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Humanizing Mathematics Learning: Secondary Students Beliefs on Mathematics Teachers' Teaching Efficacy

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Abstract

The importance of teaching mathematics as an integrated subject is recognized everywhere, not withstanding in Malaysia. Educating the pupils mathematically is more difficult, challenging and complex than teaching them some mathematics. In most of the countries including Malaysia the mathematical culture adapted in schools has the following characteristics viz. curriculum of procedures, methods, skills, rules and algorithms which insist on 'doing' mathematics rather than 'thinking' mathematics. Issues such as quantum of mathematics content, completion of stipulated syllabus in the given rigid time, examinations, interests and cognitive level of the learners were not given due considerations. Teachers generalize the learners ability i.e., teacher plans the lesson, teaches the lesson aiming at the average generalized ability of the learner considering it as every student's ability. It is evident that Mathematics teaching is dominated by dehumanisation, depersonalisation and decontextualisation. Students many times confused why are they learning about algebra, trigonometry theoretical proofs of theorems. Teaching mathematics in school classrooms is not contextual hence the aims of mathematically inclined learners are not realized by the students. The purpose of this study is to investigate the extent of humanizing mathematics among secondary mathematics teachers based on student's perception of their teachers' practices in the classroom, specifically their beliefs about the classroom context such as the role and functioning of the mathematics teacher in the classroom. The mean scores for students' beliefs in their teachers' role and functioning in the mathematics classroom were positive with high ratings on showing step-by-step procedures in solving mathematical problems. Students also showed positive beliefs on teachers' role in making mathematics learning enjoyable, interesting, and making learning mathematics understandable, meaningful and a friendly atmosphere.

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Keywords: Humanizing mathematics learning; Beliefs in mathematics classroom context; Mathematical beliefs

1. Introduction

Indeed all over the world research findings reveal examples of students at all levels rejecting mathematics, fearing it, disliking it, given a chance preferring it as last resort. In addition the modern society is demanding much greater mathematical knowledge of its citizens than ever before. How does mathematics curriculum be structure to enhance

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mathematical learning among students at all level. In attempting to look closely at mathematical learning it is essential to start examining process of effective teaching and learning. Vast literature had shown that effective teaching of mathematics is the result of a complex coordination of specific knowledge and specific beliefs and the culture on teaching and learning mathematics at the primary, secondary and tertiary level. Pajares posited that belief about mathematics can determine how one chooses to mentally construct the whole idea of mathematics (Pajares, 1992). This is especially true when the belief has been in-grained in the students' world of mathematics. Beliefs are personal principles, constructed from experience that an individual employs, often unconsciously to interpret new experiences and information and to guide action. Actions taken by students during learning processes have greatly affected the knowledge acquisition of mathematics. Cobb defined beliefs as an individual's personal assumptions about the nature of reality (Cobb, 1986). The importance of beliefs in the life of a student is stressed again because these assumptions constitute the goal-oriented activity. In learning environments, students' belief might propagate the idea for achievements and smoothness of learning. In the mathematics learning process, student's belief about the nature of mathematics and factors related to the learning are two components that always concern mathematics educators. In addition, affect is a significant and critical dimension of learning (Zembylas, 2004). With this in mind, it seems important to pay close attention to the mathematical classroom experiences of students, as these are critical in the development of affective dispositions and views towards mathematics (Gresalfi & Cobb, 2006)

2. Problem Formulation

In the later part of 20th Century, intensive efforts to improve mathematics education in schools have been tremendous. Educationists, subject experts, teacher-educators, teachers, parents, psychologists, policy makers, text book and resource material producers and many more are showing their concern about the state of mathematics education at the school level. Mathematical activity was designed to stress the importance of the 'process' over the 'product' by encouraging actual mathematical activity taking place during learning. In Malaysia many attempts were made in this regard but there appears to be insignificant or little improvement. These raised lots of questions. Why is mathematics still a problem subject for so many?

The importance of teaching mathematics as an integrated subject is recognized everywhere, not withstanding in Malaysia. Educating the pupils mathematically is more difficult, challenging and complex than teaching them some mathematics. In most of the countries including Malaysia the mathematical culture adapted in schools has the following characteristics viz. curriculum of procedures, methods, skills, rules and algorithms which insist on 'doing' mathematics rather than 'thinking' mathematics.

Issues such as quantum of mathematics content, completion of stipulated syllabus in the given rigid time, examinations, interests and cognitive level of the learners were not given due considerations. Text books written by authors mostly who have less or no chance of knowing about the pupils, teachers and mathematics classrooms. Teachers generalize the learners ability i.e., teacher plans the lesson, teaches the lesson aiming at the average generalized ability of the learner considering it as every student's ability.

Mathematics teaching is dominated by dehumanisation, depersonalisation and decontextualisation. Students many times confused why are they learning about algebra, trigonometry theoretical proofs of theorems. They mean that if Apollonius theorem or Pythagoras theorem is true everywhere, so what? Why should they learn about universal truths? If the teaching is not contextual, the aims are not realized by the pupils, mathematics learning is meaningless to them.

Recent theories on cognition and learning pointed that acquiring knowledge or learning consist of getting acquainted with the rules and concept that characterize different activities in differing contexts. Hence learning is a form of engagement with active use of cognitive and metacognitive skills. However, many posited that the heart of learning cannot be based merely on these two factors. Studies by Connell and Wellborn and Schiefele and Csikszentmihalyi pointed to the role of cognitive and affective factors with close interaction with metacognitive factors as key elements in learning (Connell & Wellborn, 1990; Schiefele & Csikszentmihalyi, 1993). They concluded that motivations are perceived as determining elements in quality learning. In addition, self-confidence and positive emotions have become the important constituent of learning and problem solving. However, recent developments had shown that students' belief about mathematics, their motivational beliefs, students' perceived confidence and

influence of emotions were determinants of mathematical learning and problem solving (Seegers & Boekaerts, 1993; Vermeer, 1997; Verschaffel & Op't Eynde, 2000). Studies have also demonstrated that students' mathematical beliefs were also related to other constructs such as affects, school culture, and personal emotions.

Within the Malaysian scenario, a step towards humanizing mathematics has been one of the driven agenda apart from teaching of the subjects in English. In a true sense, humanizing mathematics during teaching and learning has been emphasized as far as in the inception of the Integrated Curriculum for Secondary Schools in particular for Mathematics subject. Humanizing mathematics help students in enjoying mathematics and in transferring the problem solving skills to new situations hence enhancing mathematics performance during learning.

2.1 What should be the approach in the curriculum?

Should we follow the Behaviourist, the 'New-Math, the Formative approach that focuses on cognitive abilities and affective and motivational attitudes of the pupils, or the Integrated-Teaching Approach which is based on problem-solving processes. The Kilpatrick's Formative approach goes beyond the subject matter and aims at the development of cognitive abilities and motivational attitudes which describe in terms of personality traits. The Integrated approach insists on the flexibility of the curriculum and problem solving processes. The combination of Formative and the integrated teaching approach focusing on the process may be the best solution for humanizing mathematics since it provides flexible curricular units and open-ended processes for the learner.

2.2 How to bring the humanizing process in action?

Should it be interpersonal and interactional? Should it be formal, institutionalised, intentional and accountable? Should it be concerned with mathematical concepts, meanings, processes, values or should it be suitable to the social context. Above all, according to Bishop humanizing mathematics was focused on values with and insists of moving away from a 'transmission' image of mathematics education (Bishop,1998). According to Bishop humanizing mathematics is not an interpersonal process and therefore it is an interactive process between the teacher and the taught. Hence the teacher's task is to create a particular kind of social environment for the learner and it is the learner's task to construct ideas and modify them in interaction with that environment. The subject experts, the educationists, and the curriculum framers should provide the supporting system.

3. Problem Solution

3.1 What is the Scenario in Malaysia?

We examined the extent of humanizing mathematics of secondary teachers based on students' perception of their teachers' practices in the classroom, specifically their beliefs about the classroom context such as the role and functioning of the mathematics teacher in the classroom.

The distribution of scores on students' beliefs in their teachers' role and functioning in the mathematics classroom did not deviate from normal distributions. Altogether 430 participants were included in the study whose mathematics grades were obtained from the school records. The participants comprise of males (45.3%) and females (54.6%). In terms of ethnicity, 26.8% were Malays, 35.7% were Chinese, 14.5% were Indians and 23% were from the indigenous group

The mean scores for students' beliefs in their teachers' role and functioning in the mathematics classroom were detailed in Table 1. Findings indicated that students' beliefs on their teachers were positive with high ratings on showing step-by-step procedures in solving mathematical problems. Students also showed positive beliefs on teachers' role in making mathematics learning enjoyable, interesting, and making learning mathematics understandable, meaningful and a friendly atmosphere.

Findings of the survey and observational episodes indicated that the majority of Malaysian mathematics students 'beliefs in their teachers' role and functioning in the mathematics classroom falls under the fallibility which were classified as value loaded. Value loaded suggests that the mathematics teachers believed that mathematics is influenced by culture and society. Teachers also believed that mathematics teachings were aimed at helping students and individuals understand the universal principles upon which the mathematical rules and concepts are derived. Thereby there emerged some evidence of values hence humanizing mathematics learning among secondary students.

Related to classroom teaching practices, mathematics teachers adopted the absolutists' perspective. The absolutists adopt the value free paradigm in which mathematical knowledge is certain, absolute and without flaw. Based on students' beliefs on their teachers' role and functioning in the mathematics classroom, this finding suggests that secondary mathematics teachers adopt teaching approaches that emphasizes on mathematical activities that are formal, structured, and logical.

Table 1: Students' Beliefs About Mathematics Classroom Context

No.	Items Solicited	Mean	SD
1.	<i>My teacher really wants us to enjoy learning new things.</i>	4.63	1.40
2.	<i>My teacher understands our problems and difficulties with Mathematics.</i>	4.25	1.56
3.	<i>My teacher tries to make the Mathematics lessons interesting.</i>	4.61	1.51
4.	<i>My teacher appreciates it when we try hard, even if our results are not so good.</i>	4.45	1.73
5.	<i>My teacher always shows us, step by step, how to solve a mathematical problem.</i>	5.09	1.29
6.	<i>My teacher listens carefully to what we say.</i>	4.46	1.45
7.	<i>My teacher is friendly to us.</i>	4.71	1.54
8.	<i>My teacher always gives us time to really explore new problems and try out different solution strategies.</i>	4.31	1.41
9.	<i>My teacher wants us to understand the content of this Mathematics course.</i>	4.92	1.27
10.	<i>My teacher explains why mathematics is important.</i>	4.20	1.61
11.	<i>We do a lot of group work in this mathematics class.</i>	3.23	1.68
12.	<i>My teacher thinks mistakes are okay as long as we are learning from them.</i>	4.68	1.40
13.	<i>My teacher is too absorbed in the mathematics to notice us.</i>	4.27	1.63
14.	<i>My teacher does not really care how we feel in class.</i>	4.52	1.63
Overall mean of students' beliefs on teachers attributes to mathematics teaching		4.45	0.98

Thus, it can be concluded that the mathematics teachers' beliefs or mathematical values were closely affiliated with their social norms and culture. Hence, these findings suggest further investigation to be conducted on several cultural factors as earlier findings had suggested the powerful influence of cultural context on students' beliefs in mathematics. Teachers' strong influence on students' beliefs in their mathematical competency suggest the importance of teachers' role in mathematics classrooms which leads to improvement in students' mathematics performance. Thus, it is necessary for mathematics teachers to bring into mathematics classrooms positive learning climate so as to enhance students' beliefs in mathematics hence their performance in mathematics.

This can be attributed to the fact that mathematics teachers may hold this belief but the constraints and demands to fulfill the examination needs and syllabus may refrain the teachers from imparting this value in their mathematics teaching'. Similarly, the Malaysian mathematics teachers' beliefs seemed to emphasize the importance of values. However the extent of humanizing mathematics in teaching and learning were minimal. Thus efforts towards

improvement such as providing training to these teachers in modes of humanizing mathematics may provide conducive environment for mathematical activities and learning.

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