

Application of Textbooks Under the Standards for General Senior High School Curriculum to Cultivate Students' Mathematical Modeling Literacy

Can Wang, Shuang Qi, Zezhong Yang*

School of Mathematics and Statistics, Shandong Normal University, Jinan, China

Abstract

The revised "Standards for General Senior High School Curriculum" in 2017 clearly states that the core literacy of mathematics is a concentrated expression of the goals of mathematics curriculum. Mathematical modeling is one of the core literacy of the mathematics. The cultivation of mathematical modeling ability is of great significance and value for students' core literacy. Mathematics textbook is the guide to teaching, and it is the basis and blueprint for teacher teaching. Therefore, how to use the existing textbooks to cultivate students' mathematical modeling literacy has become the focus of current core literacy research. This paper starts from the importance of cultivating students' mathematical modeling literacy and the value of textbooks in implementing students' mathematical modeling literacy and analyzes the problems existing in the implementation of mathematical modeling literacy in applied textbooks. Therefore, in view of these problems, this paper puts forward some suggestions on how to apply the textbooks to cultivate students' mathematical modeling literacy from the perspectives of basic knowledge, mathematical modeling topics, comprehensive situational application, and aided teaching through visual means.

Keywords

Core Literacy, Mathematical Modeling, High School Mathematics, Textbooks

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1. The Importance of Cultivating Students' Modeling Literacy

Mathematical modeling is a mathematical abstraction of real problems, expressing problems in mathematical language, constructing models by mathematical methods, and solving problems with mathematical knowledge. It is one of the essential core qualities of students in high school. The revised "Standards for General Senior High School Curriculum" in 2017 clearly states that the core literacy of mathematics is a concentrated expression of the goals of mathematics curriculum, and it is a comprehensive reflection of the quality of thinking, key abilities, and emotions, attitudes and values

with basic mathematical characteristics. The core literacy of mathematics is gradually formed and developed in the process of mathematics learning and application. The core literacy of mathematics includes mathematical abstraction, logical reasoning, mathematical modeling, visual imagination, mathematical operations, and data analysis. Among them, the "Standards for General Senior High School Curriculum" emphasizes the important position of mathematical modeling. The mathematical model not only builds a bridge between mathematics and the external world, but also an important form of mathematical application. Moreover, it is the basic means of applying mathematics to solve practical problems, and it is the driving force for the development of mathematics. It can be seen that mathematical modeling literacy is a must-have character and key ability for students to adapt to the

* Corresponding author

E-mail address: zhongzee@163.com (Zezhong Yang)

needs of lifelong development and social development.

2. The Value of Textbooks in Implementing Students' Modeling Literacy

As the most important teaching resource, textbooks have a prominent position in the entire high school mathematics teaching system. The "Standards for General Senior High School Curriculum" points out that mathematics textbooks provide learning themes, basic clues and specific content for "teaching" and "learning" activities. It is an important teaching resource for realizing the goals of mathematics curriculum and developing the core literacy of students' mathematics disciplines. In the "Study on the Use of Contents in High School Mathematics Textbooks", Yi Fei believes that textbooks are the guide for education and teaching, and are the main basis for teacher teaching [1]. Zeng Tianshan in the "Review of the debate on the function of textbooks in foreign countries" believes that high school mathematics textbooks use the specific teaching methods that are most suitable for the goal to complete the teaching tasks. The textbooks can standardize classroom teaching and save teachers' teaching time [2]. Wang Ruixia and Deng Chen in the "Textbook Function from Multiple Perspectives" believe that the textbook carries the system knowledge and skills that teachers should teach. In the teaching system, the textbooks are the necessities of the teacher's classroom activities, and are the basis and starting point for the teacher's classroom teaching, board writing and extracurricular knowledge development [3]. Former Soviet scholar Baranov believes that textbooks are the most important means of teaching and are indispensable in the teaching process. They have the role of education, teaching and development [4]. Therefore, in high school mathematics teaching, textbooks are important teaching resources for achieving the goals of mathematics curriculum and developing the core literacy of students' mathematics disciplines. It can serve as a guide and support for teachers, provides the most authoritative source of information for teachers' teaching, and is a necessity and an important teaching resource for teachers' teaching activities.

In summary, the study of the rational use of existing textbooks in high school mathematics teaching is an important teaching resource to effectively promote the cultivation of students' core literacy of mathematics modeling, which is of great significance and research value for the implementation of students' core literacy.

3. Application of Textbooks to Implement Problems in Modeling Literacy

3.1. Textbooks Have Limited Knowledge and Too Much Emphasis on Knowledge

On the one hand, in order to meet the teaching objectives and adapt to the students' physical and mental development, the textbooks must be selected. It is impossible to present all the known content, and the information provided is not up to date. On the other hand, textbooks are suitable for the use of people across the country, and therefore cannot be considered in terms of ethnic differences, regional differences, and individual differences among learners. Therefore, the information carried by textbooks is limited, universal, lacking in pertinence, and too much emphasis on knowledge, which is an inevitable limitation of textbooks. This requires mathematics teachers to use textbooks as a support, and on this basis, continuously develop and explore creative data activities. However, in actual teaching, some high school mathematics teachers rely too much on textbooks, and regard textbooks as the only tool for teaching, giving up their initiative.

3.2. Focus on the Surface of Knowledge and Ignore the Application of Integrated Context

In order to implement mathematical modeling literacy in teaching, teachers usually combine some practical problems in real life to assess students' ability to apply mathematics knowledge. Students can only achieve the continuous development of core literacy by realizing the effective connection between mathematics knowledge and practical problems of life, establishing a correct mathematical model, and making a serious explanation. Therefore, teachers need to guide students to establish the correct steps of mathematical modeling based on the examples provided by the textbook. However, teachers rely too much on textbooks and do not dig deep into the implicit information in textbooks. In the study of example questions, they only focus on the answers to a topic or a class of questions, which makes students unable to apply the learned knowledge to solve real problems. As a result, students cannot establish a bridge between mathematics and real life, and they cannot effectively implement the mathematical modeling literacy of students.

3.3. Pay Too Much Attention to Teaching Assistants and Ignore the Subjective Status of Textbooks

The "Standards for General Senior High School Curriculum" points out that mathematics textbooks provide learning

themes, basic clues and specific content for "teaching" and "learning" activities. It is an important teaching resource for realizing the goals of mathematics curriculum and developing the core literacy of students' mathematics disciplines. Therefore, in the teaching, only based on the textbooks, teachers can realize the implementation of the core literacy of mathematics and even the mathematical modeling literacy. However, in the actual teaching, in order to improve students' scores and respond to various problems, teachers pay too much attention to the teaching resources of teaching aids and frequently use them in the preparation of lesson preparations, which leads to the neglect of the subject status of textbooks in the lectures, and the phenomenon that the preparation of lessons and the textbooks are separated. This also causes students to ignore the textbooks during the learning process. Teachers ignore the importance of textbooks and lack an in-depth understanding of mathematics topics. These not only hindered the improvement of their ability to coach, but also became an important factor in the failure to implement the core literacy of mathematical modeling.

4. Applying Textbooks to Implement Core Literacy

4.1. Strengthening the Mastery of Students' Basic Knowledge Based on Textbooks

Cultivating students' mathematical modeling literacy is not only to strengthen their mathematical application consciousness and the ability to turn practical problems into mathematical problems, but also to solve the mathematical problems that are transformed, to test the results, to improve the model, and finally to solve the practical problems. The key to the orderly development of modeling is whether students have a solid grasp of mathematics. Therefore, the application of textbooks to promote the cultivation of students' mathematical modeling literacy, not only to strengthen students' awareness of mathematics application, but also to pay attention to the grasp of textbooks, master the basic knowledge content embodied in traditional textbooks.

4.2. Pay Attention to the Topic of Mathematical Modeling in Textbooks

In May 2019, the PEP High School Mathematics Textbook was re-published in accordance with the Standards for the Ordinary High School Curriculum. Compared with the old textbooks, the key difference is that the mathematics modeling related knowledge is no longer extended after class, but mathematical modeling is presented as a topic in compulsory one. On the one hand, this change prevents teachers from paying too much attention to teaching content and attaching importance to teaching and learning, while ignoring the

cultivation of teaching and modeling ability of mathematical modeling knowledge. On the other hand, the changes in the new edition of the textbook also provide a blueprint for teachers to implement the mathematical modeling of students, so that teachers can have textbooks to follow, and time to teach. Therefore, teachers need to focus on the topic of textbooks, guide students to seriously examine the questions, dig deep into the known and unknown conditions in mathematical mathematics, and accurately grasp the implicit relationship in the questions. This can promote students' subjective understanding of mathematical modeling. It is beneficial for the teachers to guide students to establish correct mathematical modeling steps, thus effectively promoting teachers' cultivation of students' mathematical modeling literacy.

4.3. Based on Textbooks, Strengthen Mathematics Application in Comprehensive Context

Mathematical modeling is the mathematical abstraction of real problems, the use of mathematical language to express problems, and the use of mathematical methods to build models to solve problems. The writing of mathematics textbooks is basically carried out along the main line of "life situation - discovering problems - creating mathematical models - answering questions - application". However, due to the high degree of unity of the textbooks, the life situations and example exercises in the textbooks cannot be characterized by local characteristics and times. This requires teachers to not directly instill knowledge into students, but based on the textbooks, using life as a carrier, and secondary development of textbook content on the basis of textbooks. Through advancing with the times and interesting introductions and examples, teachers can attract students' interest in learning, let students actively participate in the process of learning, cultivate students' enthusiasm and initiative, arouse students' thinking and give full play to students' potential. Therefore, students are encouraged to summarize and abstract the essential characteristics of things in daily life, establish mathematical models, solve practical problems, consciously express real worlds in mathematical language, discover and ask questions, and understand the connection between mathematics and reality.

4.4. Assisting Instruction with Intuitive Means

Mathematical modeling is the basic means of applying mathematics to solve practical problems. The key problem of mathematical modeling is to find problems from practical problems and abstract the actual problems into mathematical models. However, due to its limited space and the cultivation of students' intuitive imagination, mathematics textbooks

rarely give abstract mathematical models directly in the textbooks. This requires teachers to assist teaching in the early stage of mathematical modeling literacy training through multimedia and other intuitive means. Through the visual display of mathematical models, teachers develop students' ability to translate practical problems into mathematical problems and apply mathematical knowledge to solve practical problems. Therefore, students are encouraged to use mathematical models to solve practical problems, accumulate experience in mathematics practice, understand the role of mathematical models in many fields of science, society, and engineering technology, enhance students' practical ability, and enhance their sense of innovation and scientific spirit.

5. Conclusion

In summary, based on the "Ordinary High School Curriculum Standards", this paper starts from the importance of cultivating students' mathematical modeling literacy and the value of textbooks in implementing students' mathematical modeling literacy, and analyzes the problems existing in the implementation of mathematical modeling literacy in applied textbooks. Therefore, in view of these problems, this paper puts forward some suggestions on how to apply the textbooks to cultivate students' mathematical modeling literacy from the perspectives of basic knowledge, mathematical modeling topics, comprehensive situational application, and aided teaching through visual means.

However, the author used "core literacy implementation" and "mathematics textbooks" to search on CNKI. Until June 2019, the CNKI had only 64 related articles, and only 31 were very closely related. It can be seen that the current research on the implementation of core literacy in applied textbooks is not deep enough, and further research is needed by current scholars. Seen from this article, the above analysis only analyzes and makes recommendations for teachers to use the textbooks to implement the students' mathematical modeling literacy. It does not analyze the use of textbooks and the preparation of textbooks. This is also the further improvement direction of the article.

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