminary demonstration to final implementation. At the same time, practical courses arranged by universities are mainly concentrated in a few weeks. Students participate in market research at the beginning of the project, but they cannot follow up on the optimization of the financing structure. Real-time changes such as the reconstruction of financing schemes and the reassessment of risks triggered by emergencies caused by policy adjustments require participants to track the whole process to understand the evolutionary logic of coping strategies but are limited by fixed teaching schedules; students end their practice when there are significant changes in the project, missing out on the most valuable learning opportunities.

3 Innovative practice strategy of teaching mode of Engineering Project Investment and Financing course

3.1 Industry real cases embedded in the course content

Enterprises have many unpublished practical materials, but the original materials contain trade secrets or complex technical parameters, and there are legal risks and cognitive barriers when directly introduced into the classroom. Based on this, after the enterprise provides the original project data, the teaching transformation can be carried out by the teacher team and the industry experts, and the sensitive data can be eliminated. For example, the comparison and selection process of financing schemes hides the specific amount but completely shows the calculation method of yield; the subject information of contract dispute cases is blurred, but the game process of risk allocation terms is presented. The transformed case needs to be equipped with project background specification, original document excerpts and a decision tree analysis diagram to help students form a complete cognitive chain. The policy adjustment and market change in project investment and financing are continuous, and a single case can not cover all scenarios^[4]. Therefore, the teaching of the Project Investment and Financing course can collect the stage data of the construction project quarterly and track the iterative process of the same project under different policy environments. For completed projects, follow-up operational data and risk exposure results are continuously supplemented to enable students to compare deviations from initial predictions with actual results. Under the requirements of application-oriented teaching, teachers should design matching dynamic teaching plan templates, and replace more than 30% of case materials every year to maintain core knowledge points, to ensure that theoretical tools can always guide industry practice.

3.2 School-enterprise partnership with dual tutors

In the course of Engineering Project Investment and financing, some teachers and industry experts have complementary knowledge structures. However, the difference in role orientation leads to the dispersion of teaching resources, which affects the teaching effect. To solve this problem, colleges and universities should establish a mutual recognition mechanism for tutors' qualifications, and clarify the boundaries of powers and responsibilities between theoretical and practical tutors. Among them, theoretical tutors are responsible for interpreting policies and regulations and deriving tool models. Practical Mentors are responsible for transferring project experience and industry tacit knowledge. In order to guide students in establishing a multi-dimensional decision-making perspective, monthly teaching program calibration meetings are held, knowledge fusion points are adjusted according to the latest dynamics of the industry, and double tutors are set up at key nodes. On this basis, teachers should divide the whole life cycle of the engineering project into 12-15 decision-making units and design a dual-track teaching link of theoretical input and practical verification for each unit. In the financing solution design module, the first 2 hours by the theoretical tutor to explain the theory of capital structure, followed by 4 hours by practical tutors who led students to simulate syndicated loan negotiations; in the last 2 hours, the two tutors jointly comment on the pros and cons of each group of schemes. Schools and enterprises need to build a teaching supervision team jointly, regularly check the coordination and teaching effect of the double tutors, adjust the tutor combination in time, and optimize the curriculum module in order to cultivate theoretical knowledge and practical ability and adapt to the needs of modern enterprises of high-quality compound talents.

3.3 Strengthen the combination of virtual simulation and physical project training

The teaching system of the Engineering Project Investment and Financing course needs to accurately embed two kinds of training scenarios in the whole process of the project. In the early stage of project approval, virtual simulation is

used to simulate the adjustment process of economic evaluation parameters under different policy changes, and students understand the non-linear relationship between variables through parameter sensitivity tests; in the medium-term financing stage, students design financing plans based on real financial statements and synchronize the risk of cash flow disruption after the implementation of the virtual platform simulation scheme. The decision-making results accumulated in the operation of the physical project should be imported into the virtual system in real-time to promote the optimization and upgrading of the simulation model. After the tax planning of the physical project is completed, the actual tax burden data should be input into the virtual tax model, generating a comparison map of tax planning schemes in different regions^[5]. At the same time, the error cases of virtual training are processed and transformed into the early warning database of physical projects. Students can access the virtual disposal records of similar situations as a reference when they participate in real investment and financing negotiations. The evaluation of the Project Investment and financing course needs to integrate the dual dimensions of virtual and real, that is, to assess the implementation effect of the scheme in the physical project, analyze whether the scheme is feasible, whether the cost control is reasonable, and whether the team cooperation is smooth; It also tracks the effect of strategy optimization after multiple trials and errors in the virtual system, to help students accumulate experience from practice, improve their ability to solve complex problems and prepare for future career challenges.

4 Conclusion

To sum up, under the background of application-oriented teaching reform, the innovative strategies of the teaching mode of engineering project investment and financing course include embedding the course content in the real case of the industry, implementing the dual tutor teaching mechanism of school-enterprise cooperation, and strengthening the combination of virtual simulation and physical project training. The collaborative implementation of these three strategies will help students master the application logic of investment and financing tools and realize the flexible transformation of theoretical tools and industry experience in complex situations. Future teaching reform needs to explore further the deep integration of intelligent teaching tools and real project data, continuously cultivate compound talents to adapt to future industrial changes and provide intellectual support for the high-quality development of the engineering field.

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