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On the Cultivation of Middle School Students' Mathematical Logical Reasoning Ability under the View of Core Literacy

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Abstract **– With the implementation of the new curriculum standard, the teaching idea and method of high school mathematics have changed a lot. The new curriculum standard requires students to "experience the process of observation, experiment, guess, proof and other mathematical activities, develop reasonable reasoning ability and have a clear and orderly explanation of their views". Logical reasoning, as one of the six core qualities of senior high school mathematics, is an important means to train students to form logical thinking. Therefore, teachers should adapt to the important ideas of core qualities in the teaching process and pay attention to consciously cultivating students' logical reasoning ability. Help students form rigorous thinking habits and scientific thinking methods, and enhance innovative consciousness.**

Keywords **– New Curriculum Standard, Middle School Mathematics, Logical Reasoning, Mathematics Core Literacy, Innovative Consciousness.**

I. INTRODUCTION

In July 2001, the Ministry of Education officially promulgated the Mathematics Curriculum Standards for Full-time Compulsory Education (Experimental Draft). It made it clear that in the goal of mathematical thinking, every student should "experience observation, experiment, guess, proof and other mathematical activities to develop reasonable reasoning ability and preliminary deductive reasoning ability" [1]. In 2003, "Mathematics Curriculum Criteria for Senior High Schools" also pointed out that "when people study mathematics and apply mathematics to solve practical problems, they constantly experience such thinking processes as intuitive perception, observation and discovery, induction, analogy, spatial imagination, Abstract generalization, symbol representation, deductive proof, reflection and component" [2]. "2017 New Mathematics Curriculum Standard" mentioned that "the development of reasoning ability should run through the whole process of mathematics learning. Reasoning is the basic way of thinking in mathematics, and it is also the way of thinking that people often use in their study and life. In the process of teaching, teachers should design appropriate learning activities to guide students to discover some rules through observation, attempt, estimation, induction, analogy, drawing and other activities, guess some conclusions and develop reasoning ability; Through examples, the students gradually realize that the correctness of the conclusion needs to be confirmed by deductive reasoning, and different degrees of requirements can be put forward according to students' age characteristics. In addition, students can be properly guided to explore different ideas and methods to prove the same proposition, to compare and discuss them, to stimulate students' interest in mathematical proof, and to develop students' broad and flexible thinking." The new curriculum standard emphasizes the cultivation of students' logical reasoning ability, which is of great significance for improving students' learning efficiency and mathematical literacy. At the educational level, the logical reasoning literacy trained by logic plays an irreplaceable role in the improvement of people's mathematical quality and basic social ability, as well as in the coherence of scientific thinking, direct or indirect transfer

judgment, Abstract generalization, expression and operation. Logical reasoning literacy can be said to be an important indicator of cognitive development and intellectual development, but also an indispensable factor in mathematics, science and problem solving [3]. At present, the evaluation of students' logical reasoning literacy in middle school mathematics education mainly depends on teachers' observation of students, but these problems have not been solved, such as what aspects to observe, students' different levels and students' influence on students' logical reasoning literacy in different teaching situations. Teachers should introduce new teaching resources in close connection with the actual situation of teaching, analyze the general law of students' developing logical reasoning ability, improve teaching links, and infiltrate the cultivation of students' logical reasoning ability into teaching activities.

II. Research on the Present Situation of Middle School Students' Logical Reasoning Ability in Mathematics

A. *Research Objective*

In junior high school mathematics teaching, logical reasoning ability is one of the important abilities people use in the process of analyzing and correctly understanding various things. It is a special way of thinking, which has the characteristics of rationality, certainty and consistency. For students, junior high school is an important basic stage in the process of learning mathematics in schools. Its influence on students' future mathematics learning is very far-reaching.

This research attempts to understand the current situation of the development of logical reasoning ability of high school students in the form of questionnaires. Starting from the reality of junior middle school mathematics teaching at this stage, this paper focuses on the analysis of the current situation and existing problems of junior middle school students' mathematical logical reasoning ability. Finally, find out the factors that really affect the development of this ability and analyze the reasons for its formation. In order to put forward the corresponding countermeasures and suggestions, arouse teachers' attention to the teaching of logical reasoning ability, better guide future teaching practice, improve students' logical reasoning ability.

B. *Research Object*

In order to understand the current situation of middle school students' mathematical logical reasoning in detail, a field study was carried out on mathematics teachers and students of a middle school in Yanji city to obtain first-hand information. Therefore, the research object of this paper mainly includes a middle school mathematics teacher and a middle school students. The selected school is a middle school in Yanji City. At the same time, classes of Grade 7 and grade 8 are selected, totaling 549 students. A total of 549 valid questionnaires for junior high school students and 42 valid questionnaires for junior high school teachers were collected. The following is a detailed collation and analysis of teachers' and students' questionnaires.

C. *Questionnaire Analysis*

1) *Results and Analysis of Teachers' Questionnaires*

Through the analysis of 42 effective questionnaires of teachers, we find that when asked about the importance of mathematical logical reasoning teaching, the vast majority of teachers agree that the teaching of mathematical logical reasoning is very important, even up to 82%. However, when asked whether the students are consciously

taught mathematical logical reasoning and the teaching results are significant, most teachers still do not make a positive response, the proportion of which is more than 80%. That is to say, at this stage, most of the mathematics teachers realize that it is very important to cultivate students' ability of mathematical logical reasoning, but there is no good understanding of the teaching content of logical reasoning and teaching practice.

Graphics 1. Teachers' Attention to Logical Reasoning.

problem	Always think	Often think	Sometimes think	Rarely think	Never think
Do you understand the specific meaning of the word logical reasoning?	5	27	7	3	0
Is it very important to cultivate students' logical reasoning ability in junior middle school teaching?	22	16	4	0	0
Do you often consciously cultivate students' ability of mathematical logic?	4	9	20	9	0
Are you teaching achievements in mathematical logical reasoning remarkable?	0	5	15	18	4
Is it not difficult for students to accept the knowledge of logical reasoning in mathematics?	13	20	9	0	0
Are students interested in learning mathematical logical reasoning ability?	0	12	15	10	5
Are there any differences between girls and boys in mathematical logical reasoning ability?	4	16	14	6	2
Boys are better at logical reasoning in Mathematics	3	15	13	6	5
Girls' Mathematical Logical Reasoning Ability is Better	0	0	11	21	10

2) *Results and Analysis of Students' Questionnaire*

As can be seen from Table 2, only about 20% of the students who answered the questions "Do you think you know what logical reasoning is?" Most students are vague about the concept of logical reasoning. Thus, in the actual class, teachers still have not effectively popularized the connotation and function of logical reasoning. It is worth noting that when students answer the question "Do you think they want to improve their logical reasoning ability?" However, nearly 400 students answered "often think" and "always think" (accounting for nearly 80%). On the contrary, students who answered "rarely think" and "never think" accounted for an absolute minority. It can be found that students generally recognize the importance of logical reasoning and hope to improve the ability of mathematical logical reasoning.

In this survey of students' learning status of mathematical logical reasoning, more than 70% of the students expressed positive attitudes towards the choice of "Is there any difficulty in solving the problem of mathematical logical reasoning?" More than 70% of the students expressed positive attitudes towards the choice of "are they willing to solve the problem of logical reasoning in mathematics?" The students' positive attitude and negative attitude are basically equal in the choice of "are they willing to solve the problem of logical reasoning in

mathematics?" and "Have you developed the habit of expressing your views with reason", "Can you express your ideas in mathematical language when solving logical reasoning problems"? On the two issues of judging the quality of logical reasoning in mathematics, most of the students choose to deny, which is not optimistic.

Graphics 2. Students' Attitudes towards Logical Reasoning in Mathematics.

problem	Always think	Often think	Sometimes think	Rarely think	Never think
Do you know what logical reasoning is?	63	98	221	108	59
Do you want to improve your logical reasoning ability?	263	155	90	12	29
Is there any difficulty in solving the problem of mathematical logical reasoning?	12	57	80	276	124
Are you willing to solve the problem of logical reasoning in mathematics?	46	112	215	108	68
Have you developed a well-founded habit of expressing your opinions?	41	145	193	124	46
Can you express yourself in mathematical language when solving logical reasoning problems?	68	210	136	81	54

III. Teaching Strategies for Improving Logical Reasoning Ability in Mathematics

A. *Emphasis on Knowledge Transfer in Curriculum Introduction*

The cultivation of logical reasoning ability in middle school mathematics teaching needs to be based on certain emotional experience. Only when students gradually understand the rigorous spirit of mathematics in the process of contacting the knowledge of textbooks can they gain insight and form logical reasoning ability [4]. Therefore, in the process of teaching, teachers need to help students connect the content of mathematical knowledge, establish the relationship between the content of knowledge, so as to smoothly complete the process of knowledge transfer. In the course introduction of mathematics teaching in middle schools, teachers should pay attention to guiding students to use their thinking ability to recognize curriculum knowledge, so as to complete the transfer process of new and old knowledge. From the point of view of the interrelation between teaching contents, each course content belongs to the whole branch, and there is a necessary correlation between the scattered mathematics knowledge content. In the process of contacting the new and old knowledge, students' logical reasoning ability is directly determined by their thinking methods [5]. In the process of introducing curriculum, teachers should guide students to review what they have learned and construct their own cognitive structure, so as to improve their thinking quality. The improvement of students' autonomous learning ability is also an important goal of middle school mathematics teaching. The introduction of mathematics teaching curriculum guides students to complete the transfer of knowledge, and improves students' autonomous learning ability while cultivating students' logical reasoning ability.

B. *Emphasis should be placed on Guiding Students to improve their ability to Dig Out Implicit Conditions in Topic Explanations*

Whether students have the ability to dig out the hidden conditions will directly affect the quality and level of students' thinking. Many students in the course of learning, perhaps because of the low level of reading and in the face of mathematical problems, can not dig out the hidden conditions, resulting in the limitation of thinking and narrow thinking. The cultivation of students' logical reasoning ability is related to many factors. Whether students can dig out the implicit conditions in the topic is directly related to the students' meticulousness of thinking, which is also the direct embodiment of logical reasoning ability. In the process of teaching, teachers should pay attention to guiding students to improve their ability to dig out hidden conditions in the explanation of topics, so as to help students clear thinking of solving problems in the explanation of topics, thus forming the ability of logical reasoning [6]. Teachers should guide students to attach importance to the process of topic explanation and help students develop rigorous thinking habits. The cultivation of logical reasoning ability is related to many factors. Only when teachers guide students to attach importance to implicit conditions in topic explanations can students form logical reasoning ability. The cultivation of logical reasoning ability in middle school mathematics teaching is a step-by-step process. Only by optimizing teaching links according to students' characteristics and considering the abstraction and complex and precise teaching orientation of mathematical knowledge, can the cultivation of students' logical reasoning ability be carried out reasonably and orderly [7].

C. *Adjusting Students' Psychological State*

Teachers should pay attention to students' psychological and ideological dynamics and individual differences in teaching. Psychological research shows that the accuracy of logical reasoning is directly affected by bad mood, so it is very important to help students maintain good mental state in learning. Teachers should actively guide students to face the good side of development, have methods to cultivate their interest in learning, so that they can avoid detours in the process of reasoning, and then enable them to discover the laws and aesthetics in mathematics, and abandon some bad habits [8].

In addition, teachers should pay attention to teaching students in accordance with their aptitude, encourage students' personality development, pay attention to individual differences, pay attention to teaching students in accordance with their aptitude, and combine students' existing cognitive level and physical and mental characteristics to develop different logical reasoning ability.

By adopting these teaching strategies, teachers can effectively train students' logical reasoning ability, and enable them to form an argumentative, orderly and logical thinking quality, so as to develop their core mathematical literacy.

IV. CONCLUSION

In the ordinary test, we should strengthen the investigation of students' logical reasoning ability, not only to increase the number of questions, but also to reflect the type of questions. At the same time, the evaluation of students' logical reasoning ability should not only pay attention to students' achievements, but also to the process and development of students' mathematics learning. In the aspect of teachers' teaching, we should attach importance to the cultivation of students' logical reasoning ability, and in the process of teaching, we should conform to the core qualities of mathematics, consciously strengthen infiltration, cultivate students' logical reasoning ability and interest in mathematics learning in a subtle way, and enhance students' innovative consciousness.

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