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# *Teaching and Practice of Ideology and Politics in the Course of Probability and Statistics*

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***Abstract:*** This article elaborates on the practical application of Probability and statistics in the teaching of ideological and political cases. Through project research, the team of the course team is utilized to explore ideological and political elements, establish a course ideological and political case library, and study the integration of ideological and political elements contained in the deeds of mathematicians, typical cases in daily life, and literary allusions into course teaching. This enables teachers to guide students to establish correct worldviews, values, and outlooks on life while imparting knowledge, Stimulate students' patriotic enthusiasm, fully leverage the educational role of the curriculum, and improve the quality of the curriculum.

## 1. Introduction

Probability and statistics course is one of the important basic mathematical courses in our school. It is a mathematical discipline that studies the statistical laws of random phenomena. The course has rich content and strong practicality, playing a very important role in finance, insurance, economy and enterprise management, industrial and agricultural production, and has a unique advantage in carrying out ideological and political education courses. Based on years of teaching experience, the course team teachers have compiled typical cases related to ideological and political education for each chapter and formed a case set for reference in teaching. This article only introduces a few application cases. Through the introduction of ideological and political elements, teachers can quietly integrate the spirit of scientists, teamwork awareness, unity and cooperation spirit, as well as socialist core values such as patriotism, professionalism, integrity, and friendliness into the teaching of Probability and statistics courses, ultimately achieving the core function of "cultivating morality and cultivating people" in Probability and statistics courses.

## 2. Curriculum Ideological and Political Research

The course of Probability and statistics mainly teaches the basic concepts of probability theory, random variables and their probability distributions, numerical characteristics, laws of large numbers and central limit theorems, sample and sampling distributions, parameter estimation, and hypothesis testing. By studying the basic theories and knowledge of this course, students will receive basic training in theory, methods, and abilities. They will have a preliminary understanding and

understanding of the unique thinking mode, extensive applications, and rich practical background of probability and statistics. The research and practice of ideological and political education in Probability and statistics courses aims to study and explore how to establish a student-centered awareness of ideological and political education throughout the entire education and teaching process, enhance awareness of ideological and political education in courses, practice ideological and political reform in courses, explore ways that are conducive to students' learning, stimulate their enthusiasm for learning and patriotism. Through probability and statistical course ideological and political cases, targeted teaching is designed, truly achieving the integration of "ideological and political education into the classroom", realizing the unity of knowledge transmission and value guidance. Teachers strive to become lecturers of probability and statistical knowledge, firm supporters of the Party's governance, and better assume the responsibility of guiding and guiding students' healthy growth.

## 3. Establishment of ideological and political teaching resources for courses

### 3.1 Establishing a relatively stable teacher team

Team teachers should participate in the special training on "Exploration and Integration of Ideological and Political Elements" and regularly explore teaching and discussion activities such as ideological and political education in the course teaching process. For example, how to gradually transform the teaching content of the course in teaching, focus on the teaching objectives, carry out the upgrading and transformation of the original course teaching content, combine practical cases, organically integrate "course ideological and political" elements, and at the same time, strengthen political direction and ideological guidance while imparting knowledge.

### 3.2 Extracting humanistic value materials in the curriculum

Explore the humanistic value materials behind the basic concepts, experiments, formulas, theorems, and methods in the course. For example: Professor Baolu Xu, the great master of propaganda. Mr. Baolu Xu is the main founder of the discipline of probability and statistics in China, an academician of the CAS Member, and a first-class professor of Peking University. Mr. Xu's academic work mainly focuses on the fields of mathematical statistics and probability theory. He is one of the modern scholars engaged in probability and statistics research in China, reaching the world's advanced level and having a wide international influence [1]. Professor Baolu Xu is a great master who pioneered teaching and research in the fields of Probability and statistics in China. He is recognized as one of the founders of multivariate statistical analysis worldwide, and has achieved remarkable achievements in fields such as parameter estimation theory, Neyman Pearson theory, multivariate analysis, and limit theory. Professor Xu studied and taught at the University of London in the UK, but during difficult times in his homeland, he declined to be retained by famous foreign universities and resolutely chose to return to his home country. Professor Xu has trained a group of teaching and research talents in the field of probability and statistics in China through workshops and other forms. Professor Xu's deeds of cherishing the motherland, serving the motherland, and dedicating his life to science have greatly inspired students' belief in bravely climbing the scientific peak and their patriotic feelings of serving the motherland. By introducing the rigorous, down-to-earth, hardworking, and diligent research spirit of the older generation of mathematicians, we encourage students to not forget their original aspirations, remember their mission, be strict with themselves, and actively strive for progress. By integrating the research spirit and patriotism of scientists into teaching, we fully leverage the educational role of the curriculum and improve its quality.

## 3.3 Application of Full Probability Formula and Bayesian Formula (Integrity and Friendliness)

**Case Description:** In Aesop's fable, there is a story called "The Wolf Comes". It tells the story of a shepherd who goes to the mountain to herd sheep every day. Once, he shouted on the mountain, "The Wolf Comes! The Wolf Comes!" The villagers at the foot of the mountain put down their work and ran to the mountain to fight against the wolf, only to find that the wolf did not come; The second time was still the same, and the third time, the wolf really came. No matter how much the child called for help, no one came to save him, ultimately leading to a tragic ending for the shepherd[2].

**Analysis and Solution:**

Event A represents "the child lies", and event B represents "the villagers believe what the child says",

If the credibility of villagers starting to speak to children is 0.8, that is $P(B)=0.8$ $P(\bar{B})=0.2$. If the villagers believe the children's words, the probability of the children lying is 0.1, that is $P(A|B)=0.1$, the probability of the children lying when the villagers do not believe the children is 0.8, that is $P(A|\bar{B})=0.8$.

According to the total probability formula, the probability of a child lying is

$$P(A)=P(B)P(A|B)+P(\bar{B})P(A|\bar{B})=0.8\times0.1+0.2\times0.8=0.24$$

By Bayesian formula

$$P(B|A)=\frac{P(B)P(A|B)}{P(B)P(A|B)+P(\bar{B})P(A|\bar{B})}$$

The probability of "villagers believing what children say" in the case of "children lying" is

$$P(B|A)=\frac{0.08}{0.24}=\frac{1}{3}$$

This result indicates that after being deceived once, the villagers' credibility with their children has decreased from 0.8 to 0.333,

Namely $P_2(B)=\frac{1}{3},\ P_2(\bar{B})=\frac{2}{3}$

Using the same method, the probability of a child lying for the second time can be calculated as

$$P_2(A)=P_2(B)P(A|B)+P_2(\bar{B})P(A|\bar{B})=\frac{1}{3}\times0.1+\frac{2}{3}\times0.8=\frac{17}{30}$$

After the child lied for the second time, the villagers' credibility towards the child was $P(B|A)=\frac{P_2(B)P(A|B)}{P_2(B)P(A|B)+P_2(\bar{B})P(A|\bar{B})}=\frac{1}{17}=0.059$

This indicates that after being deceived twice, the villagers' trust in the child has decreased again from 0.8 to 0.059. Therefore, no matter how the child cries for help, very few people believe him, resulting in no one coming to rescue him.

In the case, despite the friendliness of the villagers, the dishonest behavior of the shepherd boy continuously reduced the trust of the villagers in him, ultimately leading to a tragic outcome for the shepherd boy.

**Case significance:** This case demonstrates the application of conditional probability, multiplication formula, total probability formula, and Bayesian formula through the fable of "**The Wolf Comes**". Through computational reasoning, it not only enables students to deeply understand the meaning of total probability formula and Bayesian formula, but also cultivates students' logical

thinking ability and problem-solving ability. This fable fully embodies the core socialist values of "**integrity and friendliness**". Through this case study, we guide students to be honest and trustworthy in their behavior. Being dishonest and dishonest, and fooling others may come at a heavy cost.

### 3.4 Independence (Small Probability Principle)

In probability theory, we refer to events with a probability close to zero (i.e. very low frequency in a large number of repeated experiments) as low probability events. Small probability events are ubiquitous, ranging from enterprise management, social level, to personal workplace and daily life. Due to the low probability of an event occurring in an experiment or activity, it gives people a misconception that it will not occur in an activity. It is precisely this illusion that often numbs people's safety awareness. For example, traffic accidents, fire accidents, coal dust explosion accidents in coal mines, medical accidents, etc. are all small probability events, but once such events have serious consequences, they will pay a heavy price. The calculation results of small probability events remind people not to despise small probability events at ordinary times, and develop the awareness that safety is more important than Mount Tai.

**Case 1 description:** Assuming a success rate of 1% for an event, what is the probability of at least one successful attempt after 100 repeated attempts?

**Analysis and solution:** Let event $A_k$ indicate that the first attempt at an event was successful, $B$ represents at least one successful attempt after 100 attempts, then

$$P(B)=1-P(\bar{A}_1\bar{A}_2\mathrm{L}\ \bar{A}_{100})=1-P(\bar{A}_1)P(\bar{A}_2)\mathrm{L}\ P(\bar{A}_{100})$$

$$=1-0.99^{100}\ \ =1-0.37=0.63$$

This conclusion indicates that events with a success rate of 1%, after 100 attempts, the success rate miraculously increased from only 1% to 63%. This fully demonstrates the truth that miracles lie in persistence, and once again, the wise saying "perseverance and giving up, never breaking rotten wood, never giving up, can be carved out of gold and stone" is used.

**Case significance:** This case can motivate students. Although their grades are not ideal at present, after repeated efforts in learning, the degree of improvement in grades is beyond imagination.

If case 1 is changed to a traffic accident or medical accident, etc. For example, assuming that the probability of a traffic accident occurring at a special intersection is 1%, what is the probability that there will be no traffic accident on that day if there are 100 repeated passes?

According to the conclusion of Case 1, the probability of no traffic accident on that day is approximately 37%, which means that the probability of no traffic accident has decreased from 99% to 37%, reminding people to pay attention to safety and comply with traffic rules at all times when driving.

**Case 2 description:** A person shoots 400 independent shots at a target, assuming a probability of hitting the target each time is 0.02. Try to determine the probability of hitting the target at least once.

This case is still similar to Case 1

**Analysis and solution:** Let event $A_k$ to indicate hitting the target during the k-th shooting, event B represents 400 shots and at least one hit, then

$$P(B)=1-P(\bar{A}_1\bar{A}_2\mathrm{L}\ \bar{A}_{400})=1-P(\bar{A}_1)P(\bar{A}_2)\mathrm{L}\ P(\bar{A}_{400})\ \ =1-0.98^{400}\approx 1$$

**Case significance:** The probability of an event occurring in an experiment is small, but as long as the number of experiments is large and the experiments are conducted independently of each other, the probability of this event occurring will be high.

### 3.5 Binomial distribution (Union is strength)

Case description: There are 80 devices of the same type, each working independently of each other, with a probability of 0.01 for failure, and the failure of one device is handled by one person. There are currently two options for equipping maintenance personnel[3].

**Analysis and solution:** The first option:

If $X$ represents the number of machines that have malfunctioned at the same time among the 20 machines maintained by the first person, then $X \sim B(20, 0.01)$, Using $A_k (k = 1, 2, 3, 4)$ to represent the number of 20 devices maintained by the kth person that fail and cannot be repaired in a timely manner, the probability of 80 devices failing and not being repaired in a timely manner is

$$P(A_1 \cup A_2 \cup A_3 \cup A_4) \geq P(A_1) = P(X \geq 2),$$

$$P\{X \geq 2\} = 1 - P\{X = 0\} - P\{X = 1\} = 1 - \sum_{k=0}^{1} C_{20}^{k} 0.01^{k} 0.99^{20-k} = 0.0169$$

The second option: Using $Y$ to represent the number of machines out of 80 that have malfunctioned at the same time, then $Y \sim B(80, 0.01)$ ,So the probability of 80 units failing at the same time and not being repaired in a timely manner is

$$P\{Y \geq 4\} = 1 - \sum_{k=0}^{3} C_{80}^{k} 0.01^{k} 0.99^{80-k} = 0.0087$$

It can be seen that under the second plan, although there are fewer personnel available, due to unity and cooperation, the probability of not being able to receive timely maintenance after a fault occurs is reduced.

**Case significance:** As the saying goes, "A chopstick is easy to break, but a handful is difficult to break. Through this case study, students can appreciate the power of teamwork. To succeed, one must not only have high personal qualities, but also have a sense of cooperation and a spirit of unity and cooperation. A person's power is insignificant, only by uniting and working together can they play a huge role in realizing their own value.

## 4. Conclusion

Probability and statistics are one of the basic courses in science and engineering mathematics. Some knowledge points are relatively abstract. How to extract and subtly integrate the rich ideological and political elements contained in textbooks into the teaching of knowledge is a long-term consideration and research topic for teachers. It requires every teacher to constantly innovate teaching methods, optimize teaching content, reform teaching models, identify entry points, and timely introduce classic cases, Integrate professional knowledge with ideological and political education, guide ideological values throughout the entire process of education and teaching, and improve students' ideological, moral, and cultural levels.

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