ISSN 2522-6398 Vol. 6, Issue 6: 1-5, DOI: 10.25236/FER.2023.060601

The limitation and countermeasures of mathematical modeling course in finance and economics universities

Yang Xu[1,a], Wei Liu[2,b,*]

[1]*School of Finance, Anhui University of Finance and Economics, Bengbu, 233030, China*
[2]*School of Management Science and Engineering, Anhui University of Finance and Economics, Bengbu, 233030, China*
[a]*ustcxy@mail.ustc.edu.cn*, [b]*liuwei628@aufe.edu.cn*
**Corresponding author*

Abstract: *Although mathematical modeling is widely used in natural and social sciences, it is still not paid enough attention, especially in finance and economics colleges and universities. According to the teaching practice of mathematical modeling courses in these universities, this paper analyzes the existing problems from three aspects: universities, teachers, and students. For each problem, we put forward feasible solutions suitable for finance and economics colleges and universities. Finally, we call on administrators or teachers of relevant universities to pay attention to the construction of mathematical modeling courses. We believe that the implementation of mathematical modeling curriculum reform will play a positive role in talent cultivation.*

Keywords: *Finance and Economics Universities; Mathematical Modeling; Reform of Teaching*

1. Introduction

People often describe the real world by using models to express their current perception of the world or to satisfy some practical need. For example, people draw maps to show the geographical distribution of objects in the three-dimensional world in a two-dimensional way (as shown in Figure 1). In addition, maps can also be used as a guiding tool to help users reach their destinations or generals achieve their ambitions to conquer cities. Similarly, aircraft models can be used as experimental objects to help engineers design large passenger aircraft or fighter jets, as well as being toys for children. Further, we can imagine the definition of mathematical modeling. Mathematical modeling is the process of describing actual phenomena with mathematical language, that is, using mathematical language to describe things and their characteristics in real life to form a mathematical structure, and then supplemented by mathematical tools and methods to analyze the structure and deduce the general development law of things to solve practical problems[1,5,7] (the mathematical modeling process is shown in Figure 2). In the past half-century, mathematical modeling has developed rapidly with the improvement of computer technology.

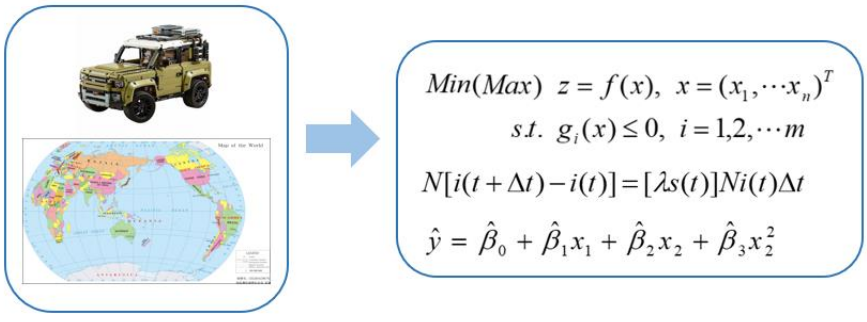

Figure 1: From model to mathematical model

Mathematical modeling has received much attention in practice[4,8,9]. Bridge engineers establish mathematical models to describe the mechanical characteristics of bridges and the conductivity of each structure (bridge span structure, support system, pier, abutment, pier), so as to achieve the purpose of assessing the load-bearing capacity of bridges. Using mathematical models to simulate the relationship

ISSN 2522-6398 Vol. 6, Issue 6: 1-5, DOI: 10.25236/FER.2023.060601

between plant density, light, and growth rate, biologists can obtain the optimal plant density and fertilizer application methods. Operations researchers can provide decision support for project schedule optimization, production optimization, personnel scheduling, and traffic management by establishing and solving planning models[2,6]. Nowadays, the application of mathematical modeling is more and more extensive, not only including physics, biology, chemistry and other natural sciences (such as high-speed iron manufacturing, quantum computer design, chemical composition analysis, material simulation, cancer treatment, etc.), but also playing an important role in solving sociological problems, such as population prediction, environmental management, medical management, economic and financial analysis.

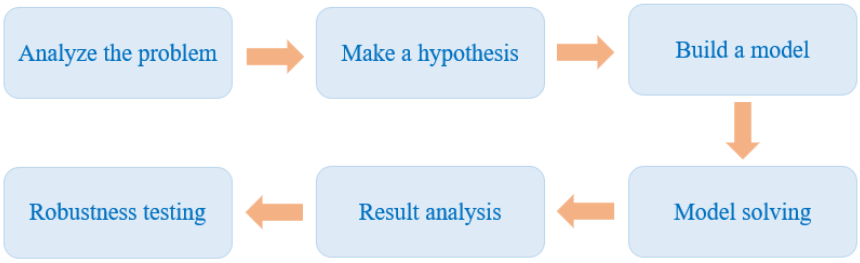

Figure 2: Mathematical modeling process

However, the course of mathematical modeling has not received enough attention, and it is mainly taught as an elective course in universities. Because it involves a large amount of mathematical knowledge, including calculus, operations research, advanced mathematics, probability theory and mathematical statistics, this course requires teachers and students to have a wealth of interdisciplinary knowledge. Especially in some colleges and universities of finance and economics, students have certain difficulties in learning this course due to the problems of curriculum design and students' weak mathematical and computer foundation. Therefore, this paper discusses the problems existing in the construction of mathematical modeling courses in financial and economic colleges and puts forward some targeted suggestions for the teaching reform of this course.

2. Existing problems of the mathematical modeling course

This section analyzes the problems existing in the teaching of mathematical modeling courses in finance and economics universities from three aspects, including universities, teachers and students (as shown in Figure 3). The specific content is as follows:

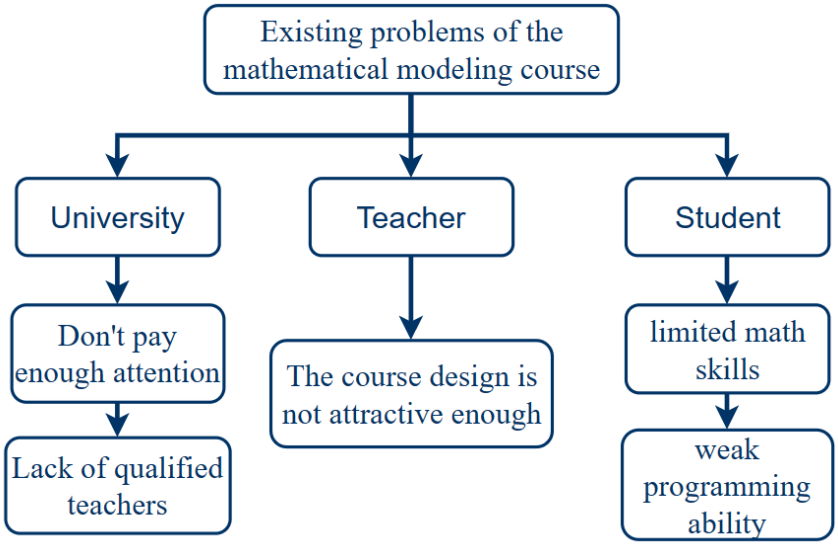

Figure 3: The existing problems in mathematical modeling courses

ISSN 2522-6398 Vol. 6, Issue 6: 1-5, DOI: 10.25236/FER.2023.060601

2.1 Universities donot pay enough attention to the course

In the current social environment, most universities attach great importance to scientific research, resulting in the situation of over-emphasis on scientific research indicators and neglect of teaching. Mathematical modeling courses are usually taught in the form of elective courses in universities. As it is a course with cross-disciplinary background, involving physics, mathematics, computer and other disciplines, it is difficult to define which discipline it belongs to. As a non-core course, mathematical modeling is easy to be ignored. For example, a finance college may focus more on core courses such as finance and investment, while a computer college may devote more time to developing students' programming and algorithm design skills.

2.2 Lack of qualified teachers

As mentioned above, mathematical modeling courses require students to have certain learning qualities and abilities, as well as teachers to a higher skill levels. For example, teachers are required to have a cross-disciplinary background, not only be good at using tools such as mathematics and computer language but also be able to analyze realistic mathematical modeling problems, which requires teachers to master some professional knowledge. Nowadays, the age structure of teachers in universities is relatively large, and the number of young teachers is insufficient. Although elderly teachers have strong teaching skills, they rarely grasp the science and technology that has developed in the 21st century. In particular, the computer skills of elderly teachers in finance and economics universities are relatively low. Therefore, there is a shortage of teachers qualified to teach mathematical modeling courses.

2.3 Students with limited math skills

The content of the mathematical modeling course includes optimization model, discrete model, differential equation model, probability model, game model and statistical regression model so that students are required to learn advanced mathematics, probability theory, econometrics, operations research and other relevant courses. Therefore, the mathematical modeling course has certain requirements for students' mathematical foundation. In traditional classes, students with limited math skills find it difficult to keep up with the progress of this course, especially students in finance and economics universities, and liberal arts students account for a large proportion. There are few mathematics courses in such universities, and students' mathematical knowledge reserve is relatively insufficient, so the limited mathematical level is the first obstacle for students to learn mathematical modeling.

2.4 Students' weak programming ability

In the modeling process, problems are often unable to be solved manually for solving optimization problems, which requires the help of MATLAB[10], Lingo and other mathematical optimization software to obtain numerical solutions. For data-related problems, software such as Stata and Python is also needed to process and analyze data[3]. However, programming software requires students to have good logical thinking ability, such as being able to understand the grammar rules of programming language or to design programs. Students in finance and economics schools usually have less exposure to or systematic learning of programming knowledge. Therefore, programming problems are the second obstacle for students to learn mathematical modeling.

2.5 The course design is not attractive enough

Nowadays, the rapid development of information technology and Internet technology is changing with each passing day, which brings convenience to people's lives but also brings a lot of negative impacts, among which the impact on teaching cannot be ignored. Students are affected by electronic products and online games, which makes it difficult for them to concentrate in class, so classroom teaching methods are very important. Mathematical modeling includes model establishment and solving process, which is difficult to avoid involving mathematical derivation, calculation and example analysis, which is easy to cause the unappealing course, and students losing patience in listening to the class.

ISSN 2522-6398 Vol. 6, Issue 6: 1-5, DOI: 10.25236/FER.2023.060601

3. The reform plan of the mathematical modeling course

In view of the above existing problems, this section proposes the following feasible schemes in Figure 4.

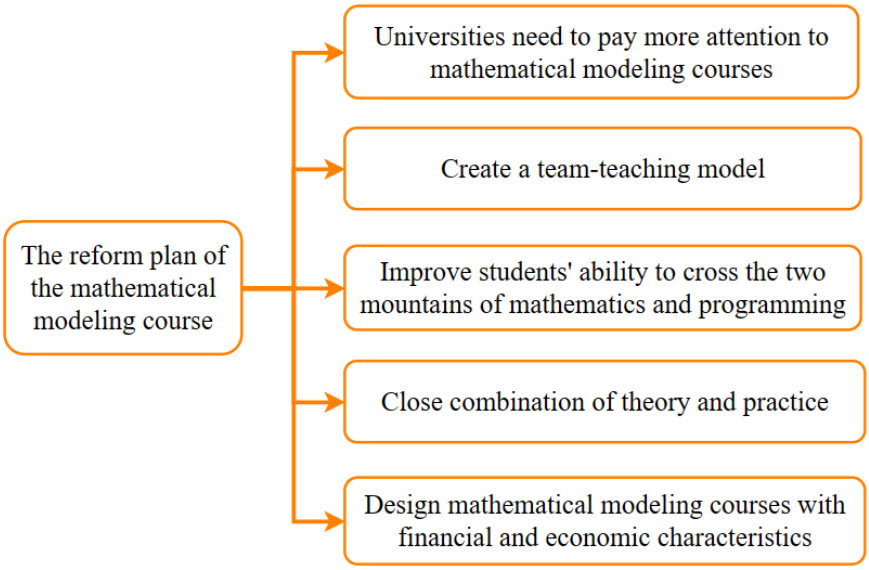

Figure 4: The reform plan of mathematical modeling course

3.1 Universities need to pay more attention to mathematical modeling courses

To solve the existing problems in mathematical modeling courses, it is essential to strengthen the emphasis on teaching at the school level and reduce the proportion of scientific research indicators, so that teachers can devote more energy to improving the quality of mathematical modeling courses. Student-oriented is the fundamental task of universities to ensure a bright future. In addition, the government also needs to formulate relevant policies to correctly guide the development path of schools, balance the relationship between teaching and research, and combine the cultivation of talents while developing science and technology.

3.2 Create a team-teaching model

For the problem of lack of teachers in mathematical modeling courses, universities should first make full use of the existing teacher resources to establish a mathematical modeling teaching team. Teachers should have the basic requirements of mathematical modeling courses and be good at one or more skills required by mathematical modeling. Teachers should learn from each other and carry out the alternate teaching model, so as to give full play to the advantages of team teaching. At the same time, colleges and universities should vigorously introduce young talents with interdisciplinary background, or mathematical background, or computer background, to improve the major structure of the teaching team.

3.3 Improve students' ability of mathematics and programming

With the development of society and the innovation of science and technology, colleges and universities of finance and economics need to pay more attention to the teaching of mathematics and computer in order to keep pace with the times and set up more courses in mathematics and computer programming language to improve students' mathematical and programming abilities. Today, not only mathematical modeling needs to use mathematics and computer knowledge, but also economics, finance, advertising, art and history and other fields need to use mathematics and computer-related theories and methods to solve practical problems. Therefore, schools should strengthen students' awareness of learning math and programming, increase the assessment of students' math and programming ability, and encourage them to master these two skills.

ISSN 2522-6398 Vol. 6, Issue 6: 1-5, DOI: 10.25236/FER.2023.060601

3.4 Close combination of theory and practice

Mathematical modeling is a course that is close to reality and demand-driven. Teachers should pay attention to the close combination of theory and practice in the teaching process. They should not only use cases in books to explain relevant theories and methods, but also encourage students to form teams to participate in mathematical modeling contests, cultivate students' interest and sense of achievement, and let students spend more time learning mathematical modeling knowledge independently. Colleges and universities can also organize students to investigate enterprises, discuss the problems faced by enterprises, and train students' ability to solve practical problems with the thinking of mathematical modeling.

3.5 Design courses with financial and economic characteristics

Finally, the reform of the mathematical modeling course should be implemented in the course itself. This paper puts forward the following suggestions. Firstly, to emphasize the importance of mathematical modeling course, the attributes of mathematical modeling course can be changed from elective courses to compulsory courses, so as to increase the credits of mathematical modeling courses. Secondly, set up some pre-placement courses or adjust the hours of mathematical modeling courses, so that students can learn mathematical modeling knowledge systematically instead of skimming the surface. Finally, content selection and object orientation are also critical. Teachers in finance and economics universities should focus on cultivating students' data analysis abilities. The teaching object of the mathematical modeling course should be sophomores or juniors with strong interests and mathematical abilities.

4. Conclusion

The mathematical modeling course is very practical, but it is not paid enough attention to in finance and economics universities which hinders its development. This paper points the problems in the existing mathematical modeling courses from five aspects and puts forward corresponding schemes to solve the problems, respectively. This paper appeals universities of finance and economics to strengthen the construction of mathematical modeling courses. It is believed that the reform and development of mathematical modeling courses will make a certain contribution to the talent training of universities in the future.

References

[1] Bender, E.A. (2000). An introduction to mathematical modeling. Courier Corporation.
[2] Goodrich, M.T., and Tamassia, R. (2015). Algorithm design and applications (Vol. 363). Hoboken: Wiley.
[3] Harris, R.J. (2001). A Primer of Multivariate Statistics. Psychology Press.
[4] Jang, Q.Y., and Xie, J.X. (2011). A successful practice of higher education reform -- exploration and practice of mathematical modeling teaching and competition activities. Higher Education Research in China, 12, 79-83.
[5] Jang, Q.Y., Xie, J.X., and Ye, J. (2015). Mathematical model. Higher Education Press.
[6] Jongen, H.T., Meer, K., and Triesch, E. (2007). Optimization theory. Springer Science & Business Media.
[7] Meerschaert, M.M. (2013). Mathematical modeling. Academic Press.
[8] Wang, Y.D. (2018). The important role of mathematical modeling in Mathematics teaching reform of finance and economics colleges. Modernization of Education, 5(26), 50-52.
[9] Wu, Y. (2020). Discussion on the teaching reform and ideological and political practice of "mathematical modeling" course in finance and economics colleges—based on the teaching practice of Shanghai Lixin Accounting and Finance College. Education and Teaching Forum, 43, 206-208.
[10] Zhuo, J.W. (2011). The application of MATLAB in mathematical modeling. Beihang University Press.