Pre-service High School Mathematics Teachers' Cognition of the Implementation of Mathematical Operation Literacy

ABSTRACT

After the reform of mathematics in the new curriculum, the educational issue of mathematical operation literacy has attracted more and more attention from all walks of life. How to implement mathematical operation literacy has become a research hotspot. In order to provide certain teaching suggestions for the implementation of mathematical operation literacy, 51 postgraduates majoring education in a university are taken as the survey object and an open-ended interview method is used to investigate their cognition of the implementation of mathematical operation literacy. It is found that the current pre-service high school mathematics teachers: 1. The cognition on the implementation of mathematical operation literacy focuses on "skills and repeated practice"; 2. The cognition of the implementation of mathematical operation literacy is not comprehensive. The degree of realization of cognitive aspects in the implementation of mathematical operation literacy has not reached half of the implementation measures proposed by predecessors; 3. The cognition of the implementation of mathematical operation literacy is not very consistent with the implementation measures proposed by predecessors. Although there is a certain degree of overlap between the two, but the coincidence ratio is low. The suggestions put forward by pre-service high school mathematics teachers are narrow in scope and need to be further explored and considered.

Keywords: Mathematics; Operation; Literacy; Pre-service teachers; Cultivation.

1.INTRODUCTION

Mathematical operation refers to the literacy of solving mathematical problems according to an algorithm based on a clear operation object. Students master the form of mathematical operations and effectively solve practical problems with the help of computing methods. Finally, they can form the quality of standardized thinking and develop a scientific spirit of meticulousness, rigorousness and truth-seeking [1]. Therefore, it is particularly important to clarify the connotation of mathematical operations and explore the implementation of mathematical operations in "general teaching" and "classroom teaching". However, the implementation of mathematical operation literacy in classrooms and teaching is not optimistic from the research of experts and scholars. "Relying on tools, poor calculation habits, thinking patterns, and improper migration methods" [2] is important obstacle to the implementation of mathematical operation literacy at present. The level of mathematical operation literacy of high school students is generally not high [3], which is inseparable from the inability to accurately implement mathematical operation literacy. The predecessors have also put forward many training strategies such as "strengthening the teaching of basic

arithmetic" and "cultivating proficient arithmetic skills" [4], which has little effectiveness. Most of the previous research focuses on theoretical research on the connotations and characteristics of mathematical operation literacy. There is no unified statement on how to implement mathematical operation literacy. Therefore, it is of great significance to study the pre-service high school mathematics teachers' cognition of the implementation of mathematical operation literacy for the implementation of mathematical operation literacy.

2. LITERATURE REVIEW

2.1 The Connotation of Mathematical Operation Literacy

The professor Zheng once raised three questions, "what is the connotation of this theory", "what is the meaning of this theory", and "what is the deficiency of this theory" about core literacy. He believes that the core literacy is to help students learn to "look at the world mathematically, discover problems, express problems, analyze problems, and solve problems". It should help students learn to think through mathematics and they can gradually learn to think more clearly, more comprehensively, deeper and more rationally[5]. Jie believes that core literacy includes not only learning ability and cultural knowledge, but also skills to adapt to society and life. The core literacy refers to the ability that students should have and be able to adapt to lifelong development and social development. With the progress of the times and the advancement of education reform, the definition of core literacy is slightly different. The general definition of core literacy includes two aspects: own ability and the ability to get along with society [6]. Ma believes that mathematical operation is one of the most core and critical teaching contents and it is one of the most basic and important teaching tasks to cultivatie students' mathematical operation ability [7]. Wu believes that mathematical operations are the basic elements of abstract mathematical structure, an important form of mathematical logical reasoning, and an important means of mathematical modeling [8]. Ma believes that computing ability is a comprehensive ability which cannot exist and develop independently, but it is interpenetrated and supported by other cognitive abilities such as memory ability, understanding ability, reasoning ability, expression ability, and spatial imagination [9]

2.2 Cognitive Situation of Students' Mathematical Operation Literacy

Ji used the questionnaire method to investigate the mathematical operation literacy of high school students. The results show that the students' cognitive level of mathematical operation literacy is generally low. Especially, the understanding of operation ideas is the worst, and there are obvious school differences [10]. Taking a middle school in Gansu County as a sample, Li investigated the cognition of the mathematical operation literacy of high first grade students. The results showed that most of the students' cognition of mathematical operation was at the second level, and there were obvious differences between urban and rural areas [11]; Yan took a middle

school in Lanzhou City as a sample and used the method of questionnaire to investigate the development status of mathematical operations among high three grade. There is a significant difference in the mathematical operation level of students, and science students are significantly better than liberal arts students [3].

2.3 Influencing Factors on Students' Mathematical Operation Literacy

Aiming at the phenomenon of weak mathematical operation ability of high school students, Wei comprehensively analyzed its factors from three aspects including students' internal, social environment, and teachers' teaching. Which has a greater impact on students' mathematical operation literacy is their interest and cognition of mathematics. In terms of the social environment, the popularization of intelligent equipment consumes students' energy excessively, which is one of the reasons why students are not interested in mathematics. In terms of a teacher teaching, teachers' teaching methods and teaching modes are an important influence on students' mathematical literacy[12]. Wang divides the influencing factors of students' mathematical operation literacy into internal factors and external factors. External factors mainly include textbooks, educational policies, policies, curriculum schedule, etc. The internal factors include attention and so on [13].

2.4 On the Cultivation Strategies of Students' Mathematical Operation Literacy

Lin researched the practical inquiry model of applying mathematical operation literacy to the classroom. The research showed that it is necessary and feasible to implement the mathematical operation core literacy model in the classroom [14]. Wang believes that the research results of core literacy must ultimately be implemented through mathematics classrooms to rely on teachers who are in direct contact with students every day and every hour. Through their behavioral cognition process, success or failure of the implementation of core mathematics literacy can be determined; Fostering real challenges lies in attitudes, teaching decisions and classrooms of all kinds [15]. Chang outlined the cultivation of the core literacy of mathematics from two aspects: grasping the essence of mathematics and grasping the essence of mathematical concepts by using mathematical examples. He concluded that cultivating students' core literacy should start from each class, each concept and each question [16]. Dong discussed about how to implement core literacy in the classroom through the derivation and simple application of the formula of "the sum of the first terms of the proportional sequence" in the teaching example [17]. Zheng conducted research on the implementation of the core literacy of mathematical operations in problem-solving teaching in response to the problem of students' "they understand as soon as they listen, and they make mistakes as soon as they are heard"[18]. Huang researched the implementation of the core literacy of mathematical operations in the classroom and proposed a practical teaching method. The research pointed out that if you want to solve students' mathematical operation problems, you should actively find the reasons for students' mathematical operation errors and carry out targeted teaching [19]. Han

pointed out that digital teaching materials have many advantages over traditional teaching materials. Teachers should make reasonable use of digital teaching materials, so that digital teaching materials can help literacy-oriented classroom teaching [20].

It can be seen from the above research that predecessors have carried out many studies on the mathematical operation literacy of high school students and some studies have been relatively mature, such as the research on the level of students' mathematical operation literacy and the research on the influencing factors of students' mathematical operation literacy level. However, there are still deficiencies that need to be improved, such as pre-service high school mathematics teachers' understanding of the implementation of mathematical literacy. Therefore, it is meaningful to study this issue. It can be seen from previous studies that under the previous educational model, the pre-service high school mathematics teachers learned from the experience summarized by predecessors, but educational theories need to be continuously supplemented and improved. The pre-service teachers also need to summarize rules and experiences themselves. Therefore, the research content of this paper is to clarify the pre-service high school mathematics teachers' cognition of the implementation of mathematical operation literacy from the two dimensions of "general teaching" and "classroom teaching".

At present, there is no unified standard on how to implement mathematical operation literacy. Therefore, the research on pre-service high school mathematics teachers' cognition of the implementation of mathematical operation literacy should be compared with experts' suggestions on how to implement mathematical operation literacy. Based on the analysis of a large number of literature and combined with the development status of the implementation of mathematical operation literacy, this paper summarizes the experts' suggestions for the implementation of mathematical operation literacy. This study is based on this.

3. RESEARCH METHODS

3.1 Participants

In order to ensure the authenticity and reliability of the data, this study took 51 masters of education students majoring in mathematics in the 2021 grade of Shandong Normal University as the survey sample including 3 boys and 48 girls where 33 of them have high school teacher qualification certificates and all of them have intentions of high school employment

3.2 Instrument

The research methods used in this paper are unstructured interviews and literature analysis. Unstructured interviews have great flexibility and can fully arouse the enthusiasm of the interviewees. The characteristics of the interviewers and the

interviewees are similar to improve the validity of the interview results. The use of unstructured interviews for information collection is more authentic and reliable. The literature analysis method is used to sort out and summarize the literature related to mathematical operation literacy, which provides certain theoretical support for this research.

3.3 Data Collection

Teaching is a bilateral interactive activity between teachers' teaching and students' learning, aiming to promote the comprehensive development of students' morality, intelligence, physique, aesthetics, and labor and classroom teaching is a method commonly used in school teaching. Therefore, in order to fully understand the pre-service high school mathematics teachers' understanding of the implementation of mathematical operation literacy, two questions were set up to implement mathematical operation literacy from the two dimensions of "general teaching" and "classroom teaching". Question 1: "How do you think the core competencies of mathematical operations are implemented in general teaching?" Question 2: "How do you think the core competencies of mathematical operations should be implemented in the mathematics classroom?" In order to avoid confusion of the data, this study conducted interviews with the masters of education one by one. The interviews are retained by recording and the recordings are later converted into text for sorting. In order to ensure the authenticity of the data, only unnecessary items were removed during the process of converting them into text. The data collected is the M.Ed's answer to the questions "How do you think the core literacy of mathematical operations is implemented in general teaching" and "How do you think mathematical operational literacy is implemented in the mathematics classroom specifically". Answers are simplified by extracting keywords, because some of them are too long and unorganized. In the end, a total of 36 key points were collected for deeper analysis.

3.4 Data Analysis

The research data were descriptively analyzed by summarizing all the research data and presented in the form of percentages. All the research data was further analyzed according to the degree of semantic similarity. Finally, the research data was divided into 8 aspects. Among them, the dimension of "implementation in general teaching" has four aspects which are divided into "improving students' interest", "standardizing steps, attaching importance to skills, and practicing a lot", "cultivating logical thinking" and "improving teachers' quality". The dimension of "implementation in the classroom" is also divided into 4 aspects including "creating a situation, connecting with life", "regulating steps, emphasizing skills, and exercising a lot", "diversified teaching" and "understanding the meaning of mathematical operations".

4.A NALYSIS OF RESULT

4.1 The Main Point of Understanding

From the perspective of "implement mathematical operations literacy in general teaching", the pre-service high school mathematics teachers' cognition of the implementation of mathematical operations literacy mainly focuses on the aspect of "regular steps, emphasis on skills, and a lot of practice". The ratio is as high as 58.06%. As far as the specific content is concerned, the focus of pre-service high school mathematics teachers is "repeated practice", accounting for 17.74%; from the dimension of "specifically implement mathematical operations literacy in classroom teaching" According to the analysis, pre-service teachers' understanding of the implementation of mathematical operation literacy mainly focuses on the level of "standardizing steps, attaching importance to skills, and practicing a lot", and the proportion of the number of pre-service teachers is as high as 43.86%. The proportion of "repeated practice" is 15.78% and 28.82% of the masters of education do not know how to implement mathematical operation literacy in the classroom. See Table 1 for details. Therefore, based on the pre-service high school mathematics teachers' cognition of the realization of mathematical operation literacy in the two dimensions of "classroom teaching" and "general teaching", practicing repeatedly is the best way to improve the operation ability.

Table 1. Statistics of pre-service teachers' awareness

First-level indicators	Second-level indicators	number	concrete content	Percentages(%)	Percentages(%)
General Teaching	A Improve studentsinterest	A1	Set up interesting activities to improve students' interest	6.45	6.45
	B Standardize steps, focus on skills, and practice a lot	B1	Repeated practice	17.74	58.06
		B2	Guide students to calculate	9.67	
		B3	Mathematical operations should be assigned in class	3.22	
		B4	Master the correct algorithm and use the correct algorithm	4.83	
		B5	Improve through specific topic	6.45	
		B6	Using information technology to improve computing ability	1.61	
		B7	Normal operation step	1.61	
		B8	Focus on arithmetic skills	3.22	
		B9	Combine specific knowledge and become familiar with algorithms	9.67	

	C Cultivate logical thinking	C1	Master correct algorithm and use correct algorithm	4.83	25.81
		C2	Infiltrating mathematical literacy in teaching	1.61	
		C3	Cultivating students' computational ability	6.45	
		C4	Develop rigorous logical thinking	9.67	
		C5	Mathematical operations follow through	3.22	
	D Teachers improve their own quality	D1	Handle the relationship between the four basics and core literacy	1.61	14.52
		D2	Teachers and students increase emphasis on core competencies	6.45	
		D3	Teachers should have high numeracy skills	6.45	
classroom teaching	**a Create a situation and connect with life**	a1	Create a reasonable situation	3.50	7.02
		a2	Contact life, contact other disciplines	1.75	
		a3	Link to real life	1.75	
	b Standardized steps, emphasis on skills, lots of practice	b1	Emphasis on skills practice	7.01	43.86
		b2	Normal operation step	5.26	
		b3	Emphasis on algorithms	8.77	
		b4	Explain the operation process	3.50	
		b5	Combining specific knowledge to develop computing ability	3.50	
		b6	Repeated practice	15.78	
	c Diversified teaching	c1	Effective feedback	1.75	17.54
		c2	More examples	3.50	
		c3	Set up diverse practice questions	1.75	
		c4	Diversify activities to increase student interest	3.50	
		c5	Cooperative learning	1.75	
		c6	Develop feasible teaching objectives	1.75	
		c7	Adopt flexible teaching methods	1.75	
		c8	Emphasis on basic concepts	1.75	

	d Understand the meaning of mathematical operations	d1	Understand the meaning of mathematical operations	1.75	1.75
	e Not clear how to implement	e1	Not very clear how to implement in class	29.82	29.82

4.2 Comprehensiveness of Cognition

This study sorts out the implementation measures of mathematical operation literacy put forward by predecessors including 20 aspects with a total of 98 points. Among them, there are 10 aspects in the dimension of "implement mathematical operation literacy in general teaching". There are 62 points. There are 10 aspects and 36 points in the dimension of "specifically implement mathematical operations literacy in classroom teaching". The details are shown in Table 2. From the perspective of "implement mathematical operations literacy in general teaching", pre-service high school math teachers have only three aspects of cognition about the implementation of mathematical operations literacy at three aspects: A, B, and C which are involved that implementation measures were put forward by predecessors; from the dimension of "specifically implement mathematical operations literacy in classroom teaching", only three levels: a, b and c, are involved in the implementation measures proposed by predecessors. Because pre-service high school mathematics teachers have only 36 points in their cognition of the implementation of mathematical operations literacy which is far less than the 98 points proposed by predecessors. High school mathematics teachers' awareness of the implementation of the core literacy of mathematical operations in teaching and classrooms has not reached half of the level of implementation measures proposed by predecessors. Knowledge of literacy is not comprehensive.

Table 2. Implementation measures proposed by predecessors

First-level indicators	Second-level indicators	Specific content	Proportion of people (%)
General Teaching	**F1 Create a situation to stimulate interest**	Pay attention to computing habits and stimulate interest in computing Create a good teaching environment Create a specific situation Mobilize computing interest Refine mathematical knowledge and cultivate	9.68

	interest in computing		
	Layered teaching to stimulate students' enthusiasm for computing		
F2 A lot of practice, intensive training	Combined with practical training, to cultivate students' mathematical operation ability		3.23
	Intensive computing training throughout the course		
	Teach arithmetic algorithms to cultivate students' mathematical operational thinking		
	Students-oriented, attach importance to students' computational thinking training		
	Develop students' thinking ability		
	With the help of mathematical models, cultivate students' awareness of mathematical operations		
	Cultivate students' correct concept		
F3 Cultivate computational thinking	Strengthen thinking training		17.74
	In-depth teaching, expand students' computational thinking		
	Contrast teaching to enhance students' operational awareness		
	Guide students to correctly and flexibly use basic computing knowledge and mathematical ideas		
	Use mathematical formulas to train computational thinking		
	Actively exercise and cultivate students' divergent thinking, and provide multiple channels for problem solving		
	Summarize computing experience and develop students' mathematical computing skills		
	Use of Activated Mathematical Formulas		
F4 Cultivating computing skills	Help students construct computational goals and match appropriate methods in the computational process	9.68	
	Strengthen students' computing skills and help improve their computing ability		
	Optimize problem solving strategies		
	Demonstration teaching to cultivate students' computing habits		
F5 Pay attention to basic knowledge	Consolidate basic knowledge, and clarify operation and arithmetic		
	Develop students' basic abilities		14.52
	Focus on the accumulation and training of basic knowledge		

	Focus on basic knowledge and mathematical thought guidance Strengthen conceptual learning and build a solid foundation for computing Fully understand mathematical concepts and consolidate the foundation of examination questions Enhance understanding of concepts Correct understanding of concepts Understand and master mathematical theoretical conceptual knowledge	
F6 Improve operation speed	Optimize operation program to improve operation speed Improve operation speed	3.23
	Guide students to learn to mine topic information Guide students to master the applicable conditions of formulas and theorems Pay attention to differences in non-intelligence factors, and cultivate students to develop good computing habits Master algorithm Train basic skills Understand arithmetic algorithms Rich computing methods	
F7 Develop good computing habits	Establish awareness, cultivate good study habits, and continuously improve computing accuracy Optimize the problem-solving method and indicate the direction of operation Develop a habit of computing to reduce arithmetic errors Develop computing habits Strengthen students' ability to understand and flexibly apply formula rules Cultivate the habit of checking calculation in students Develop a good habit of carefully examining questions Build a mathematical operation ability training system to cultivate students' mathematical operation ability	24.19
F8 Optimize teaching	Change concepts, absorb new teaching concepts, and help cultivate students' core literacy Strengthen the connection of mathematical	8.06

	strategies	content and improve students' comprehensive ability of mathematical operations Optimization of learning strategies Optimize teaching content Optimize teaching methods	
	F9 Cultivate the ability to reflect and summarize	Improve the concept of reflection Pay attention to chapter summaries Improve computing power by solving multiple problems	4.84
	F10 Pay attention to students' psychological state	Guide students to correctly understand the importance of mathematical operation ability Overcome fear Thought attention, correct attitude	4.84
classroom teaching	**f1 Optimize teaching methods**	Pay attention to the comprehensive and deepen reform of curriculum teaching Develop a reasonable teaching plan Design the core literacy teaching plan according to the content of high school mathematics teaching Teaching management development program Take the area of proximal development as the core literacy evaluation standard Complete teaching system to guide calculation preview Reinforce pre-class preparation to consolidate students' self-exercise	19.44
	f2 Develop computational thinking	Exercise flexible thinking Strengthen the thinking training of students and promote the development of students' thinking quality Cultivating students' thinking ability in teaching Methods Develop operational imagination Cultivate innovative thinking	13.89
	f3 Integrate other core literacy	Hands-on operation, and integrate the core literacy of mathematical abstraction Review the old and learn the new, integrate the core literacy of mathematical logic reasoning Active exploration, integrating the core literacy of mathematical modeling Expand the application and integrate the core	11.11

	literacy of mathematical intuitive imagination	
f4 Create a situation and increase interest	Create a problem situation skillfully and focus on problem design Inspire computing enthusiasm with competition games Cultivate students' interest in computing	8.33
f5 Contact with real life	Life teaching Connect with the reality of life and improve the sense of substitution	5.56
f6 Cultivate good problem-solving habits	Pay attention to the healthy cultivation of problem-solving habits Deepen students' understanding of mathematical concepts and formulas, and clarify the objects of operation Develop good computing habits in students Diversified algorithms to deepen problem solving Strengthen the understanding and application of basic knowledge and thinking methods related to computing ability Conduct seamless penetration and cultivate computing habits	16.67
f7 Use geometry to improve computing ability	Grasp geometric features and explore computing ideas Combining algebraic structure, choose operation method Introducing vector objects and designing operation paths Guide oral calculation practice, improve calculation speed	8.33
f8 A lot of practice	Strengthen targeted exercises and contrast exercises Strengthen operation training and increase operation teaching Train students' will quality and mobilize students' enthusiasm for mathematics learning	11.11
f9 Cooperative learning	Carry out group cooperation to improve the efficiency of computing teaching	2.78
f10 Comprehensive	Improve operational literacy in comprehensive application	2.78

application					

Table 3. Comparison of pre-service high school mathematics teachers' cognition and previous cognition

Primary index	Number of implementation measures proposed by predecessors	Number of implementation measures proposed by pre-service high school mathematics teachers	Percentage (%)	Total points of implementation measures proposed by predecessors	otal points of implementation measures proposed by pre-service high school mathematics teachers
Teaching	10	3	30	62	18
Classroom	10	3	30	36	18
Total	20	6		98	36

4.3 Consistency of Cognition

From above analysis, it can be seen that mathematical operations literacy recognized by pre-service high school mathematics teachers is implemented in four aspects of teaching. A, B, and C correspond to the three levels of F1, F2, and F3 mentioned in the literature. Analysis from the dimension of "implement mathematical operations literacy in general teaching", the aspect of "mastering the form of reasoning and reasoning reasonably" recognized by pre-service high school mathematics teachers only accounts for 3.23% of the literature, while the "cultivating good computing habits" proposed in the literature was not mentioned by pre-service high school math teachers. From the above analysis, it can be seen that the pre-service high school mathematics teachers' cognition of the implementation of the core literacy of mathematical operations in the classroom have four aspects, among which the three levels a, b, and c correspond to f4, f8, and f1 in the literature respectively. According to the dimension analysis of “implement mathematical operations literacy in classroom teaching”, the focus of pre-service high school math teachers’ cognition of the implementation of mathematical operations literacy is “regular steps, emphasis on skills, and a lot of practice”. The focus of the implementation measures of mathematical operation literacy in the literature is "optimizing teaching methods". The aspects of "regular steps, emphasis on skills, and extensive practice" recognized by pre-service high school mathematics teachers only accounts for 11.11% in the literature, while the “optimized teaching method” proposed in the literature accounted for 17.54% of the pre-service high school mathematics teachers who knew it. The detailed results are shown in Figure 1.

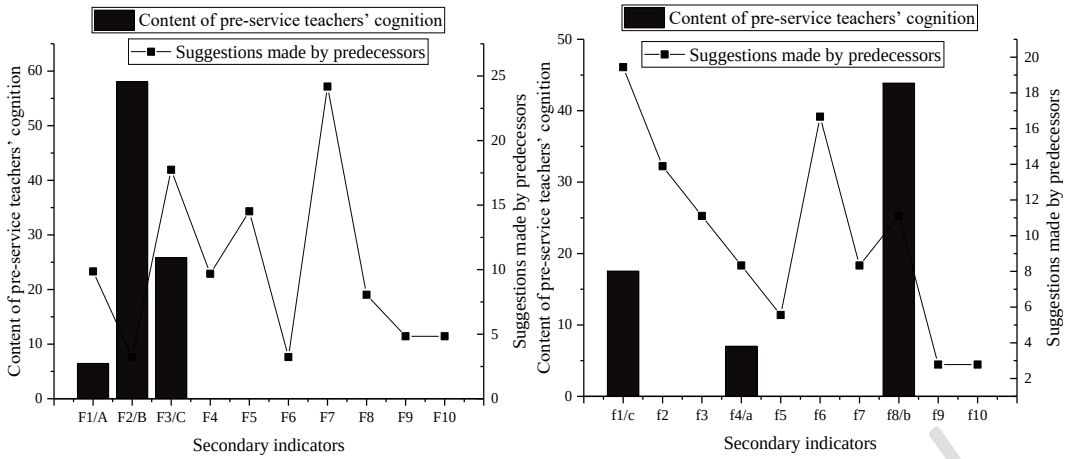

Fig. 1. Distribution of pre-service teachers' cognition points and implementation measures in the literature

As far as the specific content is concerned, there are 36 points in the expressions of pre-service high school mathematics teachers, of which 20 points are similar to those suggested by predecessors that accounts for 55.56%. From the analysis of the dimension of "implement mathematical operation literacy in general teaching", the pre-service high school mathematics teachers' expressions are summarized into 18 points, of which 9 points are similar to those suggested by predecessors that ~~it~~ accounts for 50.00%, among which "repeated practice" is relatively similar to the teaching suggestions of predecessors. About the two points of "leading students to calculate" and "cultivating rigorous logical thinking", although the number of people who recognize it is relatively large, the related content is not mentioned in the teaching suggestions of predecessors. From the analysis of the dimension of " implement mathematical operation literacy in classroom teaching", the pre-service high school mathematics teachers' expressions are summarized into 18 points, of which 11 points are similar to those suggested by predecessors, accounting for 61.11%, among which "repeated practice" is relatively similar to the teaching suggestions of predecessors. The detailed results are shown in Figure 2.

From the data analysis, it can be seen that the measures for the implementation of mathematical operations literacy proposed by pre-service high school mathematics teachers are different from those proposed by predecessors, and the scope of the measures proposed by the two is different but there is a certain overlap. It can be seen that the pre-service high school mathematics teachers' cognition of the implementation of mathematical operations literacy is inconsistent with the previous cognition of the implementation of core literacy, although they can put forward some suggestions, the scope of the suggestions is narrow and needs to be further explored and considered.

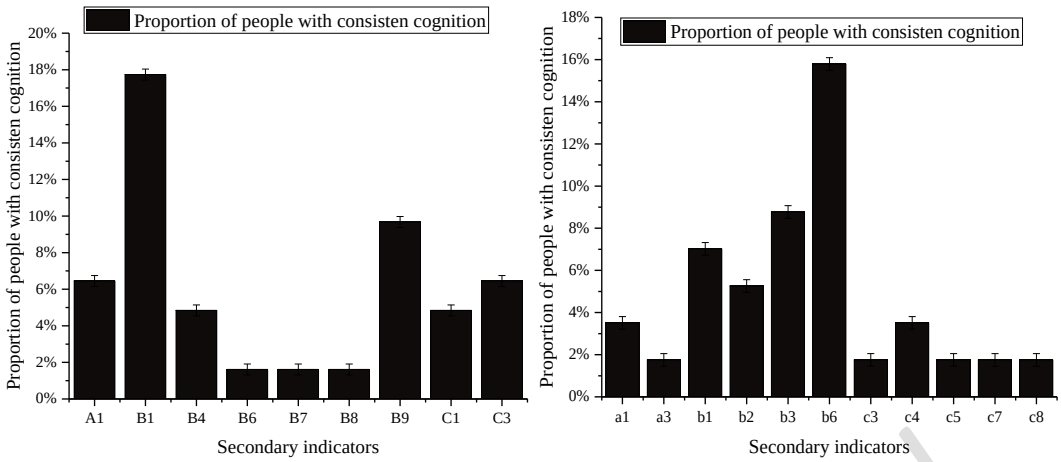

Fig. 2. Cognitive points analysis

5. DISCUSSION

5.1 The Main Point of Cognition

It can be seen from the above data analysis, for the dimension of "implementing mathematical operation literacy in general teaching", pre-service high school mathematics teachers realize that to get better implement mathematical operation literacy, students should strictly standardize the operation steps and should pass a large number of practice to improve the speed and accuracy of operations. Regarding the dimension of "implementing mathematical operation literacy in classroom teaching", pre-service high school mathematics teachers realize that teachers should adopt more flexible and diverse teaching forms to improve students' mathematical operation ability. Students should also lay a solid foundation through a lot of practice, thereby improving computing power. From this, we can see that the current pre-service high school mathematics teachers can realize that the improvement of mathematical operation ability is inseparable from a lot of practice. In addition, it is also essential to cultivate students' operational thinking. This result is somewhat similar to previous research results. Chen believes that the focus of cultivating students' mathematical operation literacy is that teachers should cultivate students' mathematical operation thinking and students should learn and practice more to master operation skills [21].

5.2 The Comprehensiveness of Cognition

From the above data analysis, it can be seen that the pre-service high school mathematics teachers' implementation measures of the implementation of mathematical operation literacy are far less than the implementation measures proposed by predecessors. Whether it is the dimension of "implement mathematical operation literacy in general teaching" or "specific to classroom teaching", the number of cognitive aspects of pre-service high school mathematics teachers on the implementation of mathematical operation literacy did not reach half of the implementation measures proposed by predecessors. From this, we can see that the

current pre-service high school mathematics teachers do not have a very comprehensive cognition of the implementation of mathematical operation literacy. This result is somewhat similar to previous research results. Ma believes that the implementation of mathematical operation literacy in teaching should be based on the development of core mathematical literacy, broaden the research content, and enrich research methods based on the actual needs of research content. Teachers should implement core literacy more comprehensively and accurately [22].

5.3 Cognitive Consistency

From the above data analysis, it can be seen that the measures proposed by pre-service high school mathematics teachers for the implementation of mathematical operation literacy are significantly different from those proposed by predecessors. The scope of the measures proposed by the two is also different, although there is a certain overlap, the overlap ratio is low. It can be seen that the pre-service high school mathematics teachers' understanding of the implementation of mathematical operation literacy is not very consistent with their predecessors' cognition of the implementation of mathematical operation literacy. Although they can make certain suggestions based on the professional knowledge and professional skills they have learned, the scope of the proposal is narrow and needs to be further explored and considered. Gu used the literature analysis method to analyze the mathematical operation literacy. The results show that there are still many problems in the implementation of mathematical operation literacy, such as unbalanced research stage, lack of theoretical research and unclear learning stage goals, etc. These problems exist. This also explains the inconsistency of cognitions obtained in this study [23].

6. CONCLUSIONS AND RECOMMENDATION

Studies have shown that teachers' understanding of the implementation of mathematical operation literacy directly affects the implementation effect of mathematical operation literacy. Therefore, the current implementation of mathematical operation literacy in middle school mathematics classrooms is not effective. Is it related to the teachers' incomplete cognition of the implementation of mathematical operation literacy? To this end, this study investigated the pre-service high school mathematics teachers' cognition of the implementation of mathematical operation literacy. Through investigation and analysis, it can be seen that the current pre-service high school mathematics teachers: 1. The emphasis on the implementation of mathematical operation literacy is "emphasis on skills and a lot of practice"; 2. The cognition of the implementation of mathematical operation literacy is not comprehensive. From different dimensions, their cognition of the implementation of mathematical operation literacy is less than half of the implementation measures proposed by predecessors; 3. The cognition of implementation of mathematical operation literacy is not very consistent with the implementation measures proposed by predecessors, although there are certain However, the overlap ratio is low and the

suggestions they put forward involve a narrow range, which needs to be further explored and considered.

It is suggested that: 1. Relevant teachers and experts who cultivate pre-service high school mathematics teachers should pay more attention to mathematical operation literacy, strengthen the training of pre-service teachers in this area and provide them with more opportunities for teaching practice; 2. Pre-service teachers high school mathematics teachers should seize the opportunity of teaching practice, pay attention to observing the students' learning status in the process of practice and take the initiative to study and research, and constantly reflect, adjust and improve.

The research object of this survey is 51 postgraduates of the same grade of education masters in the same institution. The sample size is small and the sample range is not wide and other types of pre-service high school mathematics teachers are not involved. Therefore, it is necessary to expand the scope of research samples in the future to conduct further in-depth research on the cognitive level of pre-service high school mathematics teachers on mathematical operation literacy and to adopt a variety of research methods in order to find more detailed and comprehensive results.

REFERENCE

1. Ministry of Education of the People's Republic of China. Mathematics Curriculum Standards for General High Schools (2017 Edition). Beijing: People's Education Press; 2018.
2. Jiang HF, Xie YJ, Chen WX & Gong W. Attribution analysis and countermeasures for the lack of mathematical operation ability of junior high school students. Teaching and Management, 2021; 38(36): 95-97.
3. Yan JJ, Guo YF & Zhang DQ. A survey on the status quo of high school students' mathematical operation literacy level based on tests. Education Theory and Practice, 2021; 41(05): 56-58.
4. Qiu YX & Zhang B. Cultivating Students' Computational Ability and Eliminating Math Learning Barriers. Science Consulting (Technology and Management), 2016; 17(03): 164-165.
5. Zheng YX. "Core Literacy" from the Perspective of Mathematics Education. Journal of Mathematics Education, 2016; 25(03): 1-5.
6. Xie XL. Reflections on the implementation of core literacy in high school mathematics textbooks. Mathematics Learning and Research, 2019; 37(03): 107.
7. Ma MJ & Jiang T. Research on some issues that should be paid attention to in the cultivation of mathematical operation ability. Journal of Mathematics Education, 2021; 30(6): 8-12
8. Wu LB & Wang GG. Analysis of core literacy levels from the perspective of

mathematical characteristics. Modern Basic Education Research, 2017; 27(03): 11-16.
9. Ma M. Computational ability and its training methods. Mathematical Bulletin, 1984; 49(06): 6-10.
10. Ji ML. Investigation and Research on Mathematical Operation Literacy of Senior One Students. Nanjing Normal University; 2020.
11. Li L. Investigation and Research on the Status Quo of Mathematical Computation Literacy of High School Students. Northwest Normal University; 2021.
12. Wei JX. Investigation and Research Based on High School Students' Mathematical Operation Literacy. Southwest University; 2021.
13. Wang YN. Analysis of the current situation and improvement strategies of mathematical operation literacy of senior three science students. Southwest University; 2021.
14. Lin Y. Research on the mode of practical inquiry in the implementation of mathematical operation literacy in the classroom. Mathematics Teaching Communications, 2021; 43(24): 33-34.
15. Wang JH. A preliminary study on the implementation of core competencies in junior high school mathematics in the classroom. Middle School Mathematics Research (South China Normal University Edition), 2018; 64(10): 6-9.
16. Chang YX. Middle school mathematics teaching based on core literacy: How to highlight the nature of the subject in teaching. Mathematics Communications, 2018; 86(14): 15-20.
17. Dong HT. Implementing the core competencies of mathematics in the classroom—teaching practice and reflection on "the sum of the first n terms of the proportional sequence". Mathematical Communications, 2019; 87(24): 15-17+21.
18. Zheng RK. The practice and thinking of implementing mathematical operation literacy in problem solving teaching. Mathematics Teaching Communications, 2020; 42(24): 18-20.
19. Huang YY, Qin JJ. Practical exploration of the implementation of mathematical operation literacy in the classroom. Reading and Writing, 2021; 37(22):103-104.
20. Han YL. Digital textbooks help literacy-oriented classroom teaching—taking mathematics as an example. Basic Education Curriculum, 2021; 19(21):9-15.
21. Chen RG. Research on the current situation and countermeasures of the cultivation of high school students' mathematical operation literacy. Southwest University; 2021.
22. Ma DT. A review of the research on core competencies in high school mathematics——Based on the analysis of the articles published in "Copying Newspaper Materials, High School Mathematics Teaching and Learning" by the National People's Congress in 2020. Journal of Neijiang Normal University, 2021; 36(06):19- twenty three.
23. Gu QK, Li LJ. A Review of Research on Mathematical Core Literacy. Science Consulting (Science and Technology Management), 2021; 21(08): 4-6.