

Exploration on Teaching Reform of Probability Theory and Mathematical Statistics

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Abstract: This paper analyzes the problem of “four more and four less” in the teaching of probability theory and mathematical statistics, and puts forward some measures to solve it, that is, to lay a solid foundation of probability theory, attach importance to the application of mathematical statistics, adopt a variety of teaching methods, set up probability statistics experiment, and quote multiple assessment.

Keywords: Probability statistics; Teaching reform; Course teaching

Probability theory and mathematical statistics (abbreviated as probability statistics) is a mathematical discipline which studies random phenomena and their statistical laws. On the one hand, probability statistics has a rigorous discipline theory system, using calculus, geometric algebra and other mathematical tools, to provide a theoretical basis for data processing; On the other hand, probability statistics is highly applicable and can be collected, sorted out, analyzed, inferred and made decisions based on random data in real production and life^[1].

It is the first time for students to come into contact with probability statistics, and there are some problems such as not knowing how to use formulas and axioms to calculate corresponding problems, not understanding the derivation process of some formulas, and not having a solid foundation of calculus. In the process of learning probability statistics, it is difficult for students to develop abstract thinking, integrate scattered knowledge points, and master the internal relationship between different methods^[2]. Therefore, it is necessary to explore the teaching reform in view of the problems existing in probability statistics.

1. The teaching status of probability statistics course

There are some problems in course setting, knowledge connection, explanation method and examination method in probability statistics.

1.1 The course content is large, the class time allocation is small

Probability statistics is divided into two parts: probability theory and mathematical statistics, among which probability theory is more, while statistics is less and more abstract. The teaching hours of the course are mostly 48 hours, which is obviously not enough for the above two parts. The teaching task is not completed, and considering the acceptance degree of students, the teachers will mainly explain the content of probability theory, lay emphasis on the explanation of probability theory and exercise calculation, and pay attention to the probability density and numerical characteristics of random variables, ignoring its application. There exists the problem of valuing theory over practice and knowledge over ability. In addition, for some students with poor basic knowledge of higher mathematics, the content of probability and statistics is numerous and difficult, which is not closely related to their major, and the course is not applied strongly. Therefore, students are not interested or give up in advance.

1.2 More knowledge decomposition, less connection

Probability statistics is a subject with a complete logical system. In order to explain the theory of this subject clearly, various textbooks divide the whole theoretical system into different chapters, such as probability and conditional probability, discrete random variable and discrete random variable, edge distribution and conditional distribution, etc., respectively in different chapters. It's very effective to go chapter by chapter through each point. However, the theoretical knowledge involved in

practical application is often not single, and students are at a loss once they encounter problems involving multiple knowledge points. How to combine the knowledge points of different chapters or teach them in a comprehensive way needs to be reformed at present.

1.3 More abstract explanation, less intuitive expression

Mathematics is abstract, and probability statistics is also abstract, which requires students to have high abstract thinking, so many students have difficulty in learning. At present, probability statistics basically adopts the traditional mathematics teaching method, that is, from the definition to the theorem, then to the derivation of the theorem, and finally do the example method. This method is of no help to the abstractness of probability statistics. Therefore, it is worth trying to transform the abstractness of probability problems into more intuitive probability problems with the help of other teaching methods and means.

2. The practice of curriculum teaching reform

2.1 Lay a solid foundation of probability theory

Advanced mathematics is the basic knowledge of probability statistics. Only by learning advanced mathematics calculus can we master probability density function and distribution function of probability statistics. Therefore, one is to let students realize the importance of higher mathematics for subsequent courses and improve their initiative; Second, we should strictly implement the assessment standards of higher mathematics syllabus to ensure that the foundation passes; Thirdly, in the course opening time, the probability and statistics course will be opened immediately after the completion of advanced mathematics to reduce forgetting. Fourthly, if conditions permit, take students to review some knowledge of calculus.

The main content of probability theory is the description of events, test probability, random variable definition and distribution theory, as well as how to use functions to deal with related problems. The Law of large numbers and the central limit theorem are the basis for the application of mathematical statistics in statistics, and reveal the convergence and limit distribution of arithmetic mean of random variable sequences under certain conditions^[3]. In the learning process, probability theory is followed by mathematical statistics. Probability theory is the theoretical basis of mathematical statistics. Therefore, in order to better grasp the relevant content of probability theory, 10 additional hours are added to learn basic knowledge, mainly reviewing the set, indefinite integral and definite integral of higher mathematics. In order to enable students to organically integrate the knowledge of probability theory and mathematical statistics, relevant concepts of sample and sampling distribution will be explained first, followed by parameter estimation and hypothesis testing. In the learning process, we should pay attention to the correlation between probability theory and mathematical statistics.

2.2 Attach importance to the application of mathematical statistics

In the era of big data, students' ability to extract and process data from massive data has become increasingly demanding. Therefore, for the teaching of mathematical statistics, it is necessary to increase the content of mathematical statistics application, introduce commonly used statistical methods, statistical processes and commonly used software, so as to improve students' ability of course application. In the teaching process, on the one hand, discussion teaching can be carried out according to the corresponding cases in combination with the problems of mathematical and modeling competitions of previous college students, so as to cultivate students' ability to use mathematical statistics related knowledge to carry out mathematical modeling. On the other hand, students are encouraged to try to solve real life problems. For example, the problem of bank queuing, how many business Windows are opened in different time periods, whether it reaches the average waiting time accepted by customers. In addition, probability statistics are widely used in agriculture, industry, medicine and other fields, allowing students to choose the direction related to their major and interested in research.

2.3 Use a variety of teaching methods

One is case teaching. The content of conditional probability and Bayesian formula in probability theory can be explained around the probability of failure of second-hand cars if they are soaked in water. Mathematical statistics can be explained for the daily work of the relevant data distribution and description methods and statistical ideas. For example, students can count the number of people eating in the canteen, find out its probability distribution, calculate the probability of eating in a certain period of time, and test the hypothesis. Through the above process, students not only master the theoretical knowledge, but also cultivate the application ability.

The second is transfer teaching. When explaining the probability density of continuous random variables, the physics is used to understand the density of matter, so that it can be easier to understand the non-negative properties of probability density and the relationship between the distribution function of continuous random variables and probability density. The relation and operation of

random events can be understood with the help of the content of set theory. The sample space corresponds to the whole set in the set, the event corresponds to the subset, and the basic event corresponds to the set of single elements. Meanwhile, the Venn diagram is used to represent the event, helping students to understand the abstract knowledge.

Third, discussion method teaching. Teachers can put forward some open questions for students to discuss and explain, so as to arouse students' enthusiasm for learning. For example, students are asked to calculate the probability of winning the lucky two-color ball lottery; Ask the students to count whether the height of the students in their major follows the normal distribution; To investigate the change of electricity consumption and population in a certain region; Climate change and rainfall and so on. Through discussion teaching, students can deepen their grasp of knowledge related to mathematical statistics and have the thinking of probability statistics to solve real life problems.

2.4 Set up probability statistics experiment

More and more statistical analysis and calculation, such as parameter estimation, hypothesis testing, analysis of variance, etc., can be easily calculated by mathematical software, which greatly reduces the time of manual calculation. With the help of mathematical experiments, students can strengthen the training foundation of computing software. Frequently used software, such as MATLAB, EXCEL, SPSS and other software is easy to use, with a wealth of probability statistical functions, can help users to carry out various types of probability calculation. When students use, some only need to use existing functions, some only need simple programming, simple operation, easy to get started^[4]. For example, MATLAB software can calculate common probabilities, provides a variety of discrete and continuous random variable distribution generation instructions, has a statistical toolbox, as well as parameter estimation and hypothesis testing^[5]. MATLAB software experiments can help students understand the influence of different parameters on probability statistics more intuitively, and have a clearer understanding of the hypothesis of the realization of the theorem.

3. Conclusion

Probability statistics is a compulsory course for most majors in colleges and universities. The theoretical knowledge of the course is abstract, and many students will encounter many difficulties in the learning process. By laying a solid foundation of probability theory and attaching importance to the application of mathematical statistics, we ensure that knowledge is put into practice. Through the use of a variety of teaching methods, stimulate students' interest in learning, improve the learning effect; By setting up probability statistics experiment, students can better use probability statistics knowledge; Through the introduction of multiple assessment, to ensure that students' theoretical knowledge and application ability of the comprehensive improvement.

References:

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