Title   TIMSS - R: performance of eighth graders from Singapore
Author(s)   Berinderjeet Kaur
Source   *The Mathematics Educator, 7*(1),62-79
Published by Association of Mathematics Educators

TIMSS – R: Performance of Eighth Graders from Singapore

Berinderjeet Kaur

National Institute of Education, Nanyang Technological University, Singapore.

Abstract: *In 1999, the Third International Mathematics and Science Study (TIMSS) was replicated at the eighth grade level. This study, known as TIMSS–R, was designed to highlight trends in eighth grade mathematics and science achievement in an international context. This paper reviews the mathematics achievement of eighth graders from Singapore who participated in TIMSS-R. The achievement data show that the overall performance of eighth graders from Singapore was commendable and they were ranked first amongst the thirty-eight countries that participated. Almost half of the students were amongst the top 10% of the participants in the study. Their performance on each of the 82 mathematics items that are released by IEA, highlights some of their strengths and weaknesses that are of particular interest to mathematics educators in Singapore.*

What is TIMSS-R?

The Third International Mathematics and Science Study, TIMSS, (Beaton et al., 1996) was conducted in 1995. Forty-one countries participated and testing was carried out at five grade levels. The aim of TIMSS, also known as TIMSS-1995, was to provide a base from which policy makers, curriculum specialists and researchers could better understand the performance of their educational systems. In 1999, TIMSS was replicated at the eighth grade. This study known as TIMSS–R or TIMSS-1999 (Mullis et al., 2000) was designed to highlight trends in eighth grade mathematics and science achievement in an international context. Thirty-eight countries participated in TIMSS-R. Of these, 26 countries participated in TIMSS at the eighth grade in 1995. Also, 1999 represents four years since the first TIMSS, and the population of students originally assessed as fourth graders were now in their eighth grade. Thus for 17 of the 26 countries that participated in TIMSS at the fourth grade, TIMSS-R provides information about whether the relative performance of these students has changed in the intervening years.

Singapore participated in both TIMSS and TIMSS-R. For TIMSS, Singapore participated at Populations 1 and 2 levels only (Research & Testing Division, MOE, 1996). Population 1 students comprised those at Primary Three and Four and Population 2 students, those at Secondary One and Two. All primary and secondary schools were involved in the study and an intact class at each of the two adjacent grades was randomly selected. Altogether, about 14,500 Primary Three and Four

students and 8,650 Secondary One and Two students participated in the survey. For TIMSS-R, in Singapore, about 5000 Secondary Two (grade eight) students from all secondary schools and courses participated (Research & Evaluation Branch, MOE, 2000). This paper reviews the mathematics achievement of eighth graders from Singapore who participated in TIMSS-R highlighting their strengths and weaknesses. These findings are important for mathematics educators in Singapore as they shed light on pedagogical and curriculum issues.

The Tests

The TIMSS–R tests (Research & Evaluation Branch, MOE, 2000) included more than 300 multiple-choice and open-ended test items, covering a range of mathematics and science topics and skills. About one-third of these items were identical to those in TIMSS. Eight different booklets containing a selection of the 162 mathematics and 146 science items were administered to the sampled students. Each student completed the test in one booklet. Testing time was 90 minutes. In accordance with IEA (International Association for the Evaluation of Educational Achievement) policy (TIMSS, 2000), about one-half of the TIMSS-R items were not released to the public but kept secure for future use to measure international trends in mathematics and science achievement. Eighty-two of the mathematics items used in TIMSS-R were released. The mathematics items were classified by content category and performance expectation.

Content Category

The mathematics items were reported according to five content areas (Mullis et al., 2000). These areas, with their main topics, are:

- Fractions and number sense:
  Includes whole numbers, fractions and decimals, integers, exponents, estimation and approximation, proportionality;
- Measurement:
  Includes standard and non-standard units, common measures, perimeter, area, volume, estimation of measures;
- Data representation, analysis, and probability:
  Includes representing and interpreting tables, charts, and graphs; range, mean; likelihood, simple numerical probability;
- Geometry:
  Includes points, lines, planes, angles, visualization, triangles, polygons, circles, transformations, symmetry, congruence, similarity, constructions;

- Algebra:
  Includes number patterns, representation of numerical situations, solving of linear equations, operations with expressions, representations of relations and functions.

Table 1, shows the distribution of the test items by content area and type. A total of 162 items were used in TIMSS-R and 82 of these items are released. Almost 40 % of the items were in the content area Fractions and number sense. About 20 % of the items were in the content area Algebra, 15 % in the content area Measurement, and 13 % each in the content areas Geometry and Data representation, analysis & probability. Majority of the items (i.e., 77 %) were multiple choice in type. Only about a quarter of the items were short answer (13 %) and extended response (10 %) in type.

Table 1.

Distribution of the test items by content area and type

		Type of Item		
Content Area	Number of items	Multiple Choice (MC)	Short Answer (SA)	Extended Response (ER)
Fractions & number sense	61	47	11	3
Measurement	24	15	4	5
Data representation, analysis & probability	21	19	1	1
Geometry	21	20	1	0
Algebra	35	24	4	7
Total	162	125	21	16

Performance Expectation

The mathematics items were classified into the following performance expectations:

- Knowing
- Using Routine Procedures
- Using Complex Procedures

- Investigating & Problem Solving
- Mathematical Reasoning & Communicating

Table 2 shows the distribution of the items by performance expectation. About a third (31 %) of these items belonged to the Investigating and Problem Solving category which may be considered a high level of mathematical performance, that is, applying mathematical knowledge to solve problems; while almost a fifth (19 %) of them belonged to the Knowing category which may be considered the lowest level of mathematical performance, that is, mere recall of mathematical facts and knowledge. About half (47 %) of the items belonged to the Using Routine Procedures (23 %) and Using Complex Procedures (24 %) categories. These items mainly tested mathematical skills in simple and complex situations. Only a very small percentage (2 %) of the released items belonged to the category Mathematical Reasoning and Communication, the category considered to be the highest level of mathematical performance tested in the TIMSS-R tests.

Table 2.

Distribution of the test items by performance expectation and type

Performance Category	Number of Items		
	Total	Multiple Choice	Short Answer & Extended Response
Knowing	30	28	2
Using Routine Procedures	38	28	10
Using Complex Procedures	39	34	5
Investigating & Problem Solving	51	34	17
Mathematical Reasoning & Communication	4	1	3

Findings

Overview

Singapore students performed very well in the TIMSS test. Among the countries that participated at Population 2, Singapore was ranked first for both Mathematics and Science (Research & Testing Division, MOE, 1996). The results were consistent across grades 7 and 8. For TIMSS-R, Singapore's eight graders were again ranked first for mathematics. However for Science, they were ranked second (Research & Evaluation, MOE, 2000). Table 3 compares TIMSS and TIMSS-R

scores for eight graders in mathematics. From Table 3 it is can be seen that the performance of the eighth graders from Singapore is consistent across the two studies.

Table 3.
TIMSS & TIMSS-R Data for Singapore Eighth Graders in Mathematics

	TIMSS	TIMSS-R
Mean Score		
Singapore	643	604
International	513	487
% of Students achieving International Benchmarks		
Top 10%	45	46
Top 25%	74	75
Top 50%	94	93
Lower 25%	99	99

The international benchmarks presented as part of the data (Mullis et al., 2000) help provide participating countries with a distribution of the performance scores of their eighth graders in an international setting. For the participating countries the proportions of their students reaching these benchmarks are perhaps telling of certain strengths and weaknesses of mathematics education programs in their countries. The benchmarks delineate performance of the top 10%, top quarter, top half, and lower quarter of students that participated in the studies. The analysis of performance at these benchmarks in mathematics suggests that three primary factors appeared to differentiate performance among the four levels:

- the mathematical operation required
- the complexity of the numbers or number system
- the nature of the problem situation.

It is interesting to note that for Singapore almost half of their eighth graders were among the top 10% for both TIMSS and TIMSS-R. Also, nearly all the eighth graders were amongst the top 75% of the participants in the two studies. This achievement is commendable as students from the Normal (Technical) stream also participated in the studies. Table 4, shows for TIMSS-R the average scale scores of the top five countries. The average scale scores of the top five countries were

significantly higher than the international average. The average scale score of Singapore was significantly higher than that of Japan. However, there were no statistically significant differences among the average scale scores of Singapore, Korea, Chinese Taipei and Hong Kong. In TIMSS (Beaton et al., 1996), Singapore was ranked top, Korea second, Japan third and Hong Kong fourth for the mathematics achievement of eighth graders. Chinese Taipei did not participate in TIMSS.

Content Areas
As the TIMSS-R tests covered five content areas in mathematics, Table 5 shows the average achievement of eighth graders from the top five countries in the mathematics content areas. From Table 5, it is evident that performance in the five content areas for all countries was not consistent with their overall performance in the tests. Eighth graders from Singapore had the highest scores for the content areas: Fractions and number sense and Measurement; eighth graders from Korea had the highest score for the content area Data representation, analysis and probability; eight graders from Japan had the highest score for Geometry and eighth graders from Chinese Taipei had the highest score for Algebra.

Some items within each mathematics content category which were difficult for eighth graders from Singapore

Fractions & number sense
There were altogether 61 items in this content area of which 35 are released. Based on the data of the released items, eighth graders from Singapore scored 70% or more correct on 30 of them. They found the following items relatively difficult.

Item: J14
Performance Expectation: Using Routine Procedures

Divide:

$$0.003 \overline{\smash{)}\ 15.45}$$

A.	0515	(14.3%)	B.	5.15	(22.7%)	C.	51.5	(7.1%)
D.	515	(10.2%)	E.*	5150	(44.8%)			

Percent correct: Singapore – 45, International – 39.

Although students are taught how to divide a decimal by a decimal in Year 5, less than half of the eighth graders could do this item correctly.

Table 4.
TIMSS-R: Rank and average scale scores of the top 5 countries

Country	Rank	Average Scale Score
Singapore	1	604
Korea	2	587
Chinese Taipei	3	585
Hong Kong	4	582
Japan	5	579
International Average	-	**487**

Table 5.
Average achievement in mathematics content areas

Country	Average Scale Score				
	Fraction[1]	Measure't	Data	Geometry	Algebra
Singapore	*608	*599	562	560	576
Korea	570	571	*576	573	585
Chinese Taipei	576	566	559	557	*586
Hong Kong	579	567	547	556	569
Japan	570	558	555	*575	569
International Average	*487*	*487*	*487*	*487*	*487*

* Highest score in content area
[1] Full title descriptions:
   F: Fractions & Number sense (61 items)
   M: Measurement (24 items)
   D: Data representation, analysis, & probability (21 items)
   G: Geometry (21 items)
   A: Algebra (35 items)

Item: T02A / T02B
Performance Expectation: Investigating & Solving Problems

A book publisher sent 140 copies of a certain book to a bookstore. The publisher packed the books in two types of boxes. One type of box held 8 copies of the book, and the other type of box held 12 copies of the book. The boxes were all full, and there were equal numbers of both types of boxes.

(a) How many boxes holding 12 books were sent to the bookstore?
Answer:_____

Percent correct: Singapore – 62,   International – 26.

(b) What fraction of the books sent to the bookstore were packed in the smaller boxes?
Answer:_____

Percent correct: Singapore – 48,   International – 12.

In Singapore, students are introduced to the concept ratio in Year 5, but word problems like this item are only introduced to them from Year 6 onwards. As the percent correct shows, many students in the eighth grade were not able to apply the concept and make the connection with fractions.

Item: N17
Performance Expectation: Investigating and Solving Problems

A painter has 25 L of paint. He used 2.5 L of paint every hour. He finished the job in 5.5 hours. How much paint did he have left?

A.	10.25 L (4.0%)	B.*	11.25 L (64.6%)
C.	12.75 L (10.3%)	D.	13.75 L (21.1%)

Percent correct: Singapore – 65,   International – 35.

The percent correct shows that about a third of the eighth graders from Singapore were not able to solve a two-step word problem involving multiplication of two decimal numbers. A closer examination of the responses shows that a significant number of students got the item incorrect, due to carelessness; that is, they either completed only one step of the problem and got distracted or they misread the question. Students are taught how to multiply decimals (of the order up to three decimal places) in Year 5.

Measurement

There were altogether 24 items in this content area of which eight are released. Based on the data of the released items, eighth graders from Singapore scored 70% or more correct on 4 of them. They found the following items relatively difficult.

Item: L13

Performance Expectation: Investigating & Solving Problems

Four girls measured the length of their paces. The chart shows their measurements.

Name	Length of Pace
Polly	80 cm
Maria	65 cm
Helen	75 cm
Susan	60 cm

Who would take the most paces in walking from one end of a hallway to the other?

A. Polly   (31.6%)   B.   Maria   (5.6%)
C. Helen   (1.0%)   D.*   Susan   (61.8%)

Percent correct: Singapore – 62,   International – 67.

Students found this item relatively difficult compared to their international counterparts. The difficulty may be linked to the context of the problem and the term "pace" (Kaur & Yap, 1999) which is not common in the mathematics classroom. In Year 7, students are taught direct and inverse proportions.

Item: P12

Performance Expectation: Using Complex Procedures

In the following item, nearly half of the eighth graders were unable to figure out the length of the string correctly. Although students are taught how to measure lengths and distances using rulers in Year 2, the performance on this item shows that many students were not able visualize the string pulled straight.
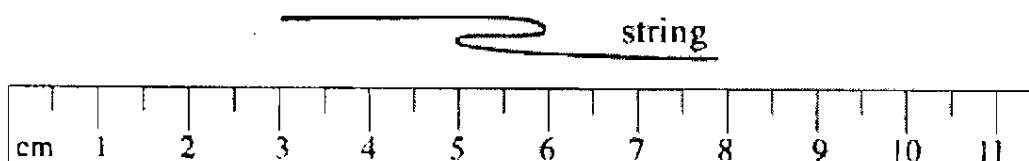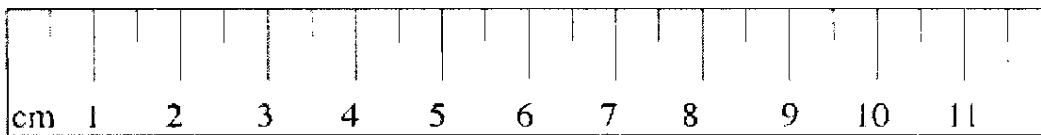
If the string in the diagram is pulled straight, which of these is closest to its length?

A. 5 cm	(0.9%)		**B.** 6 cm	(13.9%)
C.* 7 cm	(52.4%)		**D.** 8 cm	(32.6%)

Percent correct: Singapore – 52,   International – 41.

Item: F10
Performance Expectation: Knowing

Using a centimeter ruler like this one, you can measure accurately to the nearest

A. millimeter	(6.4%)		**B.** half-millimeter	(2.2%)
C. centimeter	(38.7%)		**D.*** half-centimeter	(52.3%)

Percent correct: Singapore – 52,   International – 49.

Nearly half of the eighth graders were unable to determine the accuracy of a ruler given a scale marked on it. Though students are taught how to measure with rulers from Year 2 onwards, this item has perhaps exposed an aspect of measurement that many teachers in Singapore schools may have overlooked.

Data representation, analysis, & probability
There were altogether 21 items in this content area of which 10 are released. Based on the data of the released items, eighth graders from Singapore scored 70% or more correct on 6 of them. They found the following items relatively difficult.

Item: N18
Performance Expectation: Investigating & Solving Problems

The eleven chips shown below are placed in a bag and mixed.
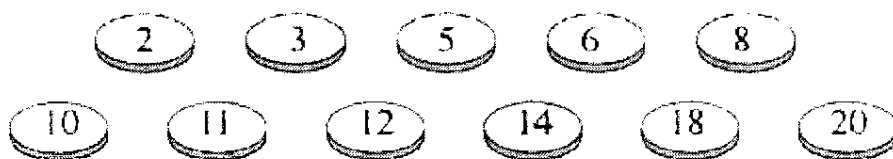
Chelsea draws one chip from the bag without looking. What is the probability that Chelsea draws a chip with a number that is a multiple of three?

A.   1/11   (4.5%)   **B.**   1/3   (27.2%)
C*. 4/11   (63.9%)   **D.**   4/7   (3.6%)

Percent correct: Singapore – 64,   International – 48.

Students are formally introduced to the concept of probability in Year 9 or Year 10. Therefore, though their performance on this item is poor compared to their performance on the other items in this content category, it is otherwise commendable.

Item: F08
Performance Expectation: Knowing

If a fair coin is tossed, the probability that it will land heads up is ½. In four successive tosses, a fair coin lands heads up each time. What is likely to happen when the coin is tossed a fifth time?

A.   It is more likely to land tails up than heads up.   (12.2%)
B.   It is more likely to land heads up than tails up.   (12.1%)
C.* It is equally likely to land heads up or tails up.   (48.5%)
D.   More information is needed to answer the question.   (27.0%)

Percent correct: Singapore – 49,   International – 57.

The performance of eighth graders from Singapore on this item was not only poor but also below the international average.   They appeared to be unaware of mathematical terminology such as "fair coin".   Students are formally taught the topic: Probability in Year 9 or Year 10.

Item: V02
Performance Expectation: Communicating & Reasoning

Chris plans to order 24 issues of a magazine. He reads the following advertisements for two magazines. *Ceds* are the units of currency in Chris' country.

Teen Life Magazine	Teen News Magazine
24 issues First four issues FREE The rest 3 *ceds* each	24 issues First six issues FREE The rest 3.5 *ceds* each

Which magazine is the least expensive for 24 issues? How much less expensive? Show your work.

Percent correct: Singapore – 57,   International – 24.

Compared to their international counterparts, eighth graders from Singapore appeared to have done well on this item that requires them to analyze data presented and work out which magazine is the least expensive. However, relative to their performance on items in this content category, they appear to have found this item difficult. Such items are not commonly found in textbooks used in Singapore.

Geometry
There were altogether 21 items in this content area of which nine are released. Based on the data of the released items, eighth graders from Singapore scored 70% or more correct on five of them. They found the following items relatively difficult.

Item: J11
Performance Expectation: Knowing

Students are introduced to the shape - rectangle - in Year 1. They study its properties in Year 4 and again more rigorously in Year 7. The performance on this item shows that about two fifths of eighth graders were not conversant with the properties of rectangles.

Of the following, which is NOT true for all rectangles?

A. The opposite sides are parallel.   (2.7%)
B. The opposite sides are equal.   (5.9%)
C. All angles are right angles.   (4.1%)
D. The diagonals are equal.   (25.4%)
E.* The diagonal are perpendicular.   (61.4%)

Percent correct: Singapore – 61,   International – 54.

Item: P10
Performance Expectation: Using Routine Procedures

The figure represents two similar triangles. The triangles are not drawn to scale.
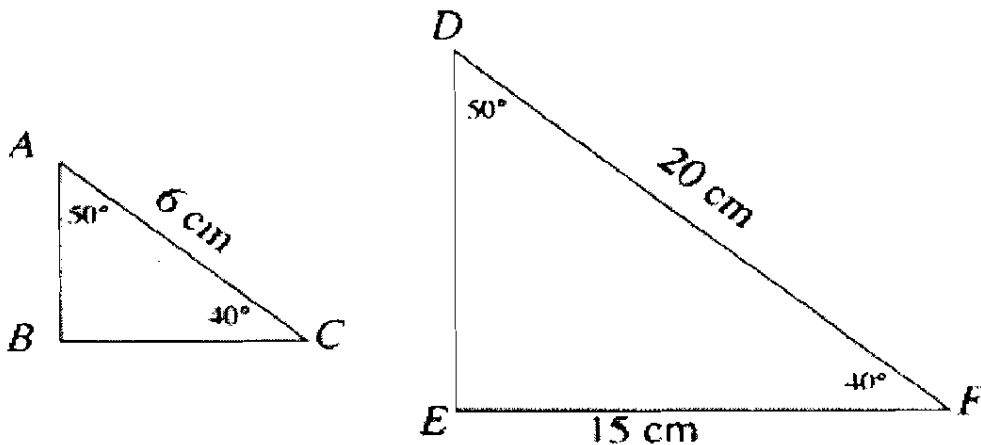
In the actual triangle ABC, what is the length of the side BC?

A. 3.5 cm (14.2%) **B.*** 4.5 cm (63.7%) **C.** 5 cm (12.0%)
**D.** 5.5 cm (5.3%) **E.** 8 cm (4.4%)

Percent correct: Singapore – 64,   International – 37.

About two fifths of the eighth graders found this item difficult, although they are taught similar triangles in Year 8. As this item is a similar to the many in Year 8 mathematics textbooks, the percent correct suggests that a significant number of eighth graders have failed to grasp the concept of similarity.

Item: N12
Performance Expectation: Using Routine Procedures

Point P (not shown) on the number line is 5 units from point N and 2 units from point M.
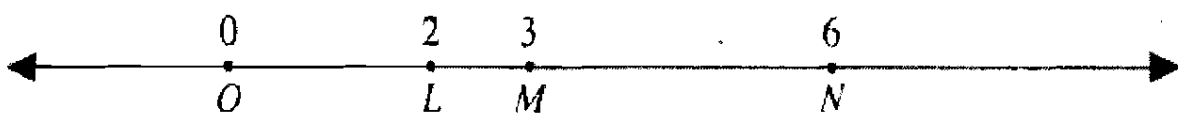
Where is point P located?

A.* Between *O* and *L* (49.7%)   **B.**   Between *L* and *M*(7.3%)

C.   Between *M* and *N*   (35.4%) **D.**   To the right of *N* (7.6%)

Percent correct: Singapore – 50,   International – 42.

Only half of the eighth graders were able to locate a point on a number line given verbal clues and reference points other than the origin. By Year 8 students would have had ample practice with number lines and the origin as a reference point but this type of item is not commonly found in their textbooks.

Algebra

There were altogether 35 items in this content area of which 20 are released. Based on the data of the released items, eighth graders from Singapore scored 70% or more correct on 13 of them. They found the following items relatively difficult.

Item: J17

Performance Expectation: Using Routine Procedures

The table represents a relation between *x* and *y*. What is the missing number in the table?

x	y
2	5
3	7
4	?
7	15

A.*   9   (66.9%)   **B.**   10   (10.6%)   **C.**   11 (16.2%)

D.   12   (5.0%)   **E.**   13   (1.2%)

Percent correct: Singapore – 67,   International – 65.

The performance of eighth graders from Singapore on this item was just as good as their international counterparts. This item expects the student to be able to recognize the relation between x and y, and find the value of y when x = 4. The percent correct shows that about a third of the eight graders found this item difficult.

Item: D10
Performance Expectation: Knowing

The cost, C, of printing greeting cards consists of a fixed charge of 100 cents and a charge of 6 cents for each card printed. Which of these equations can be used to determine the cost of printing n cards?

A.*	$C = (100 + 6n)$ cents	(64.0%)
B.	$C = (106 + n)$ cents	(6.3%)
C.	$C = (6 + 100n)$ cents	(5.1%)
D.	$C = (106n)$ cents	(17.2%)
E.	$C = (600n)$ cents	(7.0%)

Percent correct: Singapore – 64,   International – 50.

The performance of eighth graders from Singapore on this item may be considered poor as they are introduced to the basics of algebra in Year 6 with more reinforcement in Years 7 and 8. Furthermore, this item is a routine one for most students in Singapore schools.

Item: R10
Performance Expectation: Knowing

Which of the following is true when a, b, and c are different real numbers?

A.	$a - b = b - a$	(3.1%)
B.	$a (b - c) = b (c - a)$	(23.3%)
C.	$b - c = c - b$	(1.7%)
D.*	$ab = ba$	(53.0%)
E.	$ab - c = ac - b$	(17.8%)

Percent correct: Singapore – 53,   International – 37.

About half of the eighth graders got this item correct. Students are taught the properties of real numbers in Year 7. As very few students choose the distracters A and C, it shows that many of the students had some understanding of real numbers that were different in value. A desire to find a statement that had a relation between all the three numbers may have led some to choose distracters B or E. This item is one that would be unfamiliar to most students.

Discussion and Conclusions

The overall performance of eighth graders from Singapore in TIMSS-R was commendable. They were ranked first for mathematics. Their average scale score,

however, was not significantly higher than that of the next three countries: Korea, Chinese Taipei and Hong Kong. The international benchmarks show that almost half of Singapore's eighth graders were amongst the top 10% and nearly all were amongst the top 75% of the participants in both TIMSS and TIMSS-R. As students from all streams [Special / Express / Normal(Academic) / Normal(Technical)] participated in the studies, it is indeed reassuring that Singapore's school mathematics curriculum is sound.

The performance of eighth graders from Singapore in the five content areas: Fractions & number sense; Measurement; Data representation, analysis, & probability; Geometry and Algebra was not consistent with their overall performance. Eighth graders from Singapore had the highest average scale scores in two content areas: Fractions & number sense and Measurement. They were ranked second in Data representation, analysis & probability, and third in Geometry and Algebra.

Eighth graders from Singapore performed better than the international cohort on 80 of the 82 released items. The two items where they did relatively poorly on were L13 (most paces to walk) and F08 (likely result of fifth coin toss). A review of their performance on the items by content categories shows that generally:

- ❑ they found items based on content knowledge (Ministry of Education (MOE), 2000a; 2000b) they had already covered in their school curriculum easy;
- ❑ they did well on items that were of a routine type; that is, the context and format were familiar;
- ❑ they found items that included content that is not an integral part of the school curriculum, for example, probability, difficult; and
- ❑ they found items where the language or terminology was unfamiliar, for example, words like "paces" (L13) and "fair coin" (F08), difficult.

More specifically, a significant number of eight graders found items based on the following topics or skills difficult:

- ❑ division of a decimal by a decimal;
- ❑ multiplication of a decimal by a decimal;
- ❑ concept of ratio and its relation to fractions;
- ❑ measuring scales and the degree of accuracy to which they measure;
- ❑ properties of rectangles;
- ❑ the concept of similarity: properties of similar triangles;
- ❑ number line – reference points and distances from these points;

❑   given a set of values to determine the relation between two variables;

❑   construct an algebraic equation based on verbal statement;

❑   properties of real numbers

Singapore's participation in international studies such as TIMSS and TIMSS-R has provided it with an objective measure of its mathematics education against world benchmarks. Other than an affirmation that its mathematics education is sound and robust, the wealth of data made available by TIMSS and TIMSS-R are meaningful and purposeful to all those concerned with the education of the students in Singapore. With the TIMSS and TIMSS-R data as starting points, more studies of the pedagogy and school mathematics curriculum are necessary to complete "the part scene" that this paper has sketched.

References

Beaton, A.E., Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Kelly, D.L., & Smith, T.A. (1996). *Mathematics achievement in the middle school years: IEA's Third International Mathematics and Science Study (TIMSS)*. Boston MA: Boston College, TIMSS International Study Centre.

Kaur, B., & Yap, S.F. (1999). TIMSS - The strengths and weaknesses of Singapore's lower secondary pupils' performance in mathematics. In M. Waas (Ed.), *Enhancing learning: Challenge of integrating thinking and information technology in the curriculum.* (pp.436-444). Singapore: Educational Research Association.

Ministry of Education (MOE). (2000a). *Mathematics syllabus - Primary.* Singapore: Curriculum Planning and Development Division, Ministry of Education.

Ministry of Education (MOE). (2000b). *Mathematics syllabus − Lower secondary.* Singapore: Curriculum Planning and Development Division, Ministry of Education.

Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Conner, K.M., Chrostowski, S.J., & Smith, T.A. (2000). *TIMSS 1999:− International mathematics report - Findings from IEA's repeat of the Third International Mathematics and Science Study at the Eighth Grade. .Boston* MA: Boston College - Lynch School of Education, The International Study Centre.

Research & Evaluation Branch, MOE. (2000). *Third International Mathematics and Science Study 1999 (TIMSS 1999) - National report for Singapore.* Singapore: Ministry of Education.

Research & Testing Division, MOE. (1996). *Third International Mathematics and Science Study (TIMSS 1999) - National report for Singapore (Population 2).* Singapore: Ministry of Education.

TIMSS. (2000). *TIMSS - 1999 Mathematics items – Released set for eighth grade.* Boston MA: Boston College - Lynch School of Education, The International Study Centre.

Author:

Berinderjeet Kaur, Associate Professor, National Institute of Education, Nanyang Technological University, Singapore. kaurb@nie.edu.sg