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, J. Author for correspondence.

© National Science Council, Taiwan 2006

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