

The Logic and Process of Ideological and Political Education in the Practical Course of Probability and Statistics—Taking Independence as an Example

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Keywords: Curriculum Ideology and Politics, scientific logic, Probability and Statistics, independence

Abstract: Strengthening the ideological and political construction of courses is an inevitable requirement for universities to achieve the fundamental task of cultivating morality and cultivating talents. Teachers of basic courses should take this opportunity to conscientiously fulfill their duties and responsibilities, continuously deepen teaching reform, and comprehensively promote the ideological and political construction of courses. Taking independence, a specific knowledge point in Probability and Statistics courses, as an example, organically integrates professional knowledge with ideological and political elements. Through Chinese stories, Chinese culture, and students' own stories, reasonable scenarios are created to stimulate students' interest in learning, inspire them to engage in rigorous logical reasoning, guide students to actively think, analyze, and solve problems, and establish cultural confidence, institutional policy confidence, and national pride. At the same time, we also pay attention to applying what we have learned and implementing curriculum ideology and politics in practice. Practice has shown that the teaching design of integrating probability and statistics professional knowledge with ideological and political courses has achieved good teaching results.

1. Introduction

The "Symposium for Teachers of Ideological and Political Theory Courses in Schools" provide basic guidelines and action guidelines for universities to carry out ideological and political work and promote "curriculum ideological and political education". It is emphasized that the cultivation of talents in China's higher education should be closely linked with the realistic goal and future direction of China's development, and should serve the people, the CPC in governing the country, the consolidation and development of the socialist system with Chinese characteristics, reform and opening up, and socialist modernization. For whom universities cultivate people, it is related to the long-term stability of the country and the great rejuvenation of the Chinese nation. Therefore, universities should use the main channels of classroom teaching, strengthen the construction and management of classroom teaching, fully tap and utilize the ideological and political education resources contained in various disciplines, adhere to the principle of educating people from all aspects

throughout the entire process, and guide ideological values throughout the entire process and every link of education and teaching, so that all courses and ideological and political courses work together and go together, Construct a collaborative system and form synergistic effects[1-3].

Probability and Statistics is a public basic course designed for students majoring in science, engineering, economics, and management in higher education institutions. It focuses on cultivating students' abstract thinking, logical reasoning, and analytical and problem-solving abilities. It is a fundamental course for carrying out quality education, cultivating students' innovative spirit and ability [4]. Our school has over 1000 undergraduate students studying this course every year. This course has rich ideological and political elements and is an excellent carrier for carrying out ideological and political courses. As a teacher, while imparting professional knowledge, one should make good use of the main channels of classroom teaching, deeply explore the ideological and political elements in Probability and Statistics classrooms, enable students to establish correct values, help students understand the logic and development of knowledge, stimulate students' interest in exploration and research, inspire students to think scientifically, and guide them to establish cultural confidence, cultivating emotional resonance between teachers and students and self-education of ideological and political content, achieving the effect of collaborative education in basic courses, and reflecting the important significance of integrating ideological and political education into probability statistics teaching.

We take the independence of random events as an example, integrate ideological and political elements of the curriculum, and adopt a teaching model that combines problem driven, case based teaching, and heuristic teaching for teaching design, guiding students to actively participate in various aspects of the classroom. While students master the judgment, definition, and methodology theory of random event independence, they also tell Chinese stories, Chinese culture, Chinese institutional policies, and students' own stories to spread the Chinese voice, enhance students' cultural confidence and national pride, and enhance their ability to solve practical problems [5]. The natural integration of ideological and political elements in Probability and Statistics teaching is concrete and feasible, and has universality and promotion value in Probability and Statistics courses in universities.

2. Teaching design ideas

This lesson focuses on the main theme of "creating a situation - posing a problem - analyzing a problem - solving a problem" to learn and discuss the concept of independence of random events and their judgment methods. The specific steps are as follows: (1) Based on the independence knowledge points that have been learned in high school, students are required to complete a brainstorming "Lucky League Support Letter" before class. During the brainstorming response process, students not only need to recall the interpretation of this knowledge point from high school, but also need to consider how event independence is defined, forcing them to closely combine observation, practice, and thinking to discover the essence of mathematics. (2) By introducing the Chinese story "2017 Academic Level Test of Zhengzhou Secondary Vocational School", it is explained that independently setting questions is "reasonable and legal", with a probability of doing each multiple-choice question correctly of 0.25. Based on the facts, it is clarified that everyone must abide by "professional ethics and conduct", and violations must be punished. (3) Abstract the problem into a probability model. With the help of the above story, guide students to introduce the definition of independent events from the perspective of legitimate problem setting, compare it with the knowledge learned in middle school, infer their equivalence, and think and answer that a group of events are independent of each other. After replacing any multiple events with their respective opposing events, the new combination of events will still be independent of each other. (4) By using examples, students can focus on distinguishing between mutually exclusive events and independent events to avoid mistakenly believing that mutually exclusive events are consistent with independent events. (5) Through

brainstorming analogies, the definition of three independent events and the differences and connections between their pairwise independence and mutual independence are introduced, and verified through examples. (6) Through brainstorming, continue to guide students to think about more general questions - the mutual independence of n events, and associate the mutual independence of some of the n events with the definition of n events being independent of each other; The definition of n events being independent of each other is associated with the replacement of parts of n events with their respective opposing events, and the new combination of events remains independent of each other. Based on conclusions related to comparison, association, promotion, and application, students can deeply understand the dialectical relationship between the induction process from special to general and the deduction process from general to special, which is the unity of opposites. (7) Integrating theory with practice, combining the sum of multiple events with independent events, and calculating the probability of China's epidemic being controlled, compared to the probability of the epidemic being controlled under the epidemic prevention policies of Western countries, will reveal the superiority of China's policy system, thus generating confidence and pride in China's system! (8) List the application of independent events in the ancient Chinese proverb "Two heads are better than one", reflecting the philosophy of life that "unity is strength, unity of all" through extreme thinking.

3. The integration of ideological and political elements in the teaching process

3.1 Create a situation, introduce interests, and stimulate thinking

Adapt interesting stories from student circle of friends into brainstorming 'Lucky League Secretary':

During the electronic engineering experiment class, the teacher called on the 16th student to get up and answer the question. The 16th student stood up and timidly said, "Teacher, I don't know." The teacher glanced at him and asked him to sit down and listen carefully. Subsequently, the teacher continued to call for the Youth League Secretary to answer this question. Just now, the student timidly stood up again and said, "Teacher, I still don't know!" The teacher nodded and gestured for him to sit down. Finally, the teacher asked the student from booth 6 to answer this question. Just now, the student stood up again and blushed and said, "Teacher, I am from booth 6." The teacher was very speechless. Question: If there are 30 students in this class, with student numbers ranging from 1 to 30 corresponding to each other, and there is only one student in a booth, what is the probability of this group branch being "so lucky"?

Before class, students are required to actively participate in the aforementioned brainstorming activities to stimulate their learning enthusiasm. At the same time, from the students' answers, the teacher can further grasp the students' learning situation, laying the foundation for better teaching of new knowledge in the future.

In class, taking the "2017 Academic Level Test Question of Zhengzhou Vocational School" as an example, we introduced the definition of event independence, as follows:

Two choice questions:

- 1) The world's first underground railway was built and opened to traffic in 1863 in ().
 A. China; B. England; C. America; D. Korea.
- 2) The world's first underground railway was built and opened to traffic in England in ().
 A. 1638; B. 1863; C. 1368; D. 1938.

In general, teachers should independently answer questions "legally" in the test, and the probability of doing each choice question correctly is 0.25. However, if teachers use "illegal" linkage to answer questions, the probability of doing these questions correctly is 1. Based on the above facts, ideological education should be provided to students - everyone should abide by "professional ethics and conduct", and this leads to the definition and equivalence theorem of two independent events.

3.2 Continuous inspiration, layer by layer advancement, analogical induction and summary

$P(AB) = P(A)P(B)$ Definition of determining the independence of two events

$$P(AB) = P(A)P(B)$$

$$P(AC) = P(A)P(C)$$

$$P(BC) = P(B)P(C)$$

$$P(ABC) = P(A)P(B)P(C)$$

} Definition of determining the independence of three events

$$P(A_i A_j) = P(A_i)P(A_j) \quad i \neq j$$

$$P(A_i A_j A_k) = P(A_i)P(A_j)P(A_k) \quad i \neq j \neq k$$

...

$$P(A_1 A_2 \cdots A_n) = P(A_1)P(A_2) \cdots P(A_n)$$

} Definition of determining the independence of n

events

It is obvious that the mutually independent judgment definitions reflect the "distribution law" of product event probabilities. Three events that are independent of each other can necessarily derive pairwise independence, but pairwise independence does not necessarily result in three events being independent of each other. If n events are independent of each other, some of them are also independent of each other.

The same logical reasoning can lead to the following theorems in sequence:

Theorem 1: Two events are independent of each other, and if any multiple of them are replaced with their respective opposing events, the resulting two events are still independent of each other.

Theorem 2. Three events are independent of each other, and if any multiple of them are replaced with their respective opposing events, the resulting three events are still independent of each other.

Theorem 3. n events are independent of each other, and if any multiple of them are replaced with their respective opposing events, the resulting n events are still independent of each other.

Theorem 1 and Theorem 2 are special cases of Theorem 3, and Theorem 3 is a generalization of Theorem 1 and Theorem 2. In addition, Theorem 3 is applied to the machine tool management system, where four machine tools work independently and obtain the probability of certain random events, which is a special case where $n = 4$. These fully reflect the rigorous mathematical logical reasoning and dialectical materialism from special to general, from general to special.

3.3 Integrate Chinese culture, establish cultural confidence, and gain insight into life philosophy [6]

There is a Chinese proverb: "two heads are better than one." This proverb is explained through independence and events.

Supposing $A_i = \{\text{The } i \text{ cobbler can solve the problem}\} \quad i = 1, 2, 3,$

$B = \{\text{Zhuge Liang can solve the problem}\},$ And $P(A_1) = 0.55, P(A_2) = 0.60, P(A_3) = 0.65,$

$P(B) = 0.9,$ While

$$\begin{aligned} P(A_1 \cup A_2 \cup A_3) &= 1 - \overline{P(\overline{A_1} \cup \overline{A_2} \cup \overline{A_3})} \\ &= 1 - P(\overline{A_1} \cap \overline{A_2} \cap \overline{A_3}) \\ &= 1 - P(\overline{A_1})P(\overline{A_2})P(\overline{A_3}) \\ &= 1 - (1 - 0.55)(1 - 0.60)(1 - 0.65) \\ &= 0.937 \end{aligned}$$

It is obvious that the probability of each of the three stinky cobblers solving the problem is 0.55,

0.6, and 0.65, which are relatively small, far less than the probability that Zhuge Liang can solve the problem by 0.9. However, the probability of at least one of the three stinky cobblers solving the problem is 0.937, so the combined ability of the three stinky cobblers is even higher than that of Zhuge Liang alone. From the perspective of probability, the correctness of the Chinese saying 'three stinky cobblers, top Zhuge Liang' has been explained.

At the same time, if the probability of a cobbler solving the problem is only 0.01, that is $P(A_i) = 0.01$, the probability that at least one cobbler can solve the problem is:

$$P(A_1 \cup A_2 \cup \dots \cup A_n) = 1 - P(\overline{A_1})P(\overline{A_2}) \dots P(\overline{A_n}) = 1 - (1 - 0.01)^n$$

Therefore, $n \rightarrow \infty$, $P(A_1 \cup A_2 \cup \dots \cup A_n) \rightarrow 1$, regardless of personal ability, as long as there are enough "stinky cobblers", the probability of at least one person being able to solve the problem is 1, and the problem will inevitably be solved by the "stinky cobblers". This is a good explanation of the life philosophy of "the sky is bright with many stars, the wisdom is broad with many people", "the flame is high when people gather firewood", "unity is strength", and "all people are united and united as one".

3.4 Integrating current affairs and highlighting the superiority of China's system

In the spring of 2020, the epidemic of novel coronavirus pneumonia began to break out in China. In order to ensure the life safety of people all over the country and the world, the Chinese government has formulated an active epidemic prevention policy: reduce the concentration, reduce population mobility, and close some provinces. This policy isolates provinces and enables them to form independent individuals. Assuming that the probability of each province or municipality being able to control the epidemic is 0.2, i.e. $A_i = \{\text{The } i\text{th province can control the epidemic}\} \quad i = 1, 2, \dots, 34$, And $P(A_i) = 0.2$, while

$$\begin{aligned} P(A_1 \cup A_2 \cup \dots \cup A_{34}) &= 1 - P(\overline{A_1} \cup \overline{A_2} \cup \dots \cup \overline{A_{34}}) \\ &= 1 - P(\overline{A_1} \cap \overline{A_2} \cap \dots \cap \overline{A_{34}}) \\ &= 1 - P(\overline{A_1})P(\overline{A_2}) \dots P(\overline{A_{34}}) \\ &= 1 - (1 - 0.2)^{34} \\ &= 0.9995 \end{aligned}$$

So the probability of at least one out of 34 provinces and municipalities being able to control the epidemic is almost 1. If every province and municipality directly under the central government can control the epidemic, under such an epidemic policy, there is also a possibility that all parts of the country can control the epidemic.

This indicates that various provinces and municipalities in China are bound to be able to control the epidemic, and China's epidemic prevention policies are practical and feasible. On the contrary, some countries do not actively respond to the epidemic, proclaim freedom, and do not respect life, ultimately leading to the spread of the epidemic, posing a serious threat to people's lives and safety. The comparison of the two situations shows the effectiveness of China's epidemic prevention policy and the correctness of adhering to the leadership of the CPC.

3.5 Integrating theory with practice to improve students' ability to solve practical problems

At the same time, students are required to further understand the application of independence in genetic probability, circuit systems, and currency verification machines after class, and encourage them to continue collecting practical cases related to independence, so that they can further experience

the ubiquitous nature of mathematics in life and stimulate their enthusiasm to strive to learn mathematics well.

4. Conclusion

This teaching design takes the independence knowledge points of Probability and Statistics as examples to explore how to integrate ideological and political elements into this course. The design of this lesson starts with brainstorming the "Lucky League Branch Letter" to stimulate students' interest in learning. Next, from the example of "2017 Academic Level Test Question of Zhengzhou Secondary Vocational Schools", two independent definitions of events are introduced.

Acknowledgements

The authors gratefully acknowledge the financial support from Research on the Teaching Reform and Practice of Integrating Ideological and Political Elements into the Probability and Statistics A Course of the Key Teaching Reform Project of Beijing Institute of Petrochemical Technology in 2023 (ZD202306001), the General Teaching Reform Project of Beijing Institute of Petrochemical Technology in 2022 "Probability and Statistics" Course Ideological and Political Education Research and Practice (YB202207001), and the Special Project - High Quality Undergraduate Textbook Courseware - Probability and Statistics (22032005002-6/004).

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