

Malaysian Mathematics Teachers' Beliefs about the Nature of Teaching and Learning

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ABSTRACT

Teachers play a vital role in nurturing and shaping learners in school. Extensive researches have been conducted showing that beliefs in the nature of teaching and learning held by the teachers will affect their actual classroom practices. In Malaysia, not many studies have been done on mathematics teacher's beliefs at the national level. The purpose of this study is to investigate the beliefs of Malaysian mathematics teachers at the secondary level. The sample of this study consisted of 39 mathematics teachers who were randomly selected from all the secondary schools in Malaysia. This is a quantitative study using descriptive statistics and mean differences to interpret the data. The finding showed that constructivist beliefs are stronger than the direct transmission beliefs both the male and female teachers. In addition, there was no significant difference in the direct transmission beliefs and constructivist beliefs by gender.

Keywords: *Direct transmission beliefs; constructivist beliefs; secondary mathematics teachers*

INTRODUCTION

Learners require the "21st century skills" in order to succeed in today's challenging world. As part of developing these skills, teachers teaching and their role as a teacher will also change. Teachers face the challenge to start shifting from the 20th to 21st century classroom. One of the ways to help teachers to overcome the challenge is to study the beliefs held by them. This is because Pajares (1992) claimed that the teachers' beliefs about the nature of teaching and learning plays a vital role in determining the teachers' effectiveness and their instructional practices (Leder, Pehkonen, & Torner, 2002; van de Schaaf, Stokking, & Verloop, 2008; Wilkins, 2008).

Studies have suggested that teachers' beliefs and values about teaching and learning will affect their teaching practices (see reviews by Clark & Peterson, 1986; Fang, 1996; Kagan, 1992; Thompson, 1992). According to Pajares (1992), there is a strong relationship between pedagogical beliefs of teacher, their planning for teaching, teaching decisions and classroom practices (as cited by Fakhri R. Khader, 2012). Ernest (1989) believes that the beliefs held by the teachers will have a strong effect in their teaching practices. This is because the teacher will convert their beliefs into a practical reality.

Literature Review

Content knowledge, pedagogical knowledge and beliefs held by the teachers are factors that will influence the effectiveness of teaching and learning in a classroom. Among these, teacher's beliefs is the key in determining the teacher's teaching. According to Johnson (1994), there are three basic assumptions used while studying teachers' beliefs: (a) Influence of teachers' beliefs on perception and judgment, (b) role of teachers' beliefs in translating information into the classroom practices, (c) teaching practices and education

programs can be improved by understanding teachers' beliefs (as cited in Farrell, 2005, p. 439). This shows that teachers are highly influenced by their beliefs (William & Burden, 1997).

Beliefs are filters that teachers use as a guide for their instructional and curricular decision making (Pajares, 1992; Prawat, 1992). It thus affects how, what and why teachers adopt a particular approach or method during teaching, which in turn will affect the learners' development (William & Burden, 1997). Teachers' beliefs systems indicate their personal theories regarding the nature of knowledge (Hofer & Pintrich, 1997; Lovat & Smith, 1995; Pajares, 1992). Thompson (1984) claimed that teachers' beliefs is the "manifestations of unconsciously held views of expressions of verbal commitments to abstract ideas that may be thought of as part of a general ideology of teaching" (p. 112).

Beliefs held by the teachers are very complex since it involves many aspects (Dogruera, et. al, 2010). Researchers agreed that a system of mathematics beliefs mainly consist of the beliefs about (a) what mathematics is, (b) how mathematics teaching and learning actually occur, and (c) how mathematics teaching and learning should occur ideally (Ernest, 1989a, a1989b; Thompson, 1991). Among these, beliefs about what mathematics is play an important role in determining how mathematics teaching occurs and how it should actually occur, ideally.

A number of researches have been conducted both nationally and internationally. In Malaysia, the study about the teachers beliefs were analysed by qualitative (Maizan, 2010; Siti Mistima & Effandi, 2010) and quantitative (Roslina, 2007; Marzita, 2005; Cheah, 2001) methods. A study reported that the beliefs of mathematics pre-service teachers were more positive towards constructivism approach (Effandi Zakaria & Norulpaziana Musiran, 2010). Another study by Salmiza Salleh & Afik Aziz (2012) found that Malaysian teachers were still bounded by the conventional teaching methods (teacher-centered). This is consistent with a study conducted by Munirah Ghazali & Santi Sinnakaudan (2014) stating that Malaysian SJKC mathematics teachers favour informal beliefs, which is constructivist belief; while SK and SJKT teachers favour formal beliefs, which is direct transmission belief. However, the results also showed that SK and SJKT mathematics teachers held mixture of both formal and informal beliefs.

According to Schoenfeld (1985), beliefs of mathematics teacher is his / her individual perspectives on how students should engage with mathematical tasks. Beliefs held by the teachers are affected by the teachers' own experiences, experience with schooling and instruction, and experience with formal knowledge (Richardson, 1996). Randolph Philipp used "teachers' orientation" to refer to the pattern of beliefs held by the teachers. Philipp (2007) divided orientations into conceptual and calculational orientations.

This study adapted several items from The Teaching and Learning International Study (TALIS) study (OECD, 2009). In addition, this study utilised the beliefs on nature of teaching using the two constructs for the beliefs in the nature of teaching and learning, which include direct transmission and constructivist beliefs. Teachers who held the direct transmission beliefs tend "to communicate knowledge in a clear and structured way, to explain correct solutions, to give students clear and resolvable problems, and to ensure calm and concentration in the classroom" (OECD, 2009, p. 92). On the other hand, teachers with constructivist beliefs "emphasize facilitating student inquiry, prefer to give students the chance to develop solutions to problems on their own, and allow students to play active role in instructional activities" (OECD, 2009, p. 92).

Singer (1996) claimed that beliefs held by the male and female teachers may differ systematically (as cited in OECD, 2009). However, Chan (2004) reported that there are no differences in the conception of teaching and learning among the Hong Kong pre-service teachers. Research by Effandi Zakaria & Norulpaziana Musiran (2010) found that "beliefs about the nature of mathematics and mathematics learning are influenced by gender, but no difference was found regarding mathematics teaching" (p. 349).

The differences in beliefs may be caused by teachers' experiences, which includes upbringing, life experiences or their previous schooling processes (Raths, 2001). Belief was initially formed based on the teacher's experience when they were students and the influence of their former teachers on them (Effandi Zakaria & Norulpaziana Musiran, 2010). Research by Li (1999) showed that there are links between teachers' beliefs and students' gender in mathematics education. Furthermore, Li (1999) claimed that teachers tend to believe that mathematics is male dominant and thus have a more positive attitude towards them. This will, in turn, affect the students' beliefs as some of them might grow up to be an educator in the future.

Studying beliefs is very important in education research (Pajares 1992). This is not due to the emotional debate on the topic, but because teachers' belief is a complex process. In addition to that, the effects of teachers' beliefs also have to be taken into account since it involves students' performance, who will be our future leaders.

RESEARCH METHODOLOGY

Objective and Research Question

The objective of this study is to investigate the beliefs in the nature teaching and learning among the secondary (Form 1) mathematics teachers in Malaysia. The study attempted to answer two research questions:

1. What beliefs does a mathematics teachers hold on the nature of teaching and learning?
2. Is there any significant difference between the male and female mathematics teachers' beliefs on the nature of teaching and learning?

Participants

The focus was given to the national secondary schools since it covers more than 80% of the secondary schools in Malaysia. The schools were randomly selected throughout the country. Once a particular school was selected, all the form one teachers teaching Malay, English, Mathematics and Science were included in the sample. However, the teachers have the freedom to choose whether to participate or not. In addition to that, if any of the school chose not to participate in the research, then the next school in the randomized list was selected. The same process was repeated until a minimum of 30 teachers were achieved for each subject. For this study purposes, only the sample of mathematics teachers were taken. A total of 39 in-service teachers with 27 females (75%) and 12 males (25%) whose teaching experiences ranged from 1 to 25 years participated in this study. These teachers were all teaching Form One mathematics.

Research Instrument

In this study, the researcher employed the quantitative analysis method using descriptive statistics and independent t-test to analyse the data. The instrument used in this study to gather data was a survey questionnaire. The questionnaire consists of 20 items on teachers' instructional practices and beliefs in the teaching and learning. For this study, only item 17 on teachers belief on nature of teaching and learning was analysed. The beliefs were measured using four-point Likert scales, ranging from strongly disagree to strongly agree. This question will be used to assess the beliefs of the respondents involved in the research. Item 17, which was adapted from the TALIS study, consists of two main constructs, i.e. direct transmission beliefs and constructivist beliefs.

Reliability of the instrument used was determined by using Cronbach's Alpha. Table 1 shows the constructs that were measured in this study and the Cronbach's Alpha coefficients. The internal reliability of the instrument ranging from 0.570 to 0.681, while the total reliability of the eight items is 0.650; which indicates acceptable reliability.

Table 1: Constructs and its reliability

Construct	Number of items	Cronbach's Alpha Coefficient
Direct transmission beliefs	4	0.570
Constructivist beliefs	4	0.681
Total	8	0.650

RESULTS

Research question 1, “What beliefs does a mathematics teachers hold on the nature of teaching and learning?” was analysed using descriptive statistics. Table 2 summarises the frequencies and percentages of secondary teachers on the nature of teaching and learning. The results showed that the teachers have different perceptions regarding the descriptions of each of the beliefs. The results will be discussed based on the descriptor for each type of the beliefs.

Based on the items Q17a, Q17g, Q17h and Q17k that focuses on the direct transmission beliefs, majority of the teachers believes that in the process of teaching and learning, teachers should

- (i) Demonstrate the correct way of solving problem

About 92% of the teachers chose “Agree” and “Strongly Agree” that they should show to the students how to solve problems correctly. Only 2.6% chose “Disagree”.

- (ii) Provide instruction around problems with clear, correct answers and around ideas that most students can grasp quickly

Around 90% of the teachers “Agree” and “Strongly Agree” about this statement.

- (iii) Teach facts to the students

About 67% and 18% teachers “Agree” and “Strongly Agree” that factual knowledge should be delivered in a classroom.

The last item of direct transmission beliefs showed a variation. Almost the same number of teachers “Disagree” and “Agree” (15 and 13, respectively) that more quiet classroom atmosphere is needed for effective teaching.

Table 2. Frequencies and Percentages for Teachers’ Beliefs in the Nature of Teaching and Learning

Description	Strongly Disagree	Disagree	Agree	Strongly Agree
(Q17a) Effective / good teachers demonstrate the correct way to solve problem	0 0%	1 2.6%	17 43.6%	19 48.7%
(Q17g) Instruction should be built around problems with clear, correct answers and around ideas that most students can grasp quickly	0 0%	1 2.6%	28 71.8%	7 17.9%
(Q17h) How much students learn depends on how much background knowledge they have – that is why teaching facts is so necessary	1 2.6%	4 10.3%	26 66.7%	7 17.9%
(Q17k) A quiet classroom is generally needed for effective teaching	1 2.6%	15 38.5%	13 33.3%	8 20.5%
(Q17d) My role as a teacher is to facilitate students’ own inquiry	0 0%	4 10.3%	25 64.1%	9 23.1%
(Q17f) Students learn best by finding	0	2	16	19

Constructivist
Reliefs
Direct Transmission Beliefs

Description	Strongly Disagree	Disagree	Agree	Strongly Agree
solutions to problems on their own (Q17i)	0%	5.1%	41.0%	48.7%
Students should be allowed to think of solutions to practical problems themselves before the teacher shows them how they are solved (Q17l)	0%	0%	51.3%	46.2%
Thinking and reasoning processes are more important than specific curriculum content	0%	5.1%	66.7%	23.1%

Based on the items Q17d, Q17f, Q17i and Q17l that focuses on the constructivist beliefs, majority of the teachers supported this belief in teaching and learning.

- (i) About 87% of the teachers "Agree" and "Strongly Agree" that their role, in the process of teaching and learning, is to facilitate on the students' inquiry, instead of mere transferring of knowledge.
- (ii) Almost 90% of the teachers believe that students learn best by finding solutions on the own and think that thinking as well as reasoning processes are important compared to the curriculum content.
- (iii) All teachers who answered Item 17(i) "Agree" and "Strongly Agree" that students should be allowed to think of the solutions to the given problem, before they are showed how to solve.

An independent t-test was conducted to answer the research question 2, "Is there any significant difference between the male and female mathematics teachers' beliefs on the nature of teaching and learning?"

Table 3. Mean Score Differences Between Gender using Independent t-test

Construct	Gender	Mean	SD	t-value	Sig (2 tailed)
Direct transmission beliefs	Male	12.78	1.09	-.75	.46
	Female	12.30	1.81		
Constructivist beliefs	Male	13.10	1.73	.49	.63
	Female	13.37	1.42		

As shown in Table 3, the data on teachers beliefs were obtained from samples of 27 females and 12 males, with a male sample mean of 12.78 ($M=12.78$, $SD=1.09$) and a females sample mean of 12.30 ($M=12.30$, $SD=1.81$) for the direct transmission beliefs. Male teachers had stronger direct transmission beliefs than female teachers. For the constructivist beliefs, the males sample mean of 13.10 ($M=13.10$, $SD=1.73$) while the female sample means of 13.37 ($M=13.37$, $SD=1.42$). Female teachers had higher constructivist beliefs when compared to male teachers. When comparing the two beliefs constructs, male and female teachers had a stronger constructivist beliefs than the direct transmission beliefs.

The independent t test indicated that the direct transmission beliefs means were not statistically significant for male and female teachers ($t=-.75$, $df=37$, $p=.46$). Thus, we fail to reject the null hypothesis that the direct transmission beliefs means were the same by gender was rejected at the .05 level of significance. The results provide evidence to support the conclusion that males and females do not differ in direct transmission beliefs.

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DISCUSSION AND CONCLUSION

This study investigated the beliefs in the nature teaching and learning among the secondary mathematics teachers in Malaysia. The results showed some similarities and differences in terms of direct transmission beliefs and constructivist beliefs in nature of teaching and learning.

The results showed that in general Malaysian mathematics teachers had stronger constructivist beliefs than directed transmission beliefs for both male and female teachers. This would mean that they believe in a student-centered learning environment where teachers facilitate the learning and students play an active role in the mathematics classroom. Teachers with a constructivist view would not be too concerned with transmitting knowledge but to also focus on helping students construct their knowledge in mathematics. Furthermore, this would fit nicely with the 21st century learning skills that encourages students to develop their knowledge through exploration and investigation. Teacher education and curriculum implementation would have influenced teachers' constructivist beliefs. The next step would be to observe whether the constructivist beliefs of teachers would be reflected in their instructional practices.

Male teachers tend to have stronger direct transmission beliefs than female teachers in the nature of teaching and learning mathematics. This is consistent with TALIS study claiming that "female teachers are less likely than male teachers to see teaching as the direct transmission of knowledge and are more likely to adopt structuring and student oriented practices" (OECD, 2009, p. 88). However, the inferential statistics results indicated that there is no significant difference in the direct transmission beliefs by teacher's gender. For the constructivist beliefs, female teachers had a higher mean score compared to the male teachers. Nonetheless the t-test result showed that there is no significant difference in the constructivist beliefs for the male and female teachers. What is more important is the result indicated that Malaysian teachers supports direct transmission beliefs or constructivist beliefs without looking at gender. In addition, the beliefs about how beliefs in pedagogy played a pertinent role in determining how mathematics teaching occurs and how it should actually occur in the classrooms (Ernest, 1989a, Thompson, 1991).

In future studies, the consistency between teachers' beliefs and instructional practice could be investigated. This would provide a clear connection between what teachers' beliefs and how it affects their classroom practice. The beliefs study could be extended further by comparing on the nature of mathematics and beliefs about mathematics teaching and learning that includes factors such as students' learning, teacher's role and teaching practice with the results of this study. By understanding the beliefs of mathematics teachers, the teacher education programme could design and develop courses that suit the need for the 21st century learning skills. A further study could be done to explore the relationships of their beliefs, instructional practice and professional development.

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