

Research on PBL+LBL Mixed Teaching Mode of Intermediate Econometrics

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Abstract: As the basic methodology of economic and the technical analysis tool of empirical research, Econometrics is the most important for academic research of Postgraduates in finance and Economics Universities. Based on the actual survey results of Anhui University of Finance and economics, this article makes clear the feasibility of PBL + LBL mixed teaching mode, and analyzes the ratio differences of graduate students' participation mode and participation role proportion in curriculum learning. Through the PBL + LBL mixed teaching mode, it is to realize the situational and case-based teaching content, rich media teaching form and transformation, process and diversification of assessment methods. The purpose is to strengthen the cultivation of graduate students' innovation ability, and optimize the teaching reform ideas of core courses.

Keywords: Econometrics; Problem Based Learning; Lecture Based Learning; Teaching Model.

1. Introduction

Problem-based Learning (PBL) was first established in 1969 by American neurology professor Barrows at McMaster University in Canada [1]. Problem-based learning (PBL) is an instructional method in which students learn through facilitated problem solving. Student centers on a complex problem that does not have one correct answer. They always work in collaborative groups to solve problems [2]. It is a teaching mode that takes real-life problems as the starting point, student-centered, and teacher oriented. This model aims to transform and condense what happens, sees, and hears around students into real-life situations. It raises questions from the context to stimulate students' enthusiasm for self-directed learning, and enhances their ability to discover, analyze, and solve problems. Econometrics is an economics course that combines economics, statistics, mathematics, and computer science to study the quantitative relationships and laws of the economy. It is widely offered in universities with a business background. As a highly practical and technical core theoretical course in economics, it is essential for conducting academic research on graduate students majoring in economics and management.

Primary econometrics aims to clarify the basic paradigm of econometric research, which is essentially a process of "finding feelings". College students will be exposed to a large amount of theoretical knowledge such as concepts and definitions, mainly focusing on the establishment, estimation, and various testing methods of linear regression models. The teaching method is mainly classroom lectures, supplemented by online materials. During the graduate stage, intermediate econometrics will focus on much more mathematically, rigorously, and advanced knowledge. In terms of content, in addition to classical regression, non-linear models and unstructured models and time series models and panel data models and so on have been added. Intermediate econometrics emphasizes that students should transform their knowledge into scientific research applications. However, graduate students have also faced inherent pressure to conduct personal scientific research and rely on their mentor's research projects for scientific research. Therefore, as a tool

and method for academic research, Econometric should be more closely related to practical hot issues and scientific research projects, which is conducive to cultivating students' quantitative thinking patterns and improving their comprehensive ability to quantitatively analyze and solve problems. Many articles have discussed the implementation and specific effects of blended learning, course papers, "micro lessons + experiments", PBL teaching and other forms of teaching on the reform of Econometrics. Essentially, these teaching forms or means belong to the application practice of PBL teaching mode [3-6]. This article discusses the necessity of introducing the Problem-based Learning (PBL) teaching mode in the process of Traditional Lecture-based Learning (LBL). It introduces its current application status, and hopes to achieve positive results in the teaching reform process of the course of Intermediate Econometrics in the field of economics and management.

2. Investigation Status Analysis

2.1. Description of Survey Subjects

Selecting the 2022 major master's degree programs in economics and management from Anhui University of Finance and Economics (AUFE) in China as the survey subjects. There are 145 graduate students from 13 majors including Management Science and Engineering, Finance, Industrial Economics, International Trade, National Economics, Cooperative Economics, Finance, Labor Economics, Theoretical Economics, Regional Economics, World Economics, Statistics, and Investment Economics. The gender ratio is 32.41% and 67.59%, respectively. Our survey found that only 61.38% of students had studied Econometrics during their undergraduate studies. It has been found that graduate students in finance and economics universities varies greatly due to differences in student sources and majors, resulting in significant differences in the basic learning of Intermediate Econometrics during the graduate stage, which poses certain challenges to the development of the course.

2.2. Analysis of Survey Results

Our survey found that 77.93% of students believe that the

course of Intermediate Econometrics is relatively difficult to learn, and 22.07% of students believe that the course difficulty is moderate. Most students believe that compared to other professional courses, econometrics has certain difficulties in both theoretical derivation and method application, requiring more effort and time to be invested. shows that 67.59% of graduate students believe that intermediate econometrics is crucial for their future academic research. The quality of graduate students varies, and the basic knowledge of pilot courses is weak. Some graduate students, due to not participating in econometric courses during their undergraduate studies, develop a certain fear of difficulty when they first encounter econometrics, which affects their recognition of econometrics in academic research. The satisfaction rate of students with teaching elements (teaching content, teaching methods, teaching materials, software usage) is approximately 30:65:5, with very satisfied, satisfied, and basically satisfied ratios. Therefore, some students are still dissatisfied with the current study of Intermediate Econometrics, and have higher expectations for this course. Therefore, it is imperative to reform the teaching mode of intermediate econometrics for graduate students in finance and economics universities. Econometrics is a highly theoretical and applied course. In LBL mode, teachers generally explain knowledge points in chapter order and can systematically and comprehensively introduce subject knowledge to students. However, students have always been in a passive position to receive knowledge. It is difficult to understand theoretical knowledge derivation for some students. They don't have sufficient ability to apply various econometric models to explain and analyze actual economic phenomena and problems. In PBL mode, Teachers set up problem scenarios of economic phenomena and encourage students to solve problems through self-directed learning or team collaboration. However, some theoretical knowledge or professional terms in Econometrics are very abstract, and it is difficult for students to accurately understand them simply by reading literature or case studies. In PBL mode students would focus their energy on solving problems, while neglecting the applicability of the model itself. Therefore, the dual track teaching modes of PBL and LBL has become the preferred choice for graduate students. The combination of the two modes can overcome the shortcomings and highlight their respective advantages. This is like the results obtained by Linli Ye (2017) for the experimental teaching control group study [7].

The graduate students have strong self-discipline and initiative. Considering the differences in professional course settings, 53% of students occasionally read measurement related content, 32% of students can do pre class and post class review, 12% of students read relevant materials every day, and 3% of students hardly read it. Self-study methods mainly rely on reference books (46%), MOOC platforms (22%), forum style websites (17%), and professional literature reading (15%). Obviously, relying solely on reference books is not enough to practice PBL teaching mode. More extracurricular reading (including literature, websites, and platforms), as well as a lot of post class discussion, are essential.

In the survey of student willingness and participation roles in PBL, 87% of students are willing to refer to group discussions. They are willing to become active participants in group discussions, undertaking tasks such as literature selection, data collection, model building and analysis, and

result presentation. 30% of students become passive participants due to teacher assignments or group rotations. Unfortunately, 11% of students want to hitchhike and pass this course assessment without taking on substantial work. According to student survey identification, students have several goals through studying Intermediate Econometrics, such as facilitating the writing of innovative quantitative articles, improving advanced software analysis skills, further mastering quantitative processing methods at the forefront of the discipline, enhancing research team collaboration ability, and improving presentation PPT and expression ability. The final survey showed that 70.34% of students believe that implementing PBL+LBL blended teaching mode will result in greater teaching gains than learning burden.

Through this survey, it has been clarified that different rations in the proportion of feasibility, participation methods and participation roles of graduate students in implementing PBL+LBL blended teaching mode in intermediate Econometrics. Therefore, it is necessary to implement a mixed teaching mode of PBL+LBL in intermediate Econometrics. This hybrid mode will facilitate multiple transformations. Firstly, there are shifts in the roles of teachers or students. On the one hand, it is necessary to change the role of teachers, no longer just standing on the podium as "filler" to impart knowledge, but becoming guides to guide students to participate in the analysis and solution of practical problems. On the other hand, students have also shifted their roles from "Passive learning to Active learning. Through independent exploration and analysis of specific practical problems, students are able to find effective methods and approaches to solve problems on their own. After solving problems, they are able to evaluate their learning process truthfully, ultimately forming the ability to learn independently and lifelong. Secondly, there has been a change in teaching habits, from the traditional approach of "one person speaking and everyone listening" to "everyone speaking and everyone listening". Students are encouraged to solve practical problems, analyze actual economic phenomena, and manage facts through team cooperation, group discussions, and other methods, combined with the economic management theories of various majors they have learned. This provides a platform for master's students to learn and realize themselves, further achieving the goal of cultivating applied and creative talents in most financial and economic colleges. Finally, there has been a change in the evaluation of teaching outcomes, from the previous "one test determines the result" to "process determines the result". It emphasizes the diversification and long-term assessment for students.

3. The Application of PBL+LBL Mixed Teaching Mode

3.1. Teaching Content

Graduate students majoring in finance and economics mainly engage in theoretical research on various macro and micro economic behaviors, phenomena, and management laws. Studying Intermediate Econometrics facilitates quantitative analysis of its internal causal relationships. Therefore, the course content should focus on professional practicality and applicability. The mixed mode of PBL+LBL includes theoretical knowledge teaching, selection of cutting-edge hot issues, case literature analysis, and expansion. These contents are not fragmented, but intertwined and

complementary to each other.

Taking AUFE as an example, the theoretical knowledge of Intermediate Econometrics mainly includes topics such as classical regression models, time series models, ARCH class models, discrete choice models, and panel data models. In LBL mode, the core of teaching content is on concept introduction, method deduction, software implementation, and so on. In PBL mode, it emphasizes that graduate students can, on the one hand, effectively introduce scenarios and generate motivation for active thinking based on their existing knowledge reserves. On the other hand, they can propose specific research topics that are in line with reality based on some important economic issues or management phenomena. Then they have abilities of thinking, verifying, and discussing with these practical problems. Students not only understand the basic knowledge points in LBL teaching, but also improve their ability to use their brains and hands. As we known, Classical regression models are the core content of primary econometrics. LBL teaching mode emphasizes the basic steps of model construction, ordinary least squares estimation methods, and the three major statistical tests, as well as the disposal methods that violate classical assumptions (heteroscedasticity, autocorrelation, multicollinearity). Therefore, PBL teaching mode emphasizes to take production behavior, consumption behavior, investment behavior, and import and export behavior as the problem as entry points to undertake primary measurement. This transition is natural and smooth. It is beneficial for graduate students to accept.

Taking consumer behavior as an example, the LBL teaching mode for time series models focuses on the theoretical deduction of strong weak stationarity, cointegration relationships, error correction models, vector autoregressive models, and Granger causality relationships. The PBL teaching mode should distinguish between macro and micro data. On the one hand, it should focus on normalizing the non-stationary nature of macro data, discussing structural or unstructured issues in the economic system, and on the other hand, it should pay attention to the possibility of stationarity in micro data of various entities (farmers, consumers, enterprises, etc.), and discuss the realization of long-term equilibrium relationships. The LBL teaching mode for the ARCH class models focuses on the volatility changes of time series variables, introducing theoretical differences in model construction, robustness discussions, seasonal analysis, etc. This type of model mainly verifies the regularity characteristics in financial theory, and realizes the prediction and decision-making of financial markets. The PBL teaching mode requires clarifying the applicability of different ARCH models. By simulating risk and volatility, students can conduct research on rational expectations and asset pricing, futures trading system design, risk control system design, and portfolio risk management strategies. The LBL teaching mode for the discrete choice models introduce the construction, estimation, and testing of virtual dependent variable models, emphasizing the complex multivariate statistical analysis ability of qualitative data. The PBL teaching mode is aimed at micro data, even many experimental design data and network crawling data, quantitatively revealing individual behavior patterns, decision-making intentions, etc. The application level involves multiple fields such as geography, environment, society, space, economy, medicine, education, psychology, etc. The LBL teaching mode for the panel data model extends quantitative regression from one-dimensional data to two-

dimensional data. It introduces the basic concepts and model selection principles of three types of models and two types of effects, and emphasizes multiple model estimation and testing methods based on this. It also extends to related topics such as spatial panel models, panel threshold models, and dynamic panel models. The PBL teaching mode is focused on the feasibility of panel data selection, optimization of analysis results, and other aspects.

3.2. Teaching Method

The implementation of the PBL+LBL mixed teaching model for Intermediate Econometrics should focus on the organic combination of online and offline teaching methods. Online teaching should combine various means of rich media. On the one hand, it should enable graduate students to master the basic theories and methods of econometrics through relevant MOOC platforms such as watching core deduction videos, reading classic case literature, and timed chapter tests. On the other hand, it should widely use media such as QQ, WeChat, and DingDing Talk software to strengthen difficult answers, classroom attendance, topic discussions, and live recording with students. Offline teaching should focus on practical application. On the one hand, it should guide graduate students to be good at collecting and organizing macro and micro data related to their profession for software operation of learning methods. On the other hand, it should introduce specific quantitative theoretical explanations through professional literature cases, and use group discussions and flipped classrooms to complete student learning feedback. Specific literature cases are selected by SSCI or SCI journals with high influencing factors. Teachers write teaching cases in different professional fields to enable graduate students to fully understand and master the intuitive significance, application conditions, and scope of econometric methods or models, and understand the applicability of econometric methods in professional fields. After the theoretical teaching is completed, teaching methods such as group discussions or flipped classrooms are applied to subsequent teaching. Firstly, graduate students choose to read typical literature on current hot issues in economic management. Then, they need to engage in divergent thinking based on their professional characteristics, and engage in group discussions on topics such as perspective, data organization, method identification, and conclusion analysis. Alternatively, graduate students can be directed to the podium for project presentations, with teachers providing guidance, prompts, and feedback. Finally, in terms of teaching content, graduate students have increased their training in using relevant statistical analysis software. Graduate students are usually required to be proficient in using at least two conventional software tools (such as Eviews, STATA, SPSS, MATLAB, etc.). They are also encouraged to try using the big data analysis software PYTHON to enhance their learning interest, broaden their sources of data acquisition, and improve learning efficiency. The entire teaching activity has shifted from "teacher centered teaching" to "student centered discussion.". The change in teaching mode is aimed at improving the learning initiative and participation of graduate students.

3.3. Assessment Method

To demonstrate the effectiveness of PBL+LBL blended teaching in Intermediate Econometrics, the assessment methods for graduate students cannot be determined solely by

one assessment, and it is necessary to deepen the reform of assessment methods. The assessment of graduate learning effectiveness in traditional teaching mainly focuses on the acceptance of theoretical principles and methods. Therefore, the evaluation method of "written test/regular performance" has become the preferred choice. However, such assessments are not conducive to students' proficient mastery and flexible application of knowledge, and hinder the development of their creative abilities. PBL teaching mode emphasizes goal orientation. Therefore, some universities adopt the approach of "course papers/regular performance" instead of "written exams/regular performance". On the one hand, graduate students can apply what they have learned to solve practical problems in a targeted manner based on their major and interests to enhance their initiative and creativity. On the other hand, students can enhance the practicality of applying econometrics to other disciplines by writing articles. However, there are also shortcomings in the assessment method of "course paper/regular performance". For teachers, there is a strong subjective variability; For students, there are problems such as incomplete assessment scope and lack of specific basic knowledge testing. The PBL+LBL blended teaching model should achieve a diversified and process oriented curriculum assessment method. Each university can achieve a certain proportion of mixed assessments of online learning, written exams, and course papers test based on the actual course development status. Course papers should set evaluation criteria based on topics, structure, methods, language, and other aspects. Online learning test should be given objective scores based on assessment of learning duration, case reading analysis, homework, classroom discussions, etc. The written test mainly focuses on the acceptance of theoretical principles and methods. Multiple assessments are used to achieve comprehensive evaluation of graduate metrology courses. It not only assesses students' mastery of the basic knowledge of the course, but also their ability to apply the learned knowledge, analyze and solve practical problems.

4. Conclusion

Based on the actual research results of AUFE, a traditional single teaching model is not conducive to the rapid improvement of academic research ability for graduate students studying Intermediate Econometrics. We have implemented a blended learning model of "PBL+LBL" to increase graduate student participation in learning, deepen theoretical knowledge mastery, and effectively enhance team collaboration, which is beneficial for research and development of scientific research model derivation ability, data collection and processing ability, team cooperation ability, logical thinking ability, etc. The "PBL+LBL" mixed

teaching mode realizes situational and case-based teaching content, rich media and translation of teaching forms, and process oriented and diversified assessment methods. On the one hand, the mixed learning mode effectively realizes the transformation of teacher research achievements into teaching content. On the other hand, it helps to cultivate the differences in student professional and personal research directions, improve graduate innovation ability, gradually complete the transformation of teaching from "knowledge imparting" to "problem oriented", and is beneficial for the reform of core course teaching mode in economics and management majors to achieve new results.

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