Teaching Practice Exploration of Economic Mathematics Course of Economic Management Major Under the Background of "New Engineering"

Fengxia Li[1(✉)] and Zeguang Lu[2]

[1] Department of Information Engineering,
Heilongjiang International University, Harbin 150025, China
lifengxiavip@l26.com
[2] National Academy of Guo Ding Institute of Data Sciences,
Beijing 100190, China

Abstract. This paper mainly starts from the following four points to explore the solutions to some problems in the teaching process of economic mathematics 2, which is, from updating the teaching concept, integrating the teaching content to hierarchical teaching method, and adopting the project-driven mode and Massive Open Online Course teaching mode.

Keywords: Integrating the teaching content · Project-driven · Hierarchical teaching

1 Introduction

Economic mathematics is a compulsory course for the student management major; all the majors would enroll both liberal arts students and science students. Students, based on their applications, were divided into different classes [1, 2]. As the students came from different places, there are large differences between their admission scores [3]. Students with good math scores and bad math scores are intermingled, which bring about test to economic mathematics course of teaching content, as well as teaching method and so on. How to handle the relationship between the teaching task and teaching effect becomes the core problem of the practicing of teaching [4, 5]. This paper mainly starts from the following four points to explore the solutions to some problems in the teaching process of economic mathematics 2, which is, from updating the teaching concept, integrating the teaching content to hierarchical teaching method, and adopting the project-driven mode and Massive Open Online Course teaching mode.

2 Renew the Teaching Philosophy

2.1 Design Typical Cases Based on Major Features

The description of the cases should take into account the major characteristics of students, aiming to guide students to understand the relationship between economic

G. Sun et al. (Eds.): eLEOT 2019, LNICST 299, pp. 253–259, 2019.
https://doi.org/10.1007/978-3-030-35095-6_29

mathematics course and subsequent courses, and cultivate students' ability to observe, analyze and solve problems from the perspective of mathematics. For example, when explaining determinants, the value of the second-order determinant represents the area of the parallelogram in the two-dimensional space constructed by two column vectors, and the value of the third-order determinant represents the volume product of the parallelepiped in the three-dimensional space constructed by three column vectors [6].

In the explanation of a matrix, the case of gray scale image can be taken into as an example, which by itself, is a matrix, and every element in the matrix is a data between 0 and 255; Or, the computer screen could also be taken as an example, the three basic colors of the computer screen, red, green and blue, are composed of three 1024 * 768 (or 1024 * 1024, etc.) matrix.

In the explanation of the system of linear equations, begin with mathematical modeling instance, and then, followed with the concept of general linear equations, introduces the general system of linear equations solution (gauss elimination method, the augmented matrix method), give a judgment theorem of solutions of linear equations, the theory of the structure of a solution, and finally, aiming at the students doubt of how to solve the question of multiple equation, to properly introduce Seidel iteration method suitable for computer operation, Jacobi iteration method and the approximate numerical calculation method.

2.2 Pay Attention to the Introduction of the Application of Knowledge

In the linear algebra part of Economic mathematics 2, a great deal of concepts are involved, and many of them are abstract concepts, making it necessary to introduce the theoretical knowledge, properly cited the linear algebra associated mathematician historical background, interesting story, the main contribution and present situation of the development of the theory, for example, kramer, Laplace, Gloria, Tianjin horse racing, the game theory, etc., to help students, in a relaxed environment, in the meantime of understanding the context of knowledge and understanding the concept, broaden the students' knowledge, improve the math attainments.

2.3 Add a Practice Link to the Theory

In economic mathematics 2, the most time consuming and energy consuming parts are the complex calculation of higher-order determinant, higher-order matrix operation, and the solving of a linear equation group. The combination of modern technology and mathematical software in the teaching process, the additional link of the practice to theories could, on one hand, lay a good foundation for students to apply the software in engineering, information and other fields for calculation and simulation in the future, and on the other hand, make the students feel useful in learning, strengthen students' application consciousness, cultivate students' practical ability, deepen students' grasp and understanding of knowledge, and enhance students' interest in learning.

3 The Integration of the Teaching Content

Most of the compilation of mathematics textbooks tends to focus on the integrity of the theory itself, and the order of knowledge cohesion and other factors. Therefore, I suggest adding an introduction class before and an extension class after explaining the theoretical content. For example, in the first class at the beginning of the term, the teacher reintegrate the teaching materials and told the students what the course contains, its main contents, core methods and applications, so that the students get a fully understand to the course from a macro perspective and the once scattered teaching materials are integrated.

3.1 Add of the Introduction Section

In the introduction section of the Economic mathematics 2, several problems are supposed to be solved: what to tell, in what way to tell, and how to tell. (1) Clearly define the main content and core methods of the course, in the meanwhile, highlight the practical problems that linear algebra is going to solve. It is a must that the examples selected are closely related to the majors of students. For example, students majoring in economics and management can cite the benefit matrix and input-output model in the assignment problem of production and management. (2) The teaching method is demonstrated by multimedia courseware, accurately calculated by EXCEL and MATLAB software, and online learning by Blackboard online teaching platform. (3) In the course of explanation, typical examples are explained in simple terms, and after the point is given, let the students complete it, like cast away a brick in order to get a gem, setting up suspense, paving the way for the follow-up course content, so as to stimulate students' interest in learning.

3.2 Add the Extension Course

Before the end of the course, it becomes necessary to give the expanded course, which is supposed to give some guidance to students in depth and breadth of the course, and to arise some representative practical issues related to the linear algebra course.

The introduction course, in a macro perspective, has given to the course some of the "preview" of the content and methods. The expanded course is the corresponding to the introduction course in its content; also it is the extension and continuation to the course content.

Course teaching inevitably involves teaching content, teaching mode and other issues, in the fourth part of this paper, the teaching mode will be explained, and the following is only a simple statement of the teaching content.

3.3 Integrate the Teaching Contents and Optimize the Curriculum System

The Combination of Required Knowledge Points and Optional Knowledge Points. In teaching, it is necessary to grasp the internal relationship between

knowledge points, combine the requirements of obligatory knowledge points and the requirements of optional knowledge points, to optimize the course system, to grasp the core issues, and to refine and select the teaching content. The obligatory knowledge points are determinant calculation, matrix and its operation, elementary transformation of matrix and how to solve general linear equations. The optional knowledge points are cramer's rule, structure of solution of linear equations, similar matrix and quadratic form, linear space and linear transformation.

The Combination of Detailed and Roughed. While arranging the teaching content, those detailed should be combined with the roughed, and those primary content be clearly separated with the secondary content. For example, in solving the inverse matrix, the emphasis is on teaching of the primary line transformation method and the companion matrix method should be taken as a secondary method, students only need to master the composition of the companion matrix and its important equation. In finding the rank of matrix, the primary line transformation method is what should be taught mainly, rather than the method of highest order non-zero sub expression given by the definition. Matrix block method focuses on higher-order matrix multiplication, block diagonal matrix, and matrix addition, multiplication, transpose and other operations only considered as to be understood.

Change the Sequence if it is Proper. If it is proper, try to integrate linear algebra teaching content, change the order according to the order of the matrix, matrix elementary transformation, and linear equations, determinant. For example, taking matrix theory as the main line, the calculation of second-order and third-order determinants is interspersed into inverse matrix theory, and matrix equations, linear equations and linear relations of vector groups are solved mainly by using the primary transformation method of matrices.

4 The Adoption of the Leveled Teaching Method

In the teaching process, each teaching class is composed of two administrative classes with a total number of 52–72 students. The students' math scores are different, some are low, and some are high, uneven and different. Compared with students' mathematical foundations, the teaching objectives set by the syllabus are fixed. Taking this into considered in the process of teaching, the teacher could of course use the flexible and varied teaching methods, teaching design, teaching content set in the introduction, examples and exercises, problem sets, however, the breadth of content should not be too great, and as to the depth, in consideration of the level of most of the students, the only thing to do is to keep it at low and medium level, and even by doing so, for a bottom student, the content would sounds just like language from another galaxy. On the other hand, for students with good foundation and high qualification, it is not enough for their mind to absorb, like a person not having enough to eat and always in starving; this is, in all the majors of our school of economic management, a very popular phenomena.

The college mathematics course for students majoring in economics and management has a total class time of 96 class hours, which is divided into two semesters. When the number of class hours remains the same and the teaching scope remains the same, multi-level teaching can be implemented for students with large numbers and the same major. For example, there are about 500 students in the department of economics and management of the class of 2018, and 180 students in 6 classes of financial management, which is a large number. At the same time, due to different major mathematics curriculum should be separated on the class, the leveled teaching for financial management specialty is possible, formulated professional university mathematics teaching outline, teaching outline should include other similar professional knowledge teaching outline, the depth and breadth should be distinguished on the consideration of the basis of various levels of students, added with the university mathematics course and the subsequent financial management majored course system. Then revise the corresponding teaching calendar, teaching process design, assessment method, effectiveness analysis and other links involved in the teaching process, so that each link serves each other and complement each other. It is shown in Table 1.

Table 1. The proportion stratification

Before stratification	Grade of achievement	90–100	80–89	70–79	60–69	<60
	Number of people	56	63	39	52	31
	The proportion	23.24%	26.14%	16.18%	21.58%	12.86%
After leveling	Grade of achievement	90–100	80–89	70–79	60–69	<60
	Number of people	60	69	47	42	23
	The proportion	24.90%	28.63%	19.50%	17.43%	9.54%

5 Adopt the Project-Driven and Massive Open Online Course Combined Teaching Mode

5.1 Project-Driven Teaching Mode

Using the characteristics of economic mathematics 2 teaching content and knowledge being progressed layer by layer and being linked to each other, a problem could be raised to influence a class and produce a special lecture, combined with a practical case, the teaching content could be consolidated and small problems in real life could be solved.

For example, the contents of linear equations group are closely related to the primary and high school binary equations group. From the concept of equations to the writing method, from the elimination method of binary equations group to the elimination method of linear equations group, although there are differences and the applicable range is quite different, the ideas and methods are the same.

5.2 The Teaching Model of Massive Open Online Course Collaborated

MOOCs are a challenge to higher education today. With the continuous update of MOOC resources, students are expecting the change of traditional teaching mode, so it is imperative to reform the teaching mode of linear algebra course into MOOC collaborated.

Traditional Classroom and Learning Based on Massive Open Online Course. In a traditional classroom, the whole teaching progress and transfer of knowledge are controlled by teachers through face-to-face explanation to complete the teaching tasks and objectives. MOOC teaching provides rich digital teaching resources and flexible teaching space, which is conducive to students' independent inquiry oriented learning, thus cultivating their self-control ability and exploration and innovation ability. Traditional classroom teaching and MOOC teaching have their own advantages and disadvantages, while the mixed teaching mode combining offline and online under the highly developed information resource environment combines the two and achieves complementary advantages.

Three Steps of a Class, Before, on and After. But for financial management major, other majors, because of the small number of students and the major itself being scattered, are difficult to implement leveled teaching, so, other teaching methods can be adopted. For example, for students with a general foundation, they can arrange the preview content before class, give key guidance in class, consolidate and review after class. For students who have a good foundation and are able to learn, the combination of pre-class online MOOC learning, in-class key guidance and after-class tutoring and Q&A is adopted. The following is a brief statement on the details of the teaching design in the three links before, on and after class.

Before class, students are required to prepare for the class by logging on their mobile phones, and teachers are supposed to make good teaching design in advance, and upload MOOC courses, learning guiding courses to software. Before class, students in preview, should be equipped with necessary learning guiding courses, and the learning guiding courses should give enough priority to the introduction of detailed stuff and covering all knowledge points, also it should include basic exercises together with all the answers, as it is designed to be a class preview, and to help students to complete their autonomous learning, and eventually, to guide students to watch the video with the problem. Students, if encountered with problems in their learning process, could always communicate with teachers at any time via the platform. Therefore, teachers could collect and sort out the difficult problems of students before class, as the focus of detailed classroom teaching.

In the guidance class, teachers explain the general problems and key contents of students, so that students can deepen their understanding of the knowledge in this section.

After class answering questions section is the stage for students to expand their knowledge. Combined with the guidance in class and discussion in study, the teacher gives students online assignments, which can be submitted by students online. For the application of knowledge points, teachers propose research directions for students, and provide learning resources, so that students continue to deepen learning and expand knowledge. Teachers can also guide students to conduct mathematical modeling training and apply mathematical knowledge to solve practical problems. Offline learning provides students with a broader horizon.

5.3 Reasonable Application of Rain Classroom Software

Due to the uneven foundation of students' mathematics, and the substantial reduction of college mathematics class, many contents in the class cannot be fully explained. Reasonable use of rain classroom software can achieve effective and fast management of students, such as the quick collection of pre-class preview results before class, detailed explanation of students' common problems in class, and answering questions and doubts after class, so that many problems encountered by students in daily study can be solved in time. Teachers can upload courseware, exercises and thinking questions corresponding to the content of class to the rain classroom, and students can review and consolidate independently, which makes up for the lack of class hours and the problems of different learning levels. The use of rain classroom can realize the sharing of problems and methods, enabling students to put forward problems encountered in the learning process, both teachers and students can provide solutions, which are conducive to strengthening the communication between teachers and students, students and students, and stimulate students' enthusiasm for learning.

Under New Engineering background, the university mathematics teaching should not only focus on 90 min of class, what should be done is that, it should further care students about how to learn after class, how to do, and what difficulties they have. Only by always thinking about what the students are requiring and thinking, could the teachers find out the most urgent question the students are running into, fundamentally solve all the various upcoming new problems in teaching, and finally, improve the learning efficiency and make the learning effective.

Acknowledgement. This work was supported in part by school projects of Heilongjiang International University of YN2017-11 and by National Education Innovation Science Research Planning Project (CMAS180506).

References

1. Nie, C.: Preliminary study on the reform of higher mathematics stratification teaching in higher engineering colleges under the construction of "New Engineering". J. Hunan Inst. Eng. (2018)
2. Zhang, X.: The application of hybrid teaching based on online learning in higher mathematics. J. Shandong Inst. Commer. Technol. (2018)
3. Xiang, M.: Research on the reconstruction reform of the public applied higher mathematics curriculum system in local applied high-level universities. Gao Shili Sci. J. **15**, 12–18 (2019)
4. Zhou, W.: Research on higher mathematics teaching reform under the background of "Internet". J. Shandong Inst. Commer. Technol. (2018)
5. Yang, H.: An analysis of the reform of higher mathematics teaching in independent colleges. Modern Commun. **23**, 45–50 (2018)
6. Cao, H.: Based on the teaching of "Advanced Mathematics" under the background of "New Engineering". J. Qingdao Univ. Sci. Technol. (Nat. Sci. Ed.) **8**, 89–93 (2018)