Review Article

Research on the Cultivation Strategy of Junior High School Students ' Mathematical Data Concept in China

Abstract: With the continuous development of the big data era, data analysis is appearing more and more frequently, and the corresponding data concept is becoming more and more important. Many scholars have conducted relevant research on the cultivation of junior high school students ' data concept, however, few relevant findings have been summarized. Through the method of literature analysis, this paper reviews and sorts out the research on the cultivation of data concept of Chinese junior high school students, and draws the following conclusions: 1. The cultivation strategy of data concept of Chinese junior high school students is mainly studied from three aspects: before class, in class, and after class; 2. Previous studies have put forward more strategies for the cultivation of junior high school students ' data concept from the perspective of the classroom, and there are few studies on pre-class and after-class aspects; 3. Researchers mainly use four research methods: literature research, questionnaire survey, case analysis, and interview; 4. Most of the suggestions and strategies given by scholars are from the perspective of teachers, and there are gaps in the perspective of students. Therefore, in the future, it is essential for improving the research methods and conducting research from a broader perspective in order to find more reasonable and specific suggestions and strategies.
Keywords: Data Concept; Junior High School; Mathematics

1. INTRODUCTION

Compulsory education mathematics curriculum standard (2022 edition) points out that mathematics curriculum should cultivate students ' core literacy so that students can express the real world in mathematical language, and one of the manifestations of mathematical language is the concept of data. The concept of data helps students understand and express the law of random phenomena in life, and develop a scientific attitude that emphasizes evidence and reasoning [1]. Therefore, it is essential for studying the cultivation strategy of junior high school students ' data concept. At present, there are many studies on the cultivation strategy of Chinese junior high school students ' data concept, but there are few overview studies on this topic. Therefore, this paper intends to review and sort out the current research, systematically analyze the research situation of this topic, and provide a corresponding strategic reference for how to cultivate junior high school students ' data concept. More importantly, finding out the blank points can promote scholars to further study.

The question studied in this paper is: What is the research situation of the

"cultivation strategy of junior high school students ' mathematical data concept in China"? Specifically, it includes the following two aspects:

(1) What aspects have scholars studied on the cultivation strategy of junior high school students ' mathematical data concept? What are the main results? What are the main methods used?

(2) Which areas are currently being studied more? Which aspects are less researched? What are the deficiencies? Are there any blank points?

2. METHOD

2.1 Data Source

This paper selects the literature in the CNKI (China National Knowledge Infrastructure) database as the sources of data. CNKI is the most authoritative document retrieval tool in Chinese academic journals, which approximately contains all the contents of Chinese journals. This database can ensure persuasion and reliability.

2.2 Data Collection

Through the advanced search of CNKI, the two subject words ' data concept ' and ' junior high school ' were retrieved at the same time, and a total of 38 articles were retrieved. Keep 25 articles related to the topic after reading them one by one. In addition, four articles were selected according to their relevance and publication time by searching the subject word ' data concept '. Therefore, these 29 articles are analyzed in depth.

2.3 Data Collation

Through the intensive reading of the literature, the author uses the method of taking notes to summarize the research contents, research methods, and research results in previous studies.

3. RESULTS

3.1 Research Aspects and Categories

After reading 29 articles, we found that the research on the cultivation strategy of junior high school students ' mathematical data concept in China mainly involves three aspects: how to cultivate data concept before class, during class, and after class. All strategies are roughly divided into 19 categories, namely: (1) Creating real situations and connecting with reality to cultivate students ' data concept; (2) In-depth analysis of data with tools such as charts; (3) Creative use of teaching materials and accurate grasp of key points; (4) Using questions as a driving force to develop students' thinking; (5) Effective application of information technology to support teaching and learning; (6)Rationalizing instructional design; (7) Encouraging students to participate in data analysis activities and focusing on their overall experience; (8) Experiencing randomness through data analysis to help students understand its characteristics; (9) Focusing on infusing the concept of data in teaching; (10) Conducting integrated practical activities to develop students' data concept; (11) Teachers themselves should be prepared for the probability and statistics section; (12) Teachers should improve the teaching mode and focus on the guidance of students; (13) Creating opportunities for students to learn to think and discuss; (14) Strengthening the training of students' analogy skills; (15)

Implementing differentiated instruction; (16) Strengthening the integration of statistics and probability knowledge with other knowledge; (17) Strengthening the teaching of methods, paying attention to the guidance and generalization of methods; (18)Improving teaching evaluation methods; (19) Enhancing students' verbal expression of data concept and promoting the development of their data analysis thinking. The details of the number of occurrences of each type of strategy in all articles are shown in Table 1.

Table 1: Research Aspects and Categories on the Cultivation Strategy of Junior High School Students ' Mathematical Data Concept

Research aspects / Research categories	Before class	During class	After class
Creating real situations and connecting with reality to cultivate students ' data concept		19	
In-depth analysis of data with tools such as charts		2	
Creative use of teaching materials and accurate grasp of key points		3	
Using questions as a driving force to develop students' thinking		3	
Effective application of information technology to support teaching and learning		11	
Rationalizing instructional design	3		
Encouraging students to participate in data analysis activities and focusing on their overall experience		13	
Experiencing randomness through data analysis to help students understand its characteristics		3	
Focusing on infusing the concept of data in teaching		4	
Conducting integrated practical activities to develop students' data concept			7
Teachers themselves should be prepared for the probability and statistics section	5		
Teachers should improve the teaching mode and focus on the guidance of students		3	
Creating opportunities for students to learn to think and discuss		2	
Strengthening the training of students' analogy skills		1	
Implementing differentiated instruction		4	
Strengthening the integration of statistics and probability knowledge with other knowledge	4		
Strengthening the teaching of methods, paying attention to the guidance and generalization of methods		5	
Improving teaching evaluation methods			2
Enhancing students' verbal expression of data concept and promoting the development of their		1	

data analysis thinking.			

Note: Numbers indicate the number of times the corresponding strategy appears in the article.

We can see from Table 1 that "Creating real situations and connecting with reality to cultivate students ' data concept"" Encouraging students to participate in data analysis activities and focusing on their overall experience" "Effective application of information technology to support teaching and learning" and "Conducting integrated practical activities to develop students' data concept", these four strategies are the most mentioned by scholars.

3.2 The Method Adopted

By summarizing the research methods involved in the 29 articles, it was found that the articles mentioned 8 research methods, namely, literature research method, questionnaire survey method, case analysis method, interview method, classroom observation method, statistical analysis method, comparative method, and experimental method, among which literature research method was the most applied method. The details are shown in Table 2.

Table 2: Research Methods

Research method	Frequency
Literature research method	28
Questionnaire survey method	16
Case analysis method	16
Interview method	10
Classroom observation method	6
Statistical analysis method	3
Comparative method	2
Experimental method	2

Note: Numbers indicate the number of times the corresponding method appears in the article.

3.3 Main Viewpoints of Predecessors

3.3.1 How to cultivate mathematical data concept before class

How to cultivate junior high school students ' mathematical data concept before class, there are mainly 3 strategies, which are: (1) Rationalizing instructional design; (2) Teachers themselves should be prepared for the probability and statistics section; (3) Strengthening the integration of statistics and probability knowledge with other knowledge.

He et al.pointed out that when teachers design teaching, they should grasp it as a whole, set clear goals in the design of links, pay attention to the needs of students while paying attention to the resources generated in the classroom, and the choice of materials is also a problem that needs to be carefully considered [2]. Deng, Xue, and others pointed out that the content of statistics and probability is the main embodiment of the data concept. Teachers should realize the unique thinking

method and educational value of this part, have a relevant knowledge reserve, deeply explore the curriculum implementation plan, develop curriculum resources, and lay a good foundation for cultivating students ' data concept [3,4]. Yu, Cui, and others believed that in order to better cultivate students ' data concept, teachers should pay attention to strengthening the connection and integration between statistics, probability knowledge, and other knowledge in teaching, guide students to master the connection between different knowledge, and make students feel the integrity and systematicness of mathematics [5,6].

3.3.2 How to cultivate mathematical data concept during class

How to cultivate junior high school students ' mathematical data concept during class, there are mainly 14 strategies, namely: (1) Creating real situations and connecting with reality to cultivate students ' data concept; (2) In-depth analysis of data with tools such as charts; (3) Creative use of teaching materials and accurate grasp of key points; (4) Using questions as a driving force to develop students' thinking; (5) Effective application of information technology to support teaching and learning; (6) Encouraging students to participate in data analysis activities and focusing on their overall experience; (7) Experiencing randomness through data analysis to help students understand its characteristics; (8) Focusing on infusing the concept of data in teaching; (9) Teachers should improve the teaching mode and focus on the guidance of students; (10) Creating opportunities for students to learn to think and discuss; (11) Strengthening the training of students' analogy skills; (12) Implementing differentiated instruction; (13) Strengthening the teaching of methods, paying attention to the guidance and generalization of methods; (14) Enhancing students' verbal expression of data concept and promoting the development of their data analysis thinking.

Qu, Bao, Qiu, and others said that in the process of teaching practice, teachers should pay attention to the introduction of real data analysis cases, through real data and problem situations, to further deepen students ' understanding of the relationship between data analysis activities and life, help them actively apply the knowledge they have learned to describe the data, analyze the results, and effectively develop their data concept [7-9]. Huang et al.pointed out that statistical charts are an important form of data description and contain rich information. Teachers should make full use of chart resources in the teaching process to develop students ' data concept [10]. Cao, Shu, and others believed that teachers should use teaching materials creatively in the teaching process, understand, analyze, and excavate teaching materials from the formation process of knowledge, so as to understand teaching materials and interpret the spirit of curriculum standards carried by teaching materials in teaching [11].

Xue and others held that mathematical problems are very important for students ' mathematics learning. Teachers should stimulate students ' interest in learning through mathematical problems in teaching, guide students to think correctly, and effectively cultivate students ' learning and inquiry ability [4]. Yu, Huang, Fang, and others pointed out that information technology can provide students with text, sound, image, and other types of information, so that abstract knowledge and derivation

process become intuitive and vivid, help students better understand relevant knowledge, and promote their own data concept [5,10,12]. Bao, Zhang, Dong, Tian, and others believed that in the process of teaching, teachers should let students experience the process of data analysis, explore the information contained in it through data, and cultivate students ' familiarity and intimacy with data on this basis, so as to gradually cultivate students ' data concept [13-15].

Fu et al.believed that the problems studied by statistics are generally uncertain. It provides people with uncertain thinking in an inductive way. For the same thing, the data collected each time may be different. At the same time, as long as there is enough data, it is possible to find rules. The sampling that students learn is an important part of helping students experience the randomness of data [16]. He, Tian, and others pointed out that in addition to teaching students the methods and applications of data analysis, teachers should also tell students the reasons for learning data collection and analysis, and help students develop data concept on the basis of actual feelings [2,15]. Qiu and others said that teachers cannot always implement classroom teaching step by step in the teaching process. They should pay attention to guiding students to analyze data in multiple dimensions so that students can learn to use data to make reasonable inferences, and help students develop data concepts while developing certain problem-solving abilities [9]. Qu and others believed that in the process of teaching, teachers should take the initiative to create opportunities for students to think and discuss, guide students to analyze data, deepen their understanding of knowledge in the process of multiple attempts and discussions, and further develop their own data analysis concept [7].

Qu held that teachers should strengthen the training of students ' analogy ability in combination with students ' existing experience so that students can transfer knowledge through analogy [7]. Cui, Zheng, and others pointed out that in mathematics teaching, students with different learning performances should have different training methods, pay attention to teaching students in accordance with their aptitude, and select teaching methods that meet the students ' actual data analysis concept level on the basis of understanding students, and gradually cultivate students ' data concept [6,17]. Bao, Qiu, and others believed that method teaching is the key link to cultivating students ' data concept. In the process of carrying out method teaching, teachers should pay attention to guiding students to compare and analyze different methods, help them understand the specific scope of application of various methods, and choose appropriate methods according to the actual situation [8,9]. Li pointed out that in order to promote the development of students ' data concept, it is necessary to strengthen students ' verbal expression ability in data analysis. After students experience the process of data analysis, teachers require students to express them in language, so that students can gradually improve their data concept while reflecting on the formation and application of knowledge [18].

3.3.3 How to cultivate mathematical data concept after class

How to cultivate junior high school students ' mathematical data concept after class, there are 2 main strategies: (1) Conducting integrated practical activities to develop

students' data concept; (2) Improving teaching evaluation methods.

Zhang, Zhu, and others pointed out that the concept of data should be cultivated in a continuous practical exercise. Compared with focusing on exercises, interesting practical activities can attract students ' interest and cultivate students ' comprehensive, objective, and pragmatic data concept [19,20]. Peng, Lei, and others believed that teachers ' evaluation of the development status of students ' data concept can be carried out from three aspects: guiding students to self-evaluate in the classroom, evaluating students in statistical activities, and evaluating students through improved test questions [21].

4. DISCUSSION

4.1 Existing Research Aspects

Through the collation of statistics, it can be seen that the previous research on the cultivation strategy of junior high school students ' mathematical data concept mainly focused on three aspects: before class, during class, and after class, and a total of 19 strategies are proposed. The research mainly focuses on how to cultivate students ' mathematical data concept during class. It can be seen that the research on strategies during class is relatively concentrated and is the focus of current research. There are 14 types of strategies for cultivating data concept during class, and the research is more comprehensive; however, there are few studies on how to cultivate students ' data concept before and after class. Before class, only 3 strategies are proposed: rationalizing instructional design, teachers themselves should be prepared for the probability and statistics section, and strengthening the integration of statistics and probability knowledge with other knowledge. After class, only 2 strategies are proposed: conducting integrated practical activities to develop students' data concept, and improving teaching evaluation methods. It can be seen that there is a lack of research on how to cultivate students ' data concept before and after class, and further research is needed.

4.2 Existing Research Methods

For research methods, 29 articles use a total of 8 research methods, research methods are diverse, but most of them use literature research methods, questionnaire survey methods and case analysis methods, statistical analysis methods, experimental methods, and other research methods are less applied. The later studies can adopt more quantitative research methods such as experimental methods. By comparing the experimental group and the control group, the effectiveness of the relevant strategies proposed by the predecessors to cultivate students ' data concept can be verified.

4.3 Main Strategies

In view of how to cultivate junior high school students ' mathematical data concept, the researchers mainly mentioned 19 strategies. During class, the strategies commonly mentioned are creating real situations and connecting with reality to cultivate students ' data concept, encouraging students to participate in data analysis activities and focusing on their overall experience, and effective application of information technology to support teaching and learning, it can be seen that these three strategies are generally recognized by current scholars; before class, the strategy commonly mentioned is teachers themselves should be prepared for the

probability and statistics section, it can be seen that this strategy is generally recognized by current scholars; after class, the strategy commonly mentioned is conducting integrated practical activities to develop students' data concept, it can be seen that this strategy is generally recognized by current scholars. There are relatively few previous studies on the other 14 strategies, and further research is needed to verify the effectiveness of these strategies.

5. CONCLUSION

In this paper, through the analysis of the results of previous studies, the following conclusions are obtained:

(1) By sorting out 29 articles, this paper finds that the previous research on the cultivation strategy of junior high school students ' mathematical data concept mainly focuses on three aspects: pre-class, in-class, and after-class, and there is more research on the in-class aspect.

(2) By analyzing the previous views, it is concluded that the current common views are mainly creating real situations and connecting with reality to cultivate students ' data concept, encouraging students to participate in data analysis activities and focusing on their overall experience, effective application of information technology to support teaching and learning, conducting integrated practical activities to develop students' data concept.

(3) The researchers used various research methods, including eight methods: literature research method, questionnaire survey method, case analysis method, interview method, classroom observation method, statistical analysis method, comparative method, and experimental method, among which the first three methods are more used and the statistical analysis method, comparative method, and experimental method are less applied, so future research can adopt more quantitative research methods such as the experimental method to ensure the reliability of the results.

(4) At present, most of the research on the " data concept" is put forward from the perspective of teachers, while the measures from the perspective of students are relatively few. In the future, we should study from a wider perspective and give more reasonable strategies.

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