ISSN: 2688-9323

Research on the Teaching Reform of Course and Job Connection of Professional Core Courses based on the Integration between Industry and Education

-- A Case Study of "Cost Practice" Course

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Abstract

The training objectives of the "Cost Practice" course is built together via course and job connection based on the integration between industry and education, school and enterprise jointly build professional core courses, adopts the school-enterprise-school-part enterprise-enterprise alternate learning model, first enter the school to learn basic courses, then enter the enterprise for conducting job recognition internships, return to school again to learn professional courses, and finally return to the enterprise to integrate theoretical knowledge and skills, and participate in the production and operation of the enterprise. The students are taught at different levels, they are divided into ordinary classes and elite classes. The industry-education integration mechanism is formulated, and school and enterprise cooperate to carry out course teaching quality evaluation and assessment.

Keywords

Integration between Industry and Education; Professional Courses; Teaching Reform.

1. The Necessity of Teaching Reform

According to the "Opinions on Deepening the Integration between Industry and Education" ([2017] No.95) document issued by the General Office of the State Council, gradually improve the participation of industry enterprises in running schools, perfect the diversified school running system, and fully implement school-enterprise collaborative education. Carry out the No.1 document "Promotion Methods of Vocational School School-Enterprise Cooperation" of Vocational Education and Adult Education Department in 2018, the integration between industry and education and school-enterprise cooperation are the keys to do vocational education well. The project cost major is a typical applied major closely linked with professional theory and practice.

At present, there is a huge demand for talents in the project cost industry in the construction market, and there is an urgent need to increase the training of talents with applied skills to meet the needs of the construction market in Zhejiang Province. The training of talents serves the industry, in order to build a reasonable talent training system, it is necessary to analyze the talent demand based on the results of market surveys. This survey mainly carried out online questionnaires, a total of 100 survey questionnaires were distributed to Zhejiang cost-related enterprises, and 82 were recovered, including 20 construction enterprises, 23 project consulting companies, 17 bidding enterprises, 6 supervision companies, 10 project management companies, 6 cost software education and training companies. This survey is mainly aimed at the current enterprise demand for talents, the analysis of the survey questionnaire is shown in Fig 1.

ISSN: 2688-9323

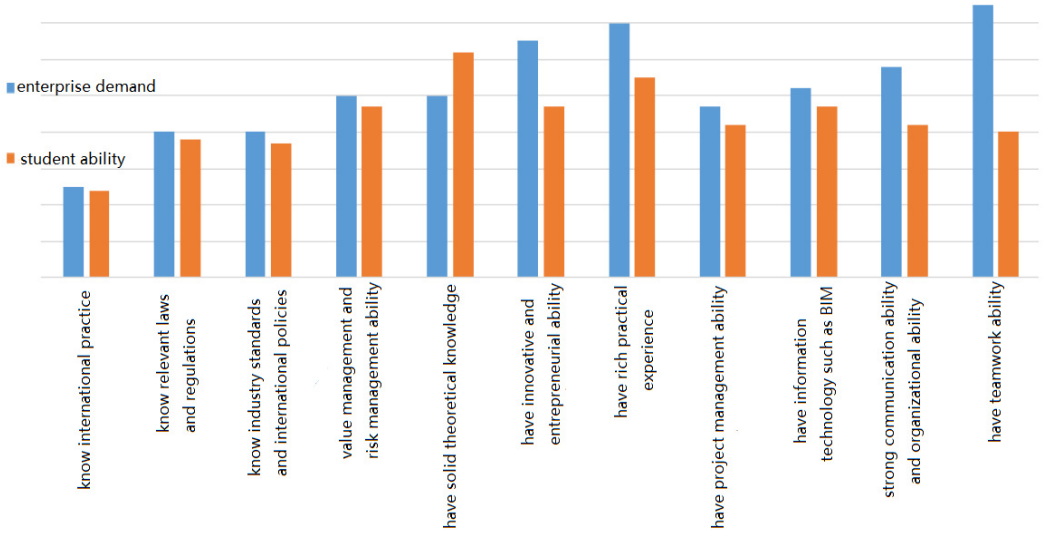

Fig 1. Analysis of enterprise demand for project cost professionals

As you can see in the Fig 1, cost enterprises in our province pay more attention to student teamwork ability, rich practical experience, and innovation and entrepreneurial ability requirements, these three aspects of ability are precisely the weaknesses of graduates trained by colleges and universities, traditional higher education mainly pays attention to assessment of the professional quality of students. Intensifying competition has caused students to become too self-aware, and their teamwork ability is getting worse; the constraints of traditional education ban students' thinking and cause students' innovative ability to decline; emphasis on the evaluation of theoretical achievements has led to insufficient practical ability of students and so on, this series of problems need to be solved by building reasonable talent training system. The school and enterprise jointly develop the talent training program, work together to improve students' vocational skills and employment competitiveness via the core ability practice activities and technical guidance of the cost major.

2. Main Contents

The economic documents corresponding to the basic construction procedures of the project are shown in Fig 2, the project cost personnel should have the professional cost related capabilities of construction project investment estimation, budgetary estimates, budget, settlement, final accounts, project changes, contract price adjustments, and claims. Firstly, determine reasonable talent training goals, and secondly, select appropriate training programs to achieve talent training goals, the key work is to build cost practice course goals according to professional requirements, rationally integrate teaching contents, and adopt project-oriented teaching mode, and then formulate appropriate evaluation criteria. The main contents of the specific research of the project are as follows:

(1) Jointly build training objectives of "Cost Practice" course via course and job connection based on the integration between industry and education.

By civil project, installation project pricing practice and improved task decomposition, multiple professional project practice, familiar with high-rise civil project, project quantity calculation, project quantity summary, sub-item project quantity list compilation, list quota group pricing of installation project system, finally, completes the compilation of the entire set of high-rises building civil project and installation project costs. Moreover, students should master the basic knowledge and theory of laws and regulations in the field of project construction, and have the

ISSN: 2688-9323

basic ability to solve related legal issues in project cost management. Besides, do project modeling well.

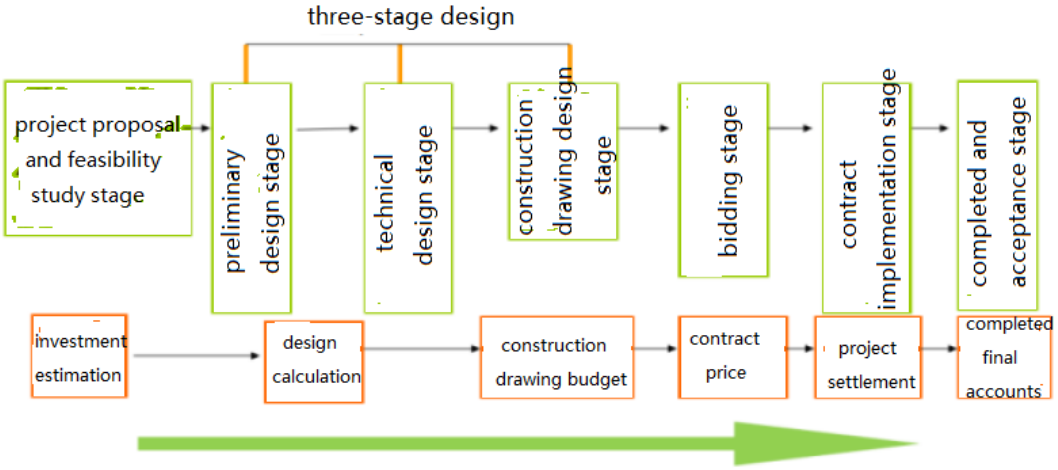

Fig 2. Corresponding economic documents of basic construction procedures

(2) Implementation measures of school-enterprise co-construction of professional core courses

The training of project cost talents adopts the work-study alternation model, adopts the school-enterprise-school-part enterprise-enterprise learning model, first, enter the school to learn basic courses, and then enter the enterprise for conducting job recognition internships, and then return to the school to learn professional courses, finally, return to the enterprise to integrate theoretical knowledge and skills, and participate in the production and operation of the enterprise. The students are taught at different levels, they are divided into ordinary classes and elite classes. The selection of elite classes is carried out by means of students' voluntary registration and skill and performance assessment, and adopts the double-tutor teaching and educating mode of enterprise masters and school teachers. Some students have solved the problem of zero-distance work under the guidance and training of enterprise double tutors via the course of "Cost Practice" in the fifth semester, as shown in Fig 3. During the enterprise internship, students are specially equipped with masters, and modern apprenticeships are adopted to conduct one-to-one job professional skills guidance, and students have the dual identity assessment.

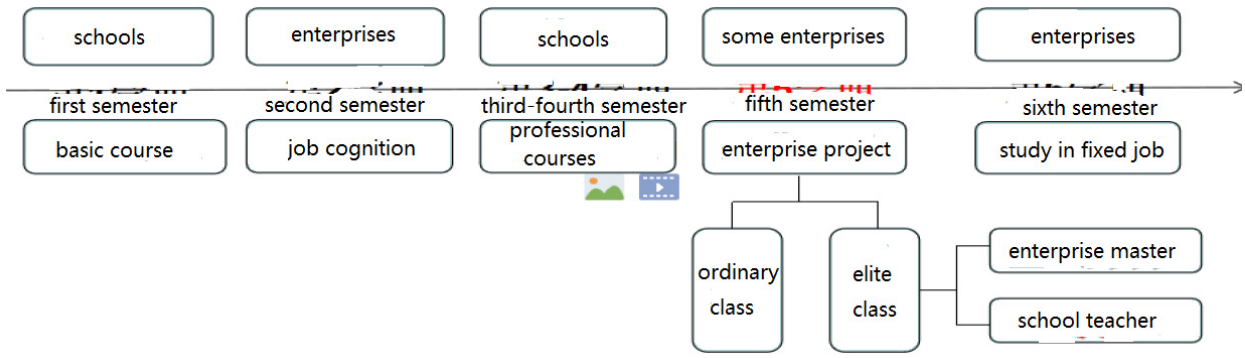

Fig 3. Implementation plan of the course "Cost Practice" in the 5th semester

ISSN: 2688-9323

Under the premise of enterprise masters and school teachers, the projects such as bidding agency, civil construction cost, installation cost, and BIM pipeline collision inspection are completed. Students complete the projects of the above four enterprises in rotation, find specific problems in the implementation process, learn from the usual practices, if they cannot be resolved, choose to communicate with all parties, strive to use the compromise method to solve the problem, and form the teaching cases.

(3) Research on the school-enterprise cooperation mechanism and integration between industry and education

At present, the school-enterprise cooperation model and integration between industry and education is widely used in China's vocational education, although it has achieved certain results, there are still problems in the legal system, management system and operating mechanism, which restrict the further development of integration between industry and education and school-enterprise cooperation. How to correctly understand the integration between industry and education, how to improve the system and regulations, and how to perfect the cooperation mechanism and operating mechanism are the urgent issues that need to be resolved in the current process of industry and education integration.

(4) School and enterprise cooperate to carry out course teaching quality evaluation and assessment

Schools should improve the quality evaluation system of talent training jointly trained by schools and enterprises, and incorporate indicators such as employment rate, employment quality, enterprise satisfaction, and entrepreneurial effect of graduates into the talent training quality evaluation system. The school and industry enterprises jointly implement the talent training quality evaluation plan, and hire enterprise technical backbones to participate in the evaluation and assessment of talent training quality. Win the support of enterprises and cooperate with schools to carry out graduate satisfaction survey. The business master and the school instructor jointly evaluate the students' course results. Enterprise instructors will give scores based on students' internship performance and work task completion, and school teachers will give scores based on students' internship performance and internship results, the evaluation scores of both parties account for 50% of the student's overall score.

3. Implementation Plan

In order for graduates to adapt to the future development of the construction industry, the project cost major has trained more applied talents in the new round of construction industry technological revolution, the core ability analysis of project cost is shown in Table 1.

Existing project cost consulting "Block F Project of Haixi Science and Technology Finance Pioneer Park", the basic situation of this project is shown in Table 2, the working contents of project cost consulting services include: construction drawing review, drawing project division, project budget preparation. Bidding quantity list and base price compilation, update and review of contract quantity list, review of project changes, review of project settlement and completion of settlement audit, etc. If there are many students enrolled, use the business standard compilation project and the BIM modeling project for group guidance, and finally conduct teaching in rotation according to the project, the implementation steps are shown in Fig 4.

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Table 1. Analysis of core ability of project cost

major	major direction	core job	core ability	original core course ability training	course connection ability training of industry-education integration
project cost	civil construction cost	civil construction estimator	(1) have construction project measurement and valuation ability (2) have the application ability of construction project measurement and pricing software (3) have ability to calculate claims for construction projects (4) have ability to handle construction project settlement (5) have ability to execute the bidding process of construction project	compile bidding control price	compile bidding documents edit bidding control price compile bidding quotation carry out project economic evaluation organize project bidding project contract management project cost control
	installation cost	installation estimator	(1) have installation project measurement and valuation ability (2) have the application ability of installation project measurement and valuation software (3) have the ability to calculate claims for installation project (4) have the ability to handle the installation project settlement (5) have the ability to execute the bidding process of installation projects (6) can implement project visa affairs (7) can calculate project cost	compile bidding control price	respond to tender documents edit bidding control price compile bid quotations execute project bidding affairs calculate project cost

Table 2. Basic situation and implementation of "enterprises' various project projects"

civil construction and installation cost project	project name	block F project of Haixi science and technology finance pioneer park	project category	house building	enterprise mentor
	construction unit	Cangnan Central Reserve Technology Co., Ltd.	project position	Cangnan County-Wenzhou City-Zhejiang Province	Hu Yuelian (hydropower installation), Lin Xuying (civil construction),
	construction nature	new construction	project use	industrial building	

ISSN: 2688-9323

	contract type	construction main contract	contract signing date	2019-08-30	Zhang Mingyan (intelligent installation)
	total investment (ten thousand yuan)	2045	total area (square meters)	9370	
	construction scale	The construction area of this project is 9370m², it is a multiple-use building. The building has 11 floors.			
BIM modeling project	project name	Block No. 2 (Jiangshan Wangfu)-Basement, North District, Jiangshan City	project category	house building	Lu Min, Jin Fantong
	construction unit	Jiangshan Jinghong Real Estate Co., Ltd.	project position	block No.2, North District, Jiangshan City	
	construction nature	new construction	project use	civil building	
	contract type	subcontract	contract signing date	September 12, 2019	
	total investment (ten thousand yuan)	1020	total area (square meters)	43003.7	
	construction scale	The construction area of this project: 43003.7m², the air defense area is 10109.05m², and the number of building floors: one underground floor. (Conduct BIM modeling, component collision inspection, net height analysis, electromechanical comprehensive optimization)			
bidding agency project	project name	sewage treatment project in Jingshan block of Wenzhou Traditional Chinese Medicine Hospital	project category	house building	Chen Su, Zhou Xiang
	construction unit	Wenzhou Hospital of Traditional Chinese Medicine	project position	Jingshan block, Wenzhou Traditional Chinese Medicine Hospital (338 Xueshan Road)	
	construction nature	new construction	project use	public building	
	contract type	bidding agency	contract signing date	July 11, 2019	
	total investment (ten thousand yuan)	40	total area (square meters)	30215	
	construction scale	sewage station cleaning, equipment dismantling and supply, installation and adjustment, check and after-sales service of sewage treatment equipment			

4. Expected Effect

The core contents of the "Cost Practice" course are the compilation of bidding control prices of civil construction costs and installation costs, the "bidding agency", "civil construction cost", "installation cost", "BIM modeling" work team can be set up, and actively carry out the school-

ISSN: 2688-9323

enterprise cooperation, can grasp the focus of employment units on the professional quality and project cost skills of students in cost major, solve the real needs of cost consulting companies, and provide them with technical services. By the integration between industry and education and course and job connection, students can complete technical service projects under the joint guidance of enterprise masters and school teachers, which enhance students' practical experience, enhance the scope and ability of school teachers' social services, and increase the economic benefits of enterprises.

Taking the basement modeling project as an example, in the collision inspection between the electromechanical model of the basement BIM modeling project in the No. 2 block of Jiangshan North District (Jiangshan Wangfu), more than 500 collision points were found via the multi-discipline BIM model, if the construction is carried out in accordance with the original CAD drawings, it will cause unnecessary turning and accumulatively cost about 120,000 yuan. The optimization and design of the collision point were conducted in accordance with the principle of optimization and design, which greatly reduces the problems in the design drawings, avoids the rework and cost waste in the later construction of the project, and improves the design and construction efficiency and construction quality. In the basement BIM modeling project of No.2 block of North District (Jiangshan Wangfu), Jiangshan City, materials can be saved by 10% via the application of BIM technology in materials, control the entry plan of materials, reduce the time required for material staff to count materials, achieve the goal of local inspection of materials and control the whole.

(1) Design innovation of the teaching mode of professional core courses.

In the current trend of technological change in the construction industry, more applied talents can be trained. Hierarchical training is more detailed and train students' abilities, teaching methods and means systematically, deepen school-enterprise cooperation, guarantee mechanisms, etc., and propose optimization suggestions for professional core courses.

In allusion the teaching condition of practical skills of project cost major in higher vocational colleges, this research actively improves the practical teaching conditions and proposes specific measures, provides active and effective methods for the cost majors to improve students' practical skills. Moreover, in order to make students to adapt to the future development of the building consulting industry, have the ability to bid for projects, compile civil construction budgets, compile installation budgets, BIM modeling, this topic will explore the comprehensive practice of shifting from the original cost practice of the fifth semester to the school-enterprise joint training model, carry out the demonstration of the superiority of school-enterprise cooperation, the comparison between the two is shown in Fig 4 below. Under the guidance of the teacher, inspect BIM modeling, the basement pipeline of the No. 2 block of Jiangshan North District (Jiangshan Wangfu), the collision inspection of the air pipe and the sprinkler pipe is shown in Fig 5.

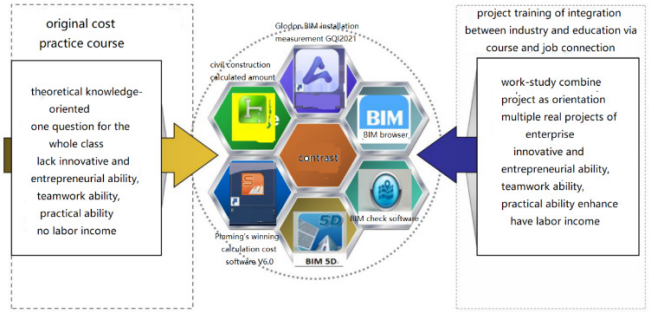

Fig 4. Comparative analysis of ability training of the original "Cost Practice" and course and job connection mode and the integration between industry and education

ISSN: 2688-9323

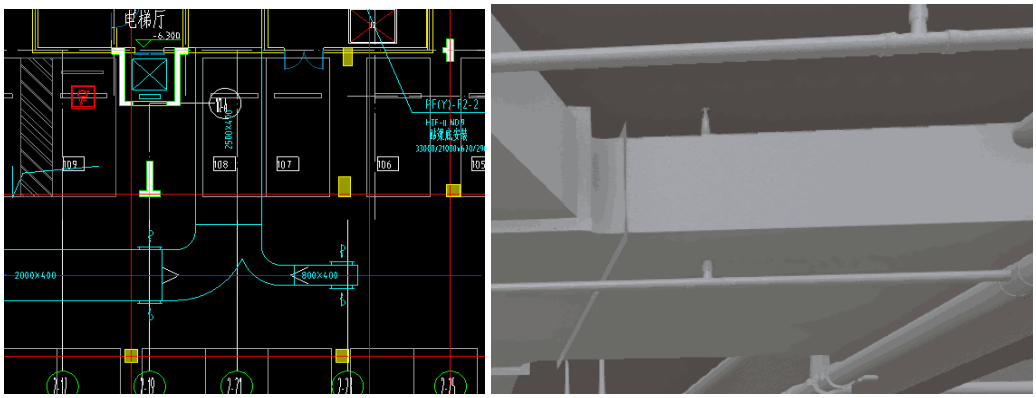

Fig 5. The wind pipe and the sprinkler pipe collide, the intersection between the C axis and the D axis and the B axis and C axis

Design and innovation of teaching mode, the course construction team combines the actual situation of higher vocational students and the requirements of the training objectives of project cost professionals, after continuous exploration and summary, change the conventional teaching ways that was mainly instillation in the past, focus on the teaching goal of training students' professional core ability, attach importance to the consistency of students' learning and actual work in school, take advantage of the cooperation with industry enterprises, take the real projects of the enterprises as the teaching carrier, use "task-driven" teaching method, case teaching method, situational simulation teaching method, and role-playing teaching method, etc., combine lecture (teaching), study (self-study), theory (discussion), work (work), answer (answering questions), etc., stimulate students' interest and initiative in learning, and train students' job vocational ability, independent spirit, innovative consciousness and comprehensive professional quality.

(2) Innovation in the organizational form of professional core courses

The process of class and post connection realizes the situational model of real project cost, when different students work together to complete a project, the differences, mutual complements and coordination will be the most valuable learning resources. The instructors play the role of audit experts in this process, provide platform for teachers to learn and communicate with each other, and it is beneficial to the improvement of teachers' professional level and the level of graduated comprehensive practical guidance.

5. Conclusion

(1) Improve the teaching effect of the core courses of cost major, and enhance students' project cost management skills;

In the fifth semester of the engineering cost major, students volunteer to sign up for the cost practice course, the enterprises appoint enterprise instructors to broaden students' horizons, improve the technical contents of professional practice, and train students' awareness of project cost management and core ability in professional application. Moreover, the "professional team" is built from the organizational form, complete work tasks together via group collaboration, train students' teamwork spirit and communication skills, and achieve the effect of all-round education of professional practice.

(2) Can promote the combination of theoretical education and social practice, to provide more valuable practical training experience for students in project cost major;

Students can apply theoretical knowledge in practice under the guidance of teachers. In this way, it can not only strengthen students' understanding of book theory knowledge, strengthen students' practical ability, but also effectively expand students' spatial imagination ability and

ISSN: 2688-9323

stimulate their interest in learning. The core course teaching reform based on the course and job connection and the integration between industry and education, it can strengthen the quality of talent training.

(3) The enterprises shorten the training period of new employees, and students can start their jobs as soon as they graduate.

While acquiring the talents they need, the enterprises also save the cost of multiple training and secondary recruitment, reduce the time when graduates adapt to the position, reduces the error rate of graduates in the work, so save time, and graduates adapt jobs as soon as possible. Students will be able to work after graduation, be able to work, and become backbones. The enthusiasm of enterprises for accepting students for employment has been improved.

Acknowledgments

Project Source: The 13th Five-Year Teaching Reform Project of Wenzhou Polytechnic. Project Number: WZYzd202013.

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