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Reflection on Implementing Data Concept in the Junior High School Mathematics Classroom

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

As one of the core literacy proposed by the *Mathematics Curriculum Standards for Compulsory Education (2022 Edition)*, the implementation of the data concept in the current junior high school mathematics classrooms has attracted much attention in China. This paper used the method of theoretical research, through in-depth and systematic analysis of the meaning of data concept literacy in curriculum standards and the requirements for junior high school students, through literature review, in-depth and systematic analysis and induction of the current teaching situation, as the theoretical basis of this study, four suggestions were put forward: 1. Design implementable statistical activities; 2. Focus on summarizing the similarities and differences and characteristics of data analysis methods; 3. Use of multimedia emerging technologies to assist teaching effectively; 4. Design the topic of probability to carry out special training, hoping to provide ideas for better development of junior high school mathematics teaching.

Keywords: Core literacy of mathematics subject; data concept; junior high school.

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1. INTRODUCTION

The Curriculum Standards for Compulsory Education (2022 Edition) clearly points out that the concept of data, as one of the important manifestations of the core literacy in the compulsory stage, is conducive to students' understanding and perception of the occurrence of random phenomena in reality. The importance of data analysis in the context of the era of big data is conducive to the development of students' ability to solve practical problems and is the basis for the formation of high school data analysis literacy [1]. The data in the junior high school stage are mainly as follows : average, mode, median, variance, statistical charts, random sampling, etc.So what is the connotation and characteristics of the core literacy of data concept? What is the current situation of junior high school mathematics teaching? To cultivate students ' data concept literacy, what measures should be taken in practical teaching? This paper will analyze the above problems.

2. ANALYSIS OF DATA CONCEPT LITERACY

The Curriculum Standards for Compulsory Education (2022 Edition)(hereinafter referred to as the *Curriculum Standards*) points out that the concept of data is a clear understanding of the meaning and randomness of data. The concept of data is an important manifestation of the core literacy of the compulsory education stage. For the core literacy of the data concept, the *Curriculum Standards* proposes the following training objectives [1]:

2.1 Able to Know the Data Contains Information

Data refers to the symbols that record and identify objective things. It is a combination of physical symbols and physical symbols that record the mutual state of objective things [2]. The purpose of this requirement is to enable students to understand that the actual information is contained in the data and to understand the significance of the data. Students should know that the data is a basic language of statistics and that the data generally has its practical meaning, and it can be collected, collated, and analyzed. Data extraction can effectively analyze the information of practical problems.For example, the average, median, and mode can describe the concentration level of this set of data, and the variance and range can describe the discrete level of this set of data [1].

2.2 Methods of Collection, Collation and Analysis can be Determined According to the Background of the Problem and the Problem to be Studied

The information contained in the data is often not obvious. After the receipt is collected, it is usually necessary to use appropriate methods to sort out and analyze it, and to mine and express the information contained in the data. This request requires that students should be able to master a variety of data collection, collation, analysis methods, and be able to analyze specific problems. According to the different problems to be studied and their backgrounds, appropriate data processing methods should be adopted to solve problems in a targeted and efficient manner [2]. Students should not only understand the methods of collecting, sorting and analyzing data such as random sampling, questionnaire survey, drawing statistical charts, and seeking average variance, but also need to choose specific methods according to the problem situation.

2.3 Able to Know How to Describe the Trend of Random Phenomena and the Likelihood of Random Events Occurring Quantitatively

The quantitative method refers to the use of numerical values to express the desired things; random phenomenon refers to the phenomenon that may or may not occur under certain conditions; the changing trend of random phenomenon refers to the overall movement trend or development direction of the random phenomenon in the future time. Random events may or may not occur in a single randomized trial, but they show a regular event in a large number of repeated trials [3]. The likelihood of random events occurring is measured by their probability. This goal hopes that students can use mathematical language to describe the overall movement trend or development direction of random phenomena at a specific time in the future based on a deep understanding of random phenomena and random events and use probability to explain the likelihood of random events. For example, students can use the obtained probability to explain the same possibility of coin tossing in the positive and

negative sides, and understand that the probability of inevitable events such as ' water flowing low ' is 1, which will certainly occur, and the probability of impossible events such as ' the sun rises from the west ' is 0, which will not occur [1].

3. CURRENT SITUATION OF TEACHING AND LEARNING

3.1 The Lack of Practice Teaching of Statistical Activities

Due to the limitation of class time, the heavy teaching task, and the time-consuming experience of the whole process of statistics, many middle school teachers only use the teaching method when teaching statistical knowledge, and just impart the existing content in the textbook to students by words [4]. There are fewer arrangements for real and operable statistical activities, fewer opportunities for students' hands-on practice, and a lack of exploratory activities [5]. Interactive communication is also mostly "teacher-student interaction". Although there is inquiry learning in class, teachers only pay attention to the results of inquiry, and "group discussion" is too formal and inefficient [6].

3.2 Pay Attention to the Teaching of Methods and Ignoring the Solution of Problems

In recent years, curriculum standards emphasize that teaching should be process-oriented and method-oriented. Teachers gradually abandon the previous teaching methods that pay too much attention to results, and gradually attach importance to explaining the process of exploring knowledge methods. However, in classroom teaching, teachers often only pay attention to the teaching of method principles and operation steps, but ignore how to apply these methods to the teaching of solving practical life problems, and rarely involve how to choose appropriate methods in specific situations [5]. It is difficult for students to make accurate choices when facing the background of practical problems, and the ability to solve problems is difficult to be improved [7].

3.3 Improper Use of Mathematics Teaching Software

Mathematics teaching software has the advantages of being intuitive and efficient, and it is widely used in contemporary junior high school mathematics Statistics classes, but there are some improper uses. Many teachers tend to formalize the use of mathematics teaching software, presenting all the teaching process on the smart board in advance, which makes it difficult to use information technology flexibly according to the teaching effect [4]. Many teachers have serious abuse of multimedia teaching, randomly download the existing courseware of different quality on the network, and lack the necessary blackboard writing teaching [8].

3.4 Some Teachers Give Priority to Teaching, Ignoring the Practice of Students

In the current mathematics class, as some teachers are influenced by traditional teaching and the reasons for the heavy teaching tasks and the large number of classes, the mathematics class is still dominated by teaching, and the students have less practice. Students' exercises are mostly in the form of homework after class. There is not much time for real guided exercises, and the practice effect is difficult to guarantee. The teachers' explanation of the problem in the classroom is also mostly one-way teaching. The students only listen by ear, the sensibility is not strong, the computing ability is weak, and it is difficult to really master the thinking method and form the knowledge system [7].

4. IMPLEMENT DATA CONCEPT LITERACY RECOMMENDATIONS IN THE CLASSROOM

To implement the core literacy of data concept in the actual class and improve the teaching effect, this paper puts forward the following suggestions to junior high school teachers [9]:

4.1 Design Implementable Statistical Activities

This strategy suggests that teachers should design clear statistical activities based on the teaching objectives and teaching content, based on grasping the class time and starting from the actual life of students. Let students experience the statistical process of sampling and collecting data, drawing statistical charts, analyzing and sorting out data, and inferring predictions.

Through the analysis of the above data concepts and teaching status: One of the requirements for students in the *Curriculum Standards* is that students should know that the data contains information, which requires students to know that the data contains practical significance, that the data is the carrier of information, and that the actual information in the data needs to be extracted through certain statistical steps. One of the current teaching situations is the lack of practical teaching of statistical activities in class. Students lack personal experience in the process of completing statistical activities, and their sensitivity is not strong, so it is difficult to understand the information contained in the data. Therefore, the current teaching should design a complete and implementable statistical activity. Statistical activity is an important way for students to understand the practical significance of data and improve their data concept literacy [9]. Students experience statistical processes such as simple sampling, data collection, data collation, and data analysis, use statistical methods to solve practical problems, and can understand the actual information contained in the data. Students' personal experience of complete statistical activities can enrich their direct experience and understand the information contained in the data. The hands-on operation can deepen students' understanding of the data and effectively improve the core literacy of the data concept.

4.2 Pay Attention to the Summary of Data Collation and Analysis Methods to Improve Students ' Problem-Solving Ability

This strategy suggests that teachers should strengthen students ' understanding of data collation and analysis methods, not only introduce the principle, derivation and method steps of each data processing method, but also pay attention to the summary of each data analysis and collation method, introduce the similarities, differences and characteristics of each method so that students can consolidate and understand the advantages and disadvantages of specific methods and operation steps in specific exercises until they understand and master them, and improve their problem solving ability [5].

Through the analysis of the above data concepts and teaching status: The *Curriculum Standards* requires students to be able to determine the methods of collection, collation, and analysis based on the background of the problem and the problem to be studied. This requires students to be able to fully grasp the various data collection, collation, and analysis methods, and fully consider the characteristics of various methods. Select the appropriate method of data collection, processing and analysis according to the characteristics of the problem situation. One of the current teaching situations is that the teachers pay attention to the explanation of methods but ignore the solution of problems. It is difficult for students to choose appropriate methods according to the problem situation. Therefore, this strategy requires teachers to pay attention to the comparison of the similarities and differences of data processing and analysis methods in the classroom. Knowing the similarities and differences between methods is conducive to students' horizontal comparison and analysis of the characteristics, advantages and disadvantages of various methods. It is helpful for students to choose suitable data analysis methods according to the characteristics of the data and the problem situations to be solved [5]. This strategy can not only enable students to experience the rigor of mathematics, and improve logical thinking ability, but also cultivate students' concept of data analysis.

4.3 Use of Multimedia Emerging Technologies to Assist Teaching Effectively

This strategy suggests that teachers should flexibly use multimedia software such as PPT, Flash and Excel to assist the teaching of statistical knowledge in classroom teaching according to the teaching objectives and contents, and use the above software to carry out data collection, sorting, screening and other processing, drawing statistical charts, simulating random experiments and other statistical activities [10].

Through the analysis of the above data concepts and teaching status: One of the requirements of the *Curriculum Standards* for the core literacy of students' data concepts is that students can use quantitative methods to describe the trend of random phenomena and the possibility of random events. This requires students to be able to understand the randomness of random phenomena and random events in random experiments, and to experience the significance of probability in a large number of repeated experiments. Modern emerging technologies can simulate a large number of repeated random

experiments and use software to show the changing trend of random phenomena by analyzing data. Students can feel the randomness of random linearity and intuitively understand the significance of random event probability, making up for the shortcomings of blackboard teaching. One of the current teaching situations is that modern information technologies widely exist in junior high school mathematics class, but it is improperly used and too formalized. It is only used as a display of knowledge points and cannot give full play to its effectiveness. Therefore,this strategy requires teachers to reasonably and effectively use the corresponding modern information technology to assist teaching, use multimedia technology to draw statistical charts, simulate a large number of simple random experiments, etc., to help students understand random events and understand the significance of probability,enrich students' perceptual experience, and comprehensively improve students' core literacy of data concepts [4].

4.4 Design Probability Topics for Thematic Training

This strategy requires teachers to set up probability topics in the statistics class based on teaching objectives and teaching content, lead students to carry out probability calculation exercises, describe the possibility of random events according to the calculation results of probability, learn the calculation of probability, and understand the significance of probability [11].

Through the analysis of the above data concepts and teaching status: In the *Curriculum Standards*, students are required to use quantitative methods to describe the trend of random phenomena and the possibility of random events. The possibility of random events is the probability of the event. This requires students to predict the trend of random events and describe the possibility of random events by calculating the probability of random events. One of the current teaching situations is that many math teachers focus on the teaching of knowledge points in their class, so that students have fewer opportunities to practice and their sensitivity is not strong, and their thinking methods are relatively simple. Therefore, this suggestion requires teachers to carry out special training on probability topics in the classroom, so that students can calculate the possibility of simple random events in a quantitative way, describe the size of the possibility of random events through the results, predict the changing trend of random phenomena, understand the significance of probability and develop the core literacy of data concept, students summarize the thinking methods, improve mathematical thinking, and develop the core literacy of data concepts [12].

5. CONCLUSION

In the *Curriculum Standards* junior high school mathematics classes are required to pay attention to the improvement of students' "core literacy". Therefore, measures must be taken to implement the cultivation of core literacy in junior high school mathematics classroom teaching. Through in-depth and systematic analysis of the meaning of data concept literacy in curriculum standards and the requirements for junior high school students, through literature review, in-depth and systematic analysis and induction of the current teaching situation, this paper believes that teachers should design implementable statistical activities in the classroom, pay attention to the summary of data collation and analysis methods to improve students ' problem-solving ability, effectively use multimedia emerging technologies to assist teaching, design probability topics for thematic training, etc., guide students to form a rational thinking method of "speaking with data"and constantly develop students' data concept.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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