

# Research on How to Use Textbooks Effectively in Mathematics Teaching in China

Qi Han, Runjie Miao, Zezhong Yang\*

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

## Abstract

As the main text material of mathematics teaching, the mathematics textbook closely links the teachers' teaching and students' learning and has important value and significance in mathematics teaching. The mathematics curriculum standard proposes that mathematics textbooks provide learning themes, basic clues and knowledge structure for students' mathematics learning activities, and are important resources for realizing the goals of mathematics courses and implementing mathematics teaching. More and more university researchers and middle-school educators at home and abroad have devoted themselves to research in this area, and have achieved fruitful results in both theory and practice. These researches not only improve and enrich the theory, but also put it into practice, and have obtained good feedback in the actual class teaching. The research includes the current situation, meaning, and approach, but there are also some shortcomings. This paper mainly uses the method of document analysis to sort out the literature on how to use textbooks effectively in mathematics teaching. The author puts forward own views from both theoretical and practical aspects. It is also necessary to timely absorb the advanced research results from abroad, take the essence, go to its dross, and apply it to teaching practice in order to make better use of mathematics teaching materials.

## Keywords

Middle School Mathematics, Mathematics Teaching, Mathematics Textbooks, Mathematics Learning

Received: May 30, 2019 / Accepted: July 14, 2019 / Published online: December 25, 2019

© 2019 The Authors. Published by American Institute of Science. This Open Access article is under the CC BY license.

<http://creativecommons.org/licenses/by/4.0/>

---

## 1. Introduction

The mathematical textbook is an important textual basis for both teaching and learning. The Mathematics Curriculum Standard for Compulsory Education (2011 edition) proposes that the mathematics textbook provides learning themes, basic clues and knowledge structures for students' mathematics learning activities, and is important resource for achieving mathematics curriculum goals and implementing mathematics teaching [1]. The Mathematics Curriculum Standard for Senior High School (2017 edition) also points that the mathematics textbook provides themes, basic clues and specific content for "teaching" and "learning" activities. It is an important material to realize the goals of mathematics curriculum and develop the core literacy of students' mathematics disciplines, which greatly increases the

necessity of studying how to effectively use textbooks in mathematics teaching [2]. In recent years, more and more college researchers and front-line educators from middle school have devoted themselves to the research in this field and achieved fruitful results in both theory and practice. In order to further enrich the research in this field and fill in the blank of the research, this paper makes a literature review on how to effectively use textbooks in mathematics teaching.

## 2. The Definition of Textbook and Its Importance in Teaching

The textbook is the main basis for teaching. It's the special book that explains the content of teaching and the

---

\* Corresponding author

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

materialization of the syllabus, and an important source of knowledge for students [3]. The textbook is a materialized form of the curriculum. It is a teaching book that is prepared according to the curriculum standards (syllabus) and systematically reflects the content of the subject [4]. The textbook is the main basis of teaching, the concrete embodiment of the syllabus, and the crystallization of the teacher's teaching experience and scientific research results. It is related to teaching as a whole and a part [5]. In the teaching process, the textbook is regarded as the carrier of knowledge, and the vitality is obtained through the interactive process of teaching and learning between teachers and students [6]. It can be seen that the textbook plays an important role in mathematics teaching. As the first-hand material for teachers and students, it plays a bridge role between teachers and students. Therefore, it is of great significance to study how to use textbooks effectively and make them play their role to the greatest extent.

### 3. The Function of Textbook in Mathematics Teaching

Judging from the advantages of the textbook itself, that is, the advantages of the textbook relative to other teaching materials, Wu Xilian, Hu Fangze, Lei Xiaoxiao and others believe that the textbook has the following effects in mathematics teaching. (1) Reading and understanding the textbook is the origin of building a high-quality mathematics class. It is necessary to clarify the status and role of the textbook that it's the basis of teaching and learning. Mathematical classes that are not based on textbooks will lose their direction and the quality of teaching will not be guaranteed. (2) The textbook is a typical guide. The content of the textbook is full and conforms to the cognitive status of the students. It is incomparable to any other handouts. In mathematics teaching, the textbook is used as a guide for students to learn, and mathematics teaching based on mathematics textbooks can achieve unexpected results. (3) The setting of the title in the textbook is representative. The examples or exercises in the textbook are the important source of the material for the proposition. It is of great significance to be familiar with the subject of the textbook. The selection of the example exercises in the limited space of the textbook is undoubtedly the most meaningful [7-11].

The object of mathematics teaching is students. Therefore, the role of textbooks in mathematics teaching should be reflected in the role of students to a large extent. From this perspective, Jin Lili, Zhang Xiuzhen, Zhang Jianqiang and others have the following views. (1) Using the textbook efficiently can help students to digest and master the basic knowledge. For example, some of the rules, definitions, theorems, narratives, generalizations and conclusions that teachers have taught in

class, students are not mastered at the same time, but through careful reading and careful study of the textbook after class, combined with the teacher's explain in class, generally can deepen understanding, gradually learn to describe them in the correct mathematical language, and also lay the foundation for flexible application. (2) The mathematics textbook can allow students to learn actively through observation, inquiry, discussion, and induction. There are lots of thinking columns interspersed in textbooks. Some of these columns get conclusions through thinking about problems, some reflect through the process of solving problems. Deepening understanding and inquiry is the process of solving problems and exploring conclusions. (3) It helps to improve students' ability to solve problems. After the teachers' teaching and their own drill down of textbooks, the calculation exercises will be handy. At the same time, the examples listed in the textbook are generally representative, especially after learning new methods, problem solving points, writing formats, etc. often need to use the example title as a template. (4) It is helpful to cultivate students' reading ability and independent study spirit. The mathematics textbook uses the scientific coherent narrative to explain the teaching content according to the syllabus, but also has unique vocabulary, different narrative formats and language features. Therefore, in-depth study of textbooks can help improve students' reading ability. The habit of studying not only greatly reduces the difficulty of accepting new textbooks, but also creates conditions for students to read mathematics extracurricular books [9, 12-16].

### 4. The Current Situation of the Use of Teaching Materials in Mathematics Teaching

The current situation of the use of textbooks in mathematics teaching, that is, the problems in the application of textbooks in mathematics teaching, mainly have the following two aspects. On the one hand, teaching is separated from textbooks, which is also the most common problem. Some teachers ask students to close the textbook during class. In addition to doing homework, they never use textbooks. Students solve problems after class first, and are unwilling to read textbooks, unless they answer difficult questions, they can flip through the books. This phenomenon seriously affects the improvement of teaching quality and the students' solid grasp of the basic knowledge of mathematics. On the other hand, teachers emphasize conclusions and light processes in the teaching process. Many teachers are constrained by the original knowledge system and teaching methods. They think that the scenarios, discussions, conjectures, inductions, discussions, and experimental activities on the new textbook are too time-consuming and cannot be completed. Therefore, they are

omitted and directly lead to conclusions. As a result, many students are unable to describe definitions and theorems in a coherent and scientific mathematical language [9, 12-15, 17].

## 5. The Methods of the Use of Teaching Materials in Mathematics Teaching

Wu Xilian, Wang Xiangru, Sun Xiaogang and others propose the following methods and strategies for how to effectively use textbooks in mathematics teaching. (1) Teachers should dig into textbooks and understand writers' intentions. This is the prerequisite for effective use of the textbook. First of all, we must read through textbooks, summarize the contents of them according to the knowledge system, grasp the intent and the connection between the knowledge from the macroscopic level. Secondly, it is necessary to read textbooks carefully, formulate teaching objectives accurately, correctly grasp the teaching requirements of each unit from the micro level, deeply study the teaching content of each class, and know the key points and difficulties of each class. (2) It is necessary to take the students as the basis and accurately grasp the goals. This is the guarantee for the effective use of the textbook. The teaching goal is not only the starting point of the teaching process, but also the destination of the teaching process. The effective use of the textbook must be based on the teaching objectives. (3) Pay attention to the introduction of concepts in the textbooks, and let students experience the concept of sensibility to rationality. There are two specific ways of introduction: introduction with the background of living materials and introduction with the model of original concept. (4) Grasp the teaching requirements, selectively teach, and adhere to the principle of "less is more". The first thing to do is to choose the content of the teaching, and spend some time on some content worthy of time, so that some strategic and principled things are understood. (5) It is necessary to make good use of the content of the course selection, including the reading materials, narration, extended content and internship assignments of the teaching materials. Some of these contents are related to the expansion and deepening of related contents, and students who are interested can learn them to deepen the understanding of relevant content, broaden their horizons, increase their knowledge and improve their ability to use knowledge. (6) It is necessary to face up to the changes in the textbook and optimize the teaching structure. With the changes in educational background and students' ability, the textbook will change with the times. When faced with new textbooks, teachers should construct a mathematical knowledge system, explore the hidden knowledge of textbooks, emphasize the process of knowledge acquisition and focus on the unification of conclusions and processes [7, 8,

13, 16, 18-24].

Jiang Hao, Lu Jierong, Hou Junxing and others propose the following methods. (1) Teachers should make full use of the textbook examples to improve students' mathematical ability. Using the example teaching, students can be guided to reflect on the thoughts and methods, improve the quality of students' thinking, and let the process of problem solving become the process of students' inquiry. (2) Teachers should instruct students to read and use teaching materials, pay attention to students' reading of textbooks. Before class, students are assigned to preview the reading knowledge related to the new course, paving the way for the study of the new course. In class, teachers and students use textbooks to study knowledge and topics together. After class, students are assigned to read textbooks first, and the amount of homework after class must be appropriate, which not only ensures that students have enough time to review textbooks, but also ensures the formation of students' operation skills. (3) It is necessary to rationally develop and reorganize the textbook, that is, the combination of "loyalty" and "betrayal". Under the new curriculum reform, the textbook has a lot of openness and flexibility, therefore, teachers should strive to change the presentation abstraction, static, tasteless, to properly change, delete, and change the textbook. (4) To change the "book textbook" to "life textbook", so that the knowledge of learning and life reality combined. In the teaching process, teachers can strengthen the life of mathematics teaching, explore the connection between mathematical knowledge and life, creatively integrate mathematical knowledge into life, draw the outline of various "life pictures", capture various "life phenomena", and design various "life situations". (5) In addition, teachers should also carry out some innovative teaching, such as restoring the process of knowledge exploration, implementing democratic, doing open exercises and so on [9, 12, 14, 15, 25-33].

## 6. Conclusions and Prospects

### 6.1. Conclusions

The conclusion has the following five aspects:

- 1) Most of the sources of current research literature come from the first-line teachers in middle school, who with rich practical experience. At the same time, the convincing cases are actually applied in practical teaching. The research keeps pace with the times. The literature before and after the new curriculum reform has different starting points and different focuses, reflecting the originality of the research and the teachers' ability to adapt to the new curriculum and the new textbook reform.
- 2) At present, research on how to use textbooks effectively in

mathematics teaching mostly stays in theory, and mainly focuses on the status quo, methods, and significance of the theory. There are few related practical researches. Most of the articles are general studies of the middle school teaching stage, and there are few sub-thematic studies.

- 3) In actual operation, it is less integrated with advanced teaching methods, such as multimedia technology and network information technology. It affects the teaching achievements and hinders the development of students. This is not only a problem in the use of the textbook, but also a problem in the overall middle school mathematics teaching.
- 4) There is a lack of measurement and statistics on student feedback. There is no detailed statistics and analysis of the students' mastery after using effective textbooks. Only by grasping the degree of acceptance of students can we judge whether teachers use textbooks properly or not.
- 5) Affected by factors such as technology and ability, there is less review of foreign research, and persuasiveness is affected.

## 6.2. Prospects

I think the follow-up study should include two aspects:

- 1) In terms of the theory research: it is not limited to the scope of mathematics teaching in middle school. It is necessary to start more research with different topics, such as functions, vectors, series, geometry, etc. Sub-thematic research to form a complete theoretical system not only helps students to form a network of mathematical knowledge, but also has a more comprehensive and systematic grasp of the textbook, and is more conducive to the development and improvement of students' mathematics ability and teachers' teaching level.
- 2) In terms of the practical research: on the one hand, students should be make special quantitative assessments, make timely measurements, and obtain feedback so as to guide the next teaching activities in a targeted manner. On the other hand, for teachers, it is necessary to collect a large number of teaching opinions from experienced teachers, and to summarize, analyze, and organize their opinions on each chapter of the textbook, thus providing constructive opinions on the teaching of teachers and the preparation of textbooks.

In addition, it is also necessary to absorb advanced foreign research, select the essence and discard the dross, and apply them to teaching practice selectively, so as to make better use of the mathematics textbook and the mathematics teaching can be more enriched and effective.

## References

- [1] The Mathematics Curriculum Standard for Compulsory Education (2011 edition). (2011). Beijing: Beijing Normal University Publishing House, 67.
- [2] The Mathematics Curriculum Standard for Senior High School (2017 edition). (2017). Beijing: People's Education Press, 90.
- [3] Jin, S. C. (2008). Education. University group. China Petrochemical Press, 5.
- [4] China Encyclopedia Editing Committee. (1976). Encyclopedia of China (Education). Beijing: Encyclopedia of China Publishing House. 145.
- [5] Yan, J. H. (2007). On the Role of Teaching Materials in College Teaching. *Science & Technology Economic Market*, (07), 198-199.
- [6] Liu, Z. S. (2004). How to Understand the Role of Teaching Materials in Chinese Teaching. *Journal of Educational Development*, (11), 64.
- [7] Wu, X. L. (2012). Not Doing "Teachers" but "Cultivating Talents" -A Case Study on How to Use Textbooks Creatively in Mathematics Teaching. *The Science Education Article Collects*, (05), 107-108.
- [8] Hu, F. Z. (2017). Some Thoughts on the Use of Teaching Materials in Junior Middle School Mathematics Teaching. *Teaching Monthly Secondary Edition (Teaching Reference)*, (04), 36-38.
- [9] Zhang, X. Z. (2007). How to Use Teaching Materials in Middle School Mathematics Teaching. *Journal of Chifeng College (Natural Science Edition)*, (04), 137+143.
- [10] Lei, X. X. (2017). The Importance of Textbooks in High School Mathematics Learning. *Liberal Arts Navigation*, (06), 9.
- [11] Ding, M. X., Li, Y. P., Li, X. B., & Gu, J. (2013). Knowing and Understanding Instructional Mathematics Content through Intensive Studies of Textbooks. *How Chinese Teach Mathematics and Improve Teaching*, 66-82.
- [12] Jin, L. L. (2014) On How to Use Mathematical Teaching Materials in Junior Middle School Teaching. *Mathematics Research and Research*, (16), 45.
- [13] Zhang, J. Q. (2011). How to Use New Textbooks in Mathematics Teaching. *The Road to Success*, (20), 41.
- [14] Jiang, H. (2012). On the Correct Use of Teaching Materials in Middle School Mathematics Teaching. *Education for Chinese After-school (Theory)*, (32), 56.
- [15] Li, G. Q. (2004). Talk About How to Use Teaching Materials in Mathematics Teaching. *Success*, (04), 39+38.
- [16] Shen, X. Q., & Shao, J. J. (2011). The Cornerstone of Teaching Research, the Source of Classroom Teaching—On the Role of Teaching Materials in Teaching. *Middle School Mathematics*, (09), 11-14.
- [17] Wen, L. L. (2018). Thoughts on the Implementation of Core Literacy in Junior High School Mathematics Textbooks. *Peak Data Design*, (09), 86.
- [18] Wang, X. R. (2014). Facing the Change of Teaching Materials and Optimizing Teaching Structure—On How to Use New Teaching Materials in High School Mathematics Teaching. *Mathematics Research and Research*, (21), 53.
- [19] Le, X. M. (2016). Thoughts on the Implementation of Core Literacy in High School Mathematics Teaching Materials. *Mathematics Teaching and Research*, (04), 89.

- [20] Yin, T. W. (2015). Analysis and Excavation of the Value of "Reading Materials" in High School Mathematics Textbooks. *Maths Teaching In Middle School*, (33), 17-18.
- [21] Zhang, W. L. (2015). The Role and Value of Narration in High School Mathematics Teaching Materials in Teaching Practice. *Maths Teaching In Middle School*, (12), 32-33.
- [22] Sun, X. G. (2017). Discussion on the Educational Value of "Internship Homework" in High School Mathematics Teaching Materials. *Mathematics Research and Study*, (01), 159.
- [23] Bi, H. L., & Wan, Y. Q. (2012). Construction and Application of Textbook Usage Models in Classroom Teaching. *Contemporary Education Sciences*, 14-17.
- [24] Jan, D. (2018) *Mathematics Textbook Development for Primary Grades and its Teachers in Mozambique*. ZDM.
- [25] Liu, L. (2011). How to Use Textbooks Creatively in Mathematics Teaching. *Mathematics Research and Research*, (24), 25.
- [26] Lu, J. R. (2012). How to Use Textbooks Creatively in Mathematics Teaching. *The Road to Success*, (08), 65.
- [27] Tai, S. J., & Zhu, Z. X. (2013). How to Use Textbooks Creatively in Mathematics Teaching. *Liaoning Education*, (21), 89.
- [28] Hou, J. X. (2013). On the Use of Teaching Materials in Middle School Mathematics Teaching. *Learning Weekly*, (17), 26.
- [29] Hua, F. (2015). Let the Teaching Value of the Examples in Mathematics Textbooks Be the Ultimate in Their Teachings. *Middle School Mathematics*, (10), 29-31.
- [30] Takahashi, A. (2016). Recent Trends in Japanese Mathematics Textbooks for Elementary Grades: Supporting Teachers to Teach Mathematics through Problem Solving. *Universal Journal of Educational Research*, 4(2), 313-319.
- [31] Gert, S., & Liang, H. F. (2018) *Recent Advances in Mathematics Textbook Research and Development: An Overview*. ZDM.
- [32] Olsher, S., & Even, R. (2018). Organizing Tools Suggested by Teachers in the Mathematics Textbook They Use in Class. *International Journal of Science and Mathematics Education*.
- [33] O'Halloran, Kay. L., Beezer, R. A., & Farmer, D. W. (2018) *A New Generation of Mathematics Textbook Research and Development*. ZDM.