

Closing Plenary Address

Continuing issues in mathematics education: The Malaysian Experience

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Abstract

Improving the quality of teaching and learning of mathematics has always been a major concern of mathematics curriculum developers. This paper examines and critically analyzes the following four recurring and inter-related issues often raised in the development of a mathematics curriculum in Malaysia:- “What type of mathematics ought to be taught?”, “Why do we need to teach mathematics?”, “How should a mathematics curriculum be planned and arranged?” and “How can teacher ensure that what is transmitted to the pupils is as planned in the curriculum?”. Within at least the last 5 decades, the Malaysian mathematics curriculum has undergone some significant changes. The main problem in curriculum development is in the selection and decision of what is suitable mathematics for students to learn (Kliebard, 1972, Olivia, 1997). In general, mathematics curriculum development parallels to that of educational development and also responding to the needs of society and in actual fact is seeking for answers to four main continuing issues. The issues are:

- 1) What mathematics should be taught in schools?
- 2) Why do we need to teach mathematics?
- 3) How should we plan and sequence the mathematics curriculum?
- 4) The role of educators, teachers in particular, in transmitting the mathematical knowledge (Weaver dan DeVault, 1970; Romberg, 1992).

In any curriculum change or innovation, curriculum developers are attempting to seek answers to questions arising from the mentioned issues.

Curriculum

The planned curriculum is often referred to as the, intended curriculum (Noor Azlan Ahmad Zanzali, 1987, 2005) as contained in the syllabus, text books recognized by the Ministry of Education, or the accompanying materials (such as teacher guides) produced by the curriculum developers. The intended or the planned curriculum must be differentiated with the implemented curriculum (Dossey, Giordano, McCrone, Weir, 2002). In this context, the constraints arising from social and environment faced by teachers in implementing the intended curriculum need to be considered. (Noor Azlan Ahmad Zanzali, 195, 1994). This is similar to the observation that:

- 1) The teaching of mathematics occurs in a social context.
- 2) Mathematics teaching must emphasize “what mathematics is being taught.”
- 3) Effective mathematics teaching should take into account on how students discover and learn mathematics.
- 4) Mathematics teaching can be conducted efficiently if the environmental aspects are considered (Bishop, 2001; Chien Chin, Yuh-Chyn Leu and Fou-Lai Lin 2001)

What mathematics should be taught in schools?

In the Malaysian context, the mathematics curriculum has undergone several significant changes. From the content perspective, the content of the curriculum before the 70’s focused on “traditional mathematics” with heavy emphases on computation. This teaching-learning approach is effective in enhancing the abilities of students in replicating or repeating algorithms but is ineffective in the inculcation of mathematical thinking.

In the late seventies a major curriculum reform saw the introduction of the modern mathematics program. Teaching approach that begins with understanding of concepts, with similar emphases on computation, based on the appreciation of structure of mathematics begun to be implemented in the Malaysian schools. Teachers are encouraged to use the inquiry method in teaching. Students are exposed to the processes of mathematics to produce certain results in mathematics. In the 80's the content of the mathematics curriculum experience yet another change. The change was said to be suitable with the philosophy and goals of mathematics education both at primary and secondary level. The syllabus was designed to strike a balance between skills and understanding. Problem solving particular those related to everyday experiences of learners was given special emphasis. This is based on the assumption that the main aim of learning mathematics is to solve problems.

Each curriculum change is planned so as to be in consonant with the current societal changes which requires more complex and sophisticated understanding of mathematics. The advent of technology, especially in the information technology, requires students to possess skills not limited to the abilities to carry out procedures as contained in the traditional mathematics, but higher order thinking skills

What is mathematics?

Most non-mathematicians such as sociologists, psychologists, school administrators and even mathematics teacher's regard mathematics as a static and limited to computation as contained in most school mathematics textbooks (Barbeau, 1989, p.2). Mathematics is often viewed as what is determined by textbooks and written out in the syllabus. The teacher's responsibility is to transmit this record of mathematical knowledge using the most efficient pedagogy and students are expected to "absorb" in the most efficient manner, the mathematical content transmitted by the teachers (Nik Azis Nik Pa, 1985/1986). Teaching and learning of mathematics is conducted in a static manner (Noor Azlan Ahmad Zanzali, 2005).

There is the realization amongst mathematics educators on the importance of presenting the intrinsic worth and wholeness of mathematics. The final aim is to generate an alternative new of mathematics with its unique features and its usefulness is appreciated by the public.

Third, it is clear that mathematics can be viewed from different perspectives. Looking at the different perspectives also helps mathematics educators in achieving deeper understanding about mathematics that should be taught in schools.

School Mathematical knowledge

The questions of what mathematics ought to be taught in schools and the assumptions underlying the process of teaching and learning must be analyzed carefully. The view that mathematics is static, existed naturally and divorced from our daily experiences has been questioned by many educators. Majority view mathematics as human invention and thus is continuously expanding. However, what is more relevant is the question of "What does it means to know mathematics?" Dewey (1916) differentiates between "knowledge" and the "record of knowledge". Mathematics as the record of knowledge has expanded into a huge area. The record of knowledge is produced through series of inquiries and thus is humanly created (Dewey, 1916, p. 186-187). School mathematics divorced from its wider applications is record of knowledge. What is taught in schools is the product of mathematics thought and not the process of mathematical thought (Skemp, 1971).

Other than the problem solving approach to be incorporated in the secondary school mathematics curriculum Steen (1988) believe that all students should be given experiences in looking for patterns in all levels of mathematics education. Finally, Romberg (1983) beliefs to

know mathematics means be able to do mathematics that regardless of the levels of complexities of mathematics learning. This means that in mathematics learning, one gathers information, finds relationships, and discovers new knowledge in the planned activities. Learning in this context involves four activities: abstracting, discovering, proving and applications. Mathematical predictions or propositions in mathematics need to be proven using logical arguments. Lastly, mathematics has wide applications. We use mathematics in our daily lives, industries and in fact in all aspects of life.

The main question often asked by mathematics educators is how much of the dynamic nature of mathematics espoused by them is implemented in the classroom. Related to this:

- 1) Is it possible to teach students to solve non-routine problems, find patterns, build models or mathematizing?
- 2) If it possible, how do we implement it?
- 3) It is possible students to acquire skills and understand concepts though project works that reflects what mathematicians do?

The above discussions are of the opinion that teaching and learning should encompass more than just knowing mathematics as a record of knowledge. Students should be trained so that they are capable to do mathematics and appreciate the mathematical thinking processes.

Why do we teach mathematics in schools?

In general, all educators agree that mathematics is an important area of study in the school curriculum (Cockroft 1982). In the Malaysian system, a student is often pressured to perform better in mathematics, than in any other subjects.

There exist literature (such as DeVault dan Weaver, 1970; Freudanthal, 1973; National Council of Teachers of Mathematics, 1980 dan 1989; Pusat Perkembangan Kurikulum, 1990: 2003) that have directly or indirectly discuss on the justification of mathematics in the school curriculum. Most are of the opinion that to be able to function effectively in the twenty-first or the coming centuries, one needs to have a good understanding of mathematics (Christiansen, Howson and Otte, 1986, Cockcroft, 1982).

Goals of teaching mathematics from utility perspective.

A justification often stated by mathematics educators why mathematics should be taught in schools is that the knowledge of mathematics will play an important role in students' future world of work (Noor Azlan, 2005).

General Justification

Apart from the utility justification, rational often used in including mathematics in school is based on the assumption that mathematics learning can be said to increase one's ability to think logically, accurately and the ability to make interpretations on space.

It is also often said that mathematics possesses an inherent beauty. For most students mathematics is seen to be difficult, confusing and thus provide little motivation. Most students in Malaysia, has no choice but to endure the agony of learning the subject all throughout their learning years in school (Noor Azlan Ahmad Zanzali, 1987, 2007; Ng See Ngean, 1983)

In general, mathematics is taught in schools because it is a very important area of study and all students at all levels should be taught mathematics as a way to prepare our future citizens. What is important to note is that different groups of people provide different rationale to the justification. The rationale depends on the current thinking and needs of society.

All educators should accept the fact that justification and roles of mathematics education in schools, as in the development and uses of mathematics itself are continuously changing.

Structuring the curriculum to enhance teaching and at the same time reflect the rational in the justification of teaching mathematics must done carefully

Structure of the mathematics curriculum

The structuring of the curriculum is a continuous problem often faced by curriculum developers. Different approaches have been used. The traditional mathematics curriculum, for example, is based on computational skills. In the mathematics modern syllabus, the content is arranged according to the structure of mathematics (see Bruner, 1976), based on the basic themes of mathematics. Set is a theme that has been used to structure the curriculum. In the primary school mathematics (KBSR) the mathematics syllabus is arranged according to the hierarchy of computing skills, while in the secondary school curriculum (KBSM), the content of the curriculum is arranged to the common occurrence in our daily lives specifically Numbers, Shapes and Relations, and Space.

Structure of mathematical knowledge in the syllabus.

The approach used in arranging the curriculum is based on the assumptions underlying the mathematical knowledge that students need to learn, the pedagogy or methodology most suitable and psychology on how do students learn mathematics (Noor Azlan, 2004). Generally, in the traditional mathematics, the syllabus is arranged as collections of skills and concepts in a hierarchical fashion. The main goal of learning is for students to acquire the speed and accuracy of computation.

In the modern mathematics program, a slightly different approach in curriculum design is used. The Modern mathematics program curriculum is designed based on the need for students to be more involved in the teaching and learning processes. This maybe achieved through guided discovery or the project methods approach. In addition, the modern topics require the use of aids or materials. The aim is help students acquire mastery in the concepts and at the same develop positive interest and attitude towards the subject. (PPK, 2000)

A slightly different picture emerged in the KBSR (primary school level) and KBSM mathematics (secondary school level). In KBSR, the emphasis is on the mastery of spontaneous computation followed by understanding. Mathematics is taught in an integrated manner within the various topics, mathematics itself and with other subject. The mathematics syllabus is arranged in three areas, Numbers, Shapes and Relations and Space. These three elements are used based on the belief that in real life experiences, one is exposed to these three elements (Pusat Perkembangan Kurikulum, 2000).

Role of teachers.

The role of teachers and students are complimentary. The main role of the mathematics teacher is to translate the contents of the syllabus in the form that can be understood by his/her students (Fernstermacher, 1986). The main responsibility of students is to learn mathematics.

If the main aim of learning is to know the “product mathematical thought” and not the “process of mathematical thought”, teaching then should not be conducted in the form of drill and practice. On the other hand, in the traditional approach, the job of teaching consists mainly of transmitting or transferring information while the job of students is to accept and absorb what is being delivered.

Summary

At the beginning of this paper, four questions related to the content, goals, structuring and the teaching of mathematics are raised. The four continuing issues must be analyzed to obtain a better picture on the issues or problems faced by curriculum developers. The basic proposal

raised is that we need to reconceptualize on what is meant by mathematics, and what form of mathematics should be taught to students. We need to look mathematics from the constructivist perspective and not vand not from the absolutist perspective. Teaching activities must be conducted in manners that allow students to construct mathematics and not just to replicate what others (or previous mathematicians) had done.

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