Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.5, No.31, 2014

A Research on Teachers' Beliefs about Mathematics Teaching and Learning between Sekolah Kebangsaan (SK), Sekolah Jenis Kebangsaan Cina (SJKC) and Sekolah Jenis Kebangsaan Tamil (SJKT)

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Abstract
The level of basic numeracy achievement in Malaysian education system is a growing concern to key stakeholders. Apart from monitoring numeracy standards, no attempt has been made to explore what are the beliefs of Malaysian primary school teachers' beliefs towards mathematics teaching and learning. It is important to understand teacher beliefs since ultimately these beliefs lead to student achievement in mathematics. Thus, this research examined the beliefs about mathematics teaching and learning held by Malaysian primary school (SK, SJKC and SJKT) teachers. A quantitative approach with a survey design was used. A total of 174 primary mathematics teachers from South Seberang Perai district of Penang participated in this research. A survey instrument with 18 items (Mathematics Beliefs Scales) was adapted from Capraro, (2005) and Fennema *et al*., (1990) and administered to the SK, SJKC and SJKT teachers in order to determine their beliefs regarding mathematics teaching and learning on three subscales, namely beliefs about student learning, beliefs about the stages of learning and beliefs about the teaching practices. Teachers' responses derived from participation in the survey were analyzed for formal and informal mathematics beliefs. Descriptive statistics were calculated to explore the beliefs of SK, SJKC and SJKT mathematics teachers. Results indicated that most of the teachers expressed beliefs that tended to fall in the mid-range between formal and informal mathematics beliefs. A multivariate analysis of variance (MANOVA) was conducted and statistically significant differences were found in the mean scores of the three subscales of the Mathematics Beliefs Scales between SK, SJKC and SJKT mathematics teachers. The SJKC teachers were found to favour more informal beliefs in teaching and learning mathematics than their counterparts from SK and SJKT. Conclusions suggest as the most of primary mathematics teachers, especially from SK and SJKT have a mixture of both formal and informal beliefs, professional development must address their fundamental beliefs about mathematics so that they would adopt informal beliefs to enhance their mathematics teaching and learning.
Keywords: Beliefs, beliefs about mathematics teaching and learning, formal beliefs, informal beliefs, student learning, stages of learning, teacher practices.

1. Introduction

The theoretical foundation for this research is belief. The term belief has a variety of meanings in common usage, and despite being a construct of great interest to researchers, there is not a generally agreed upon research definition (Philipp, 2007). Beliefs can be embodied as conscious and unconscious ideas and thoughts about oneself, the world, and one's position in it (Cross, 2009; Rokeach, 1968).

1.1 Teachers' Beliefs about Mathematics Teaching and Learning

In mathematics education, some researchers defined beliefs as personal philosophical conceptions, ideologies, worldviews and values that shape practice and orient knowledge (Ernest, 1989; Speer, 2005). Currently, appropriated classifications of beliefs in mathematics education are about the nature of mathematics and the teaching and learning of mathematics (Cooney 2003; Cross, 2009; Ernest 1989; Speer 2008; Thompson 1992). With regard to beliefs about mathematics, Collier (1972) characterized "formal" beliefs as those which identify mathematics as a body of rules and procedures which are largely prescriptive in nature. Collier (1972) also characterized "informal" beliefs as those which identify mathematics as a creative and investigative subject.

Formal beliefs about the nature of mathematics identify the subject as one of procedures (Collier, 1972; Roscoe & Sriraman, 2011; Seaman *et al*., 2005). Mathematics consists of rules, algorithms, and formulas which are hierarchically organized according to various cannons (e.g. arithmetic, algebra, geometry). Knowing mathematics is then evidenced through knowledge of and proficient performance of these procedures (e.g. times tables, the quadratic formula, the Pythagorean Theorem). Teaching mathematics is then conceived as a teacher-centred activity in which the teacher provides a clear presentation of procedures and encourages students to acquire these skills through individual drill and practice (Roscoe & Sriraman, 2011).

Informal beliefs about the nature of mathematics identify the subject as one of creative and investigative processes (Collier, 1972; Roscoe & Sriraman, 2011; Seaman *et al*., 2005). Mathematics consists of the processes

of problem-solving, proof and reasoning, communication, connection and representation (National Council of Teachers of Mathematics (NCTM), 2000) among others. Knowing mathematics is evidenced through active and successful engagement in these processes. Teaching mathematics then is conceived as a student-centred activity in which the teacher facilitates student construction of mathematical knowledge through activities that are inherently exploratory and open-ended (Collier, 1972; Roscoe & Sriraman, 2011; Seaman *et al*., 2005).

1.2 Culturally Shared Beliefs about Teaching and Learning Mathematics

Teachers' beliefs about teaching and learning may be shaped largely by culturally shared experiences and values (Correa *et al*., 2006). Culturally shared beliefs about teaching and learning may be so ubiquitous and familiar that they become difficult to recognize. For this reason, a comparison of teachers' beliefs across cultures can be an especially revealing approach to studying beliefs (Stigler & Perry, 1990). The advantage of a comparative process is that it can make familiar and widespread beliefs within one culture suddenly seem distinctive and unusual (Jacobs & Morita, 2002).

The researcher adopts a general and dualistic framework for the study of beliefs in mathematics first used by Collier (1972), followed by Seaman *et al*. (2005) and then Roscoe and Sriraman (2011). The framework envisions one's beliefs regarding mathematics on a scale that ranges from *formal* beliefs on one end to *informal* beliefs on the other (Collier, 1972; Roscoe & Sriraman, 2011; Seaman *et al*., 2005).

2. Background of the Study

In the Malaysian school system, at the end of the sixth-year of schooling, the pupils are required to sit for Primary School Assessment Test / *Ujian Penilaian Sekolah Rendah* (UPSR), a national public examination which is compulsory for all the primary school students. The results of UPSR have shown that pupils from the SJKC perform consistently better in mathematics than those in the other types of schools (Lim, 2003). This difference had been a concern of Malaysians for decades.

As all the primary schools in Malaysia follow the same curriculum and use the same type of textbooks and the teacher's are from teachers training colleges that follow the same curriculum for teacher education, one of the factor causing the difference in pupils' achievement could be the teachers' beliefs about mathematics teaching and learning.

Teachers' beliefs are considered as part of knowledge for teaching (Furinghetti, 2007), which plays a vital role in giving impact on teaching (National Research Council (NRC), 2001 as cited in Siti Mistima *et al*., 2011). Mathematics teachers' beliefs have an impact on their classroom practice, on the ways they perceive teaching, learning, and assessment, and on the ways they perceive students' potential, abilities, dispositions, and capabilities (Barkatsas-Tasos & Malone, 2005).

3. Statement of Problem

As with the mathematics curriculum of many countries, the Malaysian Primary Mathematics Curriculum has moved away from a focus on skills-and-computation towards more emphasis on the understanding and applications of the basic skills of mathematics (Curriculum Development Centre (CDC), 2003).

Since 2003, the mathematics curriculum has been seen to be more skewed towards creating thinking students with more attention being given to mathematical processes rather than emphasizing on test scores (Cheah, 2010). The Curriculum now places more emphasis on problem solving, communications, mathematical reasoning, and mathematical connections and representations (Cheah, 2010).

As much as the Ministry of Education Malaysia tries to deemphasise the focus on examinations, the orientation by the general public towards examinations over the years does not seem to have decreased (Cheah, 2010). There is also a perception that public examination results reflect the performance of schools. Good schools are often labelled as those which are able to produce good results in the public examinations (Cheah, 2010). So teachers are committing 'too much' of teaching and learning time to the mathematics that appear on tests (NCTM, 2006).

Table 1.1 displays the percentage of passes of the various types of schools from South Seberang Perai district in the UPSR examination from 2004 to 2011.

Table 1.1
Mathematics Achievement in the UPSR Examination by Types of Schools
Source: South Seberang Perai District Education Office (2012)

Year	Percentage of Passes in UPSR Examination		
	SK	SJKC	SJKT
2004	83.11	93.21	83.18
2005	86.79	95.79	75.44
2006	82.38	93.04	91.30
2007	84.75	93.65	82.90
2008	77.44	94.82	75.77
2009	85.30	95.66	86.23
2010	86.93	96.04	88.78
2011	87.57	95.88	86.76

Table 1.1 shows that SJKC pupils perform better in mathematics than their counterparts in SK and SJKT.

Comparisons among these three types of schools may have many different starting points. One essential starting point is the study of teachers' beliefs toward mathematics teaching and learning. It is possible that the differences in pupils' achievement are a consequence of the fact that the mathematics teachers from different schools hold different beliefs about mathematics teaching and learning. It was this possibility that motivated the researcher to carry out a research of the SK, SJKC and SJKT schools teachers' beliefs about mathematics teaching and learning.

Furthermore, although many research studies (Andrews & Hatch, 2000; Barkatsas-Tasos and Malone, 2005; Beswick, 2007; Gates 2006; Seaman *et al*., 2005) have been conducted to investigate teachers' beliefs about mathematics teaching and learning internationally, relatively little information is known about the Malaysian primary school teachers' beliefs about mathematics teaching and learning. Thus, the researcher would like to do a research about SK, SJKC and SJKT teachers' beliefs regarding mathematics teaching and learning in Malaysia.

4. Research Purpose

The objectives of this research was to find out the similarities and differences that exist among SK, SJKC and SJKT mathematics teachers' beliefs regarding the teaching and learning of mathematics and to determine if any statistically significant difference in mean scores exist between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales.

5. Research Questions and Hypotheses

The following research questions and hypotheses were framed to guide the data collection and analysis of this research:

5.1 Research Questions

1. What are the SK, SJKC and SJKT mathematics teachers' beliefs regarding the teaching and learning of mathematics (a. student learning, b. stages of learning and c. teacher practices)?
2. Is there a statistically significant difference in the 'a. student learning b. stages of learning and c. teacher practices' subscales mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales?

5.2 Hypotheses

Ho *2a*: There is no statistically significant difference in the 'student learning' subscale mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales.

Ha *2a*: There is a statistically significant difference in the 'student learning' subscale mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales.

Ho *2b*: There is no statistically significant difference in the 'stages of learning' subscale mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales.

Ha *2b*: There is a statistically significant difference in the 'stages of learning' subscale mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales.

Ho *2c*: There is no statistically significant difference in the 'teacher practices' subscale mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales.

Ha *2c*: There is a statistically significant difference in the 'teacher practices' subscale mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales.

6. Methodology

In this research, to allow for greater depths of understanding and insight into the teachers' beliefs about mathematics teaching and learning, a quantitative approach with a survey design was used. The sample for this study was 174 primary mathematics teachers which consisted of about 1.00 percent of the teachers within the 39 primary schools in South Seberang Perai Selatan district. SJKT, being the smallest population grouping, had the least representation with 58 respondents. So SJKC and SK were also represented by 58 teachers each. The data collection instrument had two different parts. The first part of the instrument consisted of Demographical Questionnaire and the second part of the instrument consisted of Mathematical Beliefs Scales.

7. Data collection

Letter of introduction to school principals was obtained from the University Sains Malaysia through the School of Educational Studies. In addition, the researcher also obtained letter of approval to conduct this study in South Seberang Perai District primary schools from Ministry of Education through the Education Planning, Research and Development unit (EPRD) and the State Education Department of Penang. This is to ensure the researcher has all the school administration and teachers cooperation to conduct this research among the mathematics teachers. The data was collected in April 2012. The researcher went to the schools to distribute the instruments. Teachers filled out Mathematical Beliefs Scales (MBS) individually during their free period. The suggested time of completion was 10 minutes but teachers were allowed to fill it out at their own pace.

8. Data Analysis

The Statistical Package for Social Sciences (SPSS) version 19.0 was used for statistical analysis. A combination of demographic, descriptive and inferential analyses was used to report and evaluate the data. To address the first research question, "What are the SK, SJKC and SJKT mathematics teachers' beliefs regarding the teaching and learning of mathematics (a. student learning, b. stages of learning and c. teacher practices)?" descriptive statistics were used to provide information about the mean and range of the teachers' scores on MBS and the frequencies and percentages for the three subscales.

To address the second research question, "Is there a statistically significant difference in the 'a. student learning b. stages of learning and c. teacher practices' subscale mean scores between SK, SJKC and SJKT mathematics teachers' beliefs as measured by the Mathematics Beliefs Scales?", and in order to test the hypotheses of the research, the Multivariate Analysis of Variance (MANOVA) was performed to establish if statistically significant difference existed between the teachers from SK, SJKC and SJKT regarding the three subscales of mathematics teaching and learning beliefs.

9. Results and Discussions

In order to address the first research question, participants' responses from the Mathematics Beliefs Scales were scored and analysed. The participants (N=174) of this study had beliefs scores ranging from 55 to 85 with an average score of 68 (*SD* = 6.95) as shown in Table 1.2.

Table 1.2
The Mathematics Beliefs Scales Scores of SK, SJKC and SJKT Teachers

			Type of schools			Total
			SK	SJKC	SJKT	
LEVEL	High(79-108)	Count	1	12	7	20
		% within Type of schools	1.7%	20.7%	12.1%	11.5%
	Mid(49-78)	Count	57	46	51	154
		% within Type of schools	98.3%	79.3%	87.9%	88.5%
Total		Count	58	58	58	174
		% within Type of schools	100.0%	100.0%	100.0%	100.0%

Table 1.2 shows that 88.5% of the participants reported having beliefs about the teaching and learning of mathematics that were in the mid-range (scores from 49 to 78) between formal and informal beliefs while only 11.5% were in high range (scores from 79 to 108) which reflect a belief that mathematics teaching and learning should facilitate pupils' constructive knowledge and emphasize conceptual learning over procedures. There were none in the low range (scores from 18 to 48).

The majority of teachers in high range were from SJKC (N=12) followed by SJKT (N=7) and finally SK (N=1). Teachers who are in high range have informal beliefs which emphasize the understanding of mathematics as concepts and relationships, rather than just mere rules to be memorized and applied (NCTM, 2000). 98.3% SK

teachers, 87.9% SJKT teachers and 79.3% SJKC teachers expressed beliefs that fall in the mid-range between formal and informal beliefs.

9.1 Item Frequencies and Percentages for Subscale 1: Student Learning

Concerning student learning subscale, almost all of the SK, SJKC and SJKT teachers agreed with both of the positive items (item 1 - 98.3% and item 7 - 94.8%). But only two of the negative items received the most negative response (item 4 - 33.9% and item 10 - 38.6%). These results show that more teachers are having constructivist beliefs regarding student learning which emphasizes informal beliefs over formal beliefs.

But another two negative items received the least negative response (item 13 - 17.2% and item 16 - 23.0%). Furthermore only 5.1% of SK teachers disagreed with the statement "I believe time should be spent practicing computational procedures before pupils spend much time solving problems". These results indicate a lack of trust in children's ability to construct their own knowledge and emphasis on procedures over conceptual understanding.

To interpret teachers' beliefs as informal as classified by Collier (1972), Seaman *et al*. (2005) and Roscoe and Sriraman (2011), it would require much more teachers disagreeing with the negative items in subscale 1, student learning. However, a tendency towards informal beliefs appears to be emerging. Overall, SJKC teachers indicated high percentage of agreement with positive items and high percentage of disagreement with negative items among the three schools.

In summary, SJKC teachers are closer to adopting informal beliefs toward student learning than SK and SJKT teachers.

9.2 Item Frequencies and percentages for Subscale 2: Stages of learning

Concerning stages of learning subscale, almost all of the SK, SJKC and SJKT teachers agreed with the first positive item (item 5 - 98.3%). But only half of the teachers agreed with the second positive item (item 11 - 55.8%). Only less than one third of the teachers gave negative responses to all of the negative items (item 2 - 24.7%, item 8 - 13.2%, item 14 - 37.4% and item 17 - 17.8%).

These results indicate formal beliefs of emphasizing computational skills over solving word problems. When it comes to problem solving, teachers express a belief that children cannot do this independently. They may not have enough confidence in children's learning ability (subscale 1) to lend themselves to use problem solving over or as equal to computation (subscale 2).

On the stages of learning subscale, teachers from SJKC favour active learning and allowing children to find their own ways to solve word problems more often than teachers from SK and SJKT though they also have formal beliefs like SK and SJKT teachers.

9.3 Item Frequencies and Percentages for subscale 3: Teacher Practices

The overall results for this subscale shows that the SK, SJKC and SJKT teachers' beliefs toward teacher practices are slightly informal. But the result for item 6 indicates that teachers do not favour allowing children to struggle to find their own ways to solve problems. In accordance with other research studies, these beliefs may reflect that teachers are the tellers of wisdom and children are the receivers (Allen, 2003). Considering that so many teachers teach as they were taught (Brahier & Schaffener, 2004; Lubinski & Otto, 2004), teachers may have a difficulty pulling away from the stance of 'teacher as director'.

To answer research question 2, MANOVA was conducted using mean scores from the above three subscales as the dependent variables and each of the three types of schools as independent variable. Prior to running this procedure, the assumptions for MANOVA were checked. Sample size (N = 174), homogeneity of variance-covariance matrices (employing Box's test of the equality of the covariance matrices, Box's M sig. Value = .007), normality and outliers (Mahalanobis distance = 14.92), linearity (scatterplots), multicollinearity and singularity (correlation coefficients) revealed no significant problems with test assumptions as none of the assumptions were violated.

The results of MANOVA showed that all the null hypotheses were rejected and this shows that there were statistically significant differences between the mathematics teachers of SK, SJKC and SJKT regarding their beliefs about mathematics with respect to beliefs about student learning (SL), stages of learning (SOL) and teacher practices (TP). Post hoc comparisons using the Tukey HSD test indicated that the mean scores for SK teachers were significantly different from SJKC teachers for SL and TP. The mean score for SJKC teachers was significantly different from SK and SJKT teachers for SOL. For all the three dependent variables, SJKC teachers got the highest mean scores. This shows that SJKC teachers favoured informal beliefs over formal beliefs compared to either SK or SJKT teachers.

There are several reasons that this difference could have occurred. Yu's (2008) study comparing beliefs of mathematics teachers between England and China, suggest that the beliefs of Chinese teachers generally reflect the scientific understanding of theory where Chinese teachers place more emphasis on logical and

rigorous reasoning and they agree more strongly about its application to other areas. Having the similar beliefs could have been one of the reasons why SJKC teachers' beliefs about mathematics teaching and learning differed significantly from SK or SJKT teachers.

Research conducted in a range of countries has shown that the dominant ethnic group achieves better in mathematics than indigenous or minority groups (Bouchey & Harter, 2005; Grootenboer & Hemmings, 2007; Rothman & McMillan, 2004). These findings are not consistent with the current research's findings because the dominant Malay pupils from SK are not the highest achievers in mathematics examination (Table 1.1).

But Demie's (2001) study shows that some ethnic minority groups, such as Indian and Chinese, have levels of attainment above the average of the white UK groups. Others such as Caribbean, Portuguese and African are under-performing. Overall, the message from Demie's study is that there are no simple explanations for ethnic differences in educational achievement. Ethnic heritage does not presuppose underachievement. So the researcher infers that the Chinese pupils from SJKC perform better than Malay pupils from SK or other minority groups because they have a good language command whether it is Chinese or English to understand the mathematical concepts and make connections to real life.

The findings of this study are consistent with Yoong *et al*.'s (1997) finding which reported that language seems to play a significant role in mathematics learning. According to Yoong *et al*. (1997), the Chinese language seems to have a cultural advantage over the other two languages, Malay and Tamil, particularly in terms of its simpler and consistent number-naming system. Since 2003 until 2011 mathematics had been taught in English in SK and SJKT but in bilingual in SJKC. So the SJKC teachers' beliefs that mathematics is best taught in the pupils' mother tongue (Lim & Presmeg, 2011), could have been one of factors leading to SJKC pupil's higher mathematics achievement.

Lim (2003) discussed of two case studies focused on exploring the characteristics or culture of mathematics learning in two Chinese primary schools. Findings of this study, in part, reconfirm findings by Munirah and Lim (1996) that most Chinese medium schools favour more drill and practice, as well as more homework and tuition. Lim's (2003) findings show that SJKC teachers use drill and practice because they believe that pupils' can adapt to any task, using previous knowledge (Skemp, 1971; Skemp 1987) which is more in line with informal beliefs. These findings are consistent with the findings of the current research that the SJKC teachers favour informal beliefs and practice them in their teaching and learning of mathematics.

So it can be concluded that the informal beliefs of SJKC teachers that pupils should be taught to link conceptual understanding to procedural knowledge and apply it to other tasks could one of the factors for their pupils' better achievement in mathematics.

10. Implications

The level of basic numeracy achievement in Malaysian education system is a growing concern to key stakeholders. Apart from monitoring numeracy standards, no attempt has been made to explore what are the beliefs of Malaysian primary school teachers' beliefs towards mathematics teaching and learning. It is important to understand teacher beliefs since ultimately these beliefs lead to student achievement in mathematics (Capraro, 2005).

Although the results of this research show that most of the mathematics teachers believed that the teaching and learning of mathematics should emphasize more than just basic concepts and skills as stated by CDC (2003), but when it comes to beliefs about the stages of learning, teachers tend to have formal beliefs and favour procedural over conceptual understanding. These teachers see their role as providers of all knowledge and students as sponges waiting to absorb their knowledge (Capraro, 2005). These formal beliefs would not enhance the mathematics teaching and learning.

One surprise that emerged from the beliefs inventory was the higher scores for SJKC and SJKT teachers versus SK teachers on all the subscales. As majority of the SK teachers were of mathematics major from teachers' training college, this researcher would have predicted that SK teachers would have higher scores toward informal beliefs. But the findings of this research do not support the researcher's view.

According to Sapkova (2011), at present education courses for mathematics teachers are focusing more on the acquirement of the subject content and less on the development and cultivation of teachers' own personal/individual qualities: sensitivity, creativity, spontaneity, responsibility, compassion, reverence, and a sense of wonder. This may be one of reasons why, despite continuous process of teacher education, most of the mathematics teachers favour formal beliefs and remain traditionalist.

11. Recommendations

Because the current study limited research to primary teachers in South Seberang Perai district, expansion to include the entire state or others states would be informative. Furthermore, collecting and reporting data on subgroups that are responsible for the mathematics curriculum, such as Curriculum Development Centre (CDC), Malaysian Examination Board, teacher educators and education policy makers may yield additional insights.

Speer's (2002) research points out the problem of vocabulary and shared understanding of terms in self-reported survey research. Follow-up interviews might have yielded useful information about the reasons and explanations for participants' choices in the survey. Qualitative studies that include teacher interviews and classroom observations can further probe the results of this research.

Teachers' beliefs should be studied from a variety of perspectives, including what they think (espoused beliefs) as examined in this research as well as what they do (enacted beliefs) (Thompson, 1992 as cited in Perry *et al*. 1999). Thus studying the consistencies between teachers' espoused beliefs, enacted beliefs and the underlying philosophy of the mathematics curriculum may provide more implications for the better achievement in mathematics for all of the Malaysian primary school pupils.

Malaysian mathematics teachers' quality especially those with formal beliefs about mathematics teaching and learning can be improved through ongoing professional development. This can include on-site or at school, which may involve formal activities such as mentoring and working in project teams or informal activities such as the involvement in school discussions about policy. It may also take place off-site or outside school such as conferences, workshops, on-line training, and modular programs over a period of time or network activities. Lee and Ginsberg (2009) and Forgasz (2005) reiterate the importance of professional development when trying to improve teacher quality in mathematics.

As many teachers do not receive a significant amount of professional development geared towards mathematics (Boyle & Lamprianou's 2006) the Malaysian primary school administrators should take an initiative to plan and organize relevant professional development courses for their mathematics teachers. SK or SJKT teachers should not work in isolation but together with SJKC teachers as members of learning communities. In addition, findings from Gellert's (2008) and Pritchard and McDiarmid (2005) studies emphasize that reflection in teaching and professional development is important to improve mathematics teaching and learning. So teachers should pay more attention to their beliefs and reflection.

'Mathematics teacher professional learning' should be conducted by primary school administrators with the help of 'Mathematics Excellent Teacher' *(Guru Cemerlang Matematik)* especially from SJKC. Mathematics excellent Teacher can conduct professional learning by visiting classes, observing specific lessons, teaching model lessons, guiding teachers to do reflective teaching and team teaching with the mathematics teachers who have formal mathematics beliefs. Willis (2002) states that "teachers need to learn how to analyse practice – both other teachers' practice and their own". This would hopefully lead to changes in the SK and SJKT mathematics classroom which result in changes in SK and SJKT pupils' learning outcomes. A longer term goal was a change in teachers' beliefs and attitude may also be attained (Rogers, 2007).

12. Future Research Directions

Future research can and should develop and incorporate the recommendations of mathematical research such as this in an effort to improve primary school mathematics teachers' teaching and learning styles. The awareness of the current mathematics researches and recommendations and its potential influences on teachers' beliefs about mathematics teaching and learning also should be studied as there is a critical need for collaboration between researchers and teachers if mathematics education research is to be responsive. Another area of interest for future analysis is the inclusion of cultural differences (in terms of language, practices, ritual, attitudes, values and beliefs) of the teachers' and students and the usage of mathematics in their everyday life and how it affects the teaching and learning of mathematics.

13. Conclusions

Almost all of the SK and SJKT teachers have a mixture of formal and informal beliefs towards mathematics teaching and learning. It is perhaps not surprising that these teachers have not conveyed a strong rejection of formal beliefs towards mathematics given that they have been successful students within traditional school environments themselves. But distinct informal beliefs are demonstrated by the SJKC mathematics teachers in beliefs about how students learn and how teachers should teach than their counterparts from SK and SJKT.

The findings of this research suggest that it is not ethnicity that determines better performance in mathematics learning. Indeed, ethnic differences may bring about cultural differences in terms of language, practices, ritual, attitudes, values and beliefs. Perhaps these are the factors that give rise to different ways of teaching and learning approaches towards mathematics, and consequently might have resulted in differences in mathematics achievement among the SK, SJKC and SJKT pupils.

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