



The Construction of Project Teaching Mode of Quantitative Investment Course

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Abstract. Quantitative finance has been becoming a mainstream investment method gradually with the development of quantitative trading, but there are still some issues in interdisciplinary fusion and combination of practical exercises and theory in the course construction of Quantitative Investment in colleges. In order to train students to become specialized graduates with specific ability required by relevant employer, this paper studies the construction of project teaching mode Quantitative Investment course, integrate education resources, optimize course structure, and finally formed a project-based teaching pattern. Based on the requirements of relevant employer, we reconstruct the course into 6 module which underlying 14 sub-project and 43 task based on the principle of ‘project-leading and task-driven’. The project-based teaching simulates the actual workflow and realized by means of task importing and strategy making, strategy running, strategy testing and evaluation, and strategy optimization, achieve the purpose of cultivating students' competence, improving their lifelong learning ability, and finally realize student-centered, outcomes-based education.

Keywords: quantitative investment; project teaching; task-driven; outcomes-based

1 Introduction

The development of quantitative finance began in the 1950s. Markowitz first proposed the portfolio theory, which laid a theoretical foundation for quantitative investment ^[1]. Edward Thorp set up the first quantitative investment fund in Wall Street in 1969. Since 2000, Goldman Sachs has been developing automated trading robots with complex algorithmic systems to replace traders gradually. After decades of development, quantitative finance has gradually become the mainstream investment methods.

At present, there are some issues in Quantitative Investment course construction. In terms of current teaching modes, the content of course is independent content, so it is difficult for students to combine financial theories and mathematical models to make investment strategies and implement in transactions.

This paper takes the Quantitative Investment course of Investments major of Guizhou University of Commerce as example. Based on the aim of training programs of Investments major and the principle of ‘project-leading, task-driven’, we carry out project teaching construction. It aims on teaching mode innovation, reforming course structure, integrating interdisciplinary knowledge into the corresponding module, and make practice part throughout the entire project. We determine priorities of projects contents based on position requirement, and aim on developing students’ multidimensional ability. Students first finish theory foundation, and execution simulated experiment of work scenario. Then, learn to apply multidisciplinary knowledge into related projects.

2 The necessity of implementing project teaching

Project-based teaching is a teaching method in which speculative knowledge is transformed into multiple teaching projects, and students participate in project design and implementation under the guidance of teachers^[1]. Under the trend of quantitative trading application in the securities market, employers require the practitioners to be equipped multi-dimensional ability from different aspect, like analytical ability, operational ability and research and judgment ability. As far as the quantitative investment course is concerned, it is hard to ensure the students are able to apply theory to practice under a traditional way of teaching, nor can it achieve the goal of training students to become qualified employee under the current career requirements. It is necessary to carry out the reform of Quantitative Investment course based on the ability requirements of quantitative trade position by reconstructing the course content in a project-based way, applying theory to practice and optimizing knowledge resource with practice. Project teaching is a project-leading education mode that aim on achieving the goal of each task which attaches to position requirement, and reform the traditional course mode into a student-centered, project-centered, and practice-centered course. Project-based teaching pay more attention to cultivate the students’ ability of practice and application, and more conform to the requirements of relevant position. It is conducive to the cultivation of students’ operational ability, collaboration, innovation to adapt to the development needs of quantitative trading, and to train students become application-oriented graduates who can meet the needs of relevant positions^[2].

3 The status of quantitative investment courses in investments major

Quantitative Investment is a compulsory major course of investments students in our university, with C Program Design, Probability and Statistics, Financial Derivatives, Securities Investment and other major-related curriculum as guiding courses. The course is intended to cultivate students’ ability to financial market analysis, quantitative transactions and security trade operation. It mainly educates theory on stock selection strategy, security transaction timing strategy, portfolio strategy, futures arbitrage and

risk prevention and control. Quantitative Investment plays an important role in Investments major curriculum system construction, since its' purpose is not only on theoretical knowledge education, but also on multi-dimensional ability training on students, i.e. applying theory to practice, strategy formulation based on marketing analysis, so that students can meet the ability and quality requirements proposed by relevant industry positions, to provide talents which equipped financial analysis and operation ability to relevant industries^[3].

4 Current situation of Quantitative Investment courses

(1) The theory is abstract and the level of students' mastery is unsatisfactory. The selected content of the course is mainly based on textbooks, key points are separated from real cases, figures and data. Lack of practice makes it is difficult for students to understand theory, it is difficult to stimulate students' learning initiative on the other hand. The situation which students have strong dependence on textbook brings barriers to reform the traditional teaching mode. No matter how the teacher changes the teaching method it still cannot reach to a satisfied situation if there is no clear project and task.

(2) The practice progress is occurred in the school, and there are difficulties in simulation of a real work scene^[4]. Although the curriculum system is set strictly based on the training purpose of major of Investments, and the proportion of theory taught classes and experiment classes is also in line with the training programs, the practical classes are mostly simulated in a campus situation, and there are few opportunities to participate in a real work scene.

(3) In the aspect of assessment, traditional teaching is lack of a scientific systematic assessment system. Normally we more emphasis on results, and ignore the multi-dimensional evaluation on process throughout the course, thus the result of assessment cannot fully and objectively reflect the level of students' mastery and application of theory, especially their practical application ability as well. Take the chapter of 'stock selection strategy based on financial ratio' as an example, teacher will ask questions, students will also eagerly answer during the class, and the assessments of process are all graded by the performance of questions and answers. However, the questions are mainly relied on content from textbook, we cannot evaluate whether students are able to apply the involved financial ratios into practical scenario only from the grades of question answering marks. Moreover, if process assessment only relies on experiment report grades and question answering performance, whether a student equipped the ability that relevant position really required cannot be precisely evaluated.

(4) There is a difference between the class taught content and the position requirements in real work scenario. Since there is a rapid development and innovation of enterprises, lack of investigation and survey on the relevant position requirements and then design course project and tasks, it is difficult to reach a satisfactory result of teaching which aim on training qualified students who meet the requirements of the society, enterprises and industries.

(5) Traditional Quantitative Investments teaching modes ignores developing students' consciousness of teamwork and continuous learning ability, the students-centered class is not fully achieved, thus students' initiative and creativity cannot be fully aroused. To some extent, and achievements of teaching is affected^[5], it helps little for students to adapt to work and integrate into enterprises and industries after graduation quickly.

5 Implementation Quantitative Investment course project teaching

(1) Selection of project content

The selection of project content should be targeted, practical and typical. Based on students' employment demand and outcome of course learning, the project teaching construction closely attach to goal of undergraduates training programs. Depending on the requirement of specific positions like quantitative analysis, quantitative trading, we construct an outcome-based and project-oriented curriculum structure with the principle of 'project-leading and task-driven'. The specific project content selection is student-centered, oriented by job demand and students' sustainable development, combined internet and big data technology, and are constructed into 6 modules including basic strategy module, security selection module, transaction timing module, portfolio trading module, arbitrage module and algorithm module, along with 14 projects and 43 tasks behinds. Three-dimensional goals are to be achieve: goal on knowledge, goal on ability training and goal on students' quality. In the aspect of goal on knowledge, students are required to master the basic theory and knowledge of quantitative investment, learn the knowledge of all tasks and develop operation ability to deal with the tasks. As for the goal on ability training, students will be guided to equip ability of quantitative investment analysis, estimate, decision and so on. Goal on students' quality is to develop a social humanity of "virtue, responsibility, assistance and dedication", cultivate the consciousness of teamwork, precise scientific attitude and sustainable learning ability.

(2) Multidisciplinary integration and enrich course resources

The structure of undergraduate program of Investments has been optimized. The core courses include Investment, Securities Investment, Investment Banking, Quantitative Investment, Asset Pricing Theory, etc. Mathematical courses include Calculus, linear Algebra, Probability and statistics, Statistics, Econometrics, Financial Econometrics. In terms of computer programming, programming of Python, C++ and other elective courses of programming are provided. After finish studying of those courses before start learning Quantitative Investment, students are able to develop programming ability, mathematical way of thinking and acquire theory of securities, which provide a good foundation for studying theory of quantitative investment course. Meanwhile, the Investments major provides an experiment simulation platform for trading and evaluating financial instruments like stocks, futures and options, foreign exchange, and recognizing business of financial institutions such as commercial banks, internet finance,

enterprise investment and financing, and personal finance. The multidisciplinary integration and experiment simulation platform provides a guarantee for training goals achievement and the implementation of project teaching of this course. Based on reconstruction project content, course resource will be enriched by completing the syllabus and curriculum standard, formulating experiment instruction and typical teaching material which is in line with the project content ^[3], setting relevant case library, constructing online learning system and teaching video set and so on.

(3) Improve teaching methods and enhance college-enterprise corporation.

Based on the undergraduate training program, project-based teaching, reconstruct the course into projects with existing teaching materials and other auxiliary teaching resources with the aim of meeting needs of related industry position. Each task determined with the goal on knowledge, ability and quality that students should achieve through learning. The projects simulate the actual scenario of workflow by means of 'task import--strategy determination--strategy operation--strategy test and evaluation--strategy optimization'. Compared with traditional teaching, project-based teaching ensure that students are all involved in information collection, program design and implementation independently, and teachers play role of guiding and leading. Moreover, the teaching methods need to be elected dynamically to suit different project and task. During theory teaching process, variety of approaches such as scene teaching, situational teaching, case teaching method, Problem-Based Learning and so on. In each module, relevant industry employees are invited as tutors and to give lectures from the perspective of working competency. In the practice process, the enterprise tutors proposed specific scenarios to simulate the work scenario, and made full use of the practice platform to complete the transaction operation and the analysis.

(4) Awareness of risk management and cultivation of ethics runs through the project

Quantitative investment course focuses on the application of quantitative techniques, and quantitative trading all based on computer algorithms, especially in stock selection and timing determination process since it mainly relies on technical indicators to set trading conditions. Therefore, triggered conditions will amplify the market risk due to it may cause a large-scale co-direction trading behavior. In each project, investor sentiment is considered as a factor of market performance and used to track the security market trend. Quantified investors sentiment is necessary to estimate oversold and overbought of securities. Behavior finance is also involved throughout the projects so that projects can connect quantified investors sentiment with algorithmic trading and subjective investment, achieve the concept of risk management and surplus-lose stop timing throughout the project, set a foundation to students of becoming qualified employee with ethics in the future.

(5) Project teaching to strengthen the process management, diversified assessment of students' performance

Project-based teaching focuses on students' independent learning, the ability of teamwork and cooperation, and the ability of practical operation. Therefore, records on students' attitude, ability and performance are to be set as specific process management files, is significant to give a fairer, more comprehensive and more complete evaluation of students' process performance. Cooperation between universities and enterprises should be strengthened throughout project-based teaching process, and employers from

financial institutions or regulatory institutions are invited to give lectures in related projects. Also, during the project, enterprises tutor can evaluate students' working competency. Performance assessment comprehensively consider process evaluation, ability evaluation, outcome evaluation and outcomes grade from enterprise tutors, so as to achieve the diversification of assessment methods and principal assessment body.

6 Process of project teaching implementation

Implementation of project teaching mainly by means of introduction of project tasks, executing project tasks, analysis the completion level of project tasks. The specific flows of project teaching are stated as follow.

First of all is preparation before class. Before class, tasks are sent to students online, enable student preview task requirement and execute teamwork more efficient. Teachers provide multiple related project resource and require students read the provided cases before class.

Second is executing tasks during class. According to requirements of tasks, students look for information via different media and make plans. Teachers provide guidance on the plans made by the students in each group, and apply different teaching methods in different tasks, such as case analysis or role playing. Students discuss by group, formulate an effective plan and complete specific task via classroom or training platform. After students complete the task, teachers evaluate the task under different assessment standards of tasks. For example, the performance of experiment report, mind map, platform data of experiment and so on are the evaluation basis. After evaluation, teachers should analyze the completion level of the project task, summarize the key points, difficulties, and analyze the existing problems. Finally, provide individual guidance to students.

Last but not the least is reviewing after class. Teachers upload cases which is highly completed online, to help students review the theory and key points in practical process. Moreover, teachers arrange new tasks and provide more course resource and references for student to preview.

7 Conclusion

Based on the requirement of employers and related position in new era, this paper reconstructs Quantitative Investment course into a project-based and outcomes-orientated course with six modules. Take the ability requirement of quantitative trading position (i.e., ability of theory application, ability of data mining and modeling ability) into consideration, the modules are determined as basic strategy module, security selection module, transaction timing module, portfolio trading module, arbitrage module and algorithm module. Students is to be trained as qualified talents who equip financial analysis ability operation ability in multi-dimension ways, meet the ability requirements and quality requirements of related industry positions.

References

1. Markowitz,H. Portfolio Selection. *Journal of Finance*,1952,7(1):77-91.
2. Liu Shubo, Reform and Practice of Project-driven Teaching Model Based on OBE Concept, *Journal of Liaoning Teachers College (Social Sciences Edition)*, 2021(04):62-64
3. Lyu Dayong, Liu Jing, The Design and Application of Quantitative Investment Simulation Experiment in the Fin-Tech Undergraduate Teaching, *The Science Education Article Collects*, 2020(12):126-127
4. Wang Jinle, Chen Bozheng, Construction and Reflection on Quantitative Investment Course in Colleges and Universities, *Education Modernization*, 2020,7(20):89-91
5. Du Hongjun, Reflections on the Course Construction of Quantitative Investment in Finance Major, *Education Teaching Forum*, 2017(49):69-72

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