World Scientific Research Journal (WSRJ) ISSN: 2472-3703
www.wsr-j.org

A Preliminary Study on Teaching Methods of Improving Mathematical Literacy

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Abstract: Mathematics curriculum standards for full-time compulsory education (2011 edition) clearly points out that mathematics is an important part of the culture of all mankind, and mathematics literacy is the basic literacy necessary for every citizen in modern society[1]. It is not difficult to find that improving students' mathematical literacy is a task that must be completed in school education, and the most important place of education in school education is the classroom. Therefore, teachers should constantly improve teaching methods to improve students' mathematical literacy. This article uses the case analysis method, expounds the teaching method which is beneficial to promote the mathematics literacy from the concrete teaching case, and puts forward several suggestions on this basis.
Keywords: Mathematical literacy; the teaching method.

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1. INTRODUCTION

In the current curriculum and teaching reform, the word "mathematical literacy" appears very frequently. By using "keyword" as the search scope and "mathematical literacy" as the key word in the CNKI database, 3,570 literatures can be retrieved, which have been available every year from 1992 to 2018. But in the modern society under the background of rapid development, many school mathematics teaching still stays on the test, in order to get good grades to students with knowledge, emphasize only the tool of mathematics and neglected the cultivation of mathematical thinking and mathematical ability, didn't pay attention to the discretion of mathematics and individual healthy growth and development has a great relationship.

2. THE LITERATURE REVIEW

2.1 Mathematical literacy

In the contemporary mathematics reform, it is advocated to replace mathematics ability and mathematics knowledge with mathematical literacy. So what is mathematical literacy? The 1982 Cockcroft School Mathematical Survey Committee believes that math literacy has two different meanings: First, students have the ability to use mathematics in everyday life and

learning to meet individual daily needs. The actual mathematics related needs in life; the second is that individuals can correctly understand and interpret relevant or mathematically related information. Individuals with mathematical literacy should be able to correctly understand and apply some mathematical communication methods [2]. In 2013, the Organization for Economic Co-operation and Development (OECD) developed the International Student Assessment Program (PISA), which considers math literacy to be an individual's ability to form, use, and interpret mathematics in a variety of situations; it can serve as an innovative, positive, and reflective aid. . Citizens recognize the role of mathematics in the world and can make good judgments and decisions [3]. Bobby Ojose believes that for some people, the basics of digital meaning and algebra are enough to be mathematically rewarding. For others, having the minimum skills in arithmetic, measurement, algebra, geometry, probability, statistics, and logic is enough to become a math literacy person. For others, this is the ability to use basic mathematics to solve the necessary problems in real life [4]. In summary, mathematical literacy refers to the ability of individuals to perform mathematical expressions, mathematical applications, and mathematical interpretations in a variety of contexts and environments.

2.2 Teaching methods

The teaching method is the specific teaching method that will be used in teaching: such as teaching method, conversation method, practice method, reading instruction method and so on. As the saying goes: teaching has a law, teaching has no law, one method is the main, and multiple methods are complementary. In order to improve the quality of teaching and cultivate students' multi-faceted ability, from the beginning of this century, many well-known domestic educators and front-line teachers have put forward their own views on the concepts and training of mathematical methods, and further enriched their own theories through relevant practices. There has been a lot of discussion about this.

The method of the asynchronous teaching method of Li Shifa (2013), according to the different situation of different students, not advocating the teacher teaching and student learning perfectly synchronized, but classified guidance to students, emphasizes the student found to solve the problem, in order to improve the students' thinking ability and practical ability, and enhance the students' mathematics [5]. Li Jilin (2017) situational teaching method starts from three aspects of perception, understanding and deepening, emphasizing the role of emotion and improving students' ability. However, most of these studies are theoretical considerations, and there are few empirical studies.

3. CASE ANALYSIS

Since mathematical literacy is divided into mathematical expression, mathematical application and mathematical interpretation in this paper, the use of teaching methods will be discussed from these three aspects. In the classroom teaching, every teacher and different students will encounter different sparks, teaching is important in the method, the following will analyze

some actual teaching cases to continue to discuss the teaching method of mathematical literacy [6].

3.1 The use of the descriptive approach to enhance the ability of mathematical expression

Mathematical expressive ability refers to the ability of an individual to accurately convert things in real situations into mathematical language or apply mathematical language transformation to life situations in mathematical learning. The connotation of mathematical expression requires students to use concise and clear language to express relevant definitions, relevant rules, derivation formulas and problem-solving process of mathematics. Therefore, mathematical expression is of general generality. Simplicity, abstraction and symbolism. Requires accurate mathematical expression specific, well organized, clear logic and mathematical expression ability improved, not only helps the individual to the relevant mathematical knowledge more deeply and fully understand and can improve the generalization ability of students, organized and logical ability, can further cultivate students more sincerity, integrity, more help to the progress of students' thinking. "Course standard" in the overall goal of the requirements: learn to cooperate with others, and can communicate with others thinking process and results, can be organized, clearly explain their own point of view, make sense. In class, we often observe that some students are very eager to express their ideas and opinions, but do not know how to organize the language, while some students are very afraid to express their ideas and do not have the courage to open their mouth, and some students do not answer at all[7]. This not only limits students' learning in class, but also hinders their personal development in social life. Therefore, it is necessary to develop mathematical expressive ability through mathematical teaching during the period of students [8].

Expression method of teaching is a teacher must first provide the materials to students, and this kind of materials need to be carefully prepared is processed, the need to let the student to the knowledge, the goal of the course content, focus and difficult point for the understanding of the necessary and sufficient, then use the language, such as drawing method for centralized and orderly, next, just by teachers to guide students autonomous learning, finally by the teacher to explain. In general, the steps of expressive teaching method are to provide materials -- perceptual materials -- expressive materials -- independent learning -- teacher's explanation.

Teaching sample:

(1) Activity content:

Example of multiple problem: The fruit shop shipped 140 kilograms of apples. The weight of bananas shipped was three times that of apples. How many kilograms does apple and banana weigh?

(2) Teaching fragment:

First, at the stage of providing sensory materials, a schematic is presented to motivate students to observe and think: How many times is the weight of apples? Can you calculate the weight of the banana? How to calculate? (Purpose: Let students clear the conditions). Show the next picture and ask the students: What did you find from the picture? What are the same and which are different? Can you compile a topic similar to the one above? When the students prepare

their own questions, the teacher deeply inspires the students:1. What is the problem in the title? 2. What is the most basic algorithm? 3. Can I calculate the result directly based on the conditions in the title? 4. What should I figure out first? 5. How to calculate the next step?
Under the guidance of the teacher, students can have an accurate and intuitive understanding of the quantitative relationship in the topic and have a correct understanding of the calculation method.
The second step is the presentation phase. This stage is also a key stage of this teaching method. This stage requires students to concentrate and systematically express their own content in their own understanding of their own language, and use this teaching method to promote the improvement of students' ability to express. The student makes a statement under the guidance of the teacher, also called the outline. (Expression outline: 1. what to ask for 2. How to calculate 3. Can you calculate it in one step? 4. What is the first thing? What is it? For example, 1. Ask for the weight of banana and apple. 2. Use the multiple relationship budget. 3. Can't step calculate it. 4. Calculate the weight of the banana first. 5 .Add the weight of the banana to the weight of the apple.)
In the third step, the students teach themselves and explain independently. At this stage, the teacher encourages students to conduct independent analysis and bravely express their own ideas. After self-study, students are required to open books and check whether their expressions are so simple and easy to understand and find their own mistakes and make corrections. For example, when a student expresses his or her own calculation of the weight of a banana, it may be unclear who is three times who is who, the relationship between "of" in the expression is confused The fourth step is the teacher's explanation. Finally, the teacher used simple explanations to re-emphasize the difficulties and summarize them.
(3) Case analysis:
The above is the step of expressing the teaching method. Under this teaching method, the emphasis on the initiative and consciousness of the students in the classroom not only exercises the analytical ability of the students, but also transforms the mathematical situation into the conditions in which the language is expressed, and makes the students problematic. The understanding has a systematic understanding, and more importantly, the students are speaking at the presentation stage and the self-study stage. They answer questions according to the outline and further develop the students' mathematical expression ability. The teaching method can undoubtedly improve students' mathematical expression ability, improve students' mathematical literacy and help students grow.

3.2 Using practical teaching methods to improve the ability to use mathematics

According to the definition of PISA, the ability to use mathematics refers to the process by which individuals can apply mathematical concepts, facts, steps, logically solve mathematical problems, and obtain mathematical results. In the process of applying mathematics related knowledge, individuals should use the correct mathematical methods to get a summary, and conduct further research to get relevant academic conclusions [9]. (eg mathematical operations, solving quadratic quadratic equations, obtaining logical reasoning based on mathematical

assumptions, symbolic operations, extracting mathematical information from tables or graphs, representing and manipulating spatial graphs, analyzing data), can handle problems on their own, and determine specific Related formulas, summarizing the similarities and differences between mathematical concepts, and making assumptions about mathematical problems.

Teaching sample:

(1) Activity content:

The content of the "cut five-pointed star" course mainly requires students to cut out various kinds of five-pointed stars and display them. In this case, the teacher mainly teaches the students how to cut out a regular five-pointed star, a positive hexagon, and a positive octagon. Under the guidance of the teacher, the students need to explore the steps and methods of the scrapbooking five-pointed star and can cut out the regular five-pointed star, so as to improve the ability of mathematical application.

(2) Teaching fragment:

First, the teacher shows the students all kinds of five-pointed stars according to the textbook requirements.

Teacher: Please pay attention to the differences between the regular five-pointed star and the other five-pointed stars, and summarize them in a brief language.

Student 1: Teacher, I found that A, B, and C are on the same line. (Some students nod and agree with this statement)

Teacher: Please indicate which angle corresponds to ∠β and mark it in the book.

Teacher: I found that some of the students have marked the corresponding corner of ∠βwith the corresponding position, so is there only one corresponding Angle with it?

Student: No.

Teacher: Then, please ask the students of each group to explore the degree of ∠βin the expansion diagram and share their ideas in the groups.

Student: We found it to be 126°

Teacher: Please ask your group representative to speak to the front of the podium.

Student: Because∠1 is a central angle of the regular pentagon. And ∠1=72° because △ABD is an isosceles triangle, so ∠2=54° and because ∠3=∠2=54° and because ∠4=∠5B=54° .

Teacher: Can you tell me why ∠4=∠5?

Students: because they are axisymmetric about BG.

Student: Because ∠6 plus ∠2 is 180° ,so∠7 is 126° .

Teacher: This student's point of view is very specific and complete. Suppose I need a positive hexagon now. What should I do? After cutting it out, what is the degree of ∠β? Please mark ∠β in the regular hexagon.

Student: We can divide a flat angle into six equal parts, and the average score is 30° for each angle.

Teacher: How many degrees is ∠β?

Student: 120°.

Teacher: What is your reason?

Student: Because ∠1 is a central angle of a regular hexagon,∠1=60°, and because △ABD is an isosceles triangle,∠2=60° and because ∠3 and ∠2 are both 60° (opposite angle are equal),Since ∠3 and ∠4 are both 60° and ∠5 plus ∠6 is 180°,∠7 is 120°.

Teacher: that's right, Please give this classmate applause! If I want to cut a positive anise star now, how should I cut it?

In the following teaching activities, the teacher once again asked the students to have group discussion and inquiry. The students cut the regular octagonal and regular hexagonal shapes by themselves. Each group member talked with each other to draw conclusions about their group, then the teacher asked for conclusions, the team representatives presented their results to other students.

(3) Case analysis:

In the whole teaching case of "cutting the five-pointed star", the teacher let the students operate by themselves through special to general order, exchange and discuss the content of cutting the n-pointed star. After a series of links such as operation-exploration-innovation, according to the content of the textbook, the n-gon scraping method is obtained by using the physical object of the five-pointed star as a carrier, so that not only the relevant learning situations are created for the students, but also the teachers and students, Students and students learn from each other in exchanges and learn from each other, so that both parties can constantly raise new problems in practice and try to solve them. Finally, achieving the required teaching objectives not only improves the students' ability to use mathematics, but also truly improve the ability of students to learn independently.

3.3 Improve mathematics interpretation ability in mathematical modeling

According to the definition of PISA, "mathematical interpretation refers to the process in which individuals review and summarize the methods and conclusions used in the mathematical process and transfer them to reality. In this process, the individual needs to determine whether the mathematical result is logical in the relevant context."[9] The ability of mathematical interpretation is the ability of learners to draw inferences and self-reflection.

Teaching sample:

(1) Teaching content:

The fourth grade of the People's Education Edition, "The Math of Wide Angle Chicken and Rabbit"

(2) Teaching process:

First, reveals the topic -- chicken and rabbit with cage. Ask the students about the chicken and rabbit cage. In the ancient Chinese work suanjing by sun tzu, interesting mathematical problems are recorded. Do you see what that means? Let us now turn to the subject.

Secondly, try to explore:

Teacher: can you solve this problem by yourselves? There are some chickens and rabbits in the cage. It has eight heads on the top and 26 feet on the bottom. How many rabbits and chickens were locked in this cage? What do you know from the problem?

Setting: student 1: there are 8 chickens and rabbits, and the chickens and rabbits have 26 feet. Ask the students to write or draw in different ways (teachers should actively encourage the students) and think about how to work out the problems in the questions. At this time, students according to the prompts, take the initiative to try to use the list, drawing, equations and other methods to solve the problem.

Thirdly, ask the students to communicate in groups, report list method, drawing method and other methods. The teacher guides student to speak out the principles of the whole process on their own initiative. Compares the similarities and differences between different methods, and then introduces the original problem of chicken and rabbit in the same cage -- solving the problem in suanjing by sun tzu.

Finally, let the students explore independently, expand and apply the methods used in chicken and rabbit cages to solve the problems in life. Such as the class of 38 people go to the spring cruise to East Lake, The monitor rented eight Swan boats, each boat is full. The big swan boat can hold six people. The small swan boat can hold four people. How many of those big cygnets were chartered? Teachers need to ask students to think: "what are the similarities and differences between this kind of problem and" chicken and rabbit in the same cage "? Help students to think and give them a direction of thinking, make students' thinking develop in constant introspection and reflection, they can constructed the prototype of "chicken and rabbit in the same cage" problem by themselves [10].

(3) Case analysis:

The problem of "chicken and rabbit in a cage" is an eternal classic problem in primary school mathematics. We can find the prototype of sun tzu in suanjing, and on this basis we also extend many related problems, such as the problem of chartering ships, the problem of turtles and cranes, and so on. In this case, through the teaching method of mathematical modeling, students are guided to start with the most basic data, find the way of thinking and method to solve problems, and find the way to solve related problems from special to general through the combination of Numbers and shapes and the means of hypothesization- comparation-adjustment. In this teaching method, the key is to provide basic data principles and special examples, so that students can arouse their interest, take the initiative to explore and find rules, actively think, find general principles and learn to transfer, and use mathematical models to solve problems when encountering similar problem scenarios. This teaching method of mathematical modeling is conducive to improving students' ability to draw inferences from one example and enable students to constantly reflect on their own problems in practice, continue to supplement relevant models and improve theories. It is a desirable teaching method to improve students' ability of mathematical interpretation.

4. SUGGESTIONS FOR IMPROVING MATHEMATICAL LITERACY

Through different aspects of maths study and case study of teaching methods and teaching, we can find that the current is helpful to improve maths teaching methods are based on the student, mostly based on education, advocated by learner autonomy to explore, highlight the subjectivity of students in the classroom, the claims will be introduced to the life situation of classroom teaching, using cooperative teaching methods to promote the students' mathematics accomplishment. Through the study, the following Suggestions are put forward.

4.1 The teaching method is student-oriented and emphasizes the combination of "teaching" and "educating"

In assembly of mathematics teachers want to unify the theory and practice, not only to teach students basic math instruction to cultivate the students' moral quality, this requests the teacher to choose the teaching method take the student as this, when you need to choose the method to have tested the theory basis, not only to consider the present situation of students of middle school students do have to consider the future social life, help students form the correct outlook on life.

4.2 Infiltrate mathematical culture, establish mathematical model, draw inferences from each other

In teaching, teachers should pay attention to the influence of mathematical culture. In selecting teaching methods, teachers can use more methods of citing examples and cite classics, such as the knowledge in sun tzu suan jing mentioned above in the teaching case of chicken and rabbit in the same cage, so as to let students have a good memory in modern times. For example, when we talk about the definition of limit, let students discuss "a foot of tree, take half a day, never exhausted", and experience the thought of limit. When we talk about PI, we can first introduce the background of zu chongzhi's characters, citing classics. Teachers should pay attention to the background and historical significance of mathematical knowledge, and let students understand the source of such knowledge. Long-term practice can not only improve students' comprehensive application ability, improve their understanding and in-depth understanding of mathematics, but also apply these methods to work and daily life when students leave school.

4.3 Pay attention to the combination of mathematics and life situation, let mathematics into life

Modern teaching, pay more and more attention to knowledge service for the life and living standards, in order to improve the students' mathematical quality, when choosing teaching methods related to life situation teachers should pay attention , such as the situational teaching method to inspire students' interest and ability to apply, and as the above mentioned in the life of the common pentagram into teaching, the parallelogram in learning can be more life common quadrilateral design example, let the life and the integration of mathematics learning, make students not only learn mathematics knowledge and able to let the student to apply these knowledge in life, through the observation of life to promote the absorption of mathematical knowledge.

Mathematical literacy is the core quality required for the development of students in the new era. Mathematical literacy will be more and more important in the future education and teaching. School education occupies a large proportion in the period of students, in which the classroom is the main way for students to learn, and whether the use of teachers' teaching methods is appropriate to meet the characteristics and needs of students' cognitive development is one of the keys to improve mathematical literacy. Selecting good teaching methods need to be according to the teaching guidelines, training target, teaching target, teaching content, teaching environment, teachers' own quality and the characteristics of the students to choose and use, in this paper, the now is conducive to improve maths teaching method, conducted a preliminary inquiry found that the current method is mainly based on heuristic, exploratory rich teaching means to give priority to use modern teaching media, but success is still not clear, the inspection and improvement of teaching methods still need to practice.

ACKNOWLEDGEMENTS

This paper was sponsored by Hubei Polytechnic University's Teaching Reform Project, "Strengthening and Enhancing the Empirical Ability of Normal Students Based on Core Literacy" (2018C27).

REFERENCES

[1] Ministry of Education of the People's Republic of China: Full-time compulsory education mathematics curriculum standards (2011 edition) (People's Education Press, China 2011).

[2] Xiang Huimin: Research on Mathematical Teaching of Junior Middle School Based on Mathematical Literacy (East China Normal University, China 2016).

[3] International Student Assessment Program China Shanghai Project Team: Quality and Equity--A Summary of the Results of the Shanghai 2012 International Student Assessment Program (PISA) (Shanghai Education Press, China 2012).

[4] Ojose B. Mathematics Literacy: Are We Able To Put The Mathematics We Learn Into Everyday Use, Journal of Mathematics Education, (2011) No. 4, p. 89-100.

[5] Shifa Li: Research and Practice of Asynchronous Teaching Method for 30 Years, Teaching Materials and Teaching Methods, (2019) No. 9, p. 3-10.

[6] Jilin Li: The Construction of Chinese Children's Situational Learning Paradigm, educational Research, (2017) No. 3, p. 91-102.

[7] Cheng Lu, Ying Zhou: The Loss and Reconstruction of Liu Yu's Primary School Students' Mathematical Expression Ability, Journal of China Education, (2013) No. 1, p. 46-48.

[8] Xiangru Wang: The "practice" teaching method of "Mathematics Comprehensive and Practical Activities" - from the practice of cutting the five-pointed star to improving the students' ability to use mathematics, Chinese Teenager, (2017) No. 4, p. 202-203.

[9] Pengfei Liu: Study on the division of the mathematics curriculum in compulsory education (Northeast Normal University, China 2015).

[10] Kui Ling, Jian Chen: Experiencing Mathematical Thinking Method in Mathematical

Modeling——the Teaching and Evaluation of Chicken and Rabbit Cage, China Rural Education, (2016) No. 5, p. 57-58.