Retraction

Retraction: Research on the Teaching Reform Path of Operational Research Course of Engineering Management Major Based on Computer Technology (J. Phys.: Conf. Ser. 1744 032238)

Published 16 September 2022

This article has been retracted by IOP Publishing following an allegation that raises concerns this article may have been created, manipulated, and/or sold by a commercial entity. In addition, IOP Publishing has seen no evidence that reliable peer review was conducted on this article, despite the clear standards expected of and communicated to conference organisers.

The authors of the article have been given opportunity to present evidence that they were the original and genuine creators of the work, however at the time of publication of this notice, IOP Publishing has not received any response. IOP Publishing has analysed the article and agrees there are enough indicators to cause serious doubts over the legitimacy of the work and agree this article should be retracted. The authors are encouraged to contact IOP Publishing Limited if they have any comments on this retraction.

Retraction published: 16 September 2022
Research on the Teaching Reform Path of Operational Research Course of Engineering Management Major Based on Computer Technology

Ting Han¹,*
¹Fuzhou University of International Studies and Trade, Fujian, China, 350202
*Corresponding author e-mail: 272993345@fzfu.edu.com

Abstract. Operational research is a compulsory course for engineering management specialty, which occupies a very important position in the curriculum system of engineering management specialty. However, there are many problems in practical teaching, which affect the quality of personnel training in colleges and universities. Based on computer technology, this paper summarizes a series of problems existing in the teaching process of operational research of engineering management specialty, and puts forward some improvement measures, which provides a basis for promoting the training of engineering management specialty talents.

Keywords: Operational Research, Engineering Management, Teaching Reform, Computer Technology

1. Relationship between operational research and engineering management

According to the Guiding Specialty Specification for Undergraduates majoring in Engineering Management in Colleges and Universities, engineering management expertise includes basic knowledge of civil engineering or other engineering technologies, theories and methods of management, economics and law, as well as knowledge of computer and information technology. Operational research is a compulsory course of management theory and method, and it is also a practical and applied subject[1]. Its main contents generally include the contents as shown in figure1 below.

![Figure 1. The main contents of operational research.](image-url)
Engineering management specialty is characterized by the combination of engineering and management, which pays attention to the combination of theory and practice. On the one hand, students can continuously exercise and improve their thinking mode by learning operations research, and enhance their systematic thinking ability, to realize simplify complex problems and clarify complex relationships \(^2\). On the other hand, the systematic method of operations research is helpful to cultivate the ability of engineering management professionals to solve practical problems.

2. Difficulties in operation research teaching of engineering management major

2.1. Problems with course connection
As an applied mathematics, operational research is a subject of quantitative analysis with mathematics as its main tool. In the process of learning and application of operational research, mathematical knowledge such as linear algebra, mathematical statistics, and graph theory will be involved. Therefore, the study of operational research first emphasizes the mathematical basis. In some colleges and universities, when the training program of engineering management specialty is formulated, linear algebra and operational research are taught in the same semester, this curriculum cohesion is unreasonable. Many students are relatively weak in mathematics foundation, therefore, when facing some theorem proving and problem solving skills, they will be afraid of difficulties and unwilling to learn actively, thus affecting the learning effect.

2.2. Large course contents with small course hours
The contents of Operational research courses include lots of different parts, as shown in figure 2 below, and all these components are relatively independent. The *Guiding Specialty Specification for Undergraduates of Engineering Management in Colleges and Universities* suggests that the course of Operational Research be offered 48 hours \(^3\). 48 hours seems to be quite a lot, but in actual teaching is very tense, part of the content can only require students to reach the understanding or familiarity level. In some training programs, only 32 or even 24 hours are allocated to operations research courses. The learning requirement of operations research is far from enough. Due to the limitation of class hours, teachers and students can only choose part of the content to teach. It is easy to cause one-sided and segmented learning of each chapter. It is impossible to understand how these seemingly unrelated branches are connected in series to become an independent discipline, and the essence of operational research is never grasped.

![Figure 2. The theories included in operational research courses.](image)

2.3. Lack of case teaching and weak applicability
In the teaching of operational research, due to the arrangement of class hours and teachers’ willingness, theoretical teaching accounts for a large proportion. Most teachers only talk about mathematical formulas, models, derivation and calculation, rather than combining professional knowledge, and less practical knowledge explanation. For the case after class, some teachers seldom teach or even don't let the students study by themselves, which leads to the students can only calculate, but could not do modelling, and could not analyze and solve practical problems, and lack of flexibility when facing practical problems. If the teaching of operations research leaves practice, it is like water...
without source and wood without foundation. In fact, there are a lot of problems in the construction and management of civil engineering, such as economic analysis, scheme decision-making and management optimization, which are good cases of operational research analysis and modelling. Rational use of these engineering practice cases can not only strengthen and consolidate professional basic knowledge, but also enhance the interesting teaching of operational research course [4].

3. Teaching reform path of operational research for engineering management major

In the actual teaching process, almost all students think operations research is difficult to learn. Therefore, how to make students interested in the profound and boring basic ideas of operational research and various mathematical models, and how to make students master the knowledge of this course in limited teaching time and apply it to the practice of engineering construction management decision-making is the problem that needs to be fully solved in teaching. Therefore, it is very important to carry out scientific and reasonable teaching mode and curriculum design according to the specialty characteristics.

3.1. Stimulate students' interest in operational research course

First of all, it should change the traditional teaching methods and use heuristic instead of cramming teaching methods. Heuristic teaching methods can stimulate students' interest in learning, change passive learning into active learning, and improve learning efficiency. Then branching and bounding method and cutting plane method are introduced to solve the integer programming problem, which can go from shallow to deep step by step [5]. At the same time, in the process of teaching, it could introduce some allusions of operations research, as well as the latest research results and some cutting-edge applications, such as Nash's stories, some of the latest applications of operations research in supply chain and logistics, etc. It can not only broaden students' horizons of knowledge and enrich their knowledge structure, but also stimulate students' interest in learning.

3.2. Focus on the connection between operations research and other related courses

On the basis of operational research course knowledge, engineering management specialty also includes project management, project cost planning and control, civil engineering construction and other courses. Therefore, in the process of operation research teaching, it should also pay attention to the effective connection with other related courses. In the current modern engineering management methods, network technology and equipment management have been widely used methods, but also an important part of operational research course teaching. Teachers should attach importance to the natural integration of the knowledge into the follow-up teaching.

3.3. Systematization of teaching contents to enhance systematic thinking

As an important part of system science, which includes holism, reductionism, cybernetics and other theories, operational research integrates these ideas to guide students to think comprehensively and systematically. It advocates the decomposition of a complex problem into objectives, stages and factors, taking into account the correlation between different factors, and constructing mathematical models to express this correlation. The difficulty of teaching operations research course lies not in calculation, but in the construction, principle and derivation of mathematical model. Therefore, combing the main knowledge points of operational research comprehensively and systematically is convenient for teachers and students to master together. Furthermore, according to the different characteristics of knowledge points, it can be divided into two categories: principle type and calculation type, which is convenient for distinguishing learning. The knowledge module corresponds to the main chapters of the course, and the principle and computational knowledge points correspond to each other, forming a clear knowledge context. After sorting out the knowledge system of the course, we can find that linear programming and simplex method are the foundation of the whole course, and their concepts, principles and solutions will appear repeatedly in the chapters of sensitivity analysis, transportation problems, goal programming and integer programming.
3.4. Focus on case teaching to improve the applicability of operational research course

Like advanced mathematics, linear programming, probability theory and other courses, operational research requires a lot of mathematical training, but it is much different from these courses. Operational research is closer to production and social practice, and is not purely mathematical calculation, which was born in the process of solving practical problems. Its theory and method are used to solve practical problems. In the course of decades of development, Operational research has formed a set of mature methods and models to solve practical problems, and is still developing. Students need to learn and master these methods and models, and use them to analyze engineering practice problems. And case teaching can realize the organic combination of theoretical knowledge and practical application, make theory practical, and enhance students' interest in learning, while a large number of case learning can expand students' thinking breadth, improve students' modelling ability and practical problem solving ability.

Therefore, curriculum cases should be designed rationally to enhance the interest of the classroom. Based on the teaching contents of engineering project management, civil engineering construction, engineering economics, project investment and financing, engineering design and other professional courses, this paper summarizes some practical problems of engineering management, and the basic ideas of solving them by using the methods and models of operational research.

4. Conclusion

Generally speaking, as a compulsory course for engineering management major, operational research is conducive to training students' ability to think systematically and solve practical problems, and has high curriculum value. However, due to the complexity of the curriculum knowledge system, the small number of class hours and the dull content, the teaching of operational research is also very difficult. In order to overcome these difficulties, it should optimize the course content, clarify the knowledge system, rationally use case teaching methods and improve the classroom teaching effect under the limited class hours. In the future, we should combine computer technology to further improve teaching methods and enrich engineering case analysis to increase the interest of teaching.

References
[1] Li Jichao. Reform and Practice of the Teaching Method of Operational Research[J]. Value Engineering. 2014 (5): 235-236.
[2] Zhang Wei. Exploration of Operational Research Teaching in Engineering Management Specialty[J]. Contemporary Educational Theory and Practice. 2019, 11 (1): 49-54.
[3] Professional Steering Committee of Engineering Management and Engineering Cost in Colleges and Universities. Guiding Professional Specification for Undergraduate Engineering Management in Colleges and Universities[M]. Beijing: China Construction Industry Press, 2015.
[4] Yang Maosheng, Sun Fanlou and Zhang Wei. Promoting the Reform and Exploration of Operational Research Teaching by Scientific Research[J]. Journal of Xi'an University of Architectural Science and Technology, 2006 (2): 52-54.
[5] Chen Juan, Wu Kaiwei. Case Study of Operational Research Application in Engineering Management[J]. Prospects for Science and Technology, 2006 (11): 163.
[6] Sun Yufang. Research on the Teaching Reform of Operational Research in Engineering Management Specialty - Based on the Perspective of the Construction of Superiority and Characteristic Specialty in Private Undergraduate Universities[J]. Quality Education in West China. 2015, 1 (14): 28.