

A Comparison of Cognitive Demand Levels of Tasks In 5th Grade Mathematics Textbook Used in Singapore, the United States, and Turkey

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Abstract

The purpose of this study is to compare the cognitive demand levels of activities in 5th grade mathematics textbooks used in Singapore, the United States, and Turkey. These countries were chosen based on their varying levels of success in the Trends in International Mathematics and Science Study (TIMSS). The content analyzed was limited to the topics encountered in the 8th grade TIMSS. Qualitative methods were utilized in collecting and analyzing the data. The tasks were coded according to four cognitive demand levels; lower-level demands of memorization and procedures without connections, and higher-level demands of procedures with connections and doing mathematics. In 5th grade textbooks in Singapore, the United States, and Turkey, the percentage of tasks requiring cognitive demand level of memorization was 4%, 2%, 0%; those of procedures without connections were 37%, 69%, 34% respectively. Thus, the percentages of tasks requiring lower-level demands were 41% in Singapore, 71% in the U.S., and 34% in Turkey. When tasks, requiring procedures with connections, were analyzed, their distribution was found to be 42% in Singapore, 20% in the U.S. and 52% in Turkey; whereas, those with cognitive demand level of doing mathematics was 17%, 8%, and 14%, respectively. The study indicated that the distribution of tasks with higher level demands was 59% in Singapore, 29% in the U.S. and 66% in Turkey. In addition, the percentage of tasks requiring all four cognitive demand levels was also analyzed for TIMSS 8th grade mathematical content domains. In mathematics textbooks from Singapore, the United States, and Turkey, for the content domain of number, the cognitive demand level for the percentage of tasks requiring memorization was 10%, 0%, 0%; procedures without connections was 30%, 72%, 17%; procedures with connections was 30%, 21%, 83%; and doing mathematics was 30%, 7%, 0%, respectively. Likewise, for these textbooks, in the content domain of geometry, the cognitive demand level for the percentage of tasks requiring memorization was 0%, 7%, 0%; procedures without connections was 36%, 60%, 33%; procedures with connections was 55%, 22%, 48%; doing mathematics was 9%, 11%, 19%, respectively. For all countries studied, in the content domain of data and chance, no task was determined requiring a cognitive demand level of memorization and of doing mathematics. Cognitive demand levels of tasks in the content domain of data and chance requiring procedures without connections was 67% in Singapore, 100% in the U.S., 100% in Turkey; whereas, those with connections were 33%, 0%, 0% respectively. In the 5th grade textbooks of these three countries, no activity was found in the content domain of algebra. The results indicate that even in Singapore and Turkey, where majority of 5th grade tasks require a higher cognitive demand level, the tasks mainly fall in the category of procedures with connections. Based on these results, it is recommended that the percentage of tasks requiring the cognitive demand level of doing mathematics is increased. Finally, it is strongly recommended that professionals using and/or writing textbooks should familiarize themselves with cognitive demand levels of tasks.

Keywords: Mathematical tasks, cognitive demand levels, 5th grade mathematics textbooks, QUASAR