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Mathematical Communication in Malaysian Bilingual Classrooms

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Abstract

This paper begins by arguing the importance of mathematical communication in mathematics teaching and learning. This is then supported by the emphasis of mathematical communication as stated in Malaysian mathematics curricula. However, the implementation of mathematical communication in Malaysian bilingual classroom remains challenging and much to be desired. Possible factors include the procedural approach of mathematics teaching and the poor mastery of English language as the medium of instruction for both teachers and students. A proposal of a study to promote mathematical communication will be shared at the end of the paper.

Roles of mathematical communication

Mathematical communication plays a significant role in mathematics education. As argued by Lindquist and Elliot (1996), "We all need to communicate mathematically to fulfil the societal goals of a mathematically literate workforce, lifelong learning, opportunities for all, and an informed electorate" (p.1). Besides, communication is also central to students' learning of mathematics and to the solving of mathematical problems. During mathematics learning, students need to relate their everyday language to mathematical language and symbols. When solving mathematical problems, students need to make important connections between concrete information and abstract situation. Through effective communication students will be able to organize, consolidate and explain their mathematical thinking coherently and clearly to peers, teachers and others. They can also analyze and evaluate the mathematical thinking and strategies of others.

In addition, Baroody (1993) proposes two more reasons for focusing on mathematical communication. First, mathematics is essentially a language by itself. Mathematics is not only a thinking tool that helps us to discover patterns, solving problems and drawing conclusions, but also a tool for communicating our thought, a variety of ideas clearly, precisely and succinctly. In fact, mathematics is considered "the universal language" (Jacobs, 1982) with its unique symbols and structures. People all

over the world can use it to communicate mathematical information despite differences in their native languages.

Second, mathematics teaching and learning are social activities that involve at least two parties, teachers and pupils. In the process of teaching and learning, it is crucial that thought and ideas are communicated to others through language. Basically this interchange of ideas and experiences constitute the process of teaching and learning. Indeed, communicating with peers is essential for the development of communication skills so as to learn to think like a mathematician and to solve genuine problems successfully (Baroody, 1993). Thus, Baroody (1993) proposed that by encouraging children to *talk* about their ideas is an excellent way for them to discover gaps, inconsistencies, or lack of clarity in their thinking. This implies the importance of ensuring pupils be proficient in a language so as to be able to communicate and to learn well using that language.

Mathematical communication as stated in Malaysian mathematics curriculum

A review of the recent Malaysian primary and secondary school mathematics curriculum indicate that mathematical communication is one of the essential objectives of mathematics education. It was stated explicitly as one of the objectives in the mathematics curriculum for secondary school mathematics: "able to communicate mathematically" (Ministry of Education Malaysia p. 3, 2003). It was further elaborated as follow:

> *Communication is one way to share ideas and clarify the understanding of Mathematics. Through talking and questioning, mathematical ideas can be reflected upon, discussed and modified. The process of reasoning analytically and systematically can help reinforce and strengthen pupils' knowledge and understanding of mathematics to a deeper level. Through effective communications pupils will become efficient in problem solving and be able to explain concepts and mathematical skills to their peers and teachers." (Ministry of Education Malaysia, 2003, p. xvi)*

Besides arguing the important role of communication as a way to share ideas and to understand mathematics, it also links communication to mathematical thinking and mathematics reasoning such that,

> *The development of mathematical reasoning is closely linked to the intellectual development and the communication ability of students. Therefore, mathematics reasoning skills must be emphasised in all mathematics activities so that students learn to understand better the world around them. It is imperative, therefore, that these reasoning skills be incorporated in mathematics education so that students learn to recognize, build and evaluate mathematics conjectures and statements. (Ministry of Education Malaysia, 2003p.1)*

Furthermore, the use of precise and accurate mathematical language is also very much emphasized for efficient communication in mathematics,

> *When students are giving their opinions and solving problems orally and in writing, they are guided to use correct language and the accurate mathematics register. Students are also trained to select information presented either in mathematical language and non-mathematical language; interpret information; representing this information in the form of tables, graphs, diagrams, equations or inequalities; and subsequently present this information, without changing the original meaning, in other forms that are clearly and easily understood. (Ministry of Education Malaysia, 2003, p.2)*

Nevertheless, to what extent is mathematical communication implemented in Malaysian classrooms?

Mathematical communication in Malaysian classroom

Several local studies examined classroom discourse in some primary (e.g. Jamaliah Kamal, 2001; Ruzlan Md Ali, 2007) as well as secondary (e.g.Chiew and Lim, 2003) mathematics classrooms. Their findings coherently point to a Malaysian mathematics classroom teaching is characterised by "the teacher will present the day's lesson in the form of questions-answers, or present a brief explanation of the topic through examples, either taken from textbooks or workbooks, followed by drill exercises." (Jamaliah, 2001, p.164). Ruzlan (2007) observed the communication styles of two Malaysian primary teachers when teaching fraction.

> *"The outcome of his observations indicated (i) all teaching was whole class teaching with teacher doing most of the talking. Pupils were generally inactive, responding only to the significant number of questions. These questions were not only of the closed type but could also be conceptualized as reminder of the procedural to be used when working out the solutions to worked examples, and (ii) The central focus on teaching was on the procedures and algorithms that pupils should acquire to solve the worked examples. " (p.350)*

The above data were mostly collected before the latest curriculum reform in mathematics education. The medium of instruction was then in the national language, which is mother tongue language for the majority of Malaysian students.

However, in January 2003, the Malaysian government took a brave move to switch the medium of instruction for Mathematics and Science to English. This new policy (Teaching of Mathematics and Science in English, or better known as PPSMI) was implemented in progressive phases, begin with Primary One, Form One and Lower Six in 2003, and then gradually to encompass all the other levels of the entire school system. The entire changeover is expected to be completed by 2008 for all primary and secondary schools in Malaysia.

In brief, there were four rationales (Choong, 2004) that prompted the implementation of the PPSMI policy, namely:

a) the significant role of English language as an international language for knowledge acquisition and communication;

b) to arrest the decline of the English language proficiency levels among students, both at the school and the tertiary level;

c) to equip future generation with a language that enable them to access new development and advances in science and technology to meet the challenges of globalization; and

d) to overcome the increasing challenging task of translating the latest technological developments into Malay language.

In conjunction to the change in medium, the PPSMI also aims to reform the mathematics teaching and learning strategies that promote mathematical thinking and mathematical communication. These aims and emphases were explicitly stated in the latest revision of mathematics syllabus and curriculum specifications (Ministry of Education Malaysia, 2003). Billions of Ringgit Malaysia was allocated to achieve these aims. One major strategy was providing intensive in-service training programme for teachers through "English for the teaching of Mathematics and Science" (ETeMS) by the English Language Teacher Centre (ELTC). This was to develop the teachers' English language proficiency in order to access the wealth of information on the Mathematics subject area currently available in English texts. It was also to help the mathematics teachers to develop the practical competence to deliver their Mathematics subject matter in English. In addition, information communication technology (ICT) resources such as special computer courseware, reference and hardware were provided to equip teachers with the latest technology. Mathematics teachers were given 5-10% critical allowance as special incentive for teaching mathematics in English.

However, after nearly five years of implementation of this new policy that cost considerable amount of resources in time, money and effort, have our mathematics teachers ready to cope with the change? What is the scenario of mathematics discourse in the Malaysian classroom now?

Gurnam Kaur Sidhu (2005) made ten classroom teaching observations of ten different mathematics teachers. These teachers were teaching at the primary school level (2 urban and 2 rural) and secondary level (4 urban and 2 rural). Her findings highlighted two pertinent issues concerning the language and communication in the mathematics classrooms. These two issues are (i) linguistic competency of the teachers and (ii) instructional practice.

Her results showed that rural students possessed very limited English language proficiency as compared to their urban counterpart. Consequently this changed in the medium of instruction might have resulted in some students having a negative attitude towards mathematics. One of the teachers that she interviewed added that

> *"…some of them have this psychological block. They entered secondary one with limited language proficiency and when mathematics classes were conducted in English, they immediately switched off and this has resulted in their poor performance in mathematics and their inability to cope. Therefore*

it is not surprising that some teachers have opted to explain and clarify concepts in Bahasa Malaysia". (p. 55)

Subsequently, she observed code-switching was an increasing common phenomenon in the mathematics classroom. Compounded with limited English language proficiency, some teachers tended to use colloquial language during their classroom interactions. For example:

T: okay, can you add 12 and 3, and how much now?

12 story books I get, I have, then yesterday is my birthday, my mummy got more 3 for me, so now how much I got now? 12 add 3 equal how much? (p.57)

In addition, outcome of her observations indicate that on average the ratio of teacher talk to student talk in the ten observed mathematics lessons was 3:1.

The above phenomena are alarming. Due to language deficiency, teachers and students might not be able to communicate effectively, more so to communicate mathematically using precise and accurate mathematical language.

In another study, Koh (2006) observed that 27 PPSMI teachers who were using teaching courseware became so engrossed that there were hardly much interaction between teachers and students. He quoted an example that a teacher was teaching the topic of polygon using a teaching courseware provided by the government. The teacher was observed to use only the passive click and show approach without using any further examples or communication with the students.

All the above reviews, thus, signify the needs to promote more mathematical communication in the mathematics classroom even though it was not just the issue of mathematics but also the bilingual challenges.

A proposal to promote mathematical thinking and mathematical communication through lesson study

To gain full benefit of the APEC lesson study project, we have proposed a local study to develop mathematical thinking and communication in three Malaysian primary schools based on the APEC project framework. We argue that mathematical thinking and mathematical communication are inter-related and they should be promoted hand-in-hand. We also rationale that from the review of local studies (see Lim and Hwa, 2006) show that mathematical thinking has not yet explicitly implemented in many Malaysian schools due to time constraints and mathematics teachers' lack of understanding and awareness about mathematical thinking. Likewise, as we have discussed in the earlier section, there is considerably lack of mathematical communication between Malaysian students and teachers. Therefore, there is an urgent need to develop mathematical thinking and communication among mathematics teachers before they can foster these two skills among their students.

To develop mathematical thinking, teachers must provide students with opportunities to acquire mathematical knowledge and skills through mathematical activities such as problem solving, reasoning and proof, communication, connection and representation

(National Council of Teachers of Mathematics [NCTM], 2000). To implement such activity-based learning in mathematics classroom, teachers must plan lessons and teaching approaches that develop and promote mathematical thinking and communications in mathematics.

However, as pointed out by Takahashi (2007), "one of the reasons for teachers' hesitation to provide activities that cause students to develop mathematical thinking might be that the teachers themselves have rarely experienced such lessons when they learned mathematics themselves" (p.56). Hence, by allowing teachers to experience themselves activities that foster mathematical thinking and communication through workshops is deemed an effective way of enhancing teachers' confidence and competence in mathematical thinking.

To provide enactive experiences, all participating teachers will play the role of students carrying out the hands-on activities that promote mathematical thinking and communication. These activities will be adapted from some Japanese research lessons and other relevant resources.

In view of the busy working schedule of the school teachers, the workshop will be conducted in a manner of 2-3 hours in alternative weekends or after school hours in week days. The workshop activities are distributed in such a way so as to allow time for teachers to absorb and reflect on the new experiences.

The first two workshops aim to provide and develop mathematical thinking and communication experiences for the teachers. After all these teachers have acquired a substantial conceptual understanding and know-how, each school team will collaboratively plan and design a detailed lesson plan that foster pupils' mathematical thinking and mathematical communication in the third workshop. The teaching lesson will be observed and video-taped for reflection and documentation. This process will be repeated for at least 3 times to ensure both teachers and pupils have gained sufficient experience of mathematical thinking and mathematical communication.

We hope to share more about the experiences and outcome of the above study in the next APEC-Khon Kaen conference.

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