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Cultural Differences and Mathematics Learning in Malaysia

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Abstract: *This paper reviews and highlights findings of three studies (Lim, 1993; Munirah & Lim, 1996; Yoong et al., 1997) that were carried out in Malaysia with regard to cross-cultural comparisons on mathematics learning. In the light of these studies, I examine possible cultural differences that might be determining factors in mathematics achievement, and question what and how we can learn from different cultural practices, beliefs and values to help us improve mathematics learning in all cultures. Suggestions for further research are also considered.*

Introduction

Several international comparison studies (Husen, 1967; Robitaille & Garden, 1989; Mullis, 1997) in mathematics achievement have shown that students from each major level of education in Asia seemed to outperform their counterparts in Europe and North America. These and many cross-cultural studies on mathematics learning suggest that language and cultural differences may be an important factor pertaining to mathematics teaching and achievement. These studies mostly involved students from different countries with different cultural backgrounds. An interesting question is whether mathematics learning is different among the different cultural groups within the same country as well.

In this paper, I aim to review and highlight findings of three studies (Lim & Chan, 1993; Munirah & Lim, 1996; Yoong, Santhiran, Fatimah, Lim, & Munirah, 1997) that have been carried out in Malaysia. These studies compare mathematics learning among the different cultural groups within Malaysia. First, I attempt to define the terms, culture and culture differences as used in this paper. Next, I will briefly describe the background of primary mathematics education in Malaysia because it is at this level that mathematics learning is introduced in the different cultural settings. I will then highlight three related studies (Lim & Chan; Munirah & Lim; Yoong et al.) and comment on what might be learned from these studies. At the end of this paper, I hope to suggest some issues that need to be further researched.

What is culture and cultural difference?

The term "culture" seems to encompass many different meanings. Its meaning varies according to the theoretical perspectives that it is used. For example, in an organisational perspective, Hofstede (1997) classified culture into two categories:

a) culture one which commonly means 'civilization' or refinement of the mind' and in particular the results of such refinement, like education, art and literature. (p.5); and b) culture two which refers to patterns of thinking, feeling, and acting. Likewise, in the perspective of multicultural education, Bennet (1990) contended that culture could be understood as "a system of shared knowledge and belief that shapes human perceptions and generates social behaviours" (p.47). In other words, one shares similar models of perceiving, believing, and doing, and evaluating and interpreting within the same cultural group. Thus, culture is learned and not inherited (Hofstede). One derives one's culture from one's social environment. Consequently, cultural differences exist due to the different languages that we use, as well as to our different perceptions, beliefs and values about something.

In the cultural context of mathematics learning and teaching, as suggested by Stigler and Perry (1988, p.195-196), cultural differences are found to some degree in the following ways:

a) tools and methods that children are provided with in the performance of basic mathematical operations such as abacus, and number system (as related to the different languages),
b) language used in teaching and learning, and
c) beliefs held by parents, teachers, and children about the nature of mathematics learning and teaching.

Thus, in the light of the above framework, I define the culture of mathematics learning as 'a system of shared knowledge, practices, beliefs, and values about mathematics learning'. The cultural differences will be examined in terms of the tools and method used, as well as language, beliefs and values hold by the different parties of a community (such as teachers, parents, administrators and students) in the teaching and learning of mathematics.

Background

Malaysia is a multi-ethnic and multi-cultural country. The major ethnic groups are Malay (60%), followed by Chinese (27%) and Indian (9%). The educational system is unique because there are three choices of primary schools available depending upon the medium of instruction. These are: (a) Malay medium national schools (SK); (b) Chinese medium national type schools (SRJKC), and (c) Tamil medium national type schools (SRJKT). In general, the majority of the Malay pupils (over 95%) enter the Malay medium schools and the majority of the Chinese pupils (over 85%) enter the Chinese medium schools (Yoong et al., 1997). A minority of the Malay pupils will enter the Chinese medium schools while a minority of Chinese pupils will enter the Malay medium schools. However, virtually no Malay or Chinese pupils enter the Tamil medium schools. For the

Indian pupils, about 40-50% enter the Tamil medium schools, and nearly the same proportion enters the Malay medium schools. More recently, an interesting trend that more and more Malay and Indian parents are sending their children to Chinese medium schools has developed. It is estimated that about 10% of those attending the Chinese medium schools are made up of Malay or Indian pupils.

Although the medium of instruction is different, all schools follow a national mathematics curriculum, and all pupils sit for a national examination, the Primary School Achievement Test or UPSR at the end of the six years of primary schooling. For the past decades, the results of the national examinations have shown that pupils from the Chinese medium schools perform significantly better in mathematics than those in the other types of schools. Table 1 displays the passing rates of the various types of schools in the UPSR examination.

Table 1
Mathematics Achievement in the UPSR Examination (Percentage of Passes) by Types of School

Year	Type of school		
	SK/SRK (Malay medium)	SRJKC (Chinese medium)	SRJKT (Tamil medium)
1991	60.4	86.6	49.9
1992	60.6	86.8	56.1
1993	63.1	87.6	55.8
1994	64.0	86.3	58.1
1995	67.9	87.6	59.0
1996	74.5	90.0	65.2
1997	-	85.5	-
1998	77.5	91.2	68.6
1999	76.2	90.0	70.9
2000	77.5	87.5	73.9
2001	76.0	89.9	74.4

Source: Malaysian Examination Board Yearly Report for the year 1991-2001.

Since 1992, the difference in mathematics achievement among the different ethnic schools has caused concern to various parties, including the Ministry of Education. Some common themes that appeared in the local news media reflect this concern. For example, “Maths help from Chinese schools” (The Star, 21 January, 1992); “Ministry studying Chinese approach to mathematics” (New Strait Times, 21 January 1992); “Teaching maths the Chinese way” (The Star, 3 September, 1992) and lately “Success of Chinese students in science, maths to be studied” (Business Times, 2 September 1999). Indirectly, these titles reflect the eagerness of the

Ministry of Education to upgrade the mathematics achievement of the Malay medium schools. There is also an assumption that Chinese medium school pupils perform better in mathematics because the Chinese medium schools have something “special” in teaching mathematics. But, is this a fact or an illusion?

The Prime Minister of Malaysia himself, Dr. Mahathir Mohamad, has advocated the need for the government school authorities to emulate the commitment of the Chinese schools to education. The Malay medium schools are asked to adopt the teaching approaches of the Chinese medium school. Some ministers even suggest the possibility of 'importing' mathematics teachers from Chinese schools to the Malay schools (The Star, 21 January, 1992). However, this proposal is yet to be tried. Of course, this issue is not that simple. As has been stressed by Stigler and Barnes (1988) and Bishop (1988), mathematics is a form of culturally transmitted knowledge. The success in mathematics learning among these schools may have been related to the school culture and its related community culture. Thus, we can question whether or not culture can be "imported" from one school to another, by just exchanging the mathematics teachers.

In response to the above concern, it must be noted that there are still very few studies carried out to investigate possible factors which might explain differences in mathematics achievement among different cultural groups. Perhaps, as recognised by Yoong and colleagues (1997), “ this is due in part to the reason that cultural influences are difficult to study as much of these influences appear tacit, implicit and hidden from awareness” (p. 6). Nevertheless, there are a limited number of exploratory studies that aimed to fill up this gap.

Below three Malaysian-based studies (Lim & Chan, 1993; Munirah & Lim, 1996; Yoong et al., 1997) relating to cross-cultural comparisons on mathematics learning are examined. I shall briefly describe each study before making a critical discussion of all of them.

Study 1: A case study comparing the learning of mathematics among Malay pupils in Primary National schools [SK] and Primary National Type schools (Chinese) [SRJKC]

Study 1 was carried out by Lim Soo Kheng and Chan Toe Boi of the Specialist Teachers’ Training College of Malaysia in 1993. Their study compared the teaching strategies, learning facilities, amount of exercises given, and mathematics achievement of Malay pupils between two types of primary schools, the Primary National schools [SK] and Primary National Type schools (Chinese) [SRJKC]. Their study is interesting because unlike other cross-cultural studies, they were only interested in observing pupils from one ethnic group, the Malay pupils who were studying mathematics in the different ethnic schools.

Their sample consisted of 41 Year Six Malay pupils from eight SRJKC (Chinese) schools and another 41 Year Six Malay pupils from one SK (Malay) school. As noted earlier, for the whole country, there are only about 10% of the Malay pupils studying in the SRJKC schools. This might explain why the sample of this study was collected from eight SRJKC schools. However, it was not known why the other sample was not collected from an equal number of SK schools, instead of just one of them. The question is, "can we assume that this one SK school is representative of all the other SK schools?" Similarly in the discussion of results, it was not clearly specified that the observation of a mathematics lesson was made in only one SRJKC school or all the eight schools. These are thus some potential limitations to Study 1.

The study used an observation checklist, a facilities checklist, a survey form and three mathematics achievement tests to collect data. Some observed differences between the two types of schools are highlighted below:

1. Explanation of concepts/skills
In the SRJKC school, 64% of the 30 minute mathematics lesson was spent on explaining concepts or skills. But in the SK school, only 43% of the time was used for the same reason.

2. Reinforcement activities
Two types of reinforcement activities were carried out in the SRJKC schools: group competition and solving problems on the chalkboard. The learning atmosphere was found to be livelier as nearly half of the pupils in class took part in these activities while the other half observed or checked the answers. Pupils from the SK school were given exercises to do individually in class while the teacher walked around to help those who needed help. Besides these differences, Lim and Chan also observed some similar activities that have been carried out by both types of schools.

3. Teaching aids
The use of teaching aids to explain mathematical concepts was not frequently used by either type of school.

4. School facilities
In terms of school facilities, both types of schools were found to have set up "the mathematics corner" and the "the mathematics teacher committee". The

mathematics corner was a small space on the notice board at the back of the classroom. In most cases, they found that only some charts were displayed on it. Meanwhile, the mathematics teacher committee was set up among the mathematics teachers to plan and discuss annual activities and teaching problems. Their planned activities included tuition classes as well as mathematics quizzes and competitions.

5. Mathematics achievement
Lim and Chan used three tests to determine the mathematics achievement of the Malay pupils. Test 1 aimed to test the understanding of basic concepts, Test 2 the computational skills, and Test 3 the ability to solve word problems. Their results show that the Malay pupils of the SK school performed better in Test 1 and Test 3, whereas the Malay pupils of the SRJKC school did better in Test 2. Perhaps this is not surprising because, to understand the mathematical concepts (Test 1) or to solve word problems (Test 3), one needs a mastery of language. Most Malay pupils from the Chinese medium school (55%) failed their Chinese language mid-year examination, suggesting they are weak in the language used as the medium of instruction.

Nevertheless, this is an interesting finding because it highlights the important role of the language factor in mathematics learning. Although the Chinese medium schools appear to have better teaching strategies and better learning environments, this may still be not enough to help their Malay pupils who are weak in their non-mother-tongue language, the Chinese language, to excel in mathematics. However, it was observed that the Malay pupils from the Chinese medium school performed much better in Test 2 (testing computational skills). According to the researchers, the better performance in Test 2 may have been attributed to the strong emphasis on drill and practice given by the SRJKC school.

Study 2: Primary mathematics learning and teaching in Chinese and Malay schools

Munirah Ghazali and Lim (1996) compared mathematics teaching in two different ethnic schools – one Chinese primary (SRJKC) and one Malay primary school (SK). Both schools are located in the same area, just opposite each other. The methods used included observation of mathematics classes (one from each standard) and interviews with the headmaster, mathematics teachers and some pupils of the respective schools.

They observed differences in both headmasters' and teachers' approach to teaching and learning mathematics, particularly in relation to homework, learning of multiplication tables, and tuition classes. Tuition classes are additional lessons given by the teachers after the formal school hours. They act as remedial or enrichment classes where more drill and practice is given. Teachers from the Chinese primary school gave comparatively more mathematics exercises (a difference of 10 to 40 more questions in one thirty minute lesson) than the Malay primary school. Learning and memorisation of multiplication tables started much earlier in the Chinese primary school (from Standard Two) as compared to the Malay primary school (from Standard Five). Although headmasters of both schools used tuition classes as a means to improve their students' mathematics achievement, the Chinese primary school headmaster regarded tuition classes as remedial for students who have difficulty in mathematics. Thus, tuition classes in Chinese primary school might start as early as Standard Four. Meanwhile, the headmaster of the Malay primary school seemed to have a different expectation for tuition classes which were intended to increase the number of students who would achieve higher grades in examinations. Consequently, the tuition classes were given only to high ability groups of Standard Six pupils. These results suggest that there are cultural differences in both the headmasters' and teachers' beliefs in terms of homework and tuition given between the two ethnic schools.

Study 3: Basic number concepts acquisition in mathematics learning: An exploratory cross-cultural study

Unlike the above two studies, which relate mathematics achievement to mathematics learning in general, Study 3 focused only on the acquisition of basic number concepts. It was a group project headed by Dr Yoong Suan and his colleagues in 1996-97. The main aim of the study was to investigate the acquisition of basic number concepts among the Malaysian Primary One students of different ethnic and cultural backgrounds. The sample included 152 Primary One students, distributed as shown in Table 2.

Table 2
Distribution of sample by school type and ethnicity

Ethnic group	School stream (medium)			Total
	SK (Malay) (3 schools)	SJK (Chinese) (3 schools)	SJK (Tamil) (2 schools)	
Malay	30	14	-	44
Chinese	9	32	-	41
Indian	15	17	35	67
Total	54	63	35	152
%	35.5	41.4	23.0	100.0

Source: Yoong et al., 1997, p.12

The main instrument used in this study was the Basic Number Concepts Test (BNC), developed by the research team in collaboration with three experienced primary school mathematics teachers. These three teachers, one each from each type of school, conducted the clinical testing of their pupils in the respective language media. The BNC test consisted of eight dimensions: General counting, Skip counting, Concrete counting, Comparing quantities, Word-symbol representation, Place value concept, Basic number concepts achievement, and Counting time up to 50.

Highlights of main findings

1. By means of the school mathematics test scores, the results show that there were more high mathematics ability students among the Malay sample than among the Chinese and Indian sample. It follows that there were more high mathematics ability students among the SK (Malay) school than the other two types of schools [i.e., the SRJK (Chinese) and the SRJK (Tamil)].

2. The results of the overall BNC test show that by comparison among the different medium schools, students in the Chinese medium schools (SRJKC) performed significantly better than students in the Malay medium schools (SK). However, by comparison of ethnic groups, the Malay and Indian students scored significantly better than the Chinese students. This is interesting because it shows that school stream by medium of instruction may be a more important factor for mathematics achievement than ethnicity.

3. Comparing the different sub-dimensions of the BNC Test, the results suggest that students in the Chinese medium schools (SRJKC) performed significantly better than students in the Malay medium school in counting time to 50, skip counting, word symbol representation and the acquisition of place value concepts.

4. The Malay students in the Chinese medium school performed significantly better than their counterparts in the Malay medium schools on the overall BNC Test, counting time to 50, general counting and word-symbol representation. The trends were similar for both high and low mathematics ability students of the Malay medium schools. Again, this finding suggests that the difference in school stream by medium of instruction may be a more important factor for mathematics achievement than the difference in ethnicity

5. The Indian students in the Tamil medium schools (SRJKT) performed consistently better than their counterparts in either the Chinese medium or the Malay medium schools in terms of skip counting, concrete counting and compare quantity. However, it was noted that the sample of Indian students in this study

was over-represented by the high mathematics ability students and the Tamil medium schools were also mono-ethnic. Therefore caution is needed in comparing the results with other medium schools.

In general, the findings of this study suggest that there may be a strong Chinese cultural advantage in counting skills and basic number concepts acquisition. Yoong et al. (1997) proposed that this advantage may have been related to the simpler and consistent number system of the Chinese language, as compared with that of the Malay or Tamil language. However, this claim is yet to be confirmed by further research, although there is some evidence to show that some Malay students from the Chinese medium schools tended to use the Chinese number-naming system in their mental or oral computation even at higher grades.

Another interesting aspect of the finding is the importance of language in counting and basic concepts acquisition. The results of this study show that the low mathematics ability students who entered a school stream whose instructional medium was other than their mother tongue performed badly. This may be partly due to their poor mastery of the language. This problem was found to be universal for all the ethnic groups.

What can we learn from these studies?

Although the above three studies were exploratory in nature and their findings were far from conclusive, there were at least two significant issues that can be drawn out from these studies. First, language seems to play a significant role in mathematics learning. As pointed out by Yoong et al. (1997), the Chinese language seems to have a cultural advantage over the other two languages, Malay and Tamil, particularly in terms of its simpler and consistent number-naming system. As well, and admittedly inconclusive, in a review of the possible effect of English-Chinese language differences on the processing of mathematical text, Galligan (2001) agreed that there is some research evidence for a Chinese language advantage in number sense, fraction and relational word problems. This may explain partly that some students, whether Chinese, Malay or Indian, who were trained to use the Chinese numbering system were be able to count faster and more efficiently than their counterparts who used other languages. Perhaps the easier and simpler number system aided their counting and computational skills.

However, one needs to master a language well enough to understand and to use the mathematical concepts and skills so as to solve the mathematical problems posed in words. Thus, we observed that the Malay pupils who learned mathematics in a language such as Chinese, which is not their mother tongue, seemed to face difficulty in understanding the problems and thus did not do well in mathematics tests that involved word problems. Similarly, Chinese pupils from the Malay medium schools were found to perform no better than the Malay students of the same schools. Instead the Malay pupils from the Malay medium schools were found to perform significantly better than their Chinese counterparts in the acquisition of basic number concepts. Does this suggest that it is better to teach or learn mathematics in the pupil's mother tongue language?

Second, findings from the above three studies strongly suggest that there are differences in teaching approaches that were adopted by the different medium schools. Chinese medium schools seem to favour more "lively learning atmosphere in class"; "plenty of drills and practices"; "more homework", "more tuition" as well as "more competition and quizzes". Pupils of the Chinese medium schools tended to perform better in computational skills and number counting as well as memorisation of multiplication tables. Even the Malay pupils from the Chinese medium schools were found to perform better than their counterparts in other medium schools with regard to computational skills.

Indirectly, these findings suggest that ethnicity may not be an important factor in determining a student's achievement in mathematics. Language and teaching approaches that are adopted by a school may be more important than ethnicity. Implicitly, this would imply that it is not that Chinese students are better than Malay students in mathematics, but it is the language and the mathematics learning culture that matter most.

Indeed, it may be the whole culture that supports successful mathematics learning. We know that the culture of mathematics learning in schools is not just about mathematics content (or syllabus), but it is shaped by at least four major parties: school administrators, teachers, parents and students. The interaction and negotiation of these parties' philosophies, values and beliefs of mathematics teaching and learning may then determine the practices and regulations in that particular school. Thus, we see that it is not the issue that one ethnic group might be genetically better at mathematics teaching, learning and achievement than another, but the different cultural practices, beliefs and values that might have helped to improve mathematics learning.

Suggestions for further study

In terms of cultural differences, the above three cross-cultural studies have focused mainly on tools and method used in the teaching and learning of mathematics. Therefore, for example, more research on the affective domain (such as beliefs and values) of the cultural aspect of mathematics education might be considered. To look into the impact of culture on mathematics learning, I suggest the following:

1. As suggested by Bishop (1988), there are six activities that have been found to be universal in every culture. These are counting, measuring, playing, locating, designing and explaining. Therefore, other than counting, further research may study the other five activities, to see whether there are cultural differences even within Malaysian culture.

2. According to Hofstede (1997), values are the deepest manifestation of culture. Values are broad tendencies about how one ought to behave or to prefer certain states of affairs to others. Thus, we need to study the different social and cultural values that have been manifested in the process of the teaching and learning of mathematics. These values include:

> (i) values that are manifested in goals and objectives of mathematics curriculum/education; (ii) values that are inherent in mathematics as a subject or discipline of study; (iii) values that underpin a mathematics teacher's decision making and philosophy of teaching, such as preferences or criteria for making decisions during mathematics teaching; (iv) values that influence teachers' and students' behaviours and attitudes towards mathematics, such as attributes or qualities of a successful mathematics learner; and (v) values that are hidden behind unwritten rules or curricula (decided implicitly by all members of the school and its social community).

3. The three studies reviewed all focused on primary school pupils. Further studies therefore need to look into whether or not cultural differences that are rooted in primary school may continue to exist in secondary school and/or higher learning.

Conclusion

Although there are not yet enough studies to make a substantial claim, a review of these studies suggests that it is not a person's ethnicity (whether Chinese, Malay or Indian) that determines his or her better performance in mathematics learning. Instead, it is the language used as a medium of instruction, the teaching approaches and the mathematics culture that adopted by a school, that appear to be more important than ethnicity. Implicitly, this may oppose certain stereotypical thinking that Chinese students are better than Malay students in mathematics. Indeed, ethnic differences could bring about cultural differences in terms of language, practices, ritual, attitudes, values and beliefs. These factors may then influence the attitudes and beliefs towards mathematics and mathematics teaching and learning, which consequently might have resulted in differences in mathematics achievement. Thus there is also the implication that we can improve mathematics achievement by 'adopting' some cultural beliefs, values, and attitudinal changes of one cultural group into another, to the extent of 'modifying' disadvantages of language factors by adopting some new signs and symbols in language. Altering culture is not impossible, but difficult. More importantly, more research should be considered in examining "better" culture of mathematics learning and consequently how to promote this better culture of mathematics learning in our schools.

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