
Title	Mathematics learning: Singapore students' perspective
Author(s)	Berinderjeet Kaur and Lionel Pereira-Mendoza
Source	<i>MERA-ERA Joint Conference, Malacca, Malaysia, 1-3 December 1999</i>

This document may be used for private study or research purpose only. This document or any part of it may not be duplicated and/or distributed without permission of the copyright owner.

The Singapore Copyright Act applies to the use of this document.

MATHEMATICS LEARNING – SINGAPORE STUDENTS' PERSPECTIVE

Berinderjeet Kaur & Lionel Pereira-Mendoza
Nanyang Technological University, Singapore

Abstract: As part of the Third International Mathematics and Science Study (TIMSS), some 14,000 primary school students and 8,500 secondary school students in Singapore completed the student questionnaire in 1994. This questionnaire sought their perceptions on how they were learning mathematics in school, spending their time in and out of school and also information on some background variables such as family size, expectations of parents and teachers, and socio-economic status. The paper will report on some of the findings of the survey that shed light on what Singapore students perceive to contribute to mathematics learning. Common perceptions of both primary and secondary students would be of particular interest as they may shed light on critical factors that contribute to their success in TIMSS.

Introduction

The TIMSS study provides a wealth of data on achievement, attitudes, classroom practice, etc. in mathematics. The authors have reported on the achievement data of Singapore students in other papers (Kaur and Pereira-Mendoza (1999, In press, In press); Pereira-Mendoza and Kaur, In press, In press).

This paper will focus on some of the findings that were derived from the student questionnaires. Some 14,000 primary school students (primary three and primary four) and 8,500 secondary school students (secondary one and secondary two) in Singapore completed the questionnaires. These questionnaires provide researchers with a student's perspective of the educational environment in Singapore, particularly as it relates to mathematics learning. The following discussion is under four headings: (a) Home; (b) Expectations and studying; (c) Perceptions of mathematics and (d) Mathematics teaching. Please note that all the percentages in the following are approximate, but are accurate to within a few percent. Also, unless otherwise stated the conclusions apply to both population 1 (Primary 3 and 4) and population 2 (Secondary 1 and 2). The following analysis is based *solely on released data available on the WWW* (Website: <http://wwwcsteep.bc.edu/timss>; IEA: TIMSS, 1997).

Home

In 70% of homes English is used sometimes and in 20% of the homes it is used always or almost always. Over 60% of homes have more than 25 books in the house and only 10 % have less than 10 books. Virtually all homes have a calculator, a dictionary and about half have computers. Although 65% of the homes have more than 5 people living in them, 85% of the students indicated that they had a table or study desk for their use. This picture shows that although the number of people in the home is relatively large it is an environment supportive of education.

Expectations and studying

Over 90% of the students said that their mothers thought it was important to do well in mathematics. This high percentage is particularly significant since it is higher than the importance placed on being good at sports or having fun. The percentages are also comparable to the results

regarding the expectations for their friends and their own, except that the students put greater weight on having fun and being good at sports.

The willingness of students to work at mathematics supports the importance placed on the subject. The majority of students (over 80%) spend more than 1 hour on a school day studying mathematics or doing mathematics homework outside school time. This is more time than students indicated in answers to comparable questions relating to the time they spent on playing/talking with friends, doing jobs at home, playing computer games or sports. Students spend the same amount of time studying Science. About 80% of primary students spend more than 1 hour reading for enjoyment, with this figure dropping to 60% for secondary students. The only activity that takes more time is watching TV, with over 90% of students indicating that they spent more than 1 hour watching TV. This emphasis on studying mathematics is supported by the fact that about 30% of the secondary students indicated that they had between 1 – 5 hours of extra mathematics lessons per week, but less than 5% of them spend time on either participating in a mathematics or science club. Primary students were not asked how much time they spent on extra mathematics lessons but they were asked if they had extra lessons, and 55% indicated that they did. As with the secondary students, only a small percentage (10%) spend time in a mathematics or science club. It appears that their mathematics learning is restricted to the school mathematics curriculum.

This emphasis on work seems to be supported by the fact that although about 85% of students thought that natural talent/ability was an important factor in doing well over 90% felt that lots of hard work studying at home was important. Also, only 35% of primary students and 40% of secondary students felt that luck was important. This finding is significant, since if students believe that working hard is more important than luck they will be willing to make the commitment to study mathematics.

There is one other significant finding related to expectations. Secondary students were asked about the education of their parents and their own expectations for further study. Although virtually all parents had completed at least primary school, a significant proportion of them had stopped at the end of primary school (43% for mothers and 30% for fathers). Very few parents of the students had finished University (3% for mothers and 6% for fathers). However, while a large minority (30%) indicated that they did not know how far they expected to go virtually all the remaining students expected to take some form of post-secondary education.

The data clearly indicates that working on school subjects such as mathematics is a high priority for the students and that they believe that hard work pays off. Also, secondary students have high expectations of their future education.

Perceptions

Over 80% of the students indicated that they either liked mathematics or liked it a lot. Less than 5% indicated they disliked it a lot. Similar percentages indicated that they enjoyed learning mathematics. However, 25% of secondary students and 10% of primary students indicated that mathematics was boring. It is also interesting to note that 60% of the primary students felt that mathematics was an easy subject but only 35% of the secondary students gave the same response. It appears that mathematics is perceived to get harder in secondary school. Ninety percent of the secondary students thought it was important in everyday life (the primary students were not asked this question). Secondary students were also asked about mathematics and its importance for jobs and university entry. Eighty-percent of the secondary students felt that mathematics was important to get a job and 90% felt it was important to get into the secondary school or university of their choice, but only 60% would like to get a job involving mathematics.

There are two particularly interesting findings. First, given the importance educators place on intrinsic motivation it is particularly pleasing to note that 80% of secondary students indicated that it is important to do well in mathematics to please themselves (primary students were not asked this question). Second, 35% of primary 3, 40% of primary 4, 55% of secondary 1 and 65% of secondary 2 students disagreed or strongly disagreed with the statement that it was important to memorise the textbook or notes to do well in mathematics. With the current emphasis on problem solving and understanding it is gratifying to find such a high percentage of students drawing this conclusion. Furthermore, the perception that memorisation is important decreases with experience.

It would appear that the students like mathematics, they perceive it to get harder from primary to secondary and also not important to memorise the textbook or notes to do well in it. The secondary students felt that mathematics was important both for jobs and university entry.

Mathematics teaching

All the students were asked how often the following happened in their mathematics lessons: the teacher shows us how to do mathematics problems; we copy notes from the board; we have a quiz or test; we work from worksheets or textbooks on our own; we work on mathematics projects; we use calculators; we use computers; we work together in pairs or small groups; we use things from everyday life in solving mathematics problems; the teacher gives us homework; we can begin our homework in class; the teacher checks homework; we check each other's homework; and we discuss our completed homework. Secondary students responded by indicating whether the above happened almost always, pretty often, once in a while or never while primary students responded by indicating whether the above happened in most lessons, some lessons or never. This makes the direct comparison of the results difficult. In the following discussion, unless stated otherwise the percentages for secondary students are those who indicated that the activity mentioned almost always happens or pretty often happens. For primary the results are usually discussed in terms of the combined percentages, but the breakdown for most and some lessons is given to provide the reader with more accurate information.

Teachers show students how to do problems in virtually all lessons (95% for secondary, 65% for most primary lessons and 33% for some primary lessons). Students copy notes from the board more often in the primary classes than in the secondary classes (57% for secondary, 21% for most primary lessons and 56% for some primary lessons). The teacher assigns homework (95% for secondary, 70% for most primary lessons and 25% for some primary lessons) and checks the homework (85% for secondary, 67% for most primary lessons and 25% for some primary). Students discuss their completed homework more often in the primary classes than the secondary classes (59% for secondary, 49% for most primary lessons and 42% for some primary lessons). Students begin their homework in class more often in the primary classes than in the secondary classes (56% for secondary, 27% for most primary lessons and 57% for some primary lessons). The teacher checks homework far more often than the students check each other's homework.

Another important factor is 70% of secondary students indicated that they had a quiz or test almost always or pretty often during mathematics lessons. As for the primary students 24% indicated this happened in most lessons while 71% indicated this happened in some lessons. During mathematics lessons 65% of secondary students indicated that they work from worksheets or textbooks on their own. As for the primary students 42% indicated this happened in most lessons while 47% indicated this happened in some lessons.

Working in pairs or groups is not that common, with only 15% of the secondary students indicating that this occurred. Even for primary students 25% indicated that it never occurred and only 9%

indicated that it occurred in most lessons. 80% of secondary students used calculators in their classes while 90% of primary students never used calculators in their classes. Computers were rarely used in secondary classes with 90% indicating they were never used. For primary classes 60% of students indicated that they were never used and 30% indicated that they were used in some lessons. It should be noted that at the time of carrying out this study many schools did not have computer labs, but this has changed drastically with all students spending some time on using the computer for mathematics. Less than 50% of the secondary students indicated that they use things from everyday life in solving mathematics problems. For primary students 28% indicated that everyday life situations were used in most lessons and another 55% indicated they everyday life situations were used in some lessons. Students in the secondary classes seldom worked on mathematics projects (7%) while for students in the primary classes 9% did mathematics projects in most lessons and 30% did them in some lessons.

Only the secondary students were asked how often the following happened when they began a new topic in mathematics: the teacher explain the rules and definitions; discuss a practical or story problem related to everyday life; work together in pairs or small groups on a problem or project; the teacher ask us what we know related to the new topic; look at the textbook while the teacher talks about it; and try to solve an example related to the new topic. Students responded by indicating whether these happened almost always, pretty often, once in a while or never. In the following discussion, unless stated otherwise the percentages are those who indicated that the activity mentioned almost always happens or pretty often happens.

It appears that in the secondary classes a new topic in mathematics was very often introduced via the teacher explaining the rules and definitions (94%); students trying to solve an example related to the new topic (80%); and students looking at the textbook while the teacher talks about it (75%). About half (51%) of the students indicated their teacher asked them what they knew related to the new topic when beginning it. Students did not often discuss a practical or story problem related to everyday life (34%) nor work together in pairs or small groups on a problem or project when beginning a new topic in mathematics (14%).

It appears from the above that mathematics lessons are mostly teacher centred. Teachers explain the concepts, rules and definitions, show students how to do problems and supervise them during class practice. Students work from workbooks or textbooks on their own during mathematics lessons. Homework appears to be an integral part of the mathematics learning outside class time. The teacher put considerable emphasis on monitoring through quizzes or tests and checking homework.

Conclusions

Data from the student questionnaire which is part of the Third International Mathematics and Science Study (TIMSS) show that in Singapore

- the home provides a supportive environment for studying;
- mothers think that it is important for their children to do well in mathematics at school;
- students and their peers think that it is important to do well in mathematics at school;
- students place priority on studying mathematics outside school and consider this more important than other activities such as computer games or sports;
- students feel that studying hard and not luck is important for success in mathematics;
- despite the educational attainment of their parents, vast majority of students expect to do some form of post-secondary schooling;

- generally students like mathematics and enjoy learning it;
- students perceive mathematics get harder from primary to secondary school;
- students feel that memorisation is not important for the learning of mathematics;
- secondary students feel that mathematics is important both for jobs and university entry;
- teachers play a lead role in direct teaching of mathematics, they explain concepts, rules and definitions;
- teachers demonstrate the solutions to mathematical problems and supervise students during class practice;
- students work from workbooks and textbooks;
- students almost always do homework as part of their mathematics learning outside class time;
- teachers put considerable emphasis on monitoring through quizzes or tests and grading homework assignments.

References

- Kaur, B. & Pereira-Mendoza, L (1999) Singapore Primary School TIMSS Data: Whole Numbers, Fractions and Proportionality. *The Mathematics Educator*, 4(1), 52-69.
- Kaur, B. & Pereira-Mendoza, L. (In press). Singapore Primary School TIMSS Data: Data Representation, Analysis and Probability, and Patterns, Relations and Functions. *The Mathematics Educator*.
- Kaur, B. & Pereira-Mendoza, L. (In press). TIMSS – Performance of Singapore Secondary Students Part B: Proportionality, Measurement, Fractions and Number Sense. *Journal of Science and Mathematics Education in Southeast Asia*.
- Pereira-Mendoza, L and Kaur, B. (In press) Singapore Primary School TIMSS Data: Geometry and Measurement, Estimation and Number Sense. *The Mathematics Educator*.
- Pereira-Mendoza, L and Kaur, B. (In press) TIMSS – Performance of Singapore Secondary Students Part A: Algebra, Geometry and Data Representation, Analysis and Probability. *Journal of Science and Mathematics Education in Southeast Asia*.
- TIMSS Website: <http://www.csteep.bc.edu/timss>