Application of Mathematical Modeling in the Teaching of Probability and Statistics

Rui Chen [1] and Liang Fang [2*]
[1, 2] College of Mathematics and Statistics, Taishan University, 271000, Tai'an, Shandong, China.
*Corresponding author email id: fangliang3@163.com

Abstract – **This paper applies mathematical modeling to the teaching of Probability and Statistics in order to cultivate students' creative ability bring up the case method of combining life cases, focuses on the strategy of applying mathematical modeling to probability and Statistics. Finally, the improved curriculum teaching strategy improves the students' learning enthusiasm.**

Keywords – **Mathematical Modeling, Probability and Statistics, Case Teaching, Teaching Strategy, AMS Classification Numbers: 15A69, 97B10.**

I. THE NECESSITY OF MATHEMATICAL MODELING IN PROBABILITY AND STATISTICS TEACHING

Mathematical modeling, is based on the actual problem to build a mathematical model, the mathematical model to solve, and then according to the results to solve the actual problem. When it is necessary to analyze and study a practical problem from a quantitative point of view, people should base their research on the work of in-depth investigation, understanding of object information, making simplified assumptions, analyzing internal laws, etc., mathematical models are built with mathematical symbols and language [1]. Many knowledge points of probability and Statistics are closely related to practical problems. In practical teaching, teachers combine abstract knowledge with living examples to guide students to establish mathematical models, promote the improvement and transfer of students mathematical ability. Therefore, it is very necessary to discuss how to apply the idea of mathematical modeling in probability statistics. The introduction of mathematical modeling into the course of probability and statistics is a breakthrough in the course of probability and statistics.

1.1. *Cultivate Mathematical Spirit to apply what Students have Learned*

The mathematical model is not a direct copy of the real problems, and its establishment often requires not only people's deep and subtle observation and analysis of the real problems, but also people's flexible and ingenious use of various mathematical knowledge. The probability statistics mainly take the theory deduction and the mathematics computation primarily; the student is also in the study process the theory practice primarily. The mathematics teacher applies the mathematics modeling to it, through the analysis actual case, constructs the mathematics model, transforms the actual question to the student easy to understand mathematics question, strengthened student's mathematics modeling ability, cultivate the students to learn for practical use of the mathematical spirit. All knowledge serves life, students use mathematical modeling to solve practical problems, so that students can realize more rationally that mathematics is a practical subject and realizes the value of learning mathematics [2].

1.2. *Improving ability of Mathematical Cooperation and Application*

Case method is a commonly used teaching method of probability and statistics in middle school, which is an e

-ffective way to connect the course knowledge with the practical application. In practical teaching, teachers find that it is relatively easy to construct mathematical models, but there are too many disturbing factors in the process of constructing mathematical models. In the process of mathematical modeling, teachers can guide students to use group cooperation to analyze actual cases, extract effective information through the Silkworm, build mathematical models of life, and enhance the comprehensive application of mathematics [3].

II. THE PRINCIPLES OF MATHEMATICAL MODELING IN THE TEACHING OF PROBABILITY AND STATISTICS

2.1. *Student-centered*

The main object of mathematics teaching is the middle school students. The students' subjective initiative in learning directly affects their grasp of the knowledge of probability and Statistics [3]. Teachers are required to adhere to the principle of taking students as the main body in the teaching process, actively Guide students in the course of learning to play the subjective initiative, through the group to obtain knowledge. In this process, the teacher should correctly grasp the cognition of the teacher's role, guide and serve the students, don't interfere too much in the students' modeling process, and let the students master the application methods of mathematics knowledge in the process of overcoming their learning difficulties, realize the effective promotion of self-ability, form the thought of mathematics application.

2.2. *With Real Cases*

The case is the foundation of mathematical model construction, and the case selection in the teaching of probability and Statistics is directly related to the success of student' model construction. Probability and Statistics as an important knowledge point of mathematics in middle school, teachers should, as far as possible, combine with the reality of life in the selection of cases, select cases that are close to the combination of probability and statistics and real life, so that students can master mathematics knowledge on the basis of, make students aware of the value of mathematics [4].

2.3. *Stimulate Students' Learning Interest and Motivation of Active Learning*

Mathematical modeling is used in the teaching of probability and statistics. Teachers use some questions designed in advance to inspire students to consult literature and learn new knowledge, encourage students to discuss and debate actively, and train students to explore actively, striving for an enterprising style of study, cultivating students' initial ability to engage in scientific research, cultivating students' spirit of unity and cooperation, and forming a lively environment and atmosphere, the focus of the teaching process is to create an environment to induce students' desire to learn, to cultivate their self - study ability, to enhance their mathematical quality and innovative ability, to improve their mathematical quality, and to emphasize the ability of acquiring new knowledge, is the process of problem solving, not knowledge and results [5].

III. APPLICATION STRATEGY

3.1. *Effective Combination of Problem-Based Instruction and Mathematical Modeling*

Problems are the main content of communication between teachers and students, which can inspire students 'mathematical thinking and check their mastery of mathematical knowledge [6]. In the situation of traditional

knowledge acquisition, students passively participate in it and show their personal knowledge frame to teachers, but they don't help students internalize their mathematics knowledge with the help of questions, which is disadvantageous to the improvement of students' mathematics comprehensive ability. Therefore, when teachers use mathematical modeling to carry out teaching, they can use question introduction teaching method to practice teacher's function, inspire students' mathematical thinking and help students grasp the core problem of the case.

For example: in explaining the application of Bayesian formula knowledge, you can enumerate lie detector in the judicial application, to increase the professional knowledge of students. Teacher Introduction: In real life, when the psychological state test is carried out on the tester, there will be deviation between the actual psychological state of the test subject and the result of the lie detector test, the actual psychological state of the test subjects when lying lie detector test results for the probability of lying 0.89, the actual psychological state of the test subjects when telling the truth of the lie detector test results for the probability of lying 0.15, set the question: Can the final test result of the polygraph be used as a key piece of evidence in the trial? The teacher divides the student into many groups, intersperses the grouping according to the student learning ability difference, drives the group member common progress. During the group discussion, the students agreed that the core of whether the lie detector's result can be used as the key evidence in the trial lies in whether the lie detector's result is accurate. Here's how to do it: The event A stands for the test subject's actual psychological state is lying, the event B stands for the polygraph says it's a lie. Please calculate $P(A|B)$. If the probability is high and stable, the polygraph results are considered to be crucial evidence in a trial.

Supposing that $P(A) = P(\overline{A}) = 0.5$. Previously we have known that $P(B|A) = 0.89$, $P(B|\overline{A}) = 0.15$.

Applying Bayes Formula, we have
$$P(A|B) = \frac{P(A)P(B|A)}{P(A)P(B|A) + P(\overline{A})P(B|\overline{A})} = \frac{0.5 \times 0.89}{0.5 \times 0.89 + 0.5 \times 0.15} = \frac{89}{104}.$$

In real life, the probability of people lying varies. Students construct a mathematical model, then put different data into it. Finally, the results of the lie detector test are unstable, therefore, it cannot be used as critical evidence during the trial.

3.2. *Effective Combination of Self-Exploration and Mathematical Modeling*

In order to further strengthen students' understanding of probability and statistics, teachers can combine autonomous inquiry with mathematical modeling, and respect students 'subjective initiative, let students in the process of building and applying the model to promote the key ability of students. The teacher lets the student design the life case independently, and constructs the mathematics model, consults the related data to realize the mathematics knowledge effective internalization [6]. For example, when the teacher explains the normal distribution related knowledge points, the student proposes that the normal distribution knowledge can be used to solve the problem of the choice of the best path in the specified time, assuming the normal distribution data according to the conditions in the question, the probability model is built, the related data is put into it, the best path is chosen according to the result, the students' ability of mathematical innovation and application is strengthened, the students' thinking of mathematical modeling is strengthened.

IV. CONCLUSION

Mathematical modeling is the bridge between mathematics and practical problems, the medium of mathemati-

-cs widely used in various fields, and the main approach to the transformation of mathematical science and technology. The important role of mathematical modeling in the development of Science and technology has been paid more and more attention in the fields of mathematics and engineering [7]. Applying the idea of modeling to the teaching of probability and statistics can make students' creative thinking and practical application of knowledge to a new height. On the basis of increasing the interest of class, it also increases the enthusiasm of students to listen to class and the degree of mastery of knowledge. Therefore, the quality education of students and the teaching reform have opened up a new way. In the education reform, we should permeate gradually, carry out the reform step by step in a planned way, arrange the class hour, and pass this kind of thought to the students slowly. The main thing, of course, is the students themselves. Students gradually understand the efforts made by teachers to this end, proactive, innovative, improve their ability to analyze and solve problems [8].

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AUTHOR'S PROFILE

First Author
Rui Chen is a associate professor at Taishan University. She obtained her master's degree from Shandong University in December, 2009. Her research interests are in the areas of application of probability theory, and applied statistics in recent years. email id: chenruimengting@163.com

Second Author
Liang Fang was born in December 1970 in Linyi, Shandong province, China. He is a professor at Taishan University. He obtained his PhD from Shanghai Jiaotong University in June, 2010. His research interests are in the areas of cone optimizations, numerical analysis, and complementarity problems.