



# Research on Implementation of Application Consciousness Literacy in Junior High School Mathematics Classroom Instruction

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## **Authors' contributions**

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

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## **ABSTRACT**

The Compulsory Education Mathematics Curriculum Standard (2022 Edition) proposes that the junior high school mathematics curriculum should cultivate students' mathematical application consciousness literacy in China. The classroom is the main position for students to learn mathematical knowledge, so how to better implement the cultivation of junior high school students' mathematical application consciousness literacy in classroom teaching is a key issue we need to study. This paper adopts the method of theoretical research. The first part explains the research questions. The second part analyzes the characteristics based on the connotation and requirements of application consciousness literacy. The third part analyzes the current situation of junior high school mathematics teaching. The fourth part puts forward the following training strategies to promote the implementation of application consciousness literacy: 1. Adopting a rich

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variety of teaching methods to stimulate the students' interest in learning; 2. Tapping into the connection between mathematical knowledge and real life to cultivate the students' mathematical vision; 3. Implementing interdisciplinary teaching to establish the connection between different disciplines; 4. Creating practical situations to enable students to form a learning style that combines theory and practice. The fifth part summarizes the full text.

*Keywords: Junior high school; mathematics; classroom instruction; application consciousness literacy.*

## 1. INTRODUCTION

The Compulsory Education Mathematics Curriculum Standard (2022 Edition) (hereinafter referred to as the Curriculum Standard (2022 Edition)) states that the mathematics curriculum should cultivate students' core literacy so that they can express the real world in the language of mathematics, and one of the expressions of the language of mathematics is the application consciousness literacy. Application consciousness helps students use what they have learned to solve practical problems and develop practical skills [1]. Therefore, it is very necessary to implement application consciousness literacy in junior high school mathematics classrooms [2]. What is the meaning of application consciousness literacy? What are the requirements of the Curriculum Standard (2022 Edition) for the implementation of application consciousness literacy? What are the characteristics of application consciousness literacy? What is the current situation of secondary school mathematics teaching? How to promote the implementation of application consciousness literacy in secondary school mathematics teaching? In this paper, we will discuss the above questions that are worth pondering.

## 2. ANALYSIS OF APPLICATION CONSCIOUSNESS LITERACY

### 2.1 Connotation of Application Consciousness Literacy

The Curriculum Standard (2022 Edition) states that application consciousness refers to the conscious use of mathematical concepts, principles, and methods to explain phenomena and patterns in the real world and to solve real-world problems [1].

Consciousness refers that students can actively try to apply mathematical knowledge to explain phenomena and solve problems; concepts, principles, and methods of mathematics refer to

what students have learned about mathematics. Phenomena in the real world refer to things encountered in daily life, e.g., bees building nests; laws refer to the relationships between things summarized by observing phenomena. Problems in the real world refer to problems that actually exist in the real world, and they are differentiated from math practice problems by highlighting authenticity, such as the question of what is the most appropriate way to choose when taking out a loan to buy a house.

Thus, application consciousness literacy means the literacy of individuals who can actively apply the mathematical knowledge they have learned, such as concepts, principles, and methods, to their lives, thus helping them to better understand, adapt to, and change the real world.

### 2.2 Requirements for the Development of Application Consciousness Literacy

The Curriculum Standard (2022 Edition) sets out two requirements for the development of application consciousness literacy: to be able to perceive that real life contains a large number of quantitative and graphical problems that can be solved mathematically; and to have an initial understanding of the use of mathematics as a universal scientific language in other disciplines, and to establish connections between different disciplines through interdisciplinary thematic learning [1].

Unlike recognizing, perceiving means understanding and comprehending in addition to recognizing and feeling, which is more demanding. That is to say, we cannot just know that many problems in real life can be solved by mathematical methods, but we have to further understand and comprehend them. Universal means that it can be used universally within a certain range, that is to say, the scope of application of mathematics is not limited to its own discipline, but can be used universally in other disciplines within a certain range. Interdisciplinary thematic learning means

crossing the boundaries between disciplines, establishing connections between disciplines on top of focusing on the internal logic of each discipline, and integrating the disciplines to implement integrated multidisciplinary fusion learning [3].

Thus, the first requirement is that students should be able to find out that a large number of problems in real life can be solved by mathematical methods, and that some problems can be solved directly, while others need to be transformed into mathematical problems and then solved by mathematical methods. The second requirement is that students should be able to discover the connections between mathematics and other subjects, apply what they have learned in mathematics to other subjects as needed, and build up an interconnected knowledge system between different subjects. Taken together, this literacy requires students to learn to observe and analyze, think and express, explain and interpret the real problems encountered in social life and science and technology from the perspective of mathematics, to experience the integration of mathematics with science, technology, finance, geography, art and other disciplines, to integrate the knowledge and ideas of mathematics with those of other disciplines, to accumulate experience of mathematical activities, to appreciate the scientific value of mathematics, and to develop the application consciousness and practical ability [4].

## **2.3 Characteristics of Application Consciousness Literacy**

### **2.3.1 Emphasize that students can perceive that many problems in reality are related to mathematics and can be solved mathematically**

Application Consciousness, as the name suggests, emphasizes application. Before application, students first need to recognize, feel, understand, and appreciate that many mathematics-related problems in the real world can be solved by applying mathematical methods through observation and reflection. Some problems are not direct mathematical problems, but they can be transformed into mathematical problems and solved by mathematical methods. Mathematics is everywhere in life and can be seen as a powerful tool for better understanding, adapting, and changing the world.

### **2.3.2 Emphasize that students consciously discover knowledge related to mathematics in real life and solve practical problems**

Real life contains a large number of problems related to mathematics, students need to have the consciousness of actively abstracting mathematics from real life and applying mathematical knowledge to solve practical problems, and consciously take the initiative to find knowledge related to mathematics in real life, to understand the background of this knowledge and the real situation that can be applied and so on. Based on understanding and mastering this knowledge, with the help of mathematical vision, they can find and put forward mathematical problems from real life, and then apply mathematical knowledge to solve practical problems from the perspective of mathematics.

### **2.3.3 Emphasize the combination of theory and practice, and apply the mathematical knowledge learned to real-life**

The combination of theory and practice can be regarded as two aspects of mathematical knowledge realization and real problem mathematization, which are complementary and indispensable. Learning knowledge is not the ultimate goal, combining the theoretical knowledge learned with practice, utilizing the knowledge learned to guide practice, and achieving better practical results is the practical significance of continuous learning of mathematical knowledge. Using the learned knowledge and methods to solve simple practical problems, develop the habit of linking theory to practice, and develop the practical ability, which is also the important significance of cultivating students' application consciousness literacy. Mathematics is a practical subject, for example, after learning the content of the probability part, we can calculate the probability of some events, to choose the best option in our favor.

### **2.3.4 Emphasize the application of mathematical knowledge to other disciplines and the establishment of links between different disciplines**

Apart from applying mathematical knowledge to explain phenomena and solve problems in the real world, mathematical knowledge can also be

applied to other disciplines, especially physics and chemistry. Teachers guide students to apply the mathematical knowledge they have learned to other disciplines, analyze the nature, relationship, laws, etc. of things in other disciplines with mathematical vision, break the boundaries of disciplines, and form an interdisciplinary thematic learning mode, which not only promotes the development of various disciplines, but also helps students to form an interconnected knowledge system among various disciplines, and to develop interdisciplinary application consciousness and practical ability.

### **3. ANALYSIS OF THE CURRENT SITUATION OF SECONDARY SCHOOL MATHEMATICS TEACHING**

#### **3.1 Teachers Mostly Use the Teaching Method of Lecturing**

At present, most junior high schools in China adopt the teaching method of lecturing [5]. Teachers use blackboard writing or multimedia courseware to impart the knowledge involved in the exam outline to students. Although the curriculum reform has always emphasized that students are the main body and teachers are the guides, organizers, and collaborators, from the current teaching status quo, the teacher as the lecturer still occupies a dominant position, and the students, as the receivers, follow the teacher's thinking. For students, the form of passive acceptance of knowledge is boring, which leads to a lack of interest in learning, and they adopt a mechanical learning approach to mechanically memorize a certain mathematical knowledge point. Although they memorize a certain knowledge point, they do not have the consciousness of applying the knowledge point to solve the problem, and they do not know how to apply the knowledge point to solve the problem.

#### **3.2 Teachers' Teaching Concepts Are Influenced by Exam-oriented Education**

At present, China's main evaluation method for junior high school students is still in the form of exams, although the proportion of the process evaluation method is gradually increasing, for junior high school students, the mid-term, final examination, and senior high school entrance examination still occupy the main position. This

evaluation system, in which exams are the main form of evaluation, affects teachers' teaching concepts [6], and how to maximize students' mastery of the knowledge to be examined in exams in the limited classroom teaching time has become the primary concern of every junior high school mathematics teacher. Therefore, the teaching goal of teachers is to make students absorb and master knowledge, rather than learning to apply knowledge. Under the influence of this concept, after learning new knowledge, students think about how to memorize the knowledge and be able to cope with the types of questions that will appear in the examination, to score high marks in the examination. They lack mathematical vision and find it difficult to identify mathematical problems in life and think actively about how to use what they have learned to solve real-life problems.

#### **3.3 Students' Understanding of Mathematics Knowledge is Shallow**

For some students, they can understand mathematical concepts when learning mathematics knowledge, master and use mathematical formulas, rules, and other knowledge to solve exercises. However, teachers only taught what this knowledge was and what questions would be asked in response to this knowledge, and students passively accepted this knowledge without knowing much about the background of this knowledge and the practical application. Their understanding of mathematical knowledge is shallow and superficial, and they do not find the diverse applications of mathematical knowledge in real life and other subjects [7].

#### **3.4 Students Are Intimidated by Mathematics Application Questions**

Most students are more inclined and better at completing multiple-choice and fill-in-the-blank questions than mathematics application questions and are intimidated by answer questions, which are also known as mathematics application questions [8]. Students lack the exercise of combining theory and practice in the true sense and are unfamiliar with the types of questions that apply mathematical knowledge in the actual situation. At the same time, mathematics application questions are long and difficult to understand and solve. Before solving

the problem, students have developed a sense of psychological fear and are determined that they will not do it. Therefore, they even give up before reading the problem, which is also one of the reasons for deepening students' resistance to the subject of mathematics.

#### **4. STRATEGIES FOR IMPLEMENTING APPLICATION CONSCIOUSNESS LITERACY IN SECONDARY SCHOOL MATHEMATICS CLASSROOMS**

##### **4.1 Adopting a Rich Variety of Teaching Methods to Stimulate the Students' Interest in Learning**

This strategy requires teachers to adopt a variety of teaching methods such as heuristics and cooperative inquiry based on teaching methods. In the teaching of new knowledge, teachers should teach in an inspired way, guide students to think positively and cooperate with the group to explore the further application of knowledge, so that every student can actively participate in the study of knowledge, experience a complete process of learning and inquiry, and stimulate students' interest in learning mathematics knowledge in the process of inquiry [9].

The connotation of application consciousness literacy emphasizes that students can actively apply mathematical knowledge to explain realistic phenomena and laws and solve practical problems. To cultivate students' initiative in applying mathematics knowledge, it is necessary to cultivate students' interest in learning mathematics first. Interest is the best teacher for students. After students have an interest in learning, it is easier for them to improve their consciousness of actively learning mathematical knowledge and applying mathematical knowledge to solve problems. Taking a variety of teaching methods is an important way to stimulate students' interest in learning. One of the current teaching situations is that teachers mostly adopt the teaching method, the classroom is boring, and students lack interest in learning mathematics. Therefore, the current junior high school mathematics teaching should adopt a combination of heuristic, cooperative inquiry, and other teaching methods to enhance students' interest in learning, encourage students to take the initiative to learn mathematics and help students improve their consciousness and ability to consciously use mathematical

knowledge to explain practical phenomena and solve practical problems.

##### **4.2 Tapping into the Connection Between Mathematical Knowledge and Real Life to Cultivate the Students' Mathematical Vision**

The strategy is to require teachers to guide students to understand and explore the real world from the perspective of mathematics based on tapping the connection between mathematical knowledge and real life, and cultivating their ability to find quantitative relations and spatial forms from the objective phenomena of the real world and put forward meaningful mathematical problems [1].

One of the requirements for the cultivation of application consciousness literacy is that students can perceive that there are a large number of problems in real life that can be solved by mathematical methods. This requirement requires students to have a mathematical vision [10], to abstract the research object and its attributes of mathematics, and to understand the mathematical principles behind natural phenomena [1]. Tapping the connection between mathematical knowledge and real life is an important way to cultivate students' mathematical vision. One of the current teaching situations is that teachers' teaching concepts are influenced by exam-oriented education, pay attention to knowledge teaching, students pay attention to the memory of knowledge, and lack of cognition in the connection between mathematics and life. Therefore, the current junior high school mathematics teaching should fully explore the connection between mathematical knowledge and real life, help students perceive that there are a large number of problems related to mathematics in real life, that can be solved by mathematical methods, and cultivate their ability to discover mathematical problems and apply mathematical knowledge to solve problems.

##### **4.3 Implementing Interdisciplinary Teaching to Establish the Connection between Different Disciplines**

The strategy is to require teachers to cross the boundaries between different disciplines, establish interdisciplinary links based on paying attention to the internal logic of various disciplines, and integrate disciplines so that mathematics disciplines and other disciplines can

penetrate each other, and then implement integrated multidisciplinary fusion teaching in teaching practice [3].

One of the requirements for the development of application consciousness literacy is that students can understand the applications of mathematics in other disciplines and make connections between different disciplines through interdisciplinary thematic learning. This requirement needs students to engage in interdisciplinary learning, which means that teachers need to engage in interdisciplinary teaching. One of the current teaching situations is that students' understanding of mathematical knowledge is shallow, and they can only mechanically apply formulas, laws, and other knowledge to solve exercises, and they are not aware of the important application value of mathematical knowledge [11]. Therefore, the current junior high school mathematics teaching should implement the interdisciplinary teaching mode to help students actively apply mathematics to other disciplines based on perceiving the important application value of mathematics and diversified application methods, use mathematical knowledge to solve problems in other disciplines and establish the connection between mathematics and other disciplines.

Taking the teaching of the twenty-fifth chapter "Probability Preliminary" in the ninth grade of junior high school mathematics as an example, this chapter involves the learning of knowledge such as random events, inevitable events, and impossible events. In teaching, teachers can guide students to use the mathematical knowledge they have learned to explain idioms such as 'rising ship, dripping stones, fishing for the moon in the water' so that students can feel the extensive connection between mathematics and other disciplines, and realize interdisciplinary teaching.

#### **4.4 Creating Practical Situations to Enable Students to Form a Learning Style that Combines Theory and Practice**

The strategy is to require teachers to create situations that are close to students' learning and life reality after fully preparing lessons, and which present mathematical problems with specific and vivid life scenes as carriers. With the help of these situations, mathematical knowledge is taught to help students form a learning method combining theory and practice.

The characteristics of application consciousness emphasize the combination of theory and practice, requiring students to be able to closely link mathematical knowledge with real life. The actual situation is closely related to students' lives [12], and it is an important medium to connect mathematical knowledge with real life. One of the current teaching situations is that students lack the exercise of combining theory with practice, and they are afraid of mathematical application problems. Therefore, the current junior high school mathematics teaching should create intuitive and interesting actual situations for teaching, help students learn how to realize the reality of mathematical knowledge and the mathematization of real problems, and then help students use the theoretical knowledge they have learned to guide practical activities. At the same time, it can also enrich theoretical knowledge in practical activities and achieve a good combination of theoretical knowledge and practical activities.

A researcher took two classes in Grade 7 of Tianjiabing Middle School in Fanchang County as the object, took whether there was a teaching strategy to cultivate application consciousness as the independent variable, and took the level of students' application consciousness as the dependent variable to carry out research. The experimental results show that fully excavating the relationship between mathematical knowledge and life and creating practical problem situations for teaching can help students improve their application consciousness, so these training strategies are effective [13].

## **5. CONCLUSION**

In junior high school, mathematics occupies an important position. It is very important for students to learn mathematics well and to apply mathematical knowledge flexibly. For the application consciousness literacy, one of the core accomplishments, the 'Curriculum Standard (2022 Edition)' involves the explanation of its connotation, training requirements, and other contents, hoping to help students improve their mathematics application consciousness literacy. However, the current teaching situation in junior high schools is that teachers stick to traditional teaching concepts and teaching methods, and students lack interest in learning mathematics and have a shallow understanding of mathematics knowledge. Based on the above analysis, to better implement the application consciousness literacy in junior high school

mathematics classroom teaching, teachers need to keep up with the pace of the times, update the concept of education and teaching in time [14], ensure the dominant position of students [15], cultivate students' mathematical vision, adopt a variety of teaching methods, create problem situations related to real life, stimulate students' interest in learning and desire to explore and infiltrate the application consciousness literacy in the mathematics classroom. In addition, teachers of various disciplines also need to strengthen cooperation and implement interdisciplinary teaching to help students form a knowledge system in which knowledge of various disciplines is interrelated, and form a benign relationship in which various disciplines promote each other and develop together.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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