Review Article

Research on the Cultivation Strategy of Junior Middle School Student's Mathematics Operation Ability in China

Abstract: Many scholars have carried out research on the cultivation strategy of junior middle school students mathematics operation ability in China, but few scholars have done general research on this topic. We reviewed existing research with the literature analysis method and drew the following conclusions: (1) Most of the researchers are junior middle school teachers, and a small number of researchers are master degree students. Researchers often first analyze the status quo of junior middle school students' mathematics operation ability and its influencing factors. Then, provided some the cultivation strategies; (2) The cultivation strategy of junior middle school student's mathematics operation ability focuses on teachers' perspectives, and mainly concerning on five categories: knowledge, skills, thinking, teaching concepts and teaching methods, and non-intellectual factors. There are few studies on the perspectives of students. (3) The methods used by the researchers are relatively single. The feasibility and the effectiveness of the cultivation strategy are not further followed up and analyzed. In the future, researchers should adopt a variety of research methods from the perspectives of students to explore the cultivation strategies. It is necessary to further follow up and analyze the feasibility and effectiveness of the research strategies.

Keywords: Core Literacy, Mathematics, Operation Ability, Junior Middle School

1. INTRODUCTION

The Ministry of Education of the People's Republic of China promulgated the "Opinions of the Ministry of Education on Comprehensively Deepening Curriculum Reform and Implementing the Fundamental Tasks of Moral Education" in 2014, which pointed out that schools at all levels should start from the actual situations and the characteristics of students to integrate the core literacy and requirements for the academic quality into the education of various disciplines. "Compulsory Education Mathematics Curriculum Standard (2022 Edition)" points out that operation ability mainly refers to the ability to perform correct operations according to rules and operation laws. Operation ability helps to form the quality of standardized thinking and develop a meticulous, rigorous, realistic, and scientific attitude. Under the background of core literacy, it is very important to cultivate junior middle school students' mathematics operation abilities. However, at this stage, junior middle school students have great problems with mathematics operation abilities. Therefore, it is very important and necessary to study how to improve junior middle school students

mathematics operation abilities. Under the background of core literacy, many scholars have carried out research on the cultivation strategy of junior middle school students mathematics operation ability. However, the summary of research on the cultivation strategy of junior middle school students mathematics operation ability is deficient. To fully understand the current research status of the cultivation strategy of junior middle school student's mathematics operation ability under the background of core literacy and the deficiencies in the research on this topic, this paper intends to comprehensively summarize the previous research, sort out the previous research results and the deficiencies of the research to promote scholars to do further research, and ultimately promote the development of junior middle school student's mathematics operation ability.

The research question of this paper is as follows: What is the status of the research on the cultivation strategy of junior middle school students' mathematics operation ability under the background of core literacy?

Specifically, it includes the following three aspects:

(1) What aspects have scholars studied on the cultivation strategy of junior middle school students mathematics operation ability under the background of core literacy"?

(2) What methods have predecessors used on this topic?

(3) What are the insufficient spots? Are there any blank spots?

2. METHOD

2.1 Data Source

This paper selected the literature in the CNKI (China National Knowledge Infrastructure) database as the data source. 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 the persuasiveness and reliability of the research.

2.2 Data Collection

With "mathematics operation ability" and "core literacy" as the keywords and "junior middle school" as the theme, we used the advanced retrieval function of CNKI to retrieve articles and retrieved 60 results in total. By sorting the retrieved results in chronological order, we found that the earliest literature on this topic was published in 2017. The criteria for literature selection in this paper are as follows: (1) The literature is Chinese literature published in China; (2) The literature clearly and comprehensively proposes the cultivation strategy of junior middle school students mathematics operation ability under the background of core literacy. After screening, this paper finally identified 39 articles as the data source of this study.

2.3 Data Collation

Reading the literature carefully and taking notes, we summarized and sorted out the research results, research methods, and information on samples.

3. RESULTS

After summarizing and sorting out the previous research, we found that most researchers use the experiential summary method to study this topic, and a few use the method of observation, interview, questionnaire, and analysis. Researchers often first analyze the status quo of junior middle school students' mathematics operation ability and the influencing factors of junior middle school students mathematics operation ability. Then, according to the analyses, the cultivation strategies of junior middle school students mathematics operation ability under the background of core literacy are obtained from the perspectives of teachers. In the part of cultivation strategy elaboration, researchers often further explain the strategies through examples. And the strategy mainly focuses on five categories: knowledge, skills, thinking, teaching concepts and teaching methods, and non-intellectual factors.

3.1 Research categories

The predecessors mostly obtain the cultivation strategy of junior middle school students mathematics operation ability under the background of core literacy from the perspectives of teachers. In the part of cultivation strategy elaboration, the strategies are often further explained by examples. The strategy proposed by predecessors mainly focuses on five categories: knowledge, skills, thinking, teaching concepts and teaching methods, and non-intellectual factors. The details are shown in Table 1.

Table 1. Research categories

Research categories		Number of strategies
Knowledge		8
Skills		9
Thinking		8
Teaching concepts and teaching methods		7
Non-intellectual factors	Attitude	2
	Interest	8
	Habit	12

3.2 Research Method

This paper summarized the methods involved in 39 articles and found that previous studies have mentioned five research methods: the experiential summary method, the questionnaire method, the interview method, the observation method, and the analysis method. Among them, the experiential summary method is the most used. The details are shown in Table 2.

Table 2. Research method

Research method	Number of documents

The experiential summary method	39
The questionnaire method	4
The interview method	2
The observation method	2
The analysis method	3

3.3 Main Strategies

3.3.1 Knowledge

Liu pointed out that teachers should pay attention to strengthening the study of basic knowledge in mathematics teaching to improve the accuracy of mathematical operations [1]. Zhang, Zhu, Xu, Zhang, Feng, Zhang, Zhong, Wei, Wang, and others pointed out that we should strengthen students' basic knowledge [2-12]. Fang pointed out the importance of basic knowledge and arithmetic teaching [13]. Huang emphasized the construction of the connection between old and new knowledge [14]. Niu pointed out that we should master the principle of knowledge [15]. Qiu pointed out that we should grasp the core of the concepts [16]. Zheng pointed out that teachers should combine actual life to promote students' cognition of basic concepts [17]. Yan pointed out that we should understand the concept of operation and lay the foundation for operation [18].

3.3.2 Skills

Liu, Zhuang, Xu, Tang, Feng, Wang, Wang, Zhong, Wei, and Huang pointed out that we should strengthen the training of students' basic mathematical skills and techniques [1,19,4,20,6,21,22,8,9,11]. Zhu pointed out the cultivation of students' inductive ability [23]. Fan and Feng pointed out that operational skills should be summarized [24,25]. Fang pointed out that we should cultivate students' ability to examine questions [13]. Zhu pointed out that we should improve students' operational analysis ability [3]. Zhang and Feng pointed out that we should train students' problem-solving skills to simplify the calculation steps [5,6]. Zhang pointed out that we should use variant training to cultivate students' computing skills and we should be good at using the combination of numbers and shapes to simplify mathematical operations [7]. Shen and Lin pointed out that we should strengthen students' awareness and ability to summarize [26,27]. Niu pointed out that we should summarize the operation skills and guide students to draw inferences about other cases [15].

3.3.3 Thinking

Liu pointed out that we should pay attention to the cultivation of students' thinking quality and improve the rationality, flexibility, and simplicity of operation [1]. Zhang and Zhong pointed out that it is necessary to strengthen students' operational thinking [2,8]. Zhu pointed out that we should cultivate students' logical thinking, strengthen

students' reverse operation training, and cultivate students' divergent thinking [23]. Fang pointed out the importance of infiltrating thinking methods in class and improving students' operational thinking [13]. Huang emphasized the cultivation of students' logical thinking abilities [14]. Shen pointed out that we should promote the cultivation of students' flexible thinking [26]. Niu emphasized the development of students' operational thinking [15]. Huang pointed out that we should pay attention to multiple solutions to a problem, choose the optimal solution, and cultivate students' divergent thinking [11].

3.3.4 Teaching Concepts and Teaching Methods

Fang pointed out that we should enrich the teaching methods and rationalize blackboard writing [13]. Feng, Liu, Chen, and Feng pointed out that the traditional concept of teachers should be changed [6,28,29,25]. Xu pointed out that teachers should link life practice with teaching [30]. Shen, Chen, and Yan pointed out that teachers should change the traditional way of teaching [26,31,18]. Xu pointed out that teachers should design open and exploratory activities in line with the learning situations [32]. Lin pointed out that teachers should respect students' dominant position and pay attention to the teaching guidance [27]. Yang pointed out that we should implement group layered cooperation [33].

3.3.5 Non-intellectual Factors

The strategies of non-intelligence factors mainly include three aspects: attitude, interest, and habit.

(1) Attitude

Fang and Wei pointed out that we should correct students' learning attitudes [13,9]. Huang and Huang pointed out that we should correct students' operational attitudes [14,11].

(2) Interest

Liu, Zhang, Fang, and others pointed out that teachers should stimulate students' interest in mathematics learning [1,2,13,30,25,34]. Kang, Tang, and others pointed out that teachers should create teaching situations and stimulate students' interest in learning [35,20,21,22,11]. Chen pointed out that teachers should make the classroom interesting and enhance students' interest in learning [31]. Shan pointed out that we should organize competitions to stimulate students' interest in computing [36]. Huang pointed out that teachers should contact life to create mathematical operation situations and stimulate students' interest in operation [37]. Lin pointed out that we need to make the operations more interesting [27]. Zhang pointed out that we should create a challenging and interesting operative teaching environment [12]. Yan pointed out that teachers should innovate their teaching methods and stimulate students' interest in computing [18].

(3) Habit

Liu, Fang, Xu, Feng, Chen, and others pointed out that teachers should pay attention to the cultivation of students' operation habits [1,13,4,6,29,31,8,25,36,11,34]. Zhu pointed out that students' drafts also need to be neat [23]. Fan pointed out that we should cultivate students' good problem-solving habits [24]. Zhuang and Shen pointed out that we should cultivate students' good habits and improve the accuracy of students' operations [19,26]. Tang and Huang pointed out the importance of solving problems normatively [20,37]. Chen pointed out that we should pay attention to the details of the operation and develop students' good operation habits [38]. Wei pointed out that teachers should guide junior middle school students to develop scientific mathematical computing habits [9]. Niu pointed out that teachers should guide students to give timely feedback and fill in the gaps [15]. Wang pointed out that we should strengthen students' consciousness and promote students to form computing habits [10]. Zhang pointed out the importance of recording and summarizing notes [39]. Lin pointed out that we should standardize students' operational processes and promote students to improve their operational efficiency [27]. Yan pointed out that we should use the wrong question to promote students' operational reflection [18].

4. DISCUSSION

4.1 Categories

Previous studies have mostly discussed strategies to improve junior middle school students mathematics operation ability from the perspectives of teachers, and less from the perspectives of students. Under the background of core literacy, it is necessary to further study the strategies to improve junior middle school students mathematics operation ability from the perspectives of students and families. In previous studies, the strategy mainly focuses on five categories: knowledge, skills, thinking, teaching concepts and teaching methods, and non-intellectual factors. From Table 1, we can see that there are only two strategies for attitude. In the future, researchers can study the cultivation strategies of junior middle school student's mathematics operation ability from the perspective of attitude.

4.2 Methods

From Table 2, we can see that the literature selected in this paper all involves the experiential summary method. But in the selected literature, the questionnaire method, the interview method, the observation method, and the analysis method are used less. Most of the researchers who study this topic are primary and secondary school teachers. They explore the strategies to improve junior middle school students mathematics operation ability under the background of core literacy according to their own teaching experience. Therefore, the conclusion lacks certain credibility and scientificity. In the future, researchers can collect data through the questionnaire method to study the cultivation strategies of junior middle school students' mathematics operation ability to make the conclusions more convincing.

4.3 Strategies

Many previous studies have proposed the cultivation strategies of junior middle school student's mathematics operation ability. In terms of knowledge, the strategies mainly focus on consolidating students' basic knowledge, mastering the core and principles of concepts, and strengthening the relationship between new and old knowledge. As for skills, training and summarizing computing skills is a common concern of researchers. It is necessary to cultivate students' mathematical thinking (such as reverse thinking, penetration thinking, and logical thinking). Changing teachers' teaching concepts and methods, respecting students' main position and teachers' guiding role can effectively improve junior middle school students' mathematical operation ability. In terms of non-intellectual factors, the strategies put forward by predecessors mainly focus on correcting students' learning attitudes, stimulating students' learning interests through organizing competitions, designing interesting teaching situations, and paying attention to the formation of students' good habits. However, the feasibility and effectiveness of the cultivation strategy are not further followed up and analyzed. Therefore, in the future, researchers should apply the proposed cultivation strategy to future teaching practice, and further, follow up and verify its feasibility and effectiveness.

5. CONCLUSION

This paper reviewed and sorted out the previous research, and drew the following conclusions:

(1) The research on the cultivation strategy of junior middle school students mathematics operation ability under the background of core literacy has achieved great results. Through the experiential summary method, the questionnaire method, the interview method, the observation method, and the analysis method, the predecessors have explored many cultivation strategies of junior middle school students mathematics operation ability.

(2) The strategies proposed are mostly from the perspectives of teachers, and less from the perspectives of students.

(3) The research methods are relatively simple. The predecessors mostly put forward the cultivation strategy of junior middle school students mathematics operation ability under the background of core literacy through the experiential summary method by combining their own teaching experience and specific cases.

(4) The feasibility and effectiveness of the cultivation strategy are not further followed up and analyzed.

(5) In the future, scholars can study the cultivation strategies of junior middle school students mathematics operation ability under the background of core literacy through the questionnaire method, the interview method, and other methods from the perspectives of students. Researchers should apply the proposed cultivation strategy to future teaching practice, and further follow up and verify its feasibility and effectiveness.

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