

Strategy and Efficiency Evaluation of PBL Method in Undergraduate Financial Courses

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Keywords: PBL Method, Undergraduate Financial Courses, Strategy and Challenge, Efficiency Evaluation

Abstract: The paper analysed project-based learning and its application in financial courses in an undergraduate programs. The strategy and challenges of PBL method in financial courses are discussed. The strategy, aimed at motivation and innovation, initiated through transformation of ideas in pedagogy reform, prerequisites, appropriate task design, constantly requires communication and interaction. The challenge of adaptive assessment methods and systematic knowledge infrastructure should be considered. The experiment is carried out in parallel groups of students taught by PBL method and traditional lecturing, respectively. The effectiveness of PBL method is measured by various indicators, which include final exam scores, publication contests, awards, employment rate, and postgraduate admission rate. Students from PBL group had been better in employment, while showing no significant difference in other aspects compared to the traditional group. In future research, the sample size could be increased to derive a more accurate and robust result. Other factors which influence the academic results, innovation accomplishment, and career prospects should also be included as control variables in future research.

1. Introduction

The new era of Internet+ and the concept of new economics and management in university education require new teaching methods, which could tailor into the needs of critical thinking and practical ability. Project based learning, PBL teaching method, which was originally launched in university courses in the field of medicine, has been widely adopted across different disciplines in higher education. [1, 2], Financial courses for undergraduate students are expected to adapt to ever-changing environment, cultivate the capability of critical thinking, problem detection, information gathering and processing, as well as integration with information technology. [3] This paper analyzed the application of PBL methods in financial courses, such as financial engineering, tailoring the teaching design of pedagogy reform for the needs of students, tutors, and financial industry. The research is organized as follows: the second part elaborates the strategies and challenges of PBL method in financial course; the third part illustrates the experiment process, analyzes efficiency of PBL method with quantitative research of the results; the fourth part

concludes and sums up the experience and future development.

2. Strategy and Challenge of PBL Method in Financial Courses

2.1 Strategy

The essence of PBL method depends on innovation and motivation. The role of tutor is expected to transform from lecturing to guidance. [4] The course of financial engineering is selected to conduct a pedagogy experiment based on PBL method. Financial engineering, as a compulsory course for sophomore students, is prevalently considered a theoretical course, which includes large amounts of theory and calculation. However, in the era of Internet+ and digital economic development, financial problems are becoming more entangled with information technology and other interdisciplinary knowledge. The update of knowledge is a lasting challenge in university education, while PBL method could be one of the solutions. Fast development of financial transactions requires new technologies for pricing and risk management. High frequency trading, quantitative trading, and program trading could not be learned from theories in textbooks. [5] From the problem solving point of view, students could not only snap the latest financial transactions, but also acquire the ability to adapt to the ever-changing financial environment.

The pedagogy reform based on PBL method requires through idea transformation from the teachers, who should not mix the concept with a simple form of case studies or group discussion. Cultivation of practical capabilities for financial major students is not a novel concept. However, case studies, laboratory based practice, and internship could not sufficiently enhance the capability of the students. While a case studies within the theoretical course could be obsolete and rigid; group discussions could be reduced to presentations with power points without much practical value; as a branch of social science, laboratory teaching for a financial courses could be undervalued or even straight ignored by both teachers and students; an internship which most likely organized in summer vacation time or the last semester of senior year, has weak or little connection with professional knowledge.

Reasonable task design is the prerequisite for successful project-based learning. How to select suitable projects to be discussed, analyzed, and solved is a crucial issue in the stage of course planning for teachers, tutors, or supervisors. While the traditional lecturing is supported by the existing knowledge teaching systems, PBL methods relies heavily on the teaching design of an individual teachers. [6] The teaching content of the traditional university courses is based on well-edited textbooks and academic literature for further reading, even case studies, exercises, and exam questions are standardized. However, the teaching material in PBL method is uncertain, changing, varying and could be subjective. Cooperate with effort from departments, industry, and supervision would be necessary to ensure teaching quality. Several different varieties of factors need to be taken into consideration. From the aspect of students, the workload, level of difficulty, task assignment in teamwork, should suit the propensity and ability of the students. Teaching according to the aptitude of students is also necessary, which could be realized by individualized task design and proper stratified teaching. [7] From the overall university degree education quality point of view, task design should be in compliance with the requirements of overall cultivated planning for taking the degree, and does not contradict the requirement of prerequisites and follow-up courses. From the industry aspect, the selection of task design should be up to date to the market environment, to the latest regulations, and to the newest pricing and risk management techniques for financial innovation.

Guidance and communication amongst students and tutors plays an essential role in the effectiveness of PBL methods. Traditional teaching requires some communication amongst teachers and students, but the role of communication is non-essential. Two hours of office hour in a week for

answering questions, handing out teaching materials could be sufficient for traditional up teaching. In contrast to the traditional teaching methods, communication attributes to the success of PBL methods in various ways. Brainstorming and discussion amongst students, self-exploration and problem solving requires mutual support and inspiration. Constant monitoring of student's progress, providing students with theories, calculation formula, data analyze tools, information source, closely and frequent interactive relation between teacher and student is necessary for PBL method.

2.2 Challenge

The assessment is difficult to quantify for the course based on PBL method. Critical thinking, innovation capabilities and problem solving skills are difficult to measure, almost impossible to accurately quantify. If the final exam is adopted as assessment for the course with PBL method, students tend to learn text books instead of problem solving. While team work plays an important role in PBL, the individual effort could be obscured, which leads to lower than satisfactory motivation and less individual input. [8]

The other challenge is that complete knowledge system versus problem solving. Compared with traditional lectures, one of the disadvantages is the lack of systematic knowledge structure in PBL method. Problem based learning may not be able to cover all aspects of the subject. [9] No matter how well designed, the teaching content of problem solving based learning depends on the problems, which arises from a practical issues in the industry, which may not be compatible with academic studies.

Support from industry is also a crucial issue in PBL in financial courses. In contrast to the science subjects, financial issues are embedded in the social, economic, and regulatory environments. Hence, the problems in the financial course should be sourced from the industry. To ensure its practical value, support from tutors or supervisors in the industry would be necessary. [10] The solution of the problem explored by the students should also be in compliance with the legal and regulatory rules.

The challenges could be dealt with by application of multiple forms of assessment; using PBL method as a supplement for traditional teaching other than substitution; establish an enterprise and university cooperation mechanisms to maintain positive relations with experts in the industry.

3. Efficiency Evaluation of PBL Method

3.1 Experiment Design

Divide the sophomore students majored in finance into two groups, the compulsory course of financial engineering is taught with different methods. [11, 12], the course for one of the groups follows the traditional method, including lectures, theoretical teaching, case studies, extensive literature reading, and coursework. The other group is inspired by the problem solving of practical financial problems, while the theoretical teaching of pricing and risk management is integrated with initiative problem solving. There are 40 students in the major of computer science and technology (Financial information service) in Hangzhou Normal University. The characteristic class with interdisciplinary features is selected as the sample in the research. Each group is comprised of 20 students, which are evenly distributed concerning age, previews, GPA, sex, and NCEE scores, which is shown in Figure 1.

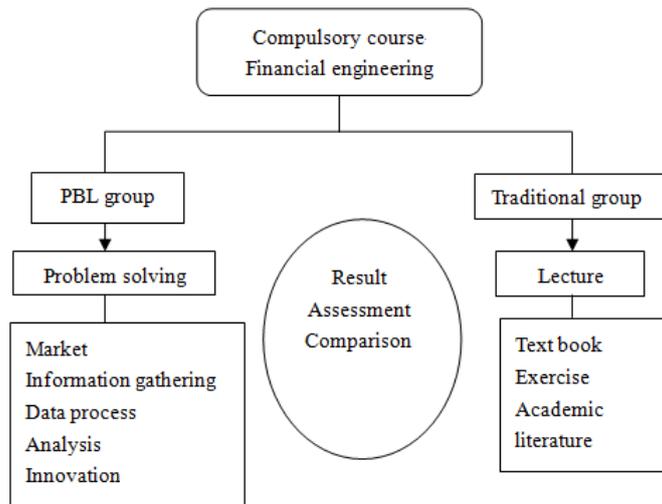


Figure 1: Comparison studies for PBL methods and traditional teaching

PBL method is utilized in Chapter 4 of financial engineering, which is the chapter elaborate, arbitrage and hedging of forwards and futures. Instead of explaining definitions and theories, deducting formulas, providing examples of calculations, doing exercise in the text book, the problem of hedge ration in futures market is brought up to be solved by students. Students would gather information of real-time listings of the underlying assets and future products of their own choice, collect, process, and analyze data to calculate the hedge ratio, and evaluate the effectiveness of the hedge from a risk management point of view. [13] While collecting data from the financial futures market in China financial futures exchange, in order to understand the listings, students would learn the definition of futures, the standardized contract factors, the concept of marking on market, and the marginal call. The otherwise difficult concepts, which are abstract and hard to explain, could be understood during the process of information gathering, which could be much better learned than by lecturing and memorizing, as shown in Figure 2.

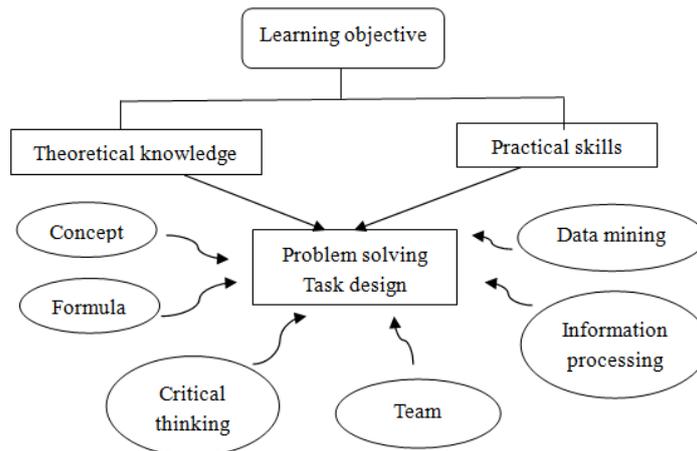


Figure 2: The task design for PBL method

3.2 Results

Firstly, the result is measured by end-of--of-term examination. With the identical final exam paper, which was decided by an outside experts, the test results indicate that no significant different between the two groups in the overall score. However, different groups of students excel in

different types of exam questions. While the student received traditional teaching had done better in objective questions, such as multiple choice questions and true or false questions, as well as essay questions concerning theory and academic literature, students guided with PBL method had done significantly better in comprehensive questions. Surprisingly, students with PBL method had also done better in calculations, despite the abundant workload of calculation homework, the traditional group showed slightly worse results in calculation. The explanation could lie on the lack of practical context of the homework in text books, which impedes thinking and inferring. The difficulty coefficient is calculated as follows, to measure the difficulty for the group of students, the higher the coefficient, the less acquired of the knowledge.

$$x1 = 1 - \left(\frac{\text{mean}}{100}\right) \quad (1)$$

The level of discrimination is derived with the following calculation, which depicts the differentiation of the students, which is shown in Table 1.

$$x2 = (\text{average of highest} - \text{average of lowest})/100 \quad (2)$$

Table 1: Final Examination Result

	PBL group	Traditional group
Mean	79	78
Standard deviation	11	17
Highest score	98	95
Lowest score	67	58
Difficulty coefficient	0.21	0.22
Level of discrimination	0.28	0.33
Excellence rate	25%	20%
Failure rate	0%	5%

Secondly, innovation and critical thinking were measured by published papers and contests. There is no significant different in publishing, while each group published one paper. In the contests, students from PBL method group had done significantly better than the traditional group, winning three contests in contrast to one. The students from PBL group developed various skill set, which includes finance and investment, information technology, and entrepreneurship, which is shown in Table 2.

Table 2: Awards, Publication and Contest

Types of award	PBL group	Traditional group
Publication	1	1
Financial and investment	1	0
Information technology	1	1
Entrepreneurship	1	0

Thirdly, career prospects and further academic research is measured by employment rate and number of students going to a master's program in graduate school. There is a slightly higher rate of employment in the students from PBL method group, while further education shows no clear difference. Considering that the experiment in one course could only influence overall education quality limitedly, the correlation could not be proved, therefore the result is unclear. [14] Other influencing factors of employment and further education should also be included as a control variables in the future research to derive a more scientific result as shown in Table 3.

Table 3: Career Prospect and Postgraduate Education

Types of institution	PBL group	Traditional group
Large financial institutions	5	2
State owned enterprises	3	2
Fortune 500 enterprises	2	1
Top 50 postgraduate program	1	1
Wait for employment	1	2

4. Conclusions

The paper analyzed project-based learning and its application in financial courses in an undergraduate program. The strategy and challenge of PBL method in financial courses is discussed. The strategy, aimed at motivation and innovation, initiated through transformation of ideas in pedagogy reform, prerequisites, appropriate task design, constantly requires communication and interaction, and should be supported by enterprise tutors from the financial industry. The challenge of adaptive assessment method and systematic knowledge infrastructure should be dealt with by supplementary theoretical teaching and various forms of assessment. The experiment is carried out in parallel groups of students for the course of financial engineering, which are taught by PBL method and traditional lecturing, respectively. The statistics of the result were analyzed. The effectiveness of PBL method is measured by various indicators, from final exam scores, publication, contest awards, employment rate, and postgraduate admission. Students from PBL group had been better in employment, while showing no significant difference in other aspects compared to the traditional group.

As for the future research, the representativeness of the sample in this paper may be satisfactory, while the size of the sample is limited. In the future, a larger number of students could be included in the experiment, to derive a more accurate, objective, and robust result. [15] Other factors which influence the academic results, innovation accomplishment, and career prospects should also be included as control variables in future research.

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