Discussion on Some Modeling Cases in Operational Research

Yu Song, Pengfei Ji  
Weifang Vocational College of Engineering, Shandong Weifang 262500

Abstract. In view of the objective trend of the development of operational research modeling technology starting from the overview of the steel girder fitting problem, the two cases of operational research modeling are analyzed by using the analysis and comparison method of a large number of references. Firstly, the first case of operational research modeling is introduced and the problem of steel girder fitting is summarized. Secondly, the solution of steel girder fitting problem is by operational research modeling and is elaborated in detail. Then, the second case of operational research modeling is introduced and the rational utilization of linear material problem is analyzed and finally, the steps of operational research modeling are summarized in detail. Therefore, It is hoped that this study will provide an effective reference for the scholars who use operational research modeling.

1. Introduction
In recent years, with the continuous attention to operational research modeling technology in China, more and more people put forward higher requirements on the application of operational research modeling in solving practical cases. Therefore, the topic of "Discussion on Some Modeling Cases in Operational Research" has become the focus of social attention, in order to promote the rapid development of operational research modeling technology, on the one hand, we should pay attention to the application of operational research modeling technology in practical cases; on the other hand, we should also pay attention to the research of operational research modeling process to make greater contributions to the development of operational research modeling technology.

2. Overview of the steel girder fitting problem
As we all know, the steel girder fitting problem has always been a concern of North China University of Water Resources and Electric Power Professor Zhang Feng. School of Economics and Management North China University of Water Resources and Electric Power explained in detail the application of modeling to operational research through linear programming in the excellent course of operational research of North China University of Water Resources and Electric Power [1]. Whose Linear programming mainly describes the modeling process of operational research clearly which is helpful to deepen college students' understanding of the knowledge points that is involved in the modeling process of operational research so as to enable college students master the whole modeling process of operational research macroscopically, because only when college students have a deep understanding and grasp of the whole modeling process of operational research can the ability of college students that is to solve the modeling problems which is involved in the operational research is improved. Therefore, when explaining the chapters of operational research modeling, teachers must cultivate students' comprehension of the overall operational research [2] as well as cultivate students' interest in operational research at the same time, teachers should explain the modeling process of operational research in plain and easy to language which is of great significance to alleviate students' learning pressure in order to
enable students to have a deeper understanding of the modeling process of operational research, below is a case study to explain how to apply modeling to operational research through linear thinking.

Example 1: Suppose an enterprise needs 150 steel products when fitting steel girders, the length of steel used for the girder is 15 meters, meanwhile, the steel used by enterprises in fitting steel girders is 7 and the steel girders with a length of 2 meters and 2 steel girders with a length of 7 meters for average set of steel product question is how to build a model to minimize the steel scrap.

3. Modeling for steel girder fitting problem
In the case of steel girder fitting problem mentioned above, Professor Zhang Feng gave the following modeling method according to the knowledge of operational research. Based on the modeling method, the mathematical model needed in the process of modeling was constructed [3]. The process of solving the problem is as follows:

Solution: In the process of fitting steel girders, three kinds of truncation methods for steel girders are set as A1, A2 and A3 variables respectively. Then, the three kinds of truncation methods are expressed in tables as follows.

| Type                      | Truncation method A1 | Truncation method A2 | Truncation method A3 |
|---------------------------|----------------------|----------------------|----------------------|
| Steel girders fitting for 2 meters | 4 meters             | 0 meter              | 7 meters             |
| Steel girders fitting for 7 meters | 1 meter             | 2 meters             | 0 meter             |
| Total length for steel girders fitting | 15 meters            | 14 meters            | 14 meters            |
| Remaining steel girders    | 0 meter              | 1 meter              | 1 meter             |

Let’s assume that the number of steel girders truncation by the j truncation method is aj when the steel girders are fitted by the enterprise. Through building a linear programming model for steel girders fitting of enterprises, the process is as follows:

\[ a_1 + a_2 + a_3 = 150; \quad (a_1 + a_2)/2 = 40; \quad \min z = a_1 + a_3; \]

Therefore, the optimal target value is 42 meters.

4. Reasonable utilization of linear materials
Professor Zhang Feng, School of Economics and Management, North China University of Water Resources and Electric Power, explained in detail the application of modeling to operational research through reasonable utilization of linear materials in the excellent course of operational research of North China University of Water Resources and Electric Power [4]. Reasonable utilization of linear materials mainly describes the modeling process of operational research clearly, which is helpful to deepen college students' understanding of the knowledge points involved in the modeling process of operational research, so as to enable college students to master the whole modeling process of operational research macroscopically. Because only when college students have a deep understanding and grasp of the whole modeling process of operational research, can the ability of college students to solve the modeling problems involved in operational research is improved, so as to improve the ability to solve linear material problems. In a word, the application of operational research modeling technology can be skilled by reasonable utilization of linear materials. That is to say, if we want to have an accurate understanding of the process of operational research modeling, we must apply operational research modeling to the actual case of solving linear material problems, so as to improve our ability to use operational research modeling knowledge to solve practical problems. The following is a case study to illustrate how to apply modeling to operational research by reasonable utilization of linear materials.

Example 1: Some hospital wants to make 100 sets of steel frame, in which there is one cylindrical steel frame with a length of 2.9 meters, there is one cylindrical steel frame with a length of 2.1 meters,
and there is one cylindrical steel frame with a length of 1.5 meters for average set of steel frames. Question is how to cut the steel frame to ensure the least material used? Solution: The length of the steel frame for each raw material used in the hospital is 2.9 meters, 2.1 meters and 1.5 meters, respectively. In this way, there is 0.9 meter left for each raw material. In order to make 100 sets of steel frames, 100 steel frames are needed, of which 90 meters of raw materials need to be saved. We can consider the following five schemes for saving raw materials. Here are five schemes in tabular form.

| Type              | Scheme 1 | Scheme 2 | Scheme 3 | Scheme 4 | Scheme 5 |
|-------------------|----------|----------|----------|----------|----------|
| Steel frame of 2.9 meters | 1 meter  | 2 meters | 0 meter  | 1 meter  | 0 meter  |
| Steel frame of 2.1 meters | 0 meter  | 0 meter  | 2 meters | 2 meters | 1 meter  |
| Steel frame of 1.5 meters | 3 meters | 1 meter  | 2 meters | 0 meter  | 3 meters |
| Total             | 7.4 meters | 7.3 meters | 7.2 meters | 7.1 meters | 6.5 meters |
| Surplus material  | 0 meter  | 0.1 meter | 0.3 meter | 0.3 meter | 0.2 meter |

5. Summary of the steps of operational research modeling
Operational research modeling has always been an important modeling knowledge. Through the explanations of the above two practical cases, we have a deeper understanding of the overall application process of operational research modeling. In order to let many scholars have a further understanding of operational research modeling, the steps of operational research modeling are summarized in detail, comprehensively and systematically through two application cases that have been analyzed above. This method of case-first and summary-second is in line with the in-depth study of operational research modeling knowledge by scholars [5]. Meanwhile, this method is a typical induction method from special to general. Therefore, the summary of the steps of operational research modeling is conducive to the learning and mastery of induction. Using operations research modeling steps are as follows. The first step is to establish a mathematical model based on the analysis of actual cases. The second step to solve the mathematical model according to the meaning of the actual case. The third step is to test the solution by examining the actual case and the mathematical model. The fourth step is to control the optimal solution of the actual case, and to control it in the scope of the requirements. The fifth step is to combine the solution and common sense of real life [6]. Through solving practical cases and linking with common sense of real life, the knowledge learned can be well applied to real life to achieve the purpose of learning for application. These are the steps used in operational research modeling, referred to as the five-step method of operational research modeling. With the five-step method of operational research modeling, any complex case can be solved. Summarization and application of operational research modeling steps is a step-by-step, complex and long process. Because knowledge is constantly updating, a set of methods summarized now may be eliminated by society in a few years for not keeping up with the updating of knowledge. Therefore, it is suggested that in the process of learning operational research modeling, scholars must learn the principles of operational research modeling knowledge, so as to keep unchanged and respond to changes. Only by thoroughly understanding the principles of operational research modeling knowledge, no matter how the later knowledge is updated, can any problems be solved.

6. Conclusion
In summary, with the continuous attention and widespread use of operational research modeling technology in China, operational research modeling has been applied in solving practical cases with the development of operational research modeling technology that has been recognized by scholars. Nowadays, operational research modeling has been well practiced in many cases, in order to popularize this technology, more scholars begin to invest in the research of operational research modeling so as to continuously improve their professional literacy and lay a certain theoretical foundation for the development of operational research modeling technology.
References

[1] Yuan He. Research and Practice of Fixed Income Product Investment Optimization Model Based on Operational Research Transportation Model [J]. Finance & Economy, 2015(2).

[2] Chunhong Li, Huihui Gao. Instructional Design and Practice of Logistics of Operations in Higher Vocational College [J]. Journal of GuangDong Industry Polytechnic, 2017(4).

[3] Xihua Zhou, Zhenhua Zhou, Meiyin Huang, et al. Research and Practice of Integrating Mathematical Modeling Experiments into Operational Research Teaching [J]. Journal of Higher Education, 2017(11):46-47.

[4] Hengyu Zhang. Research on Teaching Reform of Combining Operational Research Mathematics with Mathematical Modeling [J]. Journal of Mudanjiang Normal University (Natural Sciences Edition), 2015(1):62-63.

[5] Yue Zheng, Yunfei Hong, Tao Zhang, et al. Research on the Teaching Reform of Operational Research Course in the Transitional Development of Undergraduate Colleges [J]. Journal of Yangtze University (Natural Sciences Edition), 2015(22):79-82.

[6] Jichao Li. Probe into Teaching Problems and Teaching Mode Strategies of Operational Research [J]. Science and Technology Innovation Herald, 2015(13):174-174.