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A COMPARISON OF COGNITIVE DEMAND LEVELS OF ALGEBRA QUESTIONS

Abstract:

The purpose of this study is to compare the cognitive demand levels of algebra questions encountered in mathematic textbooks that are representative of those used in Singapore, the United States, and Turkey. These countries were chosen because Singapore is one of the top achieving countries in the Trends in International Mathematics and Science Study (TIMSS), the United States is usually about average and Turkey is below average. TIMSS is administered at the end of 4th grade and 8th grade; therefore 5th-8th grades were chosen to cover the time frame in between.

Algebra is an important part of 5th-8th grade mathematics. To compare the algebra learning opportunities provided to students in these three countries, cognitive demand levels of questions in the textbooks of 5th-8th grades were examined. Qualitative methods were utilized in collecting and analyzing the data. The algebra questions were coded according to the three cognitive demand levels currently being used in TIMSS: knowing, applying, and reasoning. The questions coded were limited to the algebra topics in the 8th grade TIMSS exam.

Cumulative findings for 5th-8th grade indicate that in Singapore, the United States, and Turkey, the percentage of questions requiring the cognitive demand level of knowing were 60% (1684), 52% (1131), and 59% (223) respectively. Those requiring the cognitive demand level of applying were 34% (948) in Singapore, 33% (715) in the United States, and 26% (99) in Turkey. The percentage of questions requiring the cognitive demand level of reasoning were 7% (191) in Singapore, 14% (311) in the United States and 15% (59) in Turkey. While none of the countries show a distribution similar to that of TIMSS', textbooks of each country had a higher percentage of questions requiring knowledge and lower percentages of questions requiring applying and reasoning than that of TIMSS'. The percentage of questions requiring the cognitive demand level of knowing is less in the US, of applying is less in Turkey, and that of reasoning is less in Singapore compared to the other two nations.

Based on the findings, the number as well as the distribution of questions among cognitive demand levels could be an important factor in students' success. Finally, it is strongly recommended that professionals using and/or writing textbooks should familiarize themselves with cognitive demand levels.

Keywords:

TIMSS cognitive demand levels, 5-8th grade mathematics textbooks, comparison of mathematics textbooks, international comparisons in mathematics education, cognitive demand levels in algebra

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