Mathematics education: The relevance of "contextual teaching" in developing countries

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Many studies had shown that rural students are lagged behind in Mathematics compared to their urban counterparts particularly in developing countries. The poor performance recorded is normally associated with negative factors such as learning cultures, poor environment, lack of teachers and other scores of attitudinal problems faced by the students. Teachers in developing countries are also faced with the dilemma of whether to adopt strictly to "*content-based teaching*" across the specified curriculum or to focus on selected topics which ensures higher percentage performance in public examinations. This paper attempts to exploit the relevance of "*context based teaching*" which enhances better understanding of mathematics in deprived communities in the developing world. This is of benevolence to policy makers as well as mathematic educators in planning curriculum development in Mathematics Education.

Introduction

Generally, members of the public agree that higher percentage passes in public examinations today implies a higher performance for a school compared to the one with lower percentage passes. This does not exclude achievement in mathematics. So much so, the teachers' desire to promote maximum percentage in examination results has become a standard norm. The ultimate aim is to ensure high credibility for the teachers as well as the schools.

The above objective is indeed a noble one. However, some university teachers had complained (at least in our university) that students who scored good grade in Mathematics in high school, large proportions of them find difficulties in understanding college Mathematics. The question arises whether, the quality of examination questions in Mathematics in the public examinations has fallen or whether the students themselves passed the examination without the sound understanding of the required skill in Mathematics? It is unlikely that the former is true. If the latter is true, it is indeed that the students learned Mathematics is basically just to pass the examination. It is this phenomenon that concerns us.

Mathematics curriculum in developing countries

Mathematics curriculum in developing countries is often based on studies as well as the experience of the developed world. Quite often the syllabi of the former are often adopted from the latter. In fact, some scholars believed that there exists extraordinary similarity in Mathematics curriculum across the globe. For instance, Hawson & Wilson (1986) claim that a "Canonical School Mathematics Curriculum was developed in Western Europe in the aftermath of the Industrial Revolution, and was adopted practically everywhere during the present century."

P. Valero & O. Skovsmose (2002) (Eds.). Proceedings of the 3rd International MES Conference. Copenhagen: Centre for Research in Learning Mathematics, pp. 1-7.

In retrospect, in most developing world today, the mathematics education system was deeply imbedded in the cultural and colonial heritage of the past. For example in Malaysia, Singapore and Hong Kong, they adopted the British System, the Philippines adopted the American system while Vietnam and Cambodia adopted the French system and so on (Nebres, 1995).

However, most countries today had revised and developed their own curriculum, albeit some of the contents are still the replica of the Western curriculum. The only variation is often reflected by the difference in socio-cultural landscape.

Learning mathematics: The teachers' and students' perspectives

In active learning situation, the three components of teacher, process and students should be present. As far as teacher is concerned, he or she should conduct a lesson that is considered as "good lesson". A good lesson is conceived as the one which keeps in balance the four aspects of achievement; namely; affect, function, knowledge and behaviour. These four aspects according to Osamu (2000), relate to the following conditions of good lesson:

- Children motivation to learning is prompted and maintained
- Purpose of the lesson is clear
- Flexible teaching is conducted
- Individual difference among students is taken into account.
- Autonomy is emphasized
- Students learn from each other
- Major concern is product of learning
- What is learned is further applied
- Product of learning is emphasized
- Fostering student's attitude.

All these are identified according to the teachers' perspective. In the case of process, the instructional delivery is of prime importance. Thus, the method of teaching becomes the backbone of effective learning.

However, we also have to take into consideration of the students' perspective in learning Mathematics. These include their interest and motivation to study, experience enjoyable thinking as well as enhancing their ability to create, express and reason out. What is important they have achieved the required skills and knowledge after attending a "Good Mathematics Lesson".

Content based and context based teaching

Traditionally, curriculum means a list of content topics in national or school syllabus and examination prescription or a course outline. However, this meaning is changing and curriculum is now envisaged as including:

1. mathematical content (what mathematicians know),

- mathematical processes (what mathematicians do)

- mathematical thinking and logical reasoning, problem solving and modeling, communicating, making connections and using computational tools,
- contexts in which the topics are set,
- assessment strategies that are used, and
- appropriate teaching methods (Begg, 1995)

These curriculum components are not always in official documents but are implied by textbooks and resources in use, and by the common practice of teachers.

In developing world, there is a diversity in the level of mathematics education among countries. Each country has a different cross-cultural heritage, different medium of instruction, different level of teacher training and in fact different socio-economic positions. In Malaysia for instance, different in ethnic group matters (Sawiran, M.S 1995). The Chinese are well exposed to the urban-business environment as compared to the Malays who are traditionally village folks. This resulted in different perception towards Mathematics itself. In Indonesia, there is a significant difference in achievement in primary Mathematics in rural schools compared to those in urban schools (Armanto, D 1993).

In this context, 'content-based' teaching is basically teaching according to the given syllabus or curriculum. This means that the main aim is to fully complete the whole syllabus at the end of the semester or year. The emphasis is more on the mystery of concepts as well as the theoretical foundations of a given topic. Hence, the responsibility of the teacher is to deliver the whole curriculum with minimum modifications. On the other hand, "contextual-based teaching" is teaching through focusing on selected topics and resorting to environmental orientations. This means that in context-based teaching, the teacher does not necessarily complete the whole syllabus but he has the flexibility in choosing relevant topics for his class. The main objective is to generate more understanding about a given problem. Hence, in this form of teaching, application of concepts rather than theory is more dominant.

With the above diversity in learning situations, teachers are faced with the dilemma whether to adopt strictly to the "content based teaching" across the specific curriculum nationwide or to focus on selected topics which ensures higher performance in public examination.

Local survey

A total of $\eta = 45$ teachers teaching mathematics at Form IV and V levels were selected from 24 schools in Segamat District, Malaysia. The sample was selected using a mixed sampling technique i.e. using both quota and multi-stage sampling (Reaves C.C. 1992).

The survey has triple objectives. The first objective is to determine the perception of teachers concerning the choice of content based teaching

compared to contextual-based teaching. The second objective however relates to the suitability of adopting totally national curriculum for both urban and rural schools. While, the third one concerned with the teachers experience involving students attitudes in mathematics learning. For the purpose of this paper, we are concentrating only to the first objective.

The reason behind choosing Form IV and Form V teachers is that these teachers are expected to be fully committed in teaching as the students are preparing for the SPM (Sijil Pelajaran Malaysia) Examination. Moreover most of the students will enter the tertiary educational institutions i.e. universities, matriculation colleges or pre university studies taking STPM (Sijil Tinggi Persekolahan Malaysia) Examination.

Five relevant questions were asked within this section of the survey. The teachers' preference is given a Likert Scale of 1 to 5, where 5 denotes the highest agreement to a given question. The related questions are:

1. I teach mathematics with the main aim of getting all students pass the examination.

- I teach the students so that they understand mathematical concepts and then use the knowledge for life.
- I teach using wholly the syllabus given by the Ministry of Education.
- I teach according to the given syllabus (not necessarily complete it) but I use suitable local examples.
- I prefer context based teaching compared to content based teaching.

Results of the local survey

With respect of the five questions posed to the teachers, the following results on the teachers' preference are as follows:

Questions	Percentage Agreement	Mean Score
1. I teach mathematics with the main aim of getting all students pass the examination.	95.6	4.41
2. I teach the students so that they understand mathematical concepts and then use the knowledge for life.	84.4	4.30
3. I teach using wholly the syllabus given by the Ministry of Education.	77.7	3.82
4. I teach according to the given syllabus but I use suitable local examples.	84.3	4.39
5. I prefer context based teaching compared to content based teaching.	75.5	3.90

This means the almost all mathematics teachers in Segamat district (95.6%) agree that the main aim of teaching is to get maximum percentage passes in the

examination. The mean score is high at 4.41 points. Similarly, on the other 4 questions, large proportion of teachers agree with the given statements i.e. 84.4% for question 2, 77.7% for question 3, 84.3% for question 4 and 75.5% for question 5 with quite high mean score ranging from 3.82 to 4.39.

It is noted here that questions 3, 4 and 5 are very relevant and related to the objective of this paper. Question 3 shows that teachers agree with their responsibility of delivering the curriculum that has been prepared by the educational authority i.e. Ministry of Education. Question 4 relates to the threshold of 'contextual-based' teaching where teachers had the flexibility of adopting certain topics according to the local environment. Question 5, on the other hand, is very straight forward. It shows more that 75% of the respondents prefer contextual based teaching compared to the content based teaching.

Further interpretation

Further analyses can be obtained from this exercise. From the last three questions (i.e. Questions 3, 4 & 5), we can test whether there is a difference between the scores of teachers from rural schools and urban schools. Out of the 45 respondents, 24 are from urban schools while 21 are from rural schools. By resorting to small sample test, A and B denote urban teachers and rural teachers respectively, we use $t_c = (X_A - X_B) / Sp\sqrt{(1/n_A + 1/n_B)}$

$$= \frac{d}{S_d}$$

where $S_p^2 = (n_A - 1) S_A^2 + (n_B - 1) S_B^2$ as a $(n_A + n_B - 2)$ calculated score given by urban and rural teachers. (Jarete J, Kraft A 1989), we have the following results:

Q	Hypothesis	n = 45	Average	S_d	t_c
3	$H_o : \mu_A = \mu_B$	$n_A = 24$	3.88		
	$H_I : \mu_A \neq \mu_B$	$n_B = 21$	3.71	2.256	0.075
4	$H_o : \mu_A = \mu_B$	$n_A = 24$	4.08		
	$H_I : \mu_A \neq \mu_B$	$n_B = 21$	4.76	0.4018	1.692*
5	$H_o : \mu_A = \mu_B$	$n_A = 24$	3.80		
	$H_I : \mu_A < \mu_B$	$n_B = 21$	4.28	0.3110	1.543*

* Significant at 10% significance level

Table 1: Testing the difference between teachers in rural and urban schools.

From Table 1 above, it shows there is no difference between the teachers score in urban and rural schools for question/statement 3. However, for statements 4 and 5, there is a significant difference between the scores of rural teachers and urban teachers at 10% significance level. In fact, for question 5, rural teachers had a higher degree of agreement concerning their preference of contextual teaching compared to content-based teaching. In this respect, the relevancy of contextual based teaching is more prominent in rural schools.

Concluding remarks

The above survey reveals some important information concerning the teaching of Mathematics in upper secondary schools in Malaysia. Segamat District though encompasses both urban and rural populace, the general view suggests that it is not a district with the entity of urban community. It is more pronounced to be categorized as ‘semi-urban’ to ‘rural’ as it is surrounded by villages and FELDA settlements [Settlement programme monitered by FELDA (Federal Land Development Authority)]. The results of the local survey and its interpretation in the preceding sections strengthen this argument. It is a good example of a scenario in a developing world.

The exercise also reveals that completing the whole doze of specific syllabi in schools, may not necessarily results in meaningful learning environment. There should be a certain degree of flexibility for the teachers in order to modify the learning specifications. In this regard, completion of syllabus is not mandatory i.e. teachers may drop one or two topics but more importantly further probe on other topics is carried out depending on the learning environment. As long as students understand better, such act should not only permissible but encouraged.

The debate of whether to teach through the approach of ‘content orientation’ or ‘contextual orientation’ should not be a deterrent to the improvement of mathematic teaching. While both approaches have their prevalent advantages, this exercise reveals that the contextual-based teaching is relevant and a preferred approach in a non-urban setting. Such a situation encourages active learning environment which in turn generates better mathematical understanding by the students. This gives an open opportunity for all citizen to receive better education to develop their potential. This is in line with the Malaysian Educational philosophy that every citizen has the right to be educated through the integrated potential developments comprising the physical, emotional spiritual as well as their intellectual development. (Ministry of Education, Malaysia (1998)). To conclude, contextual base teaching is of relevance and should be adopted where applicable in secondary schools, particularly in the developing world.

References

Armanto, D (1993) Teaching Basic Mathematic Skills in the Nine-Year Basic Education International Seminar on Mathematical Science, Kuching, Sarawak.

Begg, Andy (1995) Collaboration: Cooperation or Colonization, International Conference on Mathematics Education, ICMI, Melbourne, Australia.

Hawson, G & Wilson B (1986) *School Mathematics in the 1990s*, Cambridge, Cambridge University Press, pp 19 – 20.

Jarrett J, Kraft A (1989), *Statistical Analysis for Decision Making*, Allyn & Becon, pp 315 – 316.

Ministry of Education Malaysia (1998) *Pusat Perkembangan Kurikulum*

Nebres, B.F (1995) Mathematic Education In An Era of Globalization: Linking Education, Society and Culture in Our Region; ICMI, Melbourne, Australia.

Osamu, Y (2000) Good Lesson, Bad Lesson, Mathematics Education in Japan, *Japan Society of Mathematic Education (JSME), Tokyo*.

Reaves, C.C (1992), *Quantitative Research For the Behavioural Sciences*, John Wiley & Sons. Inc; pp 96 – 97.

Sauian, M.S (2000), National Presentation: Prevalent Issues on Mathematics Education in Malaysia, ICME-9, Tokyo, Japan.

Sawiran, M.S (1995), Collaborative Efforts in Enhancing Globalization in Mathematics Education, ICMI, Melbourne, Australia.