

Teaching Experience of Probability Statistics

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Abstract. The aim of this study is to improve teaching effect of probability statistics, so some teaching thoughts for the curriculum are presented in this paper. Due to the particularity of the study object in probability statistics, the specific teaching measures are proposed, such as the cultivation of students' learning ideas, the cultivation of students' learning interest, introduction to background knowledge, grasping the main line of the course, penetration of the curriculum's idea, correcting of typical mistakes, explanation of probability definition, solution of typical problems, introduction of methods and means, etc. The teaching practice shows that these measures are conducive to students' understanding of probability statistics, improve teaching quality, cultivate students' ability to solve problems.

Introduction

In the society based on information and technology, people are faced with more opportunities and choices, and often need to make rational decisions in a large number of random phenomena. Probability statistics is mathematical discipline which studies the law of data in random phenomena, and is also one of the important public basic courses in colleges and university [1]. From the 1933 Soviet mathematician Kolmogorov's works "the basic concept of probability theory" to the present, probability statistics has rapid development. At present, probability statistics has entered the other fields of natural science. In the field of social science, especially study on the problems of optimal decision and economic stable growth in economics, the methods of probability statistics have been used[2, 3]. Because of the close relationship between the course and many scientific problems, it is the foundation of many new developing frontier disciplines, so it is very important to learn it.

Currently, probability statistics is an important compulsory course for students majoring in science, engineering, economics and management in colleges and university [4-6]. This course is not only a necessary foundation for learning subsequent courses and carrying on theoretical research, but also important role to cultivate students' comprehensive ability and mathematical accomplishment. However, due to the special studied object of probability statistics [7, 8], so there is its unique concept and method compared with other mathematical course in leaning method. In leaning process, students often fall into a dilemma. Many students are unable to digest knowledge in time, even resulting in emotional weariness. Therefore, it is a practical significance problem to improve the teaching effect of probability statistics.

Cultivation of Students' Learning Ideas

Mathematical thought is an overall view or opinion of people for the formation of mathematics knowledge by mathematical activities. It is not only the sublimation and refinement of mathematical knowledge, but also the essence contents of the regularity and generality in dealing with mathematical problems, so it has a good navigation function in the whole process of learning and applying mathematics. The specific performance of mathematical thought is that people know how to start and do, when people encounter mathematical problems. Mathematical method is not only the thinking

strategies and models of people's learning and applying mathematics knowledge, but also a tool for dealing with the problem of mathematics effectively and quickly. The thought and method of mathematics is the soul of mathematics. The thought of probability statistics is the concrete embodiment of mathematics thought in this subject. Its essence is a dialectical unity of random, change, individual and law, static, whole, which makes people reveal the rules of nature through the accidental surface in dealing problem. If the knowledge of probability statistics is regarded as hardware, the probability method is called as software, which is one of the basic elements to establish students' knowledge structure to improve students' ability. Therefore, for the teaching of probability statistics, teachers can't only pay attention to the results and despise the process, also can't only stay in the pure calculation of the conclusion; teachers should guide the students to find the conclusion. Gaussian once said: the mathematical discovery is more important than the argument. Teachers should be good at setting teaching situation, seize the opportunity of teaching, motivate students to explore the unknown and let students gradually form a relatively complete thought of probability statistics in the exploring.

Cultivation of Students' Learning Interest

In the teaching of probability statistics, the introduction of some concepts is often critical, and it is also one of the difficulties in teaching. On the one hand, due to the constraints of the textbook and system, the explanation of mathematical concepts is often a mere formality. So students feel difficult to learn the course, not easy to master. The study object and statistical rules of probability statistics determines the thinking mode of the course, it different from those of the traditional subjects, students need to have a gradual adaptation and acceptance process. Therefore, it is an important task how to finish the process of adaptation and acceptance in the teaching as soon as possible. In the teaching of probability statistics, due to the content of probability involves many permutations and combinations knowledge, so teachers should review the content to enable students familiar them initially, then the new knowledge of probability statistics are introduced. In the explanation of the concept, teachers must combine with practice as far as possible, which can establish relationship between the course and reality. This method can make students feel that they indeed exist in practice; accordingly, students can gradually grasp the ideas and methods of probability statistics. In another word, it can promote students to master the course.

Introduction to Background Knowledge

Probability statistics is a science to study a large number of random to reveal the regularity of their statistics, and it reflects the transition from deterministic to stochastic. Because of the knowledge content and study object of probability statistics has a wealth of practical background, namely, it comes from the reality of the social and natural phenomena, so it is an effective way to know and understand the mathematical origin and background, feel the value and function of mathematics and improve the ability of solving practical problems. Therefore, in the teaching, teachers can select some realistic scenarios with representative examples, explain the actual meaning of the related concepts, principles by the corresponding data analysis and solve the corresponding practical problems using the corresponding probability method to enable students to understand the thinking method of probability statistics in wide application of social life and various fields, which can improve students' interest in learning probability statistics.

Grasping the Main Line of the Course

In probability theory, several important distributions are related to the central limit theorem. Under certain conditions, the normal distribution can be used as the approximate distribution of some distributions, such as the binomial distribution, hypergeometric distribution, etc. in mathematical statistics, the distributions of the common statistic are mostly derived from the normal distribution;

the important contents of mathematical statistics are based on the normal population, such as interval estimation, hypothesis testing, etc; the precondition of variance analysis is also the normal distribution of equal variance; the significance test of the linear regression is also closely related to the normal distribution. It is not difficult to see that the problems discussed in mathematical statistics are related to the normal distribution. Moreover, the central limit theorem is the important relation between some distributions and the normal distribution. Therefore, the central limit theorem is the main line of mathematical statistics. Accordingly, in the teaching process, it should be given prominence explained in the corresponding chapters to make students comprehensively understand the course. To do so, it can enable students to systematically master the contents and methods of the course. Especially, it can not only make students learn how to analyze and solve problems, but also make students learn how to find out its essence and internal relations from complex problems. Accordingly, the ability of solving problem can be remarkably improved for students.

Infiltration of Curriculum Thought

In the teaching, infiltration of probability's basic idea is the basis of the study of probability statistics. The following points need to be considered. (1) Infiltration of small probability events principle, that is to say, small probability events do not occur in individual trials. This principle has a wide range of applications in industrial and agricultural production and daily life. For example, the "3 σ " principle of the normal distribution, the basic idea of hypothesis testing is an important application of the principle. If this principle is introduced in the introduction part of probability theory, and this principle is penetrated into the whole teaching process, it is useful for students' understanding the quintessence of probability theory to make students understand this principle clearly. Accordingly, a solid foundation is established for the teaching of statistics. (2) Infiltration of alternative principle. The essence of moment estimation is to use the empirical distribution of the sample and the sample moment to replace the parent distribution and the parent moment, it is called as alternative principle. It plays an important role in point estimation. Moreover, it is also an important method to solve the problem of mathematical statistics. Because this content is relatively small in the textbook, there are some worries in the students' thought, so they fear of making mistake. However, if the theory and practice are penetrated into the students' thought, especially the practical examples. Accordingly, students' worries can be dispelled, and the teaching of moment estimation method can also be implemented successfully. (3) Infiltration of maximum likelihood estimation. Maximum likelihood estimation is another kind of important methods for point estimation, it was first put forward by C. F. Gauss, then R. A. Fisher is presented in 1912, its basic idea is as follows. A randomized trial has several possible results on A, B, C, \dots , if the result A appears in a test, it is generally believed that the test conditions is favorable to the result A , that is, the probability of appearing the result A is maximal, compared with other ideas, students are more difficult to accept this idea. Here, teachers can use example to teach to solve this problem in time.

Correcting of Typical Errors

In the teaching, correcting mistake in time is the guarantee for teaching probability statistics better. Like the following issues need to be corrected in time. (1) The relationship between the impossible and the zero probability events. In the textbook, impossible event is in accordance with the following definition: "if an event never happened, it is called as impossible event". But many students think that the zero probability events are never occurred, so it is impossible event. According to the survey, such students are quite a few. In the teaching, teachers should correct the error in time by practical examples. (2) Confusion of probability and frequency. Many people think that the limit of the frequency is a probability, that is, when the number of test tends to infinity, the limit of the frequency is a probability. This is also a point of view of people in the early stages of the probability development. But the two is not the simple limit relationship in fact.

Explanation of Probability Definition

The definition of probability is the most basic concept in probability statistics, understanding this definition direct influence to the whole learning of the course and the formation of the curriculum idea. Therefore, how to choose the appropriate teaching methods to make students understand probability definition, which is particularly critical for beginner. Probability can be roughly understood as opportunity, possibility, certainty, etc. It has the uncertainty of individual results, however, after many trials are implemented, the typical features of a predictable pattern appear. In the teaching, teachers can set certain teaching situation and put forward some questions to guide students to explore and think. Accordingly, after the analysis and experiments are carried out, the statistical definition of the probability is introduced. In summary, after such teaching is implemented, students are easy to receive and understand the probability concept; moreover, students can also master the key concept of the large and repeat. These are useful to learn probability statistics.

Solution of Typical Problems

Because the problems of various fields and a wide range are encountered in probability statistics, it determines the diversity and complexity of the problem, which is very flexible in solving problem. Students find it difficult to master and easy to confuse, so teachers should clarify the concepts, theorems and formulas are how to generate, and point out main application of these knowledge, moreover, some representative examples are extracted from the practical problems to enable students realize how to use this knowledge to solve practical problems. For instance, the birthday problem can be transformed into housing problems. In addition, there are lots of problems that they are derived from an actual example of the typical problems, such as ballot issues, queuing issues, sampling issues, finding a pile issues and meeting problem of geometric probability model, Buffon (throwing needle) issues, etc. These problems not only intuitive common and full of fun, but also contains profound principle of probability. Accordingly, clarifying these issues would enrich students' mathematical thinking and improve students' mathematical ability.

Introduction of Methods and Means

Another prominent problem of probability statistics is that students have not a systematic concept for statistical thoughts and methods for the course, after the course is taught. The result is that the rich statistical thinking often lack thorough understanding in addition to understand the term, a set of formulas and mechanically operation. So, how to make a thorough understanding of statistical thinking and mastering of flexible statistical methods? We believe that teachers should reform the teaching method combing teaching and practice in the teaching of mathematical statistics. In order to deepen the understanding of basic statistical thinking and concrete methods, teachers should guide students to complete classroom exercise with the assigned method and steps, which can make students active learning by the narrate of teachers to master the concept and solving way. Probability statistics, which has developed rapidly in recent decades, has been introduced in the new ideas and methods. In the classroom teaching, teachers should properly refine some content of the course to introduce new methods of statistical inference. If conditions permit, computer aided method should introduce in teaching, and let students use computer to deal with some simple problems, which can make students solve the actual problems. At the same time, it can enhance classroom atmosphere to arouse students' learning interest.

Summary

In the teaching for probability statistics, teachers should change the traditional teaching methods. How to reform and improve the teaching modes and methods to enhance the quality of teaching to enable students to understand the basic idea of probability statistics, grasp the probability statistical

inference skills, improve the ability to analyze and solve problems. These are the common research topics for the teachers of probability statistics.

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References

- [1] W.C. Yang, Probability Statistics, Science Press, Beijing, 2013.
- [2] I A Ibragimov, Probability theory and mathematics statistics, Proceedings of the Fifth Japan-USSR Symposium, Kyoto, Japan, July 8-14, 1299 (1986) 333.
- [3] S.K. Formanov, R. Mukhamedkhanova, On the origin and development of research in probability statistics in Uzbekistan up to the middle of the twentieth century, J. Optics 13 (2011) 459-462.
- [4] C.X. Wang, Pluralistic teaching practice in probability statistics, Adv. Mater. Res., 268 (2011) 692-696.
- [5] B. Xu, Teaching thinking of probability and statistics, J. Southwest Guizhou Tea. Coll. for Nati. 3 (2000) 86-88.
- [6] Z.X. Ni, M. Chen, Modern teaching method of probability and statistics of technology focusing on statistics idea, Coll. Math. J. 20(2004) 21-23.
- [7] F.P. Feng, J.X. Cui, The explorations and improvements in the teaching of probability and statistics, J. Sci. Tea. Coll. Univ. 24 (2004) 82-83, 86.
- [8] L. Yuan, Discussion on teaching reform of normal probability and statistics, J. Shandong Nor. Univ. 19 (2004) 87-89.