Research on Design Conception of Statistics and Probability in Compound Interest Mathematics Based on Flip Class

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Abstract: with China's focus on core literacy and deepening of curriculum reform, new educational concepts and teaching methods continue to attract people's attention and practice. The "compulsory education mathematics curriculum standard" for the first time included the experience of basic mathematics activities in the "four basics", reflecting its status and importance in the overall goal. On the other hand, statistics and probability knowledge are widely used in today's society, and their basic knowledge has become the basic common sense necessary for citizens. This requires schools to strengthen statistics and probability teaching so that middle school students have relevant knowledge and abilities. How to carry out teaching design from the perspective of basic mathematics activity experience to promote the effective development of statistics and probability teaching, so that students can better gain experience and use experience needs further exploration. From the perspective of basic mathematical experience, this paper investigates the current analysis of the current statistics and probability teaching design, the implementation of teaching objectives, the teaching process, and the evaluation of the teaching elements, as well as the status of students' statistics and probability knowledge. Questions: (1) teachers rarely analyze the requirements for the accumulation of activity experience in teaching materials, and cannot deeply dig into the existing activity experience foundation of students; (2) the teaching objectives lack accurate descriptions of "mathematics activity experience" objectives; (3) cannot appropriately adjust the presentation order of teaching material content and teaching difficulties according to the level of experience; (4) lack of formative evaluation of student activities; (5) students recognize the importance of mathematical activities, but do not have the consciousness of accumulating experience in mathematical activities .

1. Introduction

The flip classroom teaching model originated in american woodland parks. The school's two chemistry teachers, jon bergmann and aaron sams, observed that when students really needed teacher help, they were stuck when they had problems doing their homework, and the transfer of knowledge could be done by the students' self-study after class. Therefore, the two teachers gradually constructed a flipped classroom teaching mode that reversed the process of knowledge transfer and knowledge internalization in classroom teaching by means of information technology. At present, the flip classroom teaching model is popular in many schools in the United States. In 2011, Salman khan founded the khan academy by combining learning resources and school learning based on the development of online video courses, creating a new concept of a global world classroom, making the flipped classroom teaching model a teaching model that the global education community is concerned about. . At the same time, the flipped classroom teaching model has also attracted high attention from colleagues in the domestic education community, and has become a banner in the practice of education and teaching. Based on the study of the flipped classroom teaching model, this paper builds a flipped classroom teaching model based on bloom's teaching target classification theory, and attempts to apply the flipped classroom teaching model to the design of mathematics teaching, which provides some references for the innovation of china's mathematical teaching model.

2. Elements of Flipping Classroom Teaching Models

The flipped classroom teaching model is based on the grasp of learning theory. Mastering learning theory was proposed by American educator Benjamin Bloom, who believes that learners can master the learning content and get good grades given sufficient time and appropriate learning conditions. Mastering the learning theory takes target teaching as the core, feedback correction as the means, and the purpose of mastering learning. The flipped classroom teaching model is just a bridge for the realization of learning theory. As a carrier of knowledge transfer, instructional videos provide the best teaching for students' autonomous learning. Students can learn the course content at their own pace in sufficient time after class. After completing the class or unit learning, students can take self-test exercises or use online assessment methods to check what you have learned, and corrective learning for the content that you haven't mastered, to make up for the lack of knowledge and achieve the purpose of mastering learning. Therefore, the flipped classroom teaching model based on mastering the learning theory has become a useful practice for personalized teaching. Based on the theory of constructivism, the flipped classroom teaching model is a cognitive construction process that, based on the teacher's promotion and guidance, allows students to independently discover problems, seek answers, and obtain conclusions through independent inquiry or group collaborative discussions, which deeply reflects the problem-based approach. Centered, student-oriented teaching philosophy.

In the flipped classroom teaching model, students complete the transfer of knowledge through autonomous learning lessons outside the classroom, thus replacing the teacher's teaching process in classroom teaching. The original activities of students doing homework were transferred to the class, and the internalization process of knowledge was completed through the collaborative exploration and in-depth exchanges between students and teachers and students, completely overturning the traditional classroom "learning + homework" process.

The flipped classroom teaching model reforms the organization of class teaching in the traditional teaching model. Teachers create autonomous exploration and collaborative learning environments for students based on problems, and provide personalized teaching based on the needs of different students, tapping as much as possible inside each student Potential to promote the personality development of students, so as to achieve the ultimate goal of teaching.

Inverted classroom teaching mode enables teachers to transform from the traditional knowledge teaching and classroom administrators to the guides and facilitators of student learning, and to become partners in interaction with students. In the learning environment, the "audience" who passively receives knowledge has become an active explorer in learning activities. The flipped classroom teaching mode helps to achieve the teaching purpose of student-centered in-depth internal knowledge.

Micro-curriculum, or micro-curriculum, is a new concept emerging from the flipped classroom teaching model. Micro-learning refers to a small course with less than 10 minutes and clear teaching goals, short content, and focused on explaining a problem. Micro-teaching usually takes micro-video as the form of expression, and it has become the most important part of teaching resources of flipped classroom teaching mode. Students can use the video player's pause and playback functions while watching instructional videos, take notes and think in time, control the progress of learning independently, and facilitate a period of consolidation and review. The flipped classroom teaching mode can not only enjoy school resources during the class, but also provide rich learning resources for students' off-class learning through cloud resources provided in the social environment.
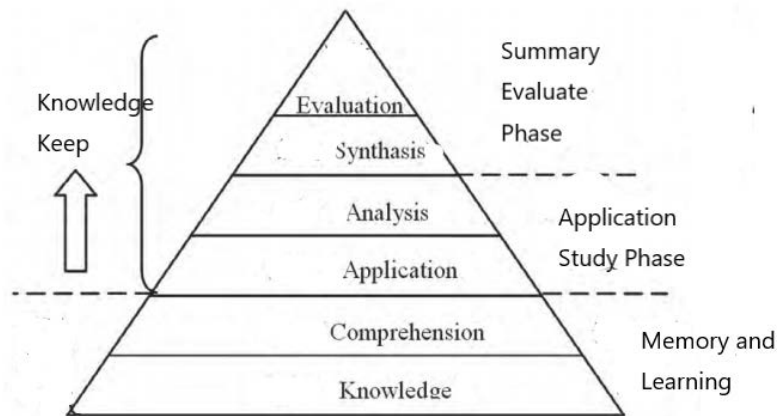
Fig.1 Flip Classroom Teaching Based on Bloom's Teaching Goal Classification

3. Positioning of Statistics and Probability in Mathematics

As a citizen of today's world, learning the necessary statistics and probability knowledge is a requirement of life and a requirement of the development of the times. "The mathematical knowledge that every citizen needs to know in the 21st century is most important to process data." Therefore, strengthen statistics The content of probability is one of the main trends in the reform of mathematics courses in the world. The Standard fully reflects this trend. Compared with the previous syllabus, the content of statistics and probability is significantly strengthened. The content enables students to experience the entire process of data statistics, emphasizing the development of students 'statistical concepts; through intuitive perception and simple analysis of the uncertainty and possibility of events, enhancing students' understanding of randomness; through "sampling" In the study, the sample is used to estimate the overall idea of the sample. Statistics and probability in mathematics, as a supplement and continuation of the obligation section, must reflect both cohesion (connection with the obligation section) and development. From these two aspects To consider, the author believes that the content of statistics and probability in mathematics should expand students 'understanding of randomness, further develop students' statistical concepts, and promote Round development of students thinking ability.

The understanding of randomness comes from the experience of the possibility of random events. Although students have obtained a preliminary understanding of randomness in the compulsory period, due to the limitation of the students' thinking level, the possibility of random events is passed Obtained through intuitive feelings and simple analysis, the knowledge of randomness still basically stays at the level of perceptual knowledge, so the content of probability should be based on the description and characterization of random events, and set up "knowledge of probability" and "random events" "Probability" and "Quantitative Quantification of Random Events" to expand students' understanding of randomness. "Knowledge of Probability" aims to clarify that probability is a mathematical model that describes the possibility of random events; "Probability" enables students to recognize the possibility of common events in daily life, such as equivalent possible events, mutually exclusive events, and independent events; "Quantitative random events" aims to enable students to use functional ideas to characterize random events. The random variable distribution column is a mathematical model that completely characterizes the randomness of random phenomena. Events in the abstract mathematical model and rise to the use of mathematical tools laid the foundation for future research randomness students.

Statistical concepts mainly include statistical awareness, statistical methods, and correct understanding of statistical results. Although these three aspects are reflected in the Standards, students' statistical concepts need to be further improved. First, as an important part of statistical concepts, the statistical methods need to be supplemented, especially the mathematical statistical methods are not sufficiently involved in the Standard (only the content of point estimates). Second,

the understanding of statistical results needs to be further improved. In most cases, the statistical results are presented probabilistically. There may be errors. In the obligatory section, students lack sufficient knowledge of the probability of statistical results. Therefore, the topics of "interval estimation", "hypothesis testing", and "maximum likelihood estimation" have been set up in the statistical content. These topics the unfolding can not only enrich the statistical methods grasped by students, but also enable students to further experience and understand the probability of statistical results. "Data fraud and misuse in media information", "experimental design", "statistical survey" and other topics It is a supplement and extension of the statistical content of the obligation section. The Standard clearly states: According to the source of the data, the method of processing the data, and the reasonable results of questioning the results obtained " is one of the main manifestations of statistical concepts, and data fraud and abuse in social media information occur from time to time. "Data fraud and misuse in media information" is not only a need to cultivate students 'statistical concepts, but also is conducive to the development of students' critical thinking; collecting data is an important part of statistical work. In many practical situations, there is no ready-made data, and experimental design It is an important means to collect data. Therefore, "experimental design" is an important supplement to the statistical process learned in the compulsory section. In addition, "statistical survey" is designed to enable students to have a deeper experience of the entire statistical process. Statistical investigation at the stage should be combined with experiments Design and collect data through experimental design. The topic of normal distribution is also selected in the content of the statistics part, on the one hand, because the normal distribution is widely used, and on the other hand, because the normal distribution is interval estimation, hypothesis testing basis.

The basic idea of mathematical statistics is to infer the population from parts. For example, interval estimation and hypothesis testing are to infer the characteristics of the population from the information obtained from the samples. This inference is actually an inductive reasoning. The result of the reasoning cannot be strictly proved and its accuracy is accurate. Sexuality and reliability are purely in the sense of probability. This inductive reasoning with probabilistic properties is completely different from deductive reasoning and inductive reasoning in deterministic mathematics. For students, this reasoning is brand new Thinking mode. In fact, this thinking mode has a wide range of applications in life. For example, when a doctor diagnoses a disease, by observing the patient's face and tongue coating, measuring the patient's temperature and pulse, testing the patient's blood and other relevant indicators, inferring the patient's illness. Disease. We see that the doctor's reasoning is not strictly deductive reasoning. He summarizes the rules between various types of diseases and their external manifestations based on predecessors (including medical and physiological literature) and his own research on a large number of diseases. , And then make a diagnosis of the disease according to these rules, no matter what, the cases that doctors have studied are always limited, so the rules obtained It is not impeccable, and the diagnosis of the disease according to the law cannot be guaranteed to be absolutely correct, but if the accuracy of the diagnosis reaches a high degree, then the diagnosis is basically reliable on the whole. Therefore, mathematical statistics This inductive reasoning with probabilistic nature is helpful to the overall development of students' thinking.

4. Content Selection and Target Requirements and Content Presentation Principles

Understand the statistical regularity of random events. Understand the meaning of the probability of random events and the frequency as an estimate of probability through specific situations. With specific examples, recognize probability is a mathematical model that describes the possibility of random events. Understand the classical probabilities and their probability calculation formulas through rich examples, and use the enumeration method to calculate the number of basic events and the probability of occurrence of events (without permutations and combinations, to avoid overly technical problems). The example understands the geometric profile and probability calculation formula, and can calculate the probability of the event by simply calculating the length, area, and volume (to avoid problems with too high skill). Estimate the probability by simulation. Use the

simulation method to calculate the frequency to estimate the simplicity the probability of a random event.

The design of statistics and probability content in mathematics should provide students with a wealth of intuitive background materials to enable students to gain a certain experience. Based on this, they should focus on revealing the basic concepts and ideas of statistics and probability to students. With the help of student experience, it is appropriate and intuitive. Under the guidance of the principle of highlighting ideas, mathematical statistics such as normal distribution, hypothesis testing, and maximum likelihood estimation can be entered into mathematics courses. For example, the presentation of this part of the normal distribution can be designed as follows: combined with typical examples (The data distribution involved in this example is a normal distribution or an approximate normal distribution.) Students should first be asked to find the mean and standard deviation of this set of data, then list the frequency distribution table, and then draw a frequency percentage histogram, and frequency percentage. Polygons and other processes gain intuitive experience of normal curves (with x = ц as the axis of symmetry, the graph shows a "high in the middle, low at both ends"), by observing the normal curve, understand the nature of the normal distribution a data (The further away from the mean, the less frequently it appears, and the degree to which the data deviates from the mean is measured in standard deviation.) Obtaining does not require strict reasoning and demonstration. It is gradually experienced by students through the column frequency distribution table, drawing frequency percentage histograms, frequency percentage polygons, and other processes. If this property is obtained, then the students already have a normal distribution I have a deeper understanding, and the normal distribution table is a concrete reflection of this property. It is entirely possible to solve many practical problems by looking at the normal distribution table without introducing the normal distribution density function and distribution function. Assumptions Tests and maximum likelihood estimation must also highlight ideas. Through specific examples, with the help of students' intuitive experience, students can understand the "Principles of Practical Inference" and "Principle of Maximum Likelihood." Mathematical textbooks in two provinces and one city (experimental) (Vol. 3) (People's Education Press) The basic idea of hypothesis testing is highlighted through the topic "Quality Control Charts in Production Process". This processing method is intuitive and can be used for reference.

In the presentation of statistics and probability content, only by providing students with a large number of practical opportunities and allowing students to personally experience statistics-related activities, can they consciously think about relevant issues from a statistical perspective. When encountering relevant issues, they can think of collecting them. Data and analysis of data, and then making decisions, only by truly investing in the exploration and research activities that use statistics and probability to solve practical problems, can we have a deeper understanding of statistics and probability ideas. The presentation of statistics and probability content can provide students with The following practical activities: use the maximum likelihood principle to estimate the total number of fish in a pond, the number of bicycles in a school, apply a classical profile to design a lottery winning scheme for a manufacturer, and experience and analyze the game by playing dice or coins. Fairness; Inferring the use of English letters in English books; Estimating the probability of random events through computer simulation; Investigating the situation of students watching TV programs in a school, etc. Practical activities can be done through "do it yourself" and "try it" , "Writing a small paper," "Writing a survey report," etc. Students. Because many practical problems take a long time to solve, and the practical problems are complex and workload, so the provision of practical opportunities must be combined with classroom and extra-curricular, students' independent thinking, independent exploration and students the combination of cooperation and communication, hands-on operation and exploration and research. Statistics and probability are powerful tools for people to make decisions. In this part, the creation of problem situations can enable students to better understand statistics and probability ideas for decision-making. It can enhance students 'awareness of using statistics and probability to solve practical problems and improve their ability to apply mathematics. Problem situations can be practical problems that are closely related to students' daily life and learning. Such as the relationship between lottery and order, lottery The problem of

the winning rate, the fairness of the game, etc. It can also be some interesting and realistic mathematical problems, such as the problem of bet allocation, Merley's gambling problem, etc. The problem situation can be determined by situation maps, stories, games, etc. This form is presented.

Probability is the science of studying random phenomena. Random phenomenon refers to a phenomenon in which the same test is repeated under the same conditions, and the test results are uncertain, so that it is impossible to predict which result will appear before the test. There is no rule to follow, which result is unpredictable in advance, but when we repeat the experiment a lot, each result of the experiment will show the stability of its frequency. The core problem of probability teaching is to let students understand the meaning of random phenomena and probability. .Lack of rich experience of random phenomena, students often have difficulty in establishing random ideas. If in probability courses, students are only required to deal with relevant data about random problems that have been collected, students often use these data as definite numbers In fact, their random ideas have not been developed. To enable students to establish random ideas, they must design practical problems or games that are familiar and interesting to students, let them personally experiment and collect random data in the original random environment, Enable them to gradually enrich their knowledge of probability in their activities and accumulate A lot of experience in activities, and experience the characteristics of random phenomenon. Teachers should encourage students to experiment with a large number of examples in daily life, and experience the uncertainty of random events and the stability of their frequency. For example, students can be collected from students of the same grade Height, weight, collect the pulse beats per minute of the same classmates, collect payment data from customers in a store in a certain period of time, collect sports lottery numbers, collect daily weather forecast data from TV stations, etc. The familiar and interesting random environment makes it easier for students to associate the new knowledge to be learned with their original experience and intuition. The principle of focusing on understanding random phenomena and the meaning of probability should run through the teaching of probability. The study of simulation methods is both a very effective and widely used method. When real-world experiments are difficult or impossible, simulation can provide us with a solution. More importantly, the study of simulation methods will It is very helpful for students to experience the characteristics of random phenomenon. To study the distribution of variables, the first thing is to make students understand the meaning of distribution to describe random phenomena. In fact, to understand the law of a random phenomenon means to understand all the possible results and the probability of each result in this random phenomenon. To this end We first introduce a variable, and each value of this variable corresponds to a possible result of the random phenomenon. This variable is a random variable. After the introduction of a random variable, understanding the rules of random phenomena translates into understanding all of the random variables. Possible values, and the probability of each value of the random variable. Once we understand these two points, we will say that the law of this random phenomenon is clear.

Calculating the probability of occurrence of random events is an important part of probability learning. For this aspect of learning, the first thing is to understand and apply various probability models, rather than focusing on applying formulas. In teaching, we should focus on using Students experience the process of summarizing specific probabilistic models from multiple examples, and experience the common characteristics of these examples; focus on understanding the characteristics of various probabilistic models, and cultivate students' ability to identify models in practical problems. For example, for classical The type of teaching should allow students to understand the characteristics of classical probabilities through examples: the finiteness of experimental results and the possibility of each experimental result appearing, so that students can learn to turn some practical problems into classical probabilities. Put it on "How to count". In fact, before the study of the classical standard, "Standard" did not arrange the content of permutations and combinations, which also showed that the permutations and combinations were not the basis for learning the classical outlines and did not promote students. An understanding of random phenomena. In this regard, David S. Moore, a professor of statistics at Purdue University, once said Road 2: "Learning combinatorics does not allow us to improve our understanding of the concept of

opportunity, nor does it develop the ability to use probabilistic modeling more than other disciplines. In most cases, combinatorial problems should be avoided, except for the simplest counting problem".

5. Focus on Building the Right Probability Intuition

Students have some life experiences. These experiences are the basis of students' learning probability, but often some of them are wrong. For example, if a uniform coin is tossed randomly, many students think that "100 positives and 50 positives" are inevitable. Or, in other words, its probability should be very large, but calculations show that this probability is only about 8%. Another example is that for a lottery with a winning rate of 1/1000, some students think that buying 1,000 tickets will definitely win, but actually buying 1,000 tickets will The probability of winning is about 63%; toss a uniform coin 5 times, and the upward side is the front side, and the sixth time it should be the front side or the reverse side. Some students think it should be the front side and some think it should be the reverse side. In fact, no matter what the results of the previous 5 experiments are, due to the independence of the experiment, the probability of a positive and negative appearance at the 6th time is 12 and has nothing to do with the previous test results. Eliminating the wrong experience step by step and establishing the correct probability intuition is An important goal of probability teaching. To achieve this goal, students must personally experience the process of exploring random phenomena, and guide students to first guess the probability of the result; then Perform experiments by hand, collect experimental data, analyze the experimental results, and compare the obtained results with your own guesses; finally, you can build a theoretical probability model and link them with actual results. In the process, students continue to make their initial guesses, Comparing experimental results with theoretical probabilities, this will facilitate them to correct their wrong experiences and establish correct probability intuition. For example, for the probability of "50 tossing a coin and 50 heads", someone gave a simulation of a uniform coin toss Experiment (see "Probability Theory and Its Application" by Feller), this experiment is equivalent to 100 people, each of whom tossed 100 uniform coins, and recorded the number of times they each flipped their heads as follows:

$$54, \quad 46, \quad 53, \quad 55, \quad 46, \quad 54, \quad 41, \quad 48, \quad 51, \quad 53,$$
$$48, \quad 46, \quad 40, \quad 53, \quad 49, \quad 49, \quad 48, \quad 54, \quad 53, \quad 45,$$
$$43, \quad 52, \quad 58, \quad 51, \quad 51, \quad \underline{50}, \quad 52, \quad \underline{50}, \quad 53, \quad 49,$$
$$58, \quad 60, \quad 54, \quad 55, \quad \underline{50}, \quad 48, \quad 47, \quad 57, \quad 52, \quad 55,$$
$$48, \quad 51, \quad 51, \quad 49, \quad 44, \quad 52, \quad \underline{50}, \quad 46, \quad 53, \quad 41,$$
$$49, \quad \underline{50}, \quad 45, \quad 52, \quad 52, \quad 48, \quad 47, \quad 47, \quad 47, \quad 51,$$
$$45, \quad 47, \quad 41, \quad 51, \quad 49, \quad 59, \quad \underline{50}, \quad 55, \quad 53, \quad \underline{50},$$
$$53, \quad 52, \quad 46, \quad 52, \quad 44, \quad 51, \quad 48, \quad 51, \quad 46, \quad 54,$$
$$45, \quad 47, \quad 46, \quad 52, \quad 47, \quad 48, \quad 59, \quad 57, \quad 45, \quad 48,$$
$$47, \quad 41, \quad 51, \quad 48, \quad 59, \quad 51, \quad 52, \quad 55, \quad 39, \quad 41.$$

A total of 10,000 tosses were made here, and the number of positive appearances, that is, the sum of the above 100 numbers, was 4979, which indicates that the frequency of positive appearances is 0.4979, and the coin can be considered to be uniform. On the other hand, among the above 100 numbers, 50 appeared 7 times. That is, the frequency of "tossing 100 coins, and 50 positive heads" is 7/100, which is not much different from 0.08. The above experimental data will undoubtedly help students to eliminate wrong experiences.

The widespread application of calculators and computers not only makes information more and more expressed in the form of data, but also enables students to focus on understanding the meaning of statistics and probability. Calculators can handle complex data, and computers can greatly improve data the effect of sorting and displaying, in terms of establishing, recording and

researching information, provides students with a good tool that can give students ample time to study problems in the real world and understand statistical thinking methods. When experiments are performed on phenomena, calculators and computers can produce enough simulation results to enable students to understand the characteristics of random phenomena. Therefore, in teaching, emphasis should be placed on the use of calculators to process complex data so that students have more energy to process A more realistic question: For places where conditions permit, the role of computers should be fully developed and utilized to play its role in processing data and conducting probability simulation experiments.

6. Conclusion

In mathematics teaching, a new flip classroom teaching mode is adopted. The quality of recorded teaching videos, the teacher's guidance to students, the arrangement of student learning time, and the organization of classroom activities all have an important impact on the quality of teaching. Therefore, it affects the information literacy of mathematics teachers Capacity building is essential. At the same time, the flipped classroom teaching mode requires students to have good self-learning ability and information literacy in order to make good use of instructional videos to learn and answer their questions in learning activities. In short, the main purpose of statistics and probability teaching is to enable students to experience the basic ideas of statistics and probability. Statistics and probability teaching should provide realistic problem situations, pay attention to the background of problems and the application of statistics and probability in daily life and science. Students are truly involved so that they are faced with the problem to be solved, actively designing solutions, collecting data, processing data, making decisions, seeking arguments to maintain their views, and discussing and communicating with others, which will enable them to Lifetime income.

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