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Application-Oriented Teaching Practice of Textile Mathematical Statistics Course

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Abstract

Textile Mathematical Statistics (TMS) course is a basic course for undergraduate students to learn and practice data analysis and application in textile fields. And it requires a close connection between theory teaching and practice. For this purpose, we proposed the application-oriented teaching practice of TMS course. The core of our teaching was implementation of project-case based teaching mode, which is to take the specific applications in textiles as examples of teaching. The teaching idea of learning-through-using was adopted. And the teaching contents were scientifically arranged according to people's basic cognitive law. Knowledge base of teaching cases was established. During our teaching practice in past five years, it has been proved that application-oriented teaching method in TMS course provides practical opportunities for students to independently solve the problems of experiment design and data analysis in textile field.

Keywords

Textile Mathematical Statistics (TMS), Project-Case, Learning-Through-Using, Knowledge Base

1. Introduction

Textile Mathematical Statistics (TMS) course is a basic compulsory course for textile major. It is a basic course for undergraduate students to learn and practice data analysis and application in textile scientific research and engineering practice. The main content of this course should include the basic concepts and knowledge of probability theory and mathematical statistics (Wang & Shen, 2018). And it shall also introduce to students the basic structural characteristics of data in textile engineering, the practical application of mathematical statistics method in textile practice including experiment design, data analysis and data prediction (Li et al., 2015).

TMS course requires a close connection between theory teaching and practice. That is, the course means to apply the basic knowledge and principles of mathematical statistics to the practice of textile research, trading and production. Therefore, the teaching of this course faces three key and difficult challenges: a) students are required to master the important basic knowledge of probability theory and mathematical statistics and the basic principles of important theories in limited class hours, and thus to lay good foundation for practical application. b) Students shall learn and master the structural characteristics of data that are frequently used in textile practice, and know the requirement and basic processing methods for data analysis. And thus students shall be able to find appropriate statistical methods to solve the problems encountered in the practice of production, trade and scientific research. c) Students shall master common statistical analysis software, and they should be able to find proper statistical methods and find suitable application software for specific problems. In a word, through learning the course, students shall first be able to master basic theoretical knowledge and basic research methods, and furthermore, innovatively find new methods or propose new ideas in view of the new problems encountered in textile engineering practice.

The core of the above teaching task is to solve the problem of putting learning into practice. For this purpose, we proposed the application-oriented teaching practice of TMS course. In order to implement of our teaching object, the application-oriented teaching practice were promoted with project cases.

2. Project-Case Based Teaching Mode

Project-case based teaching mode is to take the specific applications in scientific research and engineering practice as examples of teaching. The project cases of TMS course mainly came from textile scientific research, product design and production process. And in the course, project cases were integrated into the teaching of basic methods of mathematical statistics. Thus theoretical study and practical applications were organically combined with each other. For our students, while learning the abstract concepts and principles, they learned and understood the characteristic application of concepts and thus could correctly find the most suitable method to solve their problems in textiles.

Selection of teaching case project is the key of our teaching practice. In the selection of our teaching cases, we followed three principles of a) close connection with reality, b) well-fit the basic theory, and c) good feasibility and representativeness in practice. According to this, our teaching case projects were adopted from textile scientific research experiments, textile production process, textile testing, market and trade periods, etc. The practical application cases were mostly simplified so as to meet the needs of TMS teaching task.

Based on our teaching case projects, the teaching method of TMS course was carried out mainly in two ways.

2.1. The Teaching Idea of Learning-Through-Using Was Adopted

The traditional teaching mode of learning before using was replaced by the

mode of learning-through-using. This new type of teaching idea was proved more efficient for our teaching practice of the TMS course.

Higher mathematics, algebra and other mathematical courses teach highly abstract theoretical knowledge of Mathematics. Differently from the above, our TMS course aims to train students to have the ability to solve practical application problems. Therefore, the teaching idea of TMS course cannot completely copy the model of Mathematics courses. Although some basic knowledge and principles in the TMS course are abstract to some extent, the method of combining theory with practice could be more suitable for sophomores than learning through pure abstract mathematical formula derivation and mechanical memory method.

Sensitive cognition is the premise and base of students' creative learning activity. Hence, it's hard for a student to really learn how to apply a statistical principle to practice without sensitive acceptance and practical application.

Therefore, in our TMS class, each knowledge point and basic principle of mathematical statistics were explained combining with practical examples in textile field. On the one hand, students could more easily accept and digest knowledge points by comparing examples; and on the other hand, through grasping a typical example, students could know the similar kind. And thus our TMS course achieved good effect of learning for practical application.

2.2. The Teaching Contents Were Scientifically Arranged

The knowledge points and basic theories of probability theory and mathematical statistics are not independent of each other. Instead, they have certain connections. For example, we need to first understand the concept of random variables before learning the characteristics of various types of random variables. After that, we could learn to master the basic principles of mathematical statistics such as the law of large numbers and the central limit theorem. Similarly, when we give class around the application of statistical knowledge in textiles, we should firstly let our students fully understand the characteristics of various types of data in textile field before talking about selection of data analysis method.

Therefore, in the TMS course, knowledge points were scientifically arranged according to their inner connection. And in each class, the traditional teaching law, from shallow to deep and from simple to complex, was severely followed to conform to students' cognitive laws.

At present, the application of statistics in textile practice has been proved of large demand and wide range since new materials and new demand continually emerge. Hence, we teachers and our students have to faces the situation of tremendous and complicated demand for data analysis. Most times students are easily puzzled in face of complex practical problems.

Our teaching team proposed a comprehensive teaching idea, that is, to promote the learning of basic knowledge through key, typical and classified cases. In addition, practical teaching cases were firstly classified according to knowledge

points and then simplified according to teaching quantity and teaching difficulty. In this way, students were enabled to gradually master basic principles and application methods in the TMS course.

Our teaching method complies with students' cognitive process of knowledge and helps them give full play to their subjective initiative. Hence our students could take the initiative to learn according to the demand of the project. Hence study of the course further developed students' ability of independent learning and innovative learning.

3. Establish Knowledge Base of Teaching Cases

The core of implementation of case teaching practice, for our TMS course, was to achieve full application of the basic principles of mathematical statistics in textile fields. To fulfil this, we have tried and gradually completed two tasks in years of teaching. One task is to let the students learn and master the characteristics of the data performed by textile materials and textile products. And the other is to build and enrich the knowledge base related to the TMS course.

3.1. Characteristics of Data and Data Structure in Textile Field

Different from other engineering materials, such as steel, paper, rubber and so on, textile materials and textile products have remarkable characteristics. There are large amount of kinds of textiles, and each kind presents strong data discreteness. Textiles include all kinds of fiber materials and fibrous structural products, like yarns, fabrics, and non-woven fibrous structures. Because most fiber has the characteristics of fine, flexible and bending, the materials processed by fibers are usually soft and perform larger deformation than other materials, such that textile materials are used in a variety of products.

Due to the multi-type, multi-level and complex structure of textile materials and textile products, nearly each kind of textile products performs significant characteristics of multi-type and discrete data.

Therefore, when we use mathematical statistics method to deal with problems of data analysis of textiles, we must first know the characteristics of certain kind of textile materials. In teaching of TMS course, our student shall first learn the properties of corresponding textile materials before treat the data of them.

Based on knowing of textiles, we shall teach on sampling method of textile samples, and on how to determine sample size. These teaching contents lay a foundation for correct use of various statistical analysis methods in textiles.

After that, our class shall begin to learn the basic knowledge of Interval estimation, hypothesis test, variance analysis of related factors and regression analysis of empirical data, etc. In the teaching process of the above knowledge points of mathematical statistics，the specific samples of textiles were adopted as class display examples, exercises and assignments. In this way, students could fully grasp the application of basic knowledge points of mathematical statistics in the field of textile.

3.2. Establish Teaching Case Base of TMS Course Teaching

In the past five years of teaching practice, our teaching team has formed the basic theory knowledge base, example question base, exercise question base and test question base, which were kept enriched and improved yearly. The core of the base was constructed by two parts: the basic theory of statistics and the characteristics of data in textile field.

The basic framework of our teaching case base was constructed according to basic principles of statistics. All teaching cases were firstly classified according to the basic principles and methods of normal population statistics distribution, statistics interval estimation, hypothesis test of normal population parameters, significance analysis of normal population parameters, regression analysis, orthogonal experimental design, etc. Each practical cases applied in textiles were assigned to corresponding base. In addition, according to the special characteristics of textile materials, two categories of textile sampling method, textile quality control and data prediction were added.

After five years of teaching reform and practice, our TMS course has formed eight kinds of teaching practice cases. These provide a solid practice foundation for students to master the basic knowledge and principles of mathematical statistics course. And what is more, through study of the practical cases, the sight view of our students was remarkable expanded. I it has been proved that case teaching method in TMS course provides practical opportunities for students to independently apply the basic knowledge of mathematical statistics to solve the problems of experiment design and data analysis in the field of textile.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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