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Research on the Mathematics Context Creation of Middle School under the Background of the New Curriculum Reform

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Abstract: With the release of the "Compulsory Education Mathematics Curriculum Standards (2022 edition)", the education goal is increasingly focused on developing students' core qualities, focusing on students' problem-solving ability in real situations. Mathematics context teaching is of great significance in mathematics education, which can cultivate students' ability to solve problems. So teachers need to pay attention to mathematics context teaching, but teachers didn't think highly of context teaching in the past. Thus it led to a series of problems. These problems mean that the teaching of mathematical context needs to change. In order to solve the above problems, this research intends to use the literature review method for research and put forward some suggestions. For example, strengthen the training of teachers, control the time and complexity of context, and enrich types and presentation modes of the context, etc. These suggestions can promote the development of mathematics context teaching and promote the cultivation of students' mathematics core literacy.

Keywords: context, mathematical context, mathematics teaching, mathematical context teaching.

1. Introduction

In recent years, China has paid attention to the development of education and issued a series of policies, such as the "Compulsory Education Mathematics Curriculum Standards (2022 edition)" and the double-reduction policy. As an important part of the education system, mathematics is of great help to promote the development of students' thinking logic. At the same time, the learning of mathematics is of great difficulty, which is reflected in the difficulty of students understanding relatively abstract concepts and how to apply mathematical knowledge to solve problems.

At the same time, one of the key reforms in this policy is to attach importance to literacy orientation. It cultivates students' core literacy to adapt to students' lifelong development and social needs, and focuses on students' ability to solve problems in real contexts. Therefore, it is necessary to attach importance to the creation of a context in math classes to cultivate students' ability to solve problems.

During the compulsory education stage, students must view the actual world with mathematical vision, think about the real world with mathematical thinking, and describe the real world with mathematical language [1]. It also makes it quite evident that the context design and problem-raising

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components of the mathematics curriculum must be strengthened. Numerous topics pertaining to mathematical context design are covered, including "one-variable equation" and "sample data survey," which involve real-world contexts that are social, and scientific [2].

In addition to emphasizing the importance of context creation, the policy also emphasizes the need for teachers to guide students to think after context creation. It specific performance has three parts. First, teachers will lead students to immerse themselves in relatively real learning contexts and lead them to find and raise questions. Second, students need to understand the meaning of numbers in real context and make reasonable estimates. Third, teachers should create teaching context from the perspective of existing mathematical experience, such as social life, science, etc. Context should be close to students' actual living environment and experience, and meet students' cognition-based mathematical learning needs.

This research focused on the mathematics context creation of middle schools under the background of the new curriculum reform. At present, the academic research on the creation of contexts is still not very sufficient, and there is a large research space. Thus this research tends to find out the problems of the creation of contexts, and present some targeted and practical suggestions in the creation of contexts and mathematical context teaching. At the same time, this research can promote the development of mathematics context teaching.

2. Definition of the Key Concepts

2.1. Context

The word "context" has several psychological meanings that are expressed by different stimuli, occasions, and items [3]. In the theory of educational psychology, context is a combination of emotion and scene [4]. Thus the context can not only provide clues and methods to solve the problems, but also stimulate the problem.

2.2. Mathematical Context

Mathematical context is the environment that generates mathematical behavior [5]. It is a background that combines mathematical knowledge, mathematical thought methods and real life. It mainly comes from mathematics itself and the new contexts triggered by mathematical exploration, as well as from real life. But it focuses more on the presentation of mathematical knowledge and mathematical ideas. It is helpful for teachers to guide students to solve the contradiction between the concreteness of students' thinking and the abstractness of mathematical knowledge.

2.3. Life Context

Life context refers to various contexts or scenes experienced by individuals in their own lives. The living context completely comes from real life, which is a variety of contexts or scenes experienced by students in daily life, and it doesn't emphasize mathematical knowledge and mathematical thinking.

3. The Significance of Context Teaching

3.1. To Get a Better Score in the High School Entrance Examination

With the issuance of new curriculum standards, the proportion of context questions in high school entrance examinations and college entrance examinations has gradually increased. For the most practical reasons, in order to get a better score in the high school entrance examination, teachers should use the context creation method in classroom teaching activities. Some studies have proved

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that after teachers carry out context teaching, students' scoring rate in context questions has a certain improvement [6].

3.2. Stimulating Students' Enthusiasm in Mathematics Learning

The mathematics knowledge in middle school increases the abstract content compared with the mathematics knowledge in primary school, which leads to the improvement of the difficulty of the knowledge. In the past, the Chinese education model paid more attention to scores. In order to improve scores, teachers tended to let students accept knowledge passively. These two reasons cause students to feel that learning is boring and knowledge is difficult to understand. Furthermore, they lose the motivation to learn. Increasing the creation of context not only allows students to have a better understanding of the learning content, but also stimulates students' interest and enthusiasm in math learning [7].

Teachers create a context that students often encounter in daily life. At the same time, this life context should contain a mathematical nature and mathematical knowledge. When teachers transform abstract mathematical knowledge into a mathematical context, students can have a better understanding to the connotation of abstract mathematical knowledge and have a good command of the mathematical knowledge application.

In the process of solving the mathematical context, students' judgment of life experience may not be able to solve the problem or may conflict with the judgment which made through mathematical knowledge. This contradiction can arouse students' interest in thinking and generate their curiosity for problem-solving methods, which can successfully transform students' passive learning into active learning [8].

3.3. Improving the Efficiency of Middle School Mathematics Teaching and Promoting the Relationship between Teachers and Students

Mathematics teaching activity is the communication and interaction between students and teachers, which plays an important role in promoting the growth of both teachers and students [2]. With the help of mathematical context, teachers can attract students' attention rapidly and guide students to immerse the environment of mathematics learning. Through the teaching context, it helps students reduce the time that is spent on adapting to the class, thus it improves the teaching efficiency of the class. At the same time, it is easier for students to have a good command of mathematical knowledge and learn to make good use of it. In the same way, it reduces the time of teaching and improves the efficiency of teaching.

Through the teaching created by mathematical context, teachers need to use a variety of modern technologies in the teaching process, such as PowerPoint, Seewo, etc. These all technologies can improve teachers' teaching efficiency. In the process of context teaching, teachers and students communicate with each other, encourage each other, and find and solve problems jointly. In this process, teachers lead students to think, students provide new ideas, teachers and students have close communication, and the classroom atmosphere is harmonious, thus it is conducive to promoting the relationship between teachers and students.

3.4. Promoting the Cultivation of Students' Mathematics Core Literacy

Context teaching can promote the cultivation of students' mathematics core literacy, which has integrity, consistency and stage, but the mathematics core literacy of each learning section is not consistent [1].

In the "Compulsory Education Mathematics Curriculum Standards (2022 edition)", it is clearly stated that core literacy is mainly manifested in requiring students to observe the real world with

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mathematical vision, think about the real world with mathematical thinking, and express the real world with mathematical language in the compulsory education stage [1].

3.4.1. Mathematical Vision

The first part is observing the real world with mathematical vision. In this part, the core literacy of junior middle school mathematics includes abstract ability, geometric intuition, spatial concept and innovative consciousness [1]. Mathematics is a way to observe the world. Through context teaching, teachers create mathematical context to simulate real life, guide students to find and put forward meaningful mathematical problems in the created mathematical context, and form students' mathematical vision. Furthermore, teachers cultivate students' habit of looking at real problems from the perspective of mathematics gradually. After that, teachers cultivate students' ability to abstract the concept or structure of mathematical research objects in the real world, and discover mathematical knowledge of natural things in the world. Finally, the habit of observing the world from the perspective of mathematics should be formed. At the same time, students can cultivate curiosity, exploration and innovation awareness of the world [9].

3.4.2. Mathematical Thinking

The second part is the ability to think mathematically about the real world. In the second part, the core literacy of junior middle school mathematics includes calculation ability and reasoning ability [1]. Mathematics is a method for students to solve the problem in the world. In the last past, research just mentioned to find the problem, then it is the time to use the idea of mathematics to solve the problem.

In the process of context teaching, teachers should guide students to solve mathematical problems in the context with logical and mathematical methods after students find mathematical problems with mathematical vision. Some research proved that it is useful to improve students' reasoning ability and the problem-solving ability [10,11]. Further, teachers guide students to explore the "rediscovery" process of mathematics in the existing mathematical laws in the real world, and explore the accuracy and rigor of mathematical laws. Finally, students should form the spirit of scientific research to seek truth from facts and develop the ability of mathematical logical reasoning and rational thinking when thinking about the world with mathematical thinking.

3.4.3. Mathematical Language

The third part is being able to express the real world in mathematical language. In the third part, the core literacy of junior middle school mathematics includes data concept, model concept and application consciousness [1]. The language of mathematics is a succinct expression of the real world. After completing the steps of finding and solving problems in the context teaching, students are required to express the mathematical problems of the world with mathematical language.

In the process of context teaching, teachers should teach students the necessary and basic mathematical language first, and then guide students to express the method of solving context problems. Students are further taught to consciously use mathematical language to express problems in the real world or in other disciplines. It is also necessary for teachers to remind students pay attention to the rationality and rigor of mathematical language. When students can use mathematical language to express problems skillfully, they can experience the concise beauty and logical integrity of mathematical language.

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4. Difficulties in Context Creation and Implementation

4.1. Teachers Having an Inaccurate Understanding of Context Teaching

Xiaohu He's research shows that teachers of different ages have different understandings of context creation, and the creation methods are not accurate enough [12]. Thus many teachers have an inaccurate understanding of context teaching. The value of context teaching has not been fully reflected, because everyone's understanding is different and not entirely accurate. So it has not played the value of context teaching and not really used context teaching to help students grow up. Therefore, it can be concluded that after the release of the new curriculum standards, teachers' learning of context teaching is not deep enough. This reflected that the government's education and teaching training is not in place.

4.2. Low Efficiency of Context Teaching

Through teachers' interviews, Fengting Lu concluded that there are some problems in context teaching practice, such as the limitation of class time and the lack of group discussion [4]. Context teaching requires teachers to guide students to think independently, but students are not adapted to this teaching model. It leads that teachers often need to spend more time in the group discussion and thinking stage, but even can't get effective answers. This affects the teaching progress of teachers, furthermore, the curriculum requirements and time are relatively urgent. These two factors make it difficult for teachers to complete the teaching task.

4.3. Single Material Acquisition Approach and Presentation Modes of the Context

Muya Su's research points out that some teachers only have a single material acquisition approach to create context, which is affected by various factors [6].

Because of the single material acquisition approach, the content of context will be boring and can't attract students' attention. At the same time, the type of context that teachers created is limited and single. The most widely used context analysis framework in the world is PISA mathematical literacy assessment framework. It divides mathematical context into four categories roughly. They are personal context, professional context, social context and scientific context [13]. When most teachers create context, they tend to create social context, but other types are less [6]. Every types of context is very important in mathematics. If only one type of context is created, the value of context teaching can't be brought into full play. Accepting only one type of context for a long time will make students have boring thoughts. Thus it will reduce the enthusiasm of students to learn. The incomplete context teaching method is very limited to the help of students, and can't achieve the purpose of cultivating the core quality of students' mathematics.

At the same time, the presentation modes of the context are single. Teachers tend to only explain the mathematical knowledge instead of letting students have group discussion. Or teachers tend to use Powerpoint or blackboard to demonstrate the context, but these tools may be too single to attract students' attention.

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5. Suggestions in Mathematical Context Teaching

5.1. Suggestions in Teachers' Inaccurate Understandings

5.1.1. Strengthen the Training of Teachers

The government should strengthen the theoretical foundation of teachers and organize teachers to learn the content of mathematics context teaching in the new curriculum standards, which could help teachers clarify the important position and role of context teaching in mathematics teaching.

In addition, the government can organize teachers to learn the relevant theories of context education and the practical application of context education in mathematics teaching. This will help teachers have a better understanding of context education and lay a solid theoretical foundation for practical application. In order to update teachers' teaching knowledge and improve their teaching skills constantly. teachers should participate in various forms of mathematical context teaching training and seminars actively. The government can also invite the specialists in mathematics education to share the most recent findings from research and real-world experience with context teaching. By this way, It can help teachers to solve practical problems encountered in context teaching.

The schools can organize a seminar for teachers to share the experience of context teaching. For example, discuss how to create context and how to guide students to participate in context, etc. In addition, teachers can also observe the teaching process of others. Then they discuss its advantages and disadvantages and make suggestions for improvement, which are helpful to cultivate teachers' ability. Through communication, teachers can find problems and improve themselves, so as to enhance their context teaching ability.

Organizing teachers to observe the successful courses of teachers who have rich experience in the mathematical context teaching is a helpful way to enhance teachers' context teaching ability. After the observation, the teachers are organized to discuss and analyze the successful cases, learn different context creation methods and teaching skills, and reflect on their own teaching practice to find out the shortcomings.

5.1.2. Pay Attention to the Accuracy of the Context Creation

Inaccurate understanding will lead to inaccurate context design, so teacher should pay attention to the accuracy of the context creation. Teachers need to analyze the content of teaching materials carefully, clarify the teaching objectives, and find out the knowledge points which are suitable for the context creation. In the context creation, teachers should pay attention to whether the context and knowledge point are suitable, and create a context that can reflect the essence of mathematical knowledge, so as to help teachers and students complete the teaching objectives better and promote the all-round development of students.

5.2. Suggestions in the Low Efficiency of Context Teaching

5.2.1. Pay Attention to the Time Management

Teachers need to pay attention to the time management and complexity of context. When the time the context occupied in the mathematics class is much longer, it can't get the better result. If the time is too long, it will not only fail to play the role of the context, but also distract students' attention. So that it will fail to achieve the effect of the context teaching.

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5.2.2. Control the Complexity of Context

Teachers need to control the complexity of context. By the same token, the more complex the content and background of the context, it can't get the better result. Teachers should respect students' individual differences. The purpose of context creation is to deepen students' understanding of knowledge and improve students' abilities. Therefore, it is necessary to start from the actual learning context of students and design context which has different complexity for students with different foundations [14].

If teachers design highly complex content for students with weak foundations, it is difficult to achieve the purpose of improving the class teaching effect. If the context is too simple for students with strong foundation, it is not only difficult to attract students, but also difficult to achieve the purpose of improving students' various abilities.

For example, when learning the plane cartesian coordinate system in middle school, different learning bases can adopt different context designs. For students with weak foundation, teachers can adopt positioning games that are closer to life. For example, Mary is standing in a corner of the playground and wants to tell her friend where Tom is. How do Mary tell him? And how to let her find Mary? Give the students this game to think about, which can lead to the concept of cartesian coordinates. Through the design of the game context, the class increases interest. Thus teachers can attract students' attention quickly and trigger students' positive thinking. This can stimulate students' intrinsic learning motivation and promote students' active learning.

5.3. Suggestions in the Single Types and Presentation Modes of the Context

5.3.1. Suggestions in the Single Types and Content of the Context

Every type of context is very important in mathematics, so teachers should not only create social context and scientific context, but also create the personal context and professional context.

At the same time, the context creation should have innovation. Through this way, it can enrich the content of the context. Both the world and the objectives of education training are changing. Teachers should keep up with the pace of development of the era and understand the need of talent training. Teachers need to innovate constantly and integrate new content into the context. For example, the current orientation of education encourages the combination of traditional Chinese culture and mathematics, and encourages the combination of mathematics and modern information technology.

Regarding the combination of history and culture with mathematics, most modern studies focus on the combination of mathematics history and mathematics culture(HPM). For example, study the history of mathematics and mathematics education, and teachers will give students an example of a context in the history of mathematics.

For example, when teachers go to the content of the Pythagorean theorem, they can use the story of Gao Shang who put forward the special case of the Pythagorean theorem of "three strands, four strings and five strings" to create the context. Or ask Shuang Zhao for help, because he made the Zhao Shuang string diagram, which can testify to the Pythagorean theorem. Pythagorean theorem can be verified by means of the combination of numbers and figures. Teachers can restore the ancient background at that time and guide students to think about how Shuang Zhao reached his conclusion.

5.3.2. Suggestions in the Single Presentation Modes of the Context

Single presentation modes of the context will be too single to attract students' attention, so teachers need to enrich the presentation ways, and the combination of mathematics and modern technology is a hot topic nowadays.

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Regarding the combination of mathematics and modern technology, teachers use modern technologies to transform abstract mathematical knowledge into the concrete figure to students. It can make students have a better understanding on the mathematical knowledge and improve their imagination ability. In addition to the drawing board tool above, teachers can not only use Power point for picture display, but also use VBA program design questions for student to answer interactively.

6. Conclusion

In this paper, it studied the significance and research status of mathematics context teaching in China. Through literature review analysis, the following conclusions are reached:

It is found that mathematical context teaching has various meanings. Besides improving students' scores in the middle school entrance examination, it can also stimulate students' enthusiasm in mathematics learning, improve middle school mathematics teaching and learning efficiency, promote the cultivation of mathematics core literacy, and cultivate students' problem-solving ability. But at the same time, the research found that there are still many problems in the implementation of mathematics context teaching in China.

Firstly, the research finds that teachers have an inaccurate understanding of context teaching. About this difficulty, the research put forward that the government and schools can strengthen the training of teachers and remind the teachers of the accuracy of the context creation.

Secondly, the research finds that the efficiency of context teaching is low. About this difficulty, the research propose that teachers should pay attention to the time management and control the complexity of context. Through this way, it is helpful to improve the efficiency of context teaching.

Thirdly, the research finds that the material acquisition approach and presentation modes of the context are single. About this difficulty, the research present that teachers need to enrich the material acquisition approach and presentation modes of the context. For example, teachers can create the context combined with the mathematics history and mathematics culture.

This conclusion are helpful to the research on the mathematical context creation of middle school. This research results provide new insights and solutions for the implementation of mathematics context teaching, which will help to promote the development and progress of the field. However, there are some limitations to this study. First, this research is lacking of the complete evaluation system for the effectiveness of context teaching. Then, the data and samples of this research is not enough. Lastly, this research has not put forward a further plan for the implementation of context teaching after class. Future research could further refine and refine above approach to better address mathematics context teaching.

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