The Application of New Course Introduction Methods in Probability and Statistics Course

Xueshuang Fan[1, a, *], Yunjuan Li[1, b] and Fengjun Yan[1, c]

[1] Xi 'an siyuan university Xi 'an, Shanxi, China

[a] fanxueshuang11@163.com, [b]liyunjuan22@163com, [c]yanfj1979@163.com

*corresponding author

Keywords: New Lesson Import Method; Comparison Import Method; Experiment Import Method; Activity Import Method

Abstract: Probability and statistics course is an important course to improve students' mathematics literacy and application ability. In order to deepen students' understanding of some basic mathematical ideas in probability and statistics course, we adopted a variety of new course introduction methods in teaching practice. This paper summarizes that different new course introduction methods are adopted for different content sections in the course of probability theory and mathematical statistics, such as experiment introduction method, activity introduction method, comparison introduction method, etc., and it is compared with the traditional introduction method, so as to reflect the advantages of these introduction methods.

1. Introduction

Probability theory and mathematical statistics is a branch of mathematics that studies the statistical regularity of random phenomena and the processing technology of random data, and it is a discipline of applied mathematics with strong applicability in [1-3]. Probability theory and mathematical statistics are offered in science, engineering, economics, management and other majors in colleges and universities. Because probability theory and mathematical statistics are a course combining theory with practice, we must pay attention to the unity of knowledge and action in the teaching process. Knowledge is the power source of action, and action is the value embodiment of knowledge. Therefore, when explaining different sections of probability theory and mathematical statistics, it is necessary to adopt a variety of new course introduction methods, so that students can not only firmly grasp the knowledge system, but also apply the knowledge learned to life and production, and finally achieve the unity of knowledge and action.

As the saying goes, all things are difficult before they are easy. The introduction of a new lesson is a crucial part in the whole teaching process. Import new course, to find the best entry point of this course. In the teaching process of probability theory and mathematical statistics, the choice of the best entry point of the new course should be based on the unity of knowledge and practice. According to the different knowledge section, can adopt the different new lesson introduction method. In the following, we will introduce a variety of new course introduction methods according to several specific knowledge points in the course of probability theory and mathematical statistics, such as comparison introduction method, experiment introduction method, ; activity Import introduction method, hot spot introduction method, etc.

2. New Lesson Introduction Method

2.1 Experimental Introduction Method

In all mature scientific systems, the process of development starts from specific practical problems and finally forms abstract theoretical knowledge. From concrete to abstract, is an important way of human thinking cognition. Practice is the sole criterion for testing truth[4-5].

The teaching process of probability theory and mathematical statistics is based on experiments. Through experiments, students can give full play to their subjective initiative, help them to understand some concepts and theorems more deeply, and at the same time cultivate the personality quality of being realistic and pragmatic. The key to the experimental approach is to implement the action.

Case1 Introduction of the statistical concept of probability.

The statistical probability is defined as follow. Assumes that the number of events A occurring in the second repeat test is, when n is large, the frequency fluctuates k/n near a certain value p, and as the number of trials increases, the probability of occurrence of large fluctuations becomes smaller and smaller, then the number p is called the probability of occurrence of events, denoted as $P(A)=p$.

Import scheme1 Using existing statistics.

The coin toss experiment of some famous statisticians in history in [6].

Table 1. Coin toss experiment

Experimenter	Number of coin tosses	Number of heads	Frequency
Mofo	2048	1061	0.5181
Buffon	4040	2048	0.5069
Pearson	12000	6019	0.5016
Pearson	24000	12012	0.5005

Import scenario 2 Adopts experimental import method

Step:(1) Let the students draw two CARDS from a deck of playing CARDS (remove the jokers) for 500 times.

(2) Use table 2 below to calculate the frequency of three CARDS in the same suit and calculate the corresponding frequency.

Table 2. Record of frequency

n	1	2	3	.....	498	499	500
n_A	0	0	1	.....	97	97	98
$f_n(A)$	0	0	0.3333	.....	0.1948	0.1948	0.1960

(3) Draw (n, $f_{n(}$A)) in the rectangular system according to the range of n, and the range of n is [11,20],[101,110],[491,500].

(3) Observe the three images in (2) and analyze the change trend of relative frequency $f_n(A)$when n increases.

Compared with scheme 2, scheme 1 has the advantages of saving time and effort. However, scheme 2 is more convincing for students because it is the first-hand data.

2.2 Activity Import Method

Before explaining the new content, students can organize some activities or games related to the teaching content. Through these activities and games can fully mobilize students' learning initiative and improve their interest in learning. The core of activity introduction method is participation, which emphasizes the leading role of students in the teaching process.

There are a lot of game examples in the specific teaching content of probability theory and mathematical statistics. Therefore, we can make use of this characteristic of the course to actively explore the method of activity introduction when introducing new courses.

Case2 Introduction of mathematical expectation definition of discrete random variable.

The mathematical expectation of discrete random variables x is defined as follow. The distribution law of discrete random variables x is $P\{X=x_k\}=p_k, k=1,2,\ldots,$

If the series $\sum_{k=1}^{\infty} x_k p_k$ absolute convergence, then the series $\sum_{k=1}^{\infty} x_k p_k$ is called the mathematical expectation of the random variable, denoted as $E(X)$.

Import scheme 1 Directly gives the distribution law of the number of loops hit by a shooter.

Table 3. The number of loops hit

10	9	8	7	6	5	4	3	2
0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.05	0.05

Calculate the average number of rings hit

$10 \times 0.1 + 9 \times 0.1 + 8 \times 0.1 + 7 \times 0.3 + 6 \times 0.1 + 5 \times 0.1 + 4 \times 0.1 + 3 \times 0.05 + 2 \times 0.05 = 6.15$

Then the definition of discrete random variable X is given.

Import scenario 2 Activity import method

Step: (1) Randomly select a student, ask the student to perform a program (singing or telling jokes, etc.), ask other students to score the program, the score is from 0 to 10.

(2) To do statistics on the score of this program, complete the following table.

Table 4. Record of score

Score	10	9	....	1	0
Frequency	0	6	....	1	0
Relative frequency	0	0.2000	....	0.0333	0

(3) calculate the average score, and think can use the relevant frequency data to calculate the average score and how to express?

Obviously, the introduction of scheme 2, compared with the introduction of scheme 1, enables students to be more involved in the classroom, and at the same time deepens their understanding of the important concept of mathematical expectation and grasps the method of mathematical expectation of discrete random variables.

2.3 Comparison of Import Method

Everything is the same, everything is different. Since everything has similarities and differences, we can make use of the similarities and differences between the old knowledge and the new knowledge, and use the method of analogy and contrast to achieve the understanding of the new things.

In the course of probability theory and mathematical statistics, there are many concepts and property theorems that can be compared with each other, such as the operational properties of events and sets, discrete random variables and continuous random variables, populations and samples, one-dimensional random variables and two-dimensional random variables, and so on.

Case 3 Introduction of mathematical expectation concept of continuous random variable.

The definition of mathematical expectation of continuous random variable. Let the probability density function of continuous random variable x be $f(x)$, if the integral $\int_{-\infty}^{+\infty} xf(x)dx$ absolute convergence, the value of the integral $\int_{-\infty}^{+\infty} xf(x)dx$ is said to be the mathematical expectation of the random variable, denoted as $E(X)$.

Importing scheme1 Directly gives the mathematical expectation of the random variable.

Import scenario 2 the comparison import method is adopted.

Steps: (1) Compare the similarities between discrete random variables X_1 and continuous random variables X_2.

Similarity: the sample space is a set of real Numbers.

The probability of the discrete random variable X_1 falling at the location x_k is expressed as $P\{X_1 = x_k\} = p_k$. The probability of the continuous random variable X_2 falling near to x_i (length of I_i is Δx_i) can be approximately expressed as $P\{X_2 \in I_i\} \approx f(x_i)\Delta x_i$.

(2) Suppose that the possible value of the continuous random variable x_2 is according to the conclusion of $\{x_1, x_2, x_3, \ldots\}$ and the definition of the mathematical expectation of the discrete random variable, and the mathematical expectation can be expressed as

$$E(X_2)=\sum_{i=1}^{\infty} x_i f(x_i)\Delta x_i \quad (1)$$

(3)The mathematical expectation of continuous random variable x_2 can be obtained by the definition of integral in [7]. As follow

$$E(X_2)=\int_{-\infty}^{+\infty} xf(x)dx \quad (2)$$

Scheme1 directly gives the definition of mathematical expectation of continuous random variables, which is too abrupt and does not form an effective connection with the original knowledge, so it is not easy to be accepted by students. If scheme 2 is adopted, students not only review the definition of mathematical expectation of discrete random variables, but also form effective connection with the definition of mathematical expectation of continuous random variables, and at the same time consolidate the idea of integration.

2.4 Hot spot import method

Social hot spots refer to events that arouse wide attention, participate in discussion and cause strong repercussion in the society. With the development and popularization of information technology, we will come into contact with a large number of social hot spots. As these hot issues are closely related to our lives, students will be very interested in these hot issues. In the process of teaching knowledge, we can combine these hot social issues with the knowledge points in the course. In this way, students will not only improve their interest in learning, but also improve their awareness of applying what they have learned to life.

From the perspective of the development history of probability theory and mathematical statistics, the knowledge content is derived from hot social issues. This makes it very convenient for us to use the method of hot spot introduction when teaching new lessons.

Case 4 Exponential distribution

The definition of exponential distribution is set as the probability density function of continuous random variable X ,

$$f(x)=\begin{cases}\lambda e^{-\lambda x}, x>0,\\ 0, \quad x\le 0,\end{cases} \quad (3)$$

$\lambda(\lambda>0)$ is a constant, then X is called the exponential distribution subject to parameter is λ , denoted as $X\sim p(\lambda)$.

Scheme 1 gives the definition of exponential distribution directly by using probability density function.

Scheme 2 Use social hot spots to introduce the definition of exponential distribution.

(1) The only way to our school is a section of road called cement Factory Road, which has led to many serious traffic accidents and has been reported by the news media for many times. This has become a hot social issue.

(2) Let the students make a statistics of the traffic accidents according to the news reports.

Table 5 Traffic accidents

Accident date	June 1	June 5	....	July 10	July 20
Casualty	1	0	....	2	1
Interval	/	4	....	6	10

(3) According to traffic accident statistics, the regularity of accident interval time is analyzed.

(4) According to the regularity of accident interval, a prediction is made for the next possible traffic accident.

(5) Combined with the above process, the definition of exponential distribution is given.

Compared with plan 1, plan 2 can greatly arouse students' attention and improve their interest in learning. At the same time, it deepens students' understanding of the definition of exponential distribution. Furthermore, the application ability of students is improved.

Conclusion

To teach is to learn. With the vigorous development of China's education, educators should no longer hold the old attitude of keeping the disabled, but should be more active and open to explore various forms of new curriculum introduction methods. Due to the wealth of probability theory and mathematical statistics knowledge content, a variety of teaching methods must be used in the process of teaching. In addition to the four import methods introduced above, there are exciting import method, suspense import method, function import method, case import method [8-10], etc. These import methods also have important value in the course of probability theory and mathematical statistics.

References

[1] Rongheng Sun ,Applied mathematical statistics ,2 edition, Science press, 2002.

[2] Xishu Chen , Probability theory and mathematical statistics, Guangxi people's publishing house, 1984.

[3] Qiucheng Zeng , Methods of technical mathematical statistics, Anhui science and technology press, 1983.

[4] Ziv. A, Teaching and learning with humor: Experiment and replication, Journal Of Experimental Education, 1988.

[5] Wong, L.Y.S, Rresearch on would: Process - product research fingdings and the feeling of obviousness, Journal of educational tended, 1995.

[6] Xierui Li, Weiming Tan, Probability theory and mathematical statistics, Aviation industry press, 2017.

[7] Kezao Xie , Yongqiang Ji , Higher mathematics, Dalian university of technology press, 2014.

[8] Biyi Chen , A preliminary study on the introduction of stimulating interest, Chinese teaching and research, 2012.

[9] Yufang Zhong, The role of suspense leading method in junior high school mathematics teaching, Extralinguistic learning, 2014 (12).

[10] Suqin Cui, Case introduction and literature research, social science forum, 2005.