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Exploration and Research on Undergraduate Statistics Teaching for the Training of Comprehensive Talents in Chinese Medicine

Fang Liu[1,a,*], Sufen Miao[1,b], Meijing Gao[2,c]

[1] *School of Chinese Materia Medica, Beijing University of Chinese Medicine, Beijing, China*
[2] *School of Integrated Circuit and Electronics, Beijing Institute of Technology, Beijing, China*
[a] *liufang@bucm.edu.cn,* [b] *miaosf@bucm.edu.cn,* [c] *gaomj@bit.edu.cn*
**Corresponding author*

Abstract: *With the continuous deepening and expansion of the application of statistics in the field of traditional Chinese medicine, statistics teaching aimed at cultivating comprehensive talents in this field needs to further emphasize the infiltration of statistical ideas and the cultivation of undergraduate statistical thinking in depth. Additionally, it needs to further integrate with the background and problems of traditional Chinese medicine in breadth. By adjusting and optimizing teaching content to highlight statistical ideas and principles, and through reforming and innovating teaching methods, we aim to stimulate students' learning enthusiasm and cultivate their statistical thinking.*

Keywords: *Comprehensive talents; Statistical thinking; Comprehensive application capability*

1. Introduction

With the advent of the era of artificial intelligence and big data, statistics has become the theoretical foundation and important tool in fields such as data science, artificial intelligence, public health, and precision medicine [1]. In various fields of modern traditional Chinese medicine research and application, the theory and methods of statistics have received widespread attention and use from professionals. Statistics has also become an important foundational course for the comprehensive training of advanced talents in traditional Chinese medicine colleges and universities. To enable students to correctly and reasonably apply statistical methods in their future work and professional research. We should cultivate undergraduate students' statistical thinking and comprehensive application abilities in the statistical teaching process, and it has become a hot topic in undergraduate teaching in traditional Chinese medicine colleges.

At present, the comprehensive quality and professional competence of students in the field of medicine are receiving increasing attention [2]. Students' ability to apply professional knowledge comprehensively is an important indicator of their professional competence and overall quality. Medical students need to use statistical thinking to classify and conduct literature research on topics when conducting specialized studies. When designing research, it is necessary to provide statistical analysis of the research subjects and methods. When analyzing the validity of the results, it is necessary to make a reasonable evaluation of the uncertainty of the results. When writing a paper, it is necessary to have a complete statistical analysis of the conclusions drawn. In the process of studying and researching medicine, statistical proficiency and ability significantly reflect the comprehensive literacy of undergraduate students in the School of Medicine. However, currently undergraduate students majoring in traditional Chinese medicine have insufficient understanding of statistical thinking, and their learning of statistical theory remains at the stage of memorizing statistical concepts and formulas. They have not developed the habit of using statistical thinking to consider and study professional problems, which leads to many difficulties in matching between statistical theory and statistical methods with practice in their subsequent learning and application process [3].

The method to solve the above problems: In the case teaching of statistical knowledge and methods, emphasis is placed on the systematic infiltration of statistical thinking, and students' statistical thinking is cultivated unconsciously. Statistical thinking demonstrates strong macro guidance and micro operability. On the one hand, statistics is the cornerstone of continuous progress in various fields, and on the other hand, statistics is closely related to daily applications [4]. The macro and micro aspects of

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statistics require attention to both the general principles of statistical thinking and the applicable conditions of statistical methods in teaching. The cultivation of students' statistical thinking also relies on the integration of theoretical and practical aspects of statistics in teaching. The theoretical nature of statistics inevitably requires that the study of statistical theory not only cultivates and enhances students' rational thinking and logical concepts, but also requires the practical application of statistical knowledge to the development of various majors. Therefore, statistical teaching needs to pay attention to theoretical teaching, as well as the organic integration and matching with professional subject knowledge. This requires more consideration to integrate and match theory with practice in the teaching process.This article explores how to cultivate undergraduate students to use macro and micro statistical thinking under the guidance of statistical thinking, and to correctly and reasonably choose statistical methods based on the specific background and applicable conditions of traditional Chinese medicine majors. It explores the integration of statistical theory with traditional Chinese medicine majors.

2. Adjustment of teaching content and innovation of teaching methods for undergraduate students majoring in traditional Chinese medicine

There are significant differences in the mathematical learning foundations, learning abilities, and characteristics among students majoring in traditional Chinese medicine. Some students have outstanding computational abilities, while others have outstanding logical thinking.Students' learning interests are focused on related fields such as traditional Chinese medicine, Chinese pharmacy, and life sciences, with a particular emphasis on understanding the specific applications of statistics in these areas.The short-term goal of students is to have a comprehensive understanding of the field of traditional Chinese medicine as soon as possible, and to have a deep understanding of the specific role of statistics in the field of traditional Chinese medicine. Considering the long-term development of students, undergraduate teaching should promote the comprehensive quality development and professional ability training of undergraduate students in traditional Chinese medicine. Based on the learning foundation, abilities, interests, short-term goals, and long-term development of traditional Chinese medicine students, we will adjust and optimize teaching content, reform teaching modes, innovate teaching methods, and focus on training and cultivating students' comprehensive abilities in statistical thinking and statistical application.

2.1. Adjust and optimize teaching content, highlight statistical thinking and principles, and strengthen integration with traditional Chinese medicine professional knowledge

At present, the undergraduate teaching content of statistics mainly focuses on statistical theory, because the characteristics of statistical theory are multiple concepts and complex formulas. Faced with complex mathematical concepts and formulas, undergraduate students majoring in traditional Chinese medicine are prone to lose interest in learning statistical theory. Therefore, it is necessary to adjust and optimize the teaching content from the perspective of stimulating students' interest in learning. On the other hand, students only memorize concepts and apply formulas, making it difficult for them to organically link statistical methods with the scientific research work of traditional Chinese medicine in their future professional studies and research. They have no way of choosing reasonable statistical methods in actual scientific research work [5]. To further cultivate undergraduate students' ability to make correct choices among various statistical methods, it is necessary to adjust and optimize the teaching content. We adjust and optimize the teaching content to make the presentation of statistical theory more in line with the professional interests of undergraduate students majoring in traditional Chinese medicine. We optimize teaching content, while seeking comprehensive and thoughtful teaching of basic knowledge and concepts, effectively strengthen the integration of statistical teaching with traditional Chinese medicine professional knowledge, so that statistical knowledge, concepts and formulas can appear in a more closely integrated form with professional knowledge.

The principle of adjusting the teaching content of statistical theory is to highlight statistical ideas and principles. The core and essence of statistical concepts, formulas, and methods is statistical principles. For example, the various formulas of analysis of variance are derived from the basic ideas and principles of analysis of variance, extracting the mathematical objects of the basic ideas of analysis of variance, and the core logical reasoning process in the principles of analysis of variance.For example, the principle of experimental design needs to comply with the basic principles of statistical thinking, including the principles of control, randomness, and repeatability. The principle of repeatability requires each processing group to have a certain number of sample cases. By adjusting the teaching content related to statistical methods and formulas, emphasis is placed on showcasing the underlying ideas and principles, introducing basic knowledge and concepts in the ideas, and explaining the significance of formulas in

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the principles. We strengthen statistical thinking and principles, weaken concepts and formulas, stimulate students' interest in learning, cultivate their statistical thinking habits, and enhance their statistical analysis abilities.

From the perspective of adjusting teaching content, many important technologies and methods in the field of traditional Chinese medicine, including Chinese medicine chemistry, Chinese medicine pharmacology, Chinese medicine resources, Chinese medicine processing, and Chinese medicine clinical practice, are based on statistical methods. From these technologies and methods, we select the statistical methods and problems for daily scientific research of traditional Chinese medicine students to carry out teaching. At present, the daily statistical methods for traditional Chinese medicine research mainly include four types of methods: variance analysis of traditional Chinese medicine pharmacology, principal component analysis and multiple regression of traditional Chinese medicine resources, deep learning of traditional Chinese medicine information, and differences in the content of traditional Chinese medicine chemical components. We take the pharmacological mechanism and mechanism research of traditional Chinese medicine as an example, the method of testing models in animal model preparation, comparative studies of two or more experimental animal groups, or studies using a single animal as its own control group, comparing the pharmacological and pathological results between the model group and the control group, and comparing different dosages of drugs are often studied using analysis of variance between groups. By combining statistical methods and problems with daily research in traditional Chinese medicine, we could cultivate students' ability to apply statistical knowledge in professional research.

2.2. Reform and Innovation of Teaching Methods

Based on dual line teaching, this course introduces, explores, and expands discussions on statistical issues in the field of traditional Chinese medicine. It comprehensively applies mature scientific and technological methods, and uses images, audio, and video to vividly demonstrate the specific process and effects of statistics in the field of traditional Chinese medicine, inspiring students' learning enthusiasm and cultivating their statistical thinking.

The teaching method is the main content of statistical teaching activities and the key to teaching design. In the teaching activities of statistical theory and practice, the traditional teaching method of statistics is to arrange a series of statistical methods guided by the theory after the theoretical lecture is completed, and then give one or two application examples of these statistical methods. This teaching method focuses on the scientific nature of knowledge and does not have sufficient time to emphasize the cultivation of undergraduate students' ability to effectively participate. At present, innovative teaching methods are needed to stimulate the comprehensive potential of undergraduate students majoring in traditional Chinese medicine, expand their logical thinking, use new technologies to showcase recent advances in statistical applications, inspire students' scientific wisdom, and enable them to grow with vitality and distinctive personalities in the process of statistical learning.

Under limited offline teaching hours, dual line teaching is adopted, with mutual support and organic collaboration between online and offline teaching, forming a teaching form that relies on each other[6-7]. We offer the sources of statistical methods and related knowledge of traditional Chinese medicine in classroom assignments or study groups, and assign students to preview online before class. By contemplating and exploring issues related to traditional Chinese medicine, students are inspired to think independently, analyze statistical conditions and objectives of problems. During offline teaching, We lead students to conduct in-depth analysis of issues related to traditional Chinese medicine, and introduce statistical methods, concepts, and knowledge. Through this approach, we aim to bridge the psychological gap between statistical education and undergraduate students majoring in traditional Chinese medicine, and cultivate the habit of using statistical thinking and methods to think and analyze problems. We encourage students to use statistical methods to think and study practical problems and research projects around them, motivate students to share their ideas online, and stimulate more classmates to participate and discuss.

Focusing on the characteristics of commonly used statistical methods, the comprehensive application of advanced and mature scientific technologies can effectively improve the overall effectiveness of undergraduate statistics teaching. The reasonable application of visual methods such as video, audio, and images can effectively promote undergraduate students majoring in medicine to deepen their understanding of the relevant knowledge involved in statistics. Through short videos and micro lessons, the system showcases the basic processes of statistical practice, including sampling surveys, scheme design, data collection, data organization, and data analysis. We show the results of experimental statistics by range method, Bessel method, regression, and analysis of variance through bar charts, line

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charts, curve charts, and box plots. Reflect the theoretical basis of orthogonal design and contingency table analysis through a three line table. We introduce the statistical ideas and principles of multivariate statistics and deep learning through audio.

In the teaching design, we guide students to draw reasonable conclusions and conduct further discussion through the data analysis and results presentation of experiments in TCM related fields. In data analysis, we offer alternative statistical methods, allowing students to choose their own methods and corresponding software operations. We lead the students to analyze the rationality of the experimental results through the interpretation of the experimental data, and make comparison and discussion in combination with the literature. In the process of interpretation of experimental data, we provide statistical description of data, and select the method that can reflect the experimental results. In the discussion, students can evaluate and compare the advantages and disadvantages of experimental methods and data analysis methods, and make suggestions for improvement of the methods.

2.3. Reform the examination methods and contents, and evaluate students' scores reasonably

For many years, the examination of Statistics has been using the closed book written test. This examination method plays a certain role in ensuring the teaching quality and maintaining the normal teaching order, but it also has some defects. In the teaching of Statistics in the past, basic arithmetic ability was regarded as the primary training goal, and various examples in the textbook mainly showed students how to use formulas to calculate. As a result, in the course of learning Statistics, students spend too much energy on memorizing concepts and formulas in order to cope with the exam. The "Statistics" examination has been reformed, and the examination content and requirements not only reflect the basic knowledge of "Statistics" and the basic calculation and reasoning ability, but also pay attention to the examination of students' various abilities, especially the innovation ability.

The examination mode of Statistics is not unique. Besides the closed-book examination commonly used, the examination is also carried out in the way of discussion, defense and small papers in teaching, and the examination organization is flexible and diverse. The assessment of student achievement is based on the degree of student participation in teaching activities, book reports submitted during the learning process, computer operation and paper test results. In this way, students can be guided to pay attention to skill training and ability cultivation on the basis of learning basic knowledge.

(1) Platform learning. The main assessment platform independent learning effect and classroom performance, specifically class performance (attendance, class enthusiasm), unit tests, homework and platform activity (watching videos, Posting).

(2) Statistical work. It mainly tests the teamwork ability of the group and the practical application ability of statistical methods. Students are required to design a question paper on the issues they are interested in, collect data, and write a practice survey report in the group.

(3) Experimental operation. The main test is to assess students' practical operation ability of SPSS statistical software. Students are required to complete 9 experimental operations according to the experimental manual, understand the meaning of each value output by the software, and finally submit experimental assignments online on the platform.

(4) Extra points. Organize students to write an academic paper on the basis of the survey report of the large homework practice and the survey data.

3. Results, Discussion, and Conclusion

With the continuous deepening and expansion of the application of statistics in the field of traditional Chinese medicine, the content and teaching methods of statistics education need to be constantly adjusted and innovated. When adjusting teaching content, we should not only highlight statistical thinking and principles, but also pay attention to the combination of statistical theory and traditional Chinese medicine professional knowledge. We combine statistical concepts, formulas, and knowledge with the macro guidance and specific micro operability of corresponding statistical ideas.

We pick research on statistical methods and cases in the field of traditional Chinese medicine, and carry out statistical teaching. We reform teaching methods, innovate teaching models, and present teaching content in a way that conforms to the cognitive laws of traditional Chinese medicine students.

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issues in the field of traditional Chinese medicine. It comprehensively applies mature scientific and technological methods, and uses images, audio, and video to vividly demonstrate the specific process and effects of statistics in the field of traditional Chinese medicine, inspiring students' learning enthusiasm and cultivating their statistical thinking. In addition, to cultivate comprehensive and capable talents in traditional Chinese medicine, statistics teaching needs to pay real-time attention to the innovation of statistics in enterprise applications and scientific research trends, and use the innovation and application of statistics in enterprises and scientific research to feed back teaching.

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