FOCUS ON THE REPRESENTATION OF PROBLEM TYPES IN INTENDED CURRICULUM: A COMPARISON OF SELECTED MATHEMATICS TEXTBOOKS FROM MAINLAND CHINA AND THE UNITED STATES

ABSTRACT. This study compared how selected mathematics textbooks from Mainland China and the United States at the lower secondary grade level represent various types of problems for classroom teaching and learning. The examination of problems was carried out based on the classifications of problem types established in the study, including routine problems versus non-routine problems, open-ended problems versus close-ended problems, traditional problems versus non-traditional problems, and application problems versus non-application problems, among others. Both the similarities and differences in the representation of problems in the selected textbooks were analyzed. The results were used to explore the possible influences of those textbooks on students’ different performances in mathematics, as revealed in cross-national comparisons. Discussions about how to improve the representation of problems in mathematics textbooks were provided at the end of the study.

KEY WORDS: comparative study, mathematical problem solving, mathematics textbooks, problem types, textbook analysis

BACKGROUND OF THE STUDY

For the last two decades, the role of textbooks in mathematics teaching and learning has received mounting attention from the international mathematics education community. This growth of researchers’ interest in textbooks can be observed from the fact that the Third International Mathematics and Science Study (TIMSS) included an analysis of hundreds of textbooks and other curricular materials from about 50 countries, and it was believed to be the first time for a study of such a large scale to include textbooks as a major research subject (Schmidt, McKnight, Valverde, Houang & Wiley, 1997). Nevertheless, compared to other research areas in mathematics education, studies focusing on textbooks are still inadequate, and, with this concern, many researchers have called for more studies centering on textbooks (e.g., Bishop,

In recent years, cross-national comparative studies have consistently shown that Asian students, including those from Mainland China, Hong Kong, Taiwan, Singapore, Korea, and Japan, performed significantly better in mathematics than their peers in other geographical regions, particularly in the U.S.¹ To search for the possible reasons for the differences, researchers have investigated the features of textbooks that the students were using, with an underlying belief that textbooks played an important role in the process of teaching and learning (e.g., see Fan & Zhu, 2000).

This study is part of a larger research effort which aims to investigate how, as the intended curriculum, mathematics textbooks in Mainland China, Singapore, and the U.S. represent problem solving for classroom teaching and learning. In particular, its objective is to examine how different kinds of problems are represented in Chinese and U.S. mathematics textbooks.² By doing so, we hope not only to provide a useful documentation and knowledge of how the selected mathematics textbooks from the two largest educational systems in the East and West provide a curricula environment for students to be exposed to different types of problems, but also to explore possible ways to improve the representation of problems in mathematics textbooks, which can, in turn, improve students’ learning experiences in mathematics. Moreover, as textbooks are a key component of the intended curriculum, they also, to a certain degree, reflect the educational philosophy and pedagogical values of the textbook developers and the decision makers of textbook selection, and have substantial influence on teachers’ teaching and students’ learning. Therefore, we also hope that this study can provide us with useful insights to better understand Chinese and U.S. students’ learning experiences in problem solving, as well as their performances revealed in international comparisons.

METHODS

Selection of Textbooks

There exists a variety of mathematics textbook series being used for classroom teaching and learning in Mainland China and the U.S. Since the late 1980s,³ in Mainland China, all regions, except for Shanghai and Zhejiang, have been required to follow the national syllabus and use the textbooks developed based on the national syllabus. When the study was conducted, there were, in total, nine series of school mathematics
textbooks in use at the secondary level. The series of mathematics textbooks we selected for the analysis was published by the People’s Education Press (PEP), as it was the most widely used series in China. In fact, according to Zeng, about 70% of the junior high-school students were using the PEP series (Zeng, 1997).

It is well known that the education system has been traditionally decentralized in the U.S. With regards to the school curriculum, most of the nearly 16,000 school districts design their own curriculum or standards, usually with guidance provided by each of the 49 states (all but Iowa) (Peak, 1996; Usiskin & Dossey, 2004). The decentralization of the U.S. education system is also reflected in a much larger variety of textbooks used in the schools across the country. In this study, we selected the series of textbooks developed by the University of Chicago School Mathematics Project (UCSMP). As Fan & Kaeley (2000) pointed out, the UCSMP was one of the largest, as well as one of the most progressive, projects on curriculum reform and development in the U.S. Moreover, Goertz (2000) reported that the UCSMP series was one of the few programs that reflected high standards and was correlated with state and national standards by the National Council of Teachers of Mathematics (NCTM, 1989, 2000). As a matter of fact, the UCSMP was recognized at the national level as one of the most promising mathematics curriculum programs (U.S. Department of Education, Mathematics and Science Education Expert Panel, 1999). Having said this, we would like to remind the readers that the study is, essentially, an exploratory case study, and it is not intended to generalize the results from the selected UCSMP series to other U.S. mathematics textbooks, which would require further work beyond the scope of the current study.

In total, the following seven mathematics textbooks were selected from Mainland China and the U.S. for this study:

<table>
<thead>
<tr>
<th>Country</th>
<th>Textbooks</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td><em>The Compulsory Education Three-Year Junior Secondary School Textbooks</em> —</td>
</tr>
<tr>
<td>United States</td>
<td><em>UCSMP Algebra (2nd edn.), UCSMP Geometry (2nd edn.), published by Scott Foresman</em></td>
</tr>
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</table>

The selected textbooks are intended for mathematics teaching and learning at the lower secondary grade level, namely, Junior High One and Junior High Two in Mainland China, and, equivalently, Grade Seven and Grade Eight in the U.S. Students at this school level are usually
about 13 and 14 years old. The main reason for the study to focus on this particular school level is that, as we believe, the lower secondary grade level is a key stage in the development of students’ ability in problem solving. In fact, research has shown that there was a marked change in the use of problem solving strategies occurring between the ages of 11 and 13 (e.g., Leskow & Smock, as cited in Days, Wheatley & Kulm, 1979; Yudin & Kates, 1963), and the instruction of problem solving was more effective at the lower secondary grade level than at other school levels, including both the primary level and post-secondary level (e.g., Hembree, 1992; Pace, 1986).

Conceptual Framework

A conceptual framework about the problem types was established for the study, which starts with the definition of problems from the perspective of textbook analysis.

Although problems have occupied a central place in mathematics curriculum since antiquity (Stanic & Kilpatrick, 1988), the term “problem” has been used differently by different researchers for different purposes. The literature shows that the biggest divergence on the definition of a problem is whether there should exist blocks between a situation and its solution. However, to judge whether there exist blocks between a situation and its solution can be rather subjective, because it depends on the person who is dealing with the situation. In other words, it is not the innate feature of the situation. For textbook study, to make such a judgment is even more difficult, if not impossible, not only because often when and how the problems provided in the books will be used are not known, but also to some students there might exist some blocks between a situation and its solution, yet to others there might be no blocks at all. Furthermore, we believe that developing students’ skills in solving routine problems or conventional problems is also fundamentally important in the teaching and learning of mathematics, as life is “full of routine problems” (Holmes, 1995, p. 35).

In this study, we define a problem as a situation that requires a decision and/or answer, no matter if the solution is readily available or not to the potential problem solver. We believe this definition is more operational and meaningful in textbook analysis (also see Fan & Zhu, 2000).

Based on the above definition, the following seven classifications of problems were established for the study. For a clear explanation, a few examples are given for some of the less widely used types of problems.
Routine Problems vs. Non-routine Problems. A non-routine problem is a situation that cannot be resolved by merely applying a standard algorithm, formula, or procedure, which is usually readily available to problem solvers, and in this study, the students. In contrast, a routine problem is one for which problem solvers can follow a certain known algorithm, formula, or procedure to obtain the solution, and, usually, the path to the solution is immediately evident. More specifically, if a problem is presented after a text explanation which demonstrates particular methods (e.g., algorithm, formula, or procedure) that could be used to solve the problem, then it is regarded as a routine problem.

Traditional Problems vs. Non-traditional Problems. In the study, non-traditional problems consist of four sub-types of problems. The first sub-type is problem-posing problems that require students to create questions by using the given information as the problem situation. The second sub-type is puzzle problems that often allow students to engage in potentially enriching recreational mathematics. The third sub-type is project problems that are tasks or a series of tasks involving one or more of the following processes: gathering data, observing, looking for references, identifying, measuring, analyzing, determining patterns and/or relationships, graphing, and communicating. Project problems usually require students to take a substantial amount of time (e.g., a few days, weeks, or even months) to finish. The final sub-type of non-traditional problems is journal problems that ask students to write a piece of work to express their ideas, experiences, questions, reflections, personal understanding, or new learning. Through students’ writing, teachers can obtain useful information about both students’ learning and their own teaching. Examples of the four sub-types of non-traditional problems are given in Table I.

Open-ended Problems vs. Close-ended Problems. An open-ended problem is a problem with several or many correct answers. Correspondingly, a close-ended problem is a problem that simply has only one answer, no matter how many different approaches there are to reach the answer. This categorization emphasizes the open-endedness in the final answers to the situation, rather than the approaches to the situation.

Application Problems vs. Non-application Problems. A non-application problem is a situation that is unrelated to any practical background in everyday life or the real world. In contrast, an application problem is a problem related to or arises under the context of a real-life situation. It
should be noted that the real-life situations herein are not just confined to students’ day-to-day living, but in a more general sense. Among the application problems, two sub-types were further distinguished in this study. One category is fictitious application problems (FAP), whose conditions and data are fictitiously made by textbook author(s). The other type is authentic application problems (AAP), whose conditions and data are, indeed, from real-life situations or collected by students themselves from their daily lives. An example of an FAP is as follows:

Three bells toll at intervals of 8 min, 15 min, and 24 min, respectively. If they toll together at 3 p.m., what time will it be when they toll together again? (Teh & Looi, 1997, p. 32)

Below is an example of an AAP:

How many times can you fold a newspaper page? Explain how you arrived at your answer. (McConnell et al., 1996, p.59)
*Single-step Problems vs. Multiple-step Problems.* Problems that can be solved by one direct operation are defined as single-step problems. Otherwise, the problems are called multiple-step problems.

*Sufficient Data Problems, Extraneous Data Problems, and Insufficient Data Problems.* If a problem contains more than enough information or conditions to solve the problem, it is coded as an extraneous data problem. If the information provided in a problem is essentially not enough to obtain the solution and it is neither expected nor possible for a problem solver to fill in the missing information, then the problem is considered as an insufficient data problem. The rest of the problems, in which the information is exactly enough for a problem solver to solve the problems, are regarded as sufficient data problems. Here is an example of an extraneous data problem:

A boy scout in a jungle is heading south. He takes a right turn and walks for 40 m. Then, he takes a left turn and walks again for a further 50 m. He then takes a left turn and walks for another 45 m. Finally, he takes a right turn. In which direction is he heading now? (Teh & Looi, 1997, p. 47)

In solving this problem, the extra information about the distances that the boy walked is not needed. In contrast, an example of an insufficient data problem is given below:

How much will it cost to buy a 5-pound bag of dog food today if it cost $0.20 less last week? (Hatfield, Edwards & Bitter, 1997)

*Problems in a Purely Mathematical Form, Problems in a Verbal Form, Problems in a Visual Form, and Problems in a Combined Form.* This categorization is based on the representation forms of a problem that describe both the setting of the situation and the presentation of the data for the question. If the stem of a problem includes only mathematical expressions, then the problem is classified into the category of “problems (presented) in a purely mathematical form.” If the stem is entirely verbal, namely, in written words only, then the problem is coded into the category of “problems in a verbal form.” If the stem simply consists of figures, pictures, graphs, charts, tables, diagrams, maps, etc., then such a problem is classified into “problems in a visual form.” The rest are “problems in a combined form,” presented in a combination of two or three of the above forms.
**Procedure**

Utilizing the conceptual framework described above, we examined and coded all the problems presented in the selected Chinese and U.S. textbooks. In particular, each problem in the textbooks was examined against each of the seven classifications and then coded into one category in each of the classifications.

For the overall accuracy of the coding, the inter-reliability of coding was checked between the researchers and/or with other external scholars, especially for a small number of seemingly equivocal cases, though most were quite straightforward. In addition, an independent coder was invited to code two randomly selected sections based on the conceptual framework discussed above. There are a total of 156 problems in the two sections, one from each of the two textbook series. The coding result by the independent coder was compared to that obtained by the researchers. According to the intra-class correlation coefficient (ICC) on absolute agreement, the reliability between the different coders was found to range from 0.80 to 1.00 among the seven classifications, with an average being 0.94. Overall, we believe that the coding result in this study is very reliable.

After that, all of the coding results were analyzed using both quantitative and qualitative methods to identify the similarities and differences between the Chinese textbooks and U.S. textbooks on the representation of various types of problems.

**RESULTS AND DISCUSSIONS**

In this section, we shall report the results of this study following the seven classifications of problem types in the sequence parallel to the one described in the conceptual framework. To provide a relevant background, let us first present some general findings about the problems presented in the two selected textbook series.

**Some General Findings**

The data obtained in the analysis revealed that the U.S. textbooks provided many more problems than the Chinese textbooks in terms of the total number (China: 6,850, U.S.: 13,286). However, regarding the distribution of problems, the data showed that the number of problems in a single section was nearly the same across the two textbook series (China: 57.1, U.S.: 57.3). It seems reasonable to believe that, in general,
students in both countries are exposed to textbook problems with nearly the same exposure frequency for each mathematics theme. With respect to the frequency of exposure, the researchers have argued that it would have substantial influence on students’ learning and then their achievement in problem solving (Fan, 1999; Stigler, Fuson, Ham & Kim, 1986). In fact, the researchers were more concerned about the different types of problems than the total number of problems that the students encountered, and it was believed that the frequency of exposure of different types of problems might have an impact on the relative difficulty of problems for students (e.g., Michael, 2002), which is also one of the underlying reasons for us in conducting this study.

In addition, based on the locations of problems in the textbooks, all of the problems can be first divided into two general categories; text problems, which are contained in the text part, and exercises problems, which are located in the exercise part in the books. According to Li (1999), text problems are usually designed for teachers’ instruction purposes, whereas exercise problems are presented more for students’ practice or thinking (also see Love & Pimm, 1996). This study found that the ratio of exercise problems to text problems is higher in the U.S. textbooks than that in the Chinese books (China: 7:1, U.S.: 10:1). This indicates that the U.S. textbooks place more emphasis on students’ practice, which is consistent with other researchers’ findings (e.g., Carter, Li & Ferrucci, 1997).

In the results reported below, both text problems and exercise problems were generally included, as no substantial difference was detected between the Chinese and U.S. textbooks regarding the relative frequency distribution of the different types of problems across the two locations.

**Representation of Problem Types**

The coding results of the study showed that, in both the Chinese and U.S. textbook series, routine problems and traditional problems comprised the majority of problems. In the five Chinese textbooks, 98.8% of the problems were routine problems and 99.5% were traditional problems. The corresponding percentages of the two types of problems in the U.S. textbooks were 96.8% and 97.2%, respectively. Overall, on the representation of the two types of problems, the U.S. series contained a lower percentage than the Chinese textbooks.

The U.S. textbooks provided not only a larger number as well as a higher percentage, but also more variety of non-traditional problems than
the Chinese texts. The U.S. textbooks had all four types of non-traditional problems, whereas the Chinese books only included problem-posing problems and puzzle problems in the non-traditional problem types as identified in the study. Moreover, the distribution of different types of non-traditional problems was also more balanced in the U.S. textbooks (problem-posing problems: 14.1%, puzzle problems: 23.3%, project problems: 53.8%, journal-writing problems: 8.8%), compared to that in the Chinese books (problem-posing problems: 15.2%, puzzle problems: 84.8%).

It was found that close-ended problems were dominant in both textbook series (China: 98.1%, U.S.: 93.4%). It seems reasonable to believe that students using the selected textbooks would not have much experience with open-ended problems in class. Consistently, Cai’s (1995) study revealed that both Chinese and U.S. students performed more or less the same on open-ended problems. In his study, only 3% of Chinese students and 1% of the U.S. students could correctly provide more than one correct answer to an open-ended problem. The majority of students in both countries just provided one answer to that problem. In addition, Cai reported that, although there were infinite numerical answers to that problem, the majority of correct answers provided by both the Chinese and U.S. students concentrated on one answer (China: 58%, U.S.: 86%). It appears that students’ rare exposure to open-ended problems via textbooks could be one important reason for such performance.

The majority of problems in both the Chinese and U.S. textbooks were not contextualized in real-world situations, which, though, was more obvious in the Chinese books. Out of 6,850 problems in the Chinese textbooks, only 449 problems were application problems and the percentage of authentic application problems in the books was only 1%. More application problems were provided in the U.S. books, in which more than one-fourth of the problems were related to real-world situations and the percentage of authentic application problems was 7.7%. This finding is consistent with that in Fan’s comparative study on Chinese and U.S. mathematics textbooks at the primary level (Fan, 1999). From the perspective of cultural differences, Fan argued that the fact that more problems in the U.S. books were contextualized in real-world situations might be partially due to the fact that American values are more practical and utilitarian-oriented, as compared to the Chinese.

In terms of the number of steps required in the solutions to problems, the study revealed that problems in the Chinese textbooks were more
challenging than those in the U.S. books. It was found that over 63% of the problems in the U.S. books only needed one step to solve, whereas such problems in the Chinese textbooks were around 52%. The less frequent exposure to multiple-step problems for U.S. students might be one reason why they did not perform as well on this type of problem, as found in many studies at both the primary and secondary levels. For instance, the second National Assessment of Educational Progress (NAEP) reported that many U.S. primary students had difficulty in solving multiple-step problems, where significantly more students simply attempted to apply a single operation to the numbers given in problems than those solving the multiple-step problems correctly (Carpenter, Corbitt, Kepner, Lindquist & Reys, 1980). Quintero’s (1984) study on fifth-grade students consistently revealed that, while 80.6% of the students could successfully solve single-step problems, more than 80% of the same students could not solve two-step problems correctly. Quintero argued that one of the reasons was because some students tried to use just a single arithmetic operation to solve the problems whose solutions, in fact, needed two steps. At the upper level, the situation does not improve much. In fact, the NAEP studies showed that only 7% of 17-year-old mathematics students were able to solve multiple-step problems involving variables (Patrick, 1993).

The study found that most problems in the two textbook series provided just enough information. In the Chinese textbooks, there were only 15 out of 6,850 problems containing extraneous information and 1 lacking enough information. In the U.S. textbooks, among the 13,286 problems, 264 had superfluous information and only 4 problems did not provide enough information for the answers. Little experience with problems containing either extraneous or insufficient information would likely cause students to have an impression that problems always had exact information. In fact, researchers have shown that many students attempted to use all of the numbers presented in their solutions no matter whether those numbers were necessary in the solutions or not (e.g., Carpenter et al., 1980). However, such an impression goes against the real-life situation. In reality, people usually need to gather information, judge the quality of the information, and then select the necessary information to solve the problems, which is an indispensable procedure.

The data revealed that problems in both the Chinese and U.S. textbooks were presented in a variety of ways. The majority of problems in all the books were presented in symbolic forms, including mathematical expressions, written words, or a combination of those two forms.
(China: 86.5%, U.S.: 67.5%). Table II lists the distribution of the problems in various representation forms in the two textbook series.

From the table, we can see that more problems in the U.S. textbooks were presented by visual information (i.e., figures or tables) than the Chinese books, while the problems of this particular representation form in both textbook series were much fewer than those in other forms. Considering all of the problems containing visual information, including those in only visual form or a combined forms with visual data, one can see that the U.S. books had more of such problems (China: 13.5%, U.S.: 31.2%). The results appeared consistent with the findings from studies on students’ performance. For instance, Brenner, Herman, Ho & Zimmer, (1999) reported that the Chinese students were relatively weak on some visual representation items, while the U.S. students scored significantly higher on those items. In another study, Cai (1995) found that U.S. students, compared to their Chinese peers, preferred to use visual-related representations in problem solving. In that study, while about 13% of the U.S. students used visual-related representation modes in problem solving, none of the Chinese students used such representation modes. It seems to us from this textbook analysis that U.S. students quite likely have more experience with problems containing visual information, which is positively associated with their performance in such type of problems. Moreover, Table II also shows that the distribution of problems in various representation forms in the U.S. textbooks is more balanced than that in the Chinese books.

**SUMMARY AND CONCLUSIONS**

This study examined one Mainland China (People’s Education Press, PEP) and one U.S. mathematics textbook series (University of Chicago
School Mathematics Project, UCSMP) at the lower secondary grade level to investigate how the two series represent various types of problems. The results revealed that an absolute majority (more than 96%) of problems provided in both of the textbook series were routine and traditional. Among the small number of non-traditional problems in the two series, a larger variety was found in the U.S. textbooks than the Chinese ones, in which there were no project tasks or journal-writing problems. Moreover, the presentation of various types of non-traditional problems in the U.S. books also appeared to be in a more balanced way. The study found that, in both series, more than 90% of problems were close-ended problems and most of the problems were irrelevant to real-world situations, although more application problems, especially authentic ones, were found in the U.S. books. Nearly all of the problems in both the Chinese and U.S. series provided exactly enough information for students to find the solutions.

The results also showed that the problems in the Chinese textbooks were, overall, more challenging than those in the U.S. books, in terms of the steps involved in the problem solutions. On the other hand, the U.S. textbooks provided considerably more problems, in both absolute numbers and percentages, which were presented using visual information than the Chinese books.

In conclusion, from our examination of the PEP and UCSMP textbooks, it appeared to us that, overall, both series provided a wealthy source of problems for students to develop their ability in problem solving. In other words, they provided a rich learning environment in which students can have plenty of opportunities to experience problem solving for themselves. However, we also strongly feel that both of the textbook series could be improved in a number of aspects concerning the representation of problem types.

According to the data generated in the study, we think that both of the textbook series, especially the Chinese one, could have more innovative and non-traditional problems of various types, as some researchers have claimed that innovative problems and tasks might contribute more to students’ understanding than traditional, rule-based problems and tasks (Siemon, Vitgona & Cornielle, 2001).

From the results, we also believe that the U.S. textbook developers could consider including more multiple-step and, thus, more challenging problems in textbooks. In fact, other researches have also revealed that the problems provided in other U.S. textbooks were less challenging in terms of the number of steps involved in the solutions to problems (e.g., Harding, 1995). It seems to us that less exposure to multiple-step
problems could be one reason for many U.S. students to have less-than-satisfactory performance in solving this type of problem as reported (e.g., see Patrick, 1993), and textbooks as intended curriculum can, to a certain degree, make a difference in this aspect.

Compared to the U.S. textbooks, the Chinese textbooks, as we found from this study, could include more problems contextualized in real-world situations, especially authentic problems. Researchers have argued that increasing the number of real-life problems or application problems can enhance the variation of problems, which can help bring to students a learning environment favorable to a higher level of understanding (Gu, Huang & Marton, 2004; Wong, Lam & Chan, 2002). In this aspect, we think that the Chinese textbook developers could gain insight from the U.S. textbooks, in which problems were situated in a richer context.

From the findings of this study, we also think it would be helpful if more problems with extraneous information and those with insufficient information could be introduced in the textbooks, especially in the Chinese books, as it appears to us that one possible reason why many students tend to fail to distinguish extraneous information from necessary data and then tend to use all of the information provided in the problems is that the students seldom have opportunities to work on other types of problems besides the type with just enough information.

Finally, we wish to point out that, although textbook analysis is helpful to realize a better understanding of not only what students learn, but also why teachers teach in certain ways, there is, understandably, some gap between what is intended in the textbooks and what actually happens in classrooms (also see Fan & Zhu, 2000). In particular, as Hiebert, Stigler, Jacobs, Givvin, Garnier, Smith, et al. (2005) mentioned, the nature of problems can actually be changed as they are worked out in classrooms, corresponding to the ways in which teachers use the problems. In addition, as researchers have reported, many teachers do not have enough knowledge about the textbooks they are using, which makes it difficult for teachers to use their books in an effective way (e.g., Korithoski, 1988; Sosniak & Stodolsky, 1993). Therefore, not only is more research on textbooks needed, but also, teachers themselves should study the texts that they are using to make clear about the strengths and weaknesses of the books, so that they can use the teaching materials more wisely and, therefore, teach mathematics more effectively.
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NOTES

1 For a comprehensive review concerning Chinese students’ performance in large-scale international comparisons, see Fan & Zhu (2004).
2 For the results on the Singapore mathematics textbooks, readers can refer to Fan & Zhu (2000).
3 In the latest curriculum reform, Shanghai is still allowed to have its local syllabus, but the Zhejiang Province has started to revert to the national syllabus (now call “standards”) since 2004.
4 It should be noted that, different from Mainland China, students at the same grade level in the U.S. may take different school subjects/contents. In mathematics, only about the top 10% of the seventh and eighth graders take algebra and geometry, respectively, and most seventh graders learn transition mathematics (focusing on the arithmetic topics) and eighth graders learn algebra (see Usiskin, Flanders, Hynes, Polonsky, Porter & Viktora, 1995). In other words, a large percentage of students might only start to take geometry at Grade Nine. The reason we selected the UCSMP Algebra and Geometry texts is for a better comparability in contents with the selected Chinese textbooks.
5 For convenience, the study used one term classification to name all the divisions, no matter if the division includes two categories (dichotomy) or more.
6 In both of the textbook series, a chapter consists of several sections, each of which usually focuses on one particular mathematics theme.

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