Comparative Study of Secondary Mathematics Curriculum between Malaysia and Singapore

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Abstract

This preliminary study attempts to compare the Malaysian Secondary Mathematics (MSM) curriculum published in 2003 with the Singapore Secondary Mathematics (SSM) implemented in 2007. The study aims to examine the math content and the level at which the content is introduced between the two countries. The results from the study indicated that there is a need for Malaysia Mathematics Curriculum to be revised in order to enable students to have literacy in mathematics and the ability to apply mathematics into other disciplines at higher level.

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1. Introduction

Over the years, it is a well known fact that secondary school graduates entering universities lacking the basic math skills in trigonometry, algebra, and even arithmetic, and high dependence on calculators. In Malaysia, much has been said about students with high score in the national exam, Sijil Pelajaran Malaysia (SPM) entering the universities. Majority of these students lack mastery in the basic math skills, reasoning and proof, and not be able to make connections in other disciplines. The performance of students in their SPM mathematics paper cannot be used as an indicator of their ability in mathematics. Therefore, our purpose of the study is to determine whether the current mathematics curriculum is adequate in enabling the students in doing higher level mathematical proofs and analysis courses at the university level, in particular majoring in Mathematics.

As reported in \textit{Trends in International Mathematics and Science Study} (TIMSS) 2007 [8] which were released by International Association for Evaluation of Educational Achievement (IEA), Hong Kong and Singapore were the top performing countries in Mathematics for fourth grade (Primary 4). At the eighth grade (Secondary 2), Chinese Taipei, Korea, Singapore and Hong Kong had the highest above average achievement in mathematics. Likewise, in TIMSS 2003 [7] Singapore is ranked first in both Mathematics and Science in a 49-country study of Grade 4

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In this report, for Mathematics, 44% of Singapore students reached the advanced benchmark, 77% reached the high benchmark, and 93% reached the intermediate benchmark. The corresponding international averages were 7%, 23% and 49%. Unfortunately, the findings in TIMSS report 2007 shows there was a drop in Malaysian students’ performance in Science and Mathematics. Since the consistent and high achievement of Singapore students in the last three studies viz. TIMSS 1995 [5], TIMSS 1999 [6] and TIMSS 2003 [7], Singapore’s mathematics curriculum is constantly being used and studied by other countries as comparison. How Singapore is attained high achievement in Mathematics as compared to other countries in the world. One approach would be to compare the content of the Mathematics curriculum with Singapore Mathematics. Below are some questions that needs examine when comparing the curriculum.

- Will students who follow our current curriculum be ready to enter college?
- Are modifications of our mathematics curriculum needed?
- What is in Singapore Math curriculum that is not in ours?
- Is it the method of delivering which make the difference?

2. Methodology

The preliminary study is based on the content of the curriculum from the following website [1,4]. First, we start with an overview of the Malaysia’s and Singapore Education System.

Overview of the Structure of Malaysia’s Education Systems

The structure of school education in Malaysia is based on a 6+3+2 system.

- 6 years of primary school
- 3 years of lower secondary school referred as Secondary 1, 2 and 3. Secondary education for Malaysian students starts at the age of 13.
- 2 years of upper secondary school referred as Secondary 4 and 5.

Overview of the Structure of Singapore’s Secondary Education Systems

General levels of education system in Singapore are Primary School, Secondary School, Pre-University and Tertiary.

- 6 years of primary school (begins at age 6)
  The primary school is divided into two stages namely foundation stage (age 6 to 10) and orientation stage (age 11 to 12). At the end of the sixth year, students must take the national examination known as the Primary School Leaving Examination (PSLE).

- 4 to 5 years in secondary school.
  Based on results of the PSLE, students undergo secondary education in either the Special, Express or Normal (Academic) or Normal (Technical) courses. Students under the Special or Express courses take the “Singapore Cambridge General Certificate of Education Ordinary Level”, otherwise known as O-level while students under the Normal (Academic) or Normal (Technical) take the GCE ‘N’ levels after 4 to 5 years of education.

The structure of Singapore Mathematics Curriculum (SMC)

In Singapore, the mathematics curriculum for schools, are issued by the Ministry of Education in collaboration with University of Cambridge Local Examinations Syndicate and will undergo a periodic review every ten years to ensure that the curriculum remain in line with the national objectives (Kaur, 2004). The breadth and depth to which the mathematics topics are taught at a particular year level differs and depend on the pupils ability (Kaur, 2003b). The main topics in O-Level Mathematics for Secondary 1, 2, 3/4 comprised of three topics namely Numbers and Algebra, Geometry and Measurement and topics on Statistics and Probability. In O-Level Additional Mathematics
for Secondary 3/4, the topics are Algebra, Geometry and Trigonometry and Calculus. Refer to [1] for the details of the curriculum.

The Malaysian Mathematics Curriculum (MMC)

Students follow a common curriculum through the implementation of the Integrated Secondary School Curriculum (ISSC, popularly known as the KBSM). The current curriculum is review in 2001 where the language of instructions is English and the emphasis are on the five principles of learning Mathematics namely, problem solving, mathematical communication, making connection, reasoning and the use of technology. The five principles are adopted from the National Council for Teachers of Mathematics (NCTM). The KBSM mathematics framework provides a set of broad learning outcomes that summarize the knowledge, skills and understanding, values and attitudes essential for all students to succeed in and beyond their schooling. In KBSM, all students in lower secondary regardless of ability and achievement take the same mathematics curriculum. Refer to [3] for the details of the curriculum.

3. Findings

When comparing the Malaysian Mathematics curriculum with the Singapore math curriculum at the secondary level, our curriculum does not differ much in terms of the topics covered. The significant difference is on the depth each topic is covered and the level at which the topic is introduced. For example, the topic in circles is covered in stages in two or three years in Malaysia curriculum. By doing this, the teachers have to keep repeating the topic introduce at earlier stages since the basic is needed at other stages. In other words, the topic is fully covered, but not at the same time frame.

- The preliminary studies shows that there is an obvious difference at which level certain topic been introduced. Some of the Form Four Mathematics in Malaysia curriculum is been introduced at Secondary 1 and 2 in Singapore. Refer to [1,4] and Table 1 for the details of the mathematics curriculum for both countries.

- Unlike the Singapore math, the Malaysian curriculum put less emphasis on algebra. This is proven in TIMSS report 2003, [7].

- The study also found that in certain topics, the Malaysian curriculum does not dealt with the topic in as much depth as the Singapore curriculum. This can be done by comparing the mathematics textbooks in both country so as to establish the depth of each topic that is being covered and its effectiveness in reflecting the mathematics curriculum.

- Topic on Mathematical reasoning is not dealt with in the Singapore curriculum.

Some comparative results are given in the following table.

| Topic/Sub-topics                    | MMC       | SMC                        |
|-------------------------------------|-----------|----------------------------|
| Set language and notation           | Form 4    | Secondary Two              |
| Mathematical Reasoning              | Form 4    | Not covered at any secondary level |
| Quadratic expressions and equations |           |                            |
| - Factorise quadratic expressions   | Form 4    | Secondary Two              |
Functions and graphs

- The gradient of a linear graph as the ratio of the vertical change to the horizontal change

Solutions of equations and Linear inequalities

- Use of symbols <, >, ≤, ≥
- Solving simple inequality

Statistics and Probability

- Data handling
  - tables
  - bar graphs
  - pictograms
  - line graphs
  - pie charts
  - histograms

Circles

- Form 2, 3 and Form 4 Secondary Three/Four

Matrices

- Form 5 Secondary Three/Four

4. Conclusion

The comparisons lead to suggestion:
- to revise some of the contents in the current Malaysia Mathematics Curriculum.
- to do some modifications at which level certain topics are best introduced.

In summary, Singapore superiority in math may be credited to
- the ability to master math concepts in numbers and arithmetic and geometry
- the students’ problem-solving skills and reasoning skills including solving real-world problems
- Singapore emphasized thinking skills through each component of a problem instead of plugging the problem direct into a formula. The students are trained to think actively as they work through each step of a problem.
- Singapore curriculum focuses only on a few key concepts for each school year.

The preliminary study also suggest that further study should be conducted to look into the details in the contents of the curriculum and whether our teachers are knowledgeable and ready to meet the demand of the modern
curriculum. However, there are some limitations to this study due to shortage of depth of the topics covered. It is important to study each topic through mathematics text book in both country for the details. Further, the actual practice on time spent teaching mathematics should also be taken into account and compared. Another issue in the study is the stages or age the use of computers and calculators are introduced in both countries.

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