Asian Journal of Education and Social Studies

Volume 49, Issue 4, Page 20-26, 2023; Article no.AJESS.109474
ISSN: 2581-6268

Analysis of Operation Ability Literacy in Junior Middle School Mathematics Classroom Teaching

Dan Lu [a] and Zezhong Yang [a*]

[a] School of Mathematics and Statistics, Shandong Normal University, Jinan, China.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJESS/2023/v49i41183

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/109474

Short Communication

Received: 17/09/2023
Accepted: 24/11/2023
Published: 29/11/2023

ABSTRACT

The "Compulsory Education Mathematics Curriculum Standards (2022 Edition)" revised in 2022 clearly points out that the cultivation of mathematical operation ability is of great significance and value to the development of students' core literacy. Starting from the analysis of the connotation and requirements of mathematical operation ability literacy in the new curriculum standard, this paper analyzes the current situation of implementing mathematical operation ability literacy in the current junior middle school mathematics classroom teaching. Therefore, specific suggestions are put forward for the implementation of operation ability literacy: 1. Teachers should pay attention to the introduction in class and students' mastery of algorithms and calculation laws; 2. Teachers should standard their own problem-solving process to play an exemplary role; 3. Teachers should emphasize the principle of operation so as to encourage the students to make simple calculations; 4. In the teaching process, teachers should pay attention to guiding and questioning students, so as to promote the development of students' mathematical reasoning ability. These strategies can provide a reference for junior middle school mathematics teachers to cultivate students' mathematical operation abilities.

**Corresponding author: Email: zhongzee@163.com;*

Keywords: Core literacy; operation ability; junior middle school mathematics; mathematics classroom.

1. INTRODUCTION

The "Compulsory Education Mathematics Curriculum Standards (2022 Edition)" revised in 2022 clearly points out the development of students' core literacy. As one of the manifestations of core literacy, operation ability has attracted the attention of many scholars. Operation ability helps to form the quality of standardized thinking and develop a meticulous, rigorous and realistic scientific attitude [1]. Therefore, the cultivation of mathematical operation ability is a problem that middle school teachers need to pay continuous attention to. So, what are the connotations and requirements of operation ability? What is the current situation of the teaching of operation ability in middle school classrooms? What measures should teachers take to improve students' mathematical operation ability in teaching? This paper will analyze and discuss the above problems. This study can provide teaching reference for middle school mathematics teachers, and then promote the development of junior middle school students' mathematical operation ability.

2. ANALYSIS OF MATHEMATICAL OPERATION ABILITY LITERACY

2.1 The Connotation of Mathematical Operation Ability

The "Compulsory Education Mathematics Curriculum Standards (2022 Edition)" points out that operation ability mainly refers to the ability to perform correct operations according to the rules and operation laws [1].

Rules refer to the norms, regulations, guidelines, theorems, effects, phenomena, methods, etc. The operational law refers to the laws related to operations that are abstracted and summarized through the observation, comparison, and analysis of some equations, including addition commutative law and associative law, multiplication commutative law and associative law, as well as the distributive law of multiplication for addition, and so on. Correctness refers to conforming to facts, laws, truths or some recognized standards. Not only the result is correct, but also the process is correct. Mathematically, operation is a kind of behavior, through the possible combination of known quantities, to obtain new quantities. Ability is the comprehensive quality embodied in the completion of a goal or task.

Therefore, operational ability refers to the ability of students to obtain new quantities in line with the facts according to the theorems, and other rules, with the help of the law of addition and exchange, the law of combination and other operational laws.

2.2 Requirements for Mathematical Operation Ability

2.2.1 Requirement one

To be able to clarify the object and significance of operation, and to understand the relationship between algorithm and the principle of operation is the requirement of compulsory education mathematics curriculum standard for operation ability literacy [1].

Clarity is a clear and definite meaning. The object of operation refers to the object involved in the operation, that is, the object of the operation rules. The meaning of operation refers to the meaning represented by the operation. The meaning of understanding is to analyze in detail along the order, so as to know. The algorithm is the rule of calculation, and the principle of operation is the basis of why we can do this at each step. The two are inseparable [2]. The relationship between the algorithm and the principle of operation is as follows: the principle of operation is the logical basis of the algorithm, and the algorithm is a simplified operation step based on the principle of operation.

Therefore, the mathematics curriculum standard of compulsory education requires students to be able to understand the objects of operation, to be able to understand the meaning of the operation, to understand that the algorithm is the operation step based on the principle of operation, and the principle of operation is the logical basis of the algorithm.

2.2.2 Requirement two

Understanding the problem of operation and choosing a reasonable and concise operation strategy to solve the problem is also the requirement of compulsory education mathematics curriculum standard for operation ability literacy [1].

Questions are subjects that require answers or explanations. Reasonableness refers to conforming to reason. Concise refers to simple and clear. Strategy refers to the principles and methods determined according to the situation. Problem-solving refers to the process of achieving a goal through thinking and reasoning in a problem situation.

Therefore, the new curriculum standard requires students to be able to analyze in detail along the order when facing the operation questions that they are required to answer, so as to understand the questions to be answered. They can choose reasonable, concise methods, through thinking, and reasoning to solve the problem required to answer. The reasonable emphasis here is on correctness, while conciseness emphasizes flexibility, simplicity and skill.

2.2.3 Requirement three

Promoting the development of mathematical reasoning ability through operation is also a requirement of compulsory education mathematics curriculum standard for operation ability literacy [1].

Reasoning ability is also one of the core qualities of mathematics in junior middle school. It mainly refers to the ability to introduce other propositions or conclusions based on rules from some facts and propositions [1]. Promoting development refers to taking measures to promote the good development of things.

Therefore, the new curriculum standard requires students to be able to start from some facts and propositions and to launch other propositions or conclusions according to the rules through operations.

3. THE CURRENT SITUATION OF IMPLEMENTING OPERATION ABILITY LITERACY IN JUNIOR MIDDLE SCHOOL MATHEMATICS CLASSROOM TEACHING

3.1 Teacher Angle

3.1.1 Teachers fail to write completely on the blackboard

Middle school classroom time is very valuable. In the process of teaching, in order to save time, teachers often only tell students the idea of solving problems, instead of writing on the blackboard. They think that calculation is only a tedious mechanical activity without thinking. As long as the idea is told to students, students can get the results according to the existing operation rules, and pay little attention to the operation process [3]. Huang pointed out that teachers' teaching habits will affect students' mathematical operation ability [4]. Bao pointed out that teachers should urge students to develop good mathematics learning habits [5]. Teachers are the guides on the way of students' learning and play an exemplary role in students. Teachers' light process approach often gets imitated by many students. In the long run, students do not pay attention to the process of solving problems, and it is difficult to further improve their operation ability.

3.1.2 Teachers have a tendency to learn the new curriculum standard, but the interpretation of the new curriculum standard is not thorough

The new curriculum standard just introduced in 2022 has caused a sensation in the education sector. Many teachers hold a curious attitude, in line with the idea of improving students' ability, to understand the new curriculum standard. However, in the face of the length of the new curriculum standard, they are discouraged, and few people can understand the new curriculum standard in depth and think about the combination of the new curriculum standard and teaching. By analyzing the data of questionnaires and interviews, Liu found that some mathematics teachers' understanding of mathematical operations only stays on the surface. For example, in the process of interview, teachers think that mathematical operation ability is only computing ability, operation skills, basic ability and necessary ability [6]. Teachers cannot understand the new curriculum standards in depth, so the cultivation of students' core literacy becomes more difficult.

3.1.3 Teachers do not emphasize enough the principle of operation

Algorithms and the principle of operation are interrelated and organically unified as a whole. They are two indispensable elements. Therefore, a correct understanding of the principle of operation and active learning of algorithms are important guarantees for cultivating students'

mathematical operation ability [7]. The number of students is increasing, and the pressure of teachers is increasing. Teachers cannot lead students to conduct more in-depth mathematics learning, resulting in poor teaching results [8,9]. Through the investigation, Yang found that teachers do not pay enough attention to the teaching of the principle of operation in the process of operation. Because of this, students cannot better understand the principle of operation. They can only memorize formulas and rules mechanically, so they cannot use them flexibly [10]. In order to cater to examination-oriented education, teachers often only emphasize the algorithm in the teaching process and do not explain the reason to the students. Many teachers believe that operation ability is a mechanical operation. Therefore, many students in the middle school classroom do not even understand the meaning of rational multiplication and do not know whether to use addition or multiplication in the face of application problems. If the teacher only tells the students the algorithm but does not explain the principle of operation to the students, and does not explain the relationship between the algorithm and the principle of operation to the students, then the students cannot understand the truth. In the face of some deformation problems, the students cannot use the existing knowledge to solve them.

3.1.4 Teachers pay attention to student cooperation

Huang pointed out that cooperative learning can improve the effect of mathematics learning [11]. In middle school mathematics classroom teaching, teachers often attach importance to the role of classmates' mutual assistance. For example, they will take the form of checking each other's homework between desks, so that two people can check each other's operation steps. This method has many advantages, such as improving teaching efficiency and cultivating students' sense of cooperation. For the cultivation of operation ability, this method has its unique advantages. On the one hand, students may find other algorithms in the process of checking each other's problem-solving steps, so as to open up students' ideas, and students can better grasp the principle of operation. On the other hand, for other people's wrong actions, two people can analyze the cause of the error together to avoid the next error.

3.2 Student Angle

3.2.1 Students lack flexibility in solving problems

In middle school classroom teaching, many students cannot use algorithms and calculation laws flexibly, and can only use the algorithms directly [12,13,14]. Some students do not simplify the operation but choose to perform the operation directly, resulting in students spending more time on such problems, and the cumbersome operation process also greatly increases the error rate of students.

3.2.2 Students attach importance to problem-solving ideas, but do not attach importance to the problem-solving process, and the problem-solving is not standardized

In the middle school classroom, students have a strong sense of self-esteem. Many students think that the operation problem is a rote problem, which cannot reflect a person's intelligence level. Therefore, compared with the operation problem, students care more about the thinking problem. For the operation problem, only the general idea is found, and the standard solution is not carried out. In addition, the operation problem has a certain complexity, and the process is more complicated, in order to save time, they also choose to simply look at the operation problems [15]. The above two reasons lead to the problem that students often have low efficiency in solving problems or wrong results in the face of operation problems.

3.2.3 Students' logical reasoning ability is weak

Logical reasoning ability seems to have no relationship with mathematical operation ability, but in fact, in the process of mathematical operation, many deformations need students' logical reasoning ability to participate. However, in actual teaching, students have the problem of changing concepts and unequal changes in the process of deformation, which leads to errors in calculation [16]. On the other hand, teachers should also promote the development of students' logical reasoning abilities in the process of cultivating students' operational abilities.

4. SUGGESTIONS ON IMPLEMENTING THE OPERATION ABILITY LITERACY IN JUNIOR MIDDLE SCHOOL MATHEMATICS CLASSROOM TEACHING

4.1 Teachers Should Pay Attention to The Introduction in Class and Students' Mastery of Algorithms and Calculation Laws

This strategy is to require teachers to set up an introduction link for students in the teaching of mathematical operation ability. By introducing it, students can understand algorithms and calculation laws, and then encourage students to remember the algorithms and calculation laws. At the same time, the teacher should check the students' mastery of the algorithms and calculation laws to ensure that the students master them.

The operation ability mainly refers to the ability to perform correct operations according to operation rules and operation laws. However, in middle school mathematics classroom teaching, some students have the problem that the operation rules and operation laws are not firmly grasped and their memory is confused. Therefore, teachers need to set up the introduction link reasonably in the teaching process, so that students can memorize on the basis of understanding algorithms and calculation laws. For example, when teaching the distribution law of multiplication to addition, teachers can first give several examples, so that students can use the two algorithms to calculate the same results, summarize the calculation law, and then explain the meaning of the calculation law to students. In addition, teachers should check the students' mastery of the situation to guide the next step of teaching, to ensure that students master algorithms and calculation laws.

4.2 Teachers should standard their own problem-solving process to play an exemplary role

This strategy is to require teachers to standardize blackboard writing in the teaching process of mathematical operation ability. It is necessary to ensure that the steps are complete and the expression is accurate.

The correct operation in the problem of operation not only refers to the correct operation result of students but also refers to the correct operation process of students. Therefore, teachers should encourage students to standardize problem-solving and ensure the correctness of their operation process. However, in the actual teaching, teachers have failed to write completely on the blackboard, and students have also had problems with non-standard answers. As a guide on the way of students' learning, teachers should be able to become an example for students. Therefore, teachers must first do their own blackboard writing norms, writing neat, do not step jumping.

4.3 Teachers should Emphasize the Principle of Operation so as to Encourage the Students to Make Simple Calculations

This strategy is to require teachers to explain the meaning of the algorithm to students in the teaching process of mathematical operation ability, and to explain the truth behind the algorithm to students. Teachers should emphasize the relationship between algorithm and the principle of operation, so as to promote students' simple operation.

The operation ability requires students to be able to clarify the object and meaning of the operation and understand the relationship between the algorithm and the principle of operation. If students want to understand the relationship between the algorithm and the principle of operation, they must first understand the principle of operation. The ability to operate also requires students to understand the problem of operation and choose a reasonable and concise operation strategy to solve the problem. The rationality and simplicity here are the simple operations we often say. The premise of students' simple operation is to master the principle of operation. Only by understanding the truth behind the algorithm can students carry out simple operations according to the truth. However, in practical teaching, some teachers ignore the the principle of operation and emphasize the algorithm, which makes students unable to carry out simple operations smoothly. Therefore, in mathematics classroom teaching, teachers should pay attention to the principle of operation, not only to speak about algorithms but also to explain the relationship between algorithms and the principle of operation. When explaining each step, explain to the students why to do so.

4.4 In the Teaching Process, Teachers should Pay Attention to Guiding and Questioning Students to Promote the Development of Students' Mathematical Reasoning Ability

This strategy requires teachers to ask students questions through guidance in the process of leading students to solve problems in the process of mathematics operation teaching, and to ask students why they get the next step from this step, so as to promote the development of students' mathematical reasoning ability.

Operation ability is required to promote the development of students' mathematical reasoning ability through operation. However, students often have logical errors in the process of operation. In view of this problem, teachers should first explain the truth of each step to students when explaining operational problems in teaching. On this basis, they can guide students to think about what to do next and encourage students to draw correct conclusions from known propositions and facts to promote the development of students' mathematical reasoning ability.

5. CONCLUSION

Based on the "Compulsory Education Mathematics Curriculum Standards (2022 Edition)", this paper analyzes the connotation and requirements of mathematical operation ability literacy and analyzes the current situation of implementing the mathematical operation ability literacy of junior middle school mathematics curriculum standards in junior middle school mathematics classroom teaching. Suggestions are put forward on how to implement the operation ability literacy in junior middle school mathematics classroom teaching: 1. Teachers should pay attention to the introduction in class and students' mastery of algorithms and calculation laws; 2. Teachers should standard their own problem-solving process to play an exemplary role; 3. Teachers should emphasize the principle of operation to encourage the students to make simple calculations; 4. In the teaching process, teachers should pay attention to guiding and questioning students to promote the development of students' mathematical reasoning ability. In the teaching process, teachers can refer to the connotation and requirements of mathematical operation ability mentioned in this paper and the current situation of mathematical operation ability teaching, and combine the research results of this paper with specific teaching practice, so as to promote the development of students' mathematical operation ability. However, the above analysis only analyzes and suggests the cultivation of students' operation ability literacy in mathematics classroom teaching. It does not analyze the scheduling of mathematics classrooms in teaching. This is also the direction of further improvement in this paper.

FUNDING

This research was supported by Shandong Provincial Education Department (Grant number: SDYJG21023).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ministry of Education of the People's Republic of China. Compulsory education mathematics curriculum standards (2022 Edition). Beijing: Beijing Normal University Press; 2022.
2. Feng JQ. Interpretation of the Core Word 'Operational Ability' -Thinking and Research on the 2022 Edition of 'Compulsory Education Mathematics Curriculum Standard'. Friends of Mathematics. 2023;37(07):60-64.
3. Zhang FY. Investigation and research on the present situation of mathematical operation ability of grade 8 students. Northwest Normal University; 2023.
4. Huang J. Investigation on the current situation of mathematical operation ability of students in grade 9. Northwest Normal University; 2023.
5. Bao JY. The cultivation of students' computing ability in junior high school mathematics teaching under the core literacy. Xueyuan Education; 2023;(03):4-6.
6. Liu PP. Investigation on the current situation of addition and subtraction ability of students in grade 7. Changji University; 2023.
7. Yan MF. Research on the cultivation strategy of junior high school students' mathematical operation ability based on core literacy. Xueyuan Education. 2021; (12):41-42.
8. Liu T. The cultivation strategy of junior high

school students' mathematical operation ability from the perspective of core literacy. Intelligence. 2020;(35):127-128.
9. Xu W. From the perspective of core literacy, the cultivation of students' computing ability in junior middle school mathematics teaching is explored. Examination and Evaluation. 2018;(11): 109.
10. Yang HX. Research on mathematical operation ability of grade 7 students in rural areas. Northwest Normal University; 2023.
11. Huang CX. Research on the application of cooperative learning in junior high school mathematics teaching. Examination Weekly. 2023;(46):82-86.
12. Liu YP. Investigation on the current situation of computing ability of students in grade 8. Yangzhou University; 2023.
13. Wang H. The cultivation of mathematical operations in junior high school mathematics core literacy. Examination and evaluation. 2021;(03):151.
14. Wei W. Research on the cultivation of junior high school students' mathematical operation ability under core literacy. Intelligence. 2021;(02):75-76.
15. He ZQ. Research on the current situation and training strategies of junior high school students' mathematical operation literacy. Ningbo University; 2023.
16. Zhang LL. Investigation and research on mathematical operation errors of junior middle school students. Guizhou Normal University; 2023.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/109474