

# How to Use the New Textbooks to Implement the Core Literacy of the Mathematics Subject

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## Abstract

Two years ago, the press conference held by Beijing Normal University proposed that cultivating students' core literacy is the direction of deepening the new round of curriculum reform and it was necessary to focus on the development of students' core literacy of mathematics subject as the training goal of ordinary high schools. At present, People's Education Press has written high school mathematics textbooks under the guidance of the core literacy of mathematics subject, which is expected to be officially used nationwide in the autumn of 2019. In order to better help teachers use the new textbooks to cultivate students' core literacy of mathematics subject, based on the understanding of textbooks and the requirements of implementing the core literacy of mathematics subject in ordinary high schools, this paper puts forwards specific suggestions to help teachers understand the new textbooks from a macro perspective, interpret the new textbooks from a microscopic perspective and carry out teaching activities on the basis of the textbooks. At the macro level, teachers should understand the changes of textbooks and the extent of textbooks to implement the students' core literacy of mathematics subject. At the micro level, teachers should understand the intention of material selection in textbooks, grasp the intention of the arrangement sequence of textbooks, and grasp the intention of creating the situations in the textbooks. When carrying out teaching activities on the basis of textbooks, teachers should implement the concept of "teaching with textbooks".

## Keywords

High School, New Textbooks, Core Literacy of Mathematics Subject

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## 1. Introduction

Core literacy is known as the DNA of contemporary basic education. The top-level concept of future basic education is to strengthen students' core literacy [1]. In 2017, the newly issued "Mathematics Curriculum Standards for Ordinary High Schools" put forward that it was necessary to focus on the development of students' core literacy as the training objective of the ordinary high schools. As the concrete expression of mathematics curriculum standard, mathematics textbooks should be fully excavated to broaden students' horizons, so as to achieve the core goal of improving students' core literacy [2, 3]. How to understand the new textbooks from a macro perspective? How

to interpret the new textbooks from a microscopic perspective? How to carry out teaching activities on the basis of the textbooks? The study of these problems will be helpful for teachers to use the new textbooks to cultivate students' core literacy of mathematics subject.

## 2. Understanding on the Textbooks

### 2.1. The Connotation of the Textbooks

Textbooks are resources (materials) designed for teachers and students to use in teaching, which is often printed and published [4]. When writing the textbooks, the age

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characteristics and cognitive level of the students are taken into account, so that the students can understand the new knowledge according to the existing mathematical experience and can carry out effective learning activities. In the aspect of knowledge, appropriate materials are selected according to the characteristics of specific teaching contents, and appropriate life situations are created [5].

## 2.2. The Importance of Textbooks in Teaching

Textbooks are an important factor restricting the teaching process, and the purpose of writing textbooks is to facilitate teaching [6, 7]. The "Mathematics Curriculum Standards for Ordinary High Schools" issued in 2017 pointed out that mathematics textbooks provided learning themes, basic clues and specific content for "teaching" and "learning" activities, and were an important teaching resource for realizing the objective of mathematics curriculum and developing the core literacy of students' mathematics subject [8]. They were also the carrier of teaching, the useful material of teaching, the treasure of the hands of teachers, and the spiritual food for the healthy growth of students. In teaching, teachers only need to organize students to carry out various activities according to the arrangement of textbooks, which can effectively realize the transformation of students' learning styles, truly guide students to learn independently, cooperate with each other, actively explore, and with the help of textbooks, teachers can excavate the potential of students, open up students' intelligence, develop students' ability, and ultimately develop personalized students who will be useful for social development in the future [9, 10, 11].

## 3. The Requirements of Implementing the Mathematical Core Literacy

Core literacy of mathematics subject is a necessary character and key ability with basic characteristics of mathematics and adapting to the needs of personal lifelong development and social development. It is the concentrated embodiment of the objective of mathematics curriculum, which is gradually formed in the process of mathematics learning [1].

The outline of the National Medium-and Long-term Education Reform and Development Plan (2010-2020) pointed out that insisting on people-oriented and carrying out quality education in an all-round way was the strategic theme of educational reform and development [12]. In March 2014, the Ministry of Education issued the "Opinions on Comprehensively Deepening the Reform of Curriculum and Carrying out the Fundamental Tasks of cultivating talents", pointing out that "core literacy"

should be regarded as an important basis for curriculum objectives and teaching requirements of various subjects: "According to the core literacy system for students' development, it is necessary to clarify the requirements for students to complete the learning content of different sections of learning, different grades and different subjects." At the same time, schools of all levels and types are required to implement the requirements of core literacy and academic quality in the teaching of various subjects according to the actual situation and the characteristics of students [1]. The "Mathematics Curriculum Standards for Ordinary High Schools" issued in 2017 took the implementation of the core literacy of mathematics subjects as the revision focus, and clearly pointed out that mathematical abstraction, logical reasoning, mathematical modeling, intuitive imagination, mathematical operation and data analysis was the six core literacy of mathematics subject. In order to implement the core literacy, it was proposed in the compilation of textbooks that the compilation of mathematics textbooks should run through the main line of developing the core literacy of students' mathematics subject. Specific suggestions are as follows: (a) the compilation of textbooks should take the development of student's core literacy of mathematics subject as the purpose and promote the development of students' core literacy of mathematics subject. (b) the compilation of textbooks should reflect the integrity and highlight the integration of content and core literacy of mathematics subject. In teaching, teachers should establish a teaching consciousness oriented to the development of students' core literacy of mathematics subject, and cultivate the core literacy of mathematics subject throughout the whole process of teaching activities. In teaching practice, teachers should constantly explore and innovate the teaching methods, not only pay attention to how to teach, but also pay attention to how to learn, guide students to learn mathematics, develop good learning habits; strive to stimulate students' interest in mathematics learning and encourage more students to love mathematics [8].

At present, the task of high school mathematics teaching is to implement the six core literacy of mathematics subject. The new textbooks, which is expected to be officially used nationwide in autumn 2019, run through the main line of developing students' core literacy of mathematics subject. As we all know, high school mathematics textbooks are the materials that teachers and students must apply in teaching activities, the main media of teaching, and play an important role in teaching. Therefore, teachers should fully study the textbooks, deeply understand and grasp the intention of the arrangement sequence of textbooks, and carry out teaching activities based on the textbooks, so as to develop students' core literacy of mathematics subject.

## 4. Using New Textbooks to Implement the Mathematical Core Literacy

### 4.1. Understanding the Changes in the Textbooks

In order to cultivate students' core literacy of mathematics subject, People's Education Press has rewritten high school mathematics textbooks according to the "Mathematics Curriculum Standards for Ordinary High Schools". Textbooks are teachers' teaching books, teachers should grasp the new version mathematics textbooks of high school guided by core literacy from a macro perspective, and understand some changes and implementation suggestions of textbooks. For example, teachers can learn about the changes in the new textbooks from the following aspects: (a) comparing with the original textbooks, the new textbooks delete polar coordinates and parametric equations, program charts, preliminary algorithm, three views, linear programming, relations between propositions, logical connectives, definite integrals and so on. (b) the knowledge points of the new textbooks are more integrated, such as the content of arbitrary angles and the radian system, the concept of trigonometric functions, the images and properties of trigonometric functions distributed in chapter 1 of the compulsory fourth volume and the content of trigonometric identity transformation distributed in chapter 3 of the compulsory fourth volume, which are now all integrated into chapter 5 of the compulsory first volume. (c) the difficulty of the new textbooks is obviously distinguishable: The content of the two compulsory textbooks of the new textbooks is relatively basic, which is suitable for the students in the first year of high school; the content of three optional compulsory textbooks of the new textbooks are obviously more difficult in content, which is suitable for students in the second year of high school. (d) the new textbooks pay more attention to the students' mastery of the basic knowledge, and the proportion of mathematics culture and mathematics application in the textbooks also begins to increase. For example, after the concept of function, reading and thinking links are supplemented to introduce the development of the concept of function. In the aspect of implementation suggestions, the class hour suggestions and teaching suggestions for each chapter of each textbook are given.

### 4.2. Understanding the Extent of Textbooks to Implement the Students' Core Literacy of Mathematics Subject

The new high school mathematics textbooks are based on the core literacy of mathematics subject. The "Mathematics Curriculum Standards for Ordinary High Schools" divided the

core literacy of mathematics subject into three levels (level one, level two, level three), and each level was divided into the same four stages (situation and problems, knowledge and skills, thinking and expression, communication and reflection). In order to better grasp the textbooks and carry out the task of cultivating students' core literacy of mathematics subject, teachers need to understand the level of core literacy achieved in the design of each section of the new high school mathematics textbooks in terms of knowledge presentation, propositional derivation, student's activity arrangement, example presentation and post-class exercises, and on this basis, the teaching content which can't reach the higher level of cultivating students' core literacy in the textbooks should be expanded appropriately. It is necessary for ordinary high school mathematics teachers with many years of teaching experience to evaluate which level and which stage of the new textbooks reach the three levels and the four stages of the "Mathematics Curriculum Standards for Ordinary High Schools" in each section. These data are also under investigation by us at present.

### 4.3. Understanding the Intention of Material Selection in Textbooks

The materials selected for the textbooks are not arbitrary, but rather profound. Textbook compilers should not only take into account the content of knowledge, but also take into account students. Neither of them should not be abandoned and neither of them is indispensable. As far as knowledge is concerned, it is necessary to choose the appropriate materials according to the characteristics of the specific teaching content; from the perspective of students, the materials should be in line with the age characteristics and cognitive level of students, and should enable students to understand new knowledge according to the existing mathematical experience and carry out effective learning activities. When studying textbooks, teachers must grasp the profound intentions of the selection of teaching materials [5]. For example, in the chapter 1.1 concept of set in compulsory volume 1, chapter 1, the textbooks select typical examples (an even set, a set of solutions to quadratic equations, a set of points that make up a circle, a set of students, a set of squares, and a four-ocean set.) on the basis of a set of numbers, a set of solutions and a set of points, then abstract the concept of element and sets, which helps to develop students' mathematical abstract literacy. In addition, the selection of these typical materials not only helps students look back on old knowledge, but also get the new knowledge.

### 4.4. Grasping the Intention of the Arrangement Sequence of Textbooks

Textbooks often elaborate the order of teaching content based on students' cognitive characteristics and cognitive rules. Therefore, teachers should deeply understand and grasp the

intention of the teaching sequence when studying the textbooks, and apply it effectively in teaching [5]. For example, in chapter 3, the concepts and properties of functions, 3.1 arrange the concept and representation of functions, 3.2 arrange the basic properties of functions, 3.3 arrange the power functions, and 3.4 arrange the application of functions, aiming to build the research framework of functions (fact of a function-definition of the concept of a function, representation-property of a function-basic elementary function.). When the content specific to 3.1.1 the concept of function, the arrangement sequence of textbooks is the analysis of function background, summarizing common features, giving a definition, discriminating the concept, simple application and perfecting concept, which is intended to enable students to accurately grasp the concept of function and cultivate students' mathematical abstract literacy; when the content specific to 3.4 power function, the arrangement sequence of textbooks is definition, representation, image and nature, application, which is intended to enable students to master the basic ideas of studying a class of functions, and to cultivate students' mathematical abstract literacy, intuitive imagination literacy, mathematical operations literacy and mathematical modeling literacy.

#### 4.5. Grasping the Intention of Creating Situations in the Textbooks

The situation creation plays an important role in the classroom teaching of high school mathematics, and the textbooks also have a profound design intention when it is created, so teachers must accurately grasp it when they study the textbooks [5]. For example, in the chapter head diagram of trigonometric functions in chapter 5 of compulsory volume 1, the phase change diagram of the moon with periodic changes in the real world is adopted, and in the chapter introduction, the author introduces the phenomenon of the alternation of day and night caused by the earth's rotation and the alternation of seasons caused by its revolution, and it is clearly pointed out that "trigonometric functions" can describe periodic phenomenon, which is helpful for students to grasp the realistic meaning of learning trigonometric functions and to define the learning objectives of this chapter. When the content specific to the 5.6 function  $y = A \sin(\omega x + \varphi)$ , the mathematical model of the uniform circular motion of the scoop waterwheel is created in the textbooks, and the equation  $y = A \sin(\omega x + \varphi)$  is obtained through mathematical modeling. In the process of modeling, it is helpful for students to understand the practical significance of parameters  $A, \omega, \varphi$  and pave the way for the next study on the influence of a parameter on images, which is conducive to the cultivation of students' mathematical

modeling ideas.

#### 4.6. Carrying out Teaching Activities on the Basis of Textbooks

The textbooks are an example, textbook compilers also expect teachers to understand their writing skills, and on this basis, textbooks will be adapted and created according to the students' learning situation. If teachers only teach textbooks, then the classroom will often be boring, and students' desire to explore will be destroyed if they continue to do so [13]. Therefore, teachers must break through the shackles of textbooks, design teaching on the basis of understanding the learning situation, point teaching to the improvement and development of students' real ability, and truly implement the concept of "teaching with textbooks" put forward in the eighth curriculum reform [14]. For example, when adapting and creating textbooks, teachers can reorganize the contents of textbooks from the following three aspects to optimize the effect of teaching. Firstly, in the design of ideas, teachers should update, adjust, supplement and reorganize the contents of textbooks in a programmatic and dynamic way when they apply them, so as to achieve the optimization of instructional design. Secondly, in the design of the content, teachers should fully understand and grasp the curriculum standards and teaching objectives according to the elements reflected in the textbooks, and re-select and re-organize them on this basis to make them become teachable. Thirdly, in terms of activity design, it is necessary to pay attention to the situational nature of the designed activities and guide students to experience the learning process through the activities, that is to say, students' thinking should be gradually deepened along with the activities. In addition, in addition to reflecting some direct facts, the results of the activity also need to contain some questions that can go beyond the superficial facts of the activity and provoke students to think deeply, that is, the activity must be generative [15].

### 5. Conclusion

The new textbooks will be used in high school teaching. In order to better cultivate students' core literacy of mathematics subject and implement the training objective of the ordinary high schools, teachers can do some preparatory work from the following aspects. First of all, teachers need to know what content of the new textbooks has changed compared with the old textbooks, and what are its complication characteristics; secondly, teachers need to understand the extent of textbooks to implement the core literacy of mathematics subject; thirdly, the teacher should understand the intention of the editor from a microscopic perspective such as the selection of materials in textbooks, the arrangement sequence of textbooks and the

scenes of the creation of textbooks; fourthly, teachers need to determine the teaching objective according to the level of the class he teaches, develop the textbooks twice, and truly point the teaching to the improvement and development of the students' actual ability, so as to achieve the task of cultivating students' core literacy of mathematics subject.

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