Teachers Level of Understanding and Readiness for HOTS Mathematic Item Construction in Penang Tamil Primary Schools

Thavamani Alagan, S. Kanageswari Suppiah Shanmugam*, and Arsaythamby Veloo

School of Education and Modern Language, University Utara Malaysia 06010 Sintok, Kedah.

ABSTRACT

This is a descriptive research that uses the quantitative analysis. The research sample consisted of 209 mathematics teachers who were teaching Years 4, 5 and 6 from 28 Tamil Primary Schools in Penang, Malaysia. The objective of the research is to study the teachers' level of understanding and readiness from the cognitive, affective and behavioural aspects in the process of constructing higher order mathematics items in Tamil schools. The researcher used questionnaires adapted from Rahim (2017) to collect the data. Prior to the actual research, a pilot study was carried out to ensure its validity and reliability of the questionnaire. The questionnaires were distributed through the headmasters of the respective schools and the gathered data was analysed using the SPSS Windows Version 23.0. Descriptive statistics were used for data analysis. The study revealed that the overall mean of teachers' understanding in constructing higher order mathematics items were only moderate. Teachers with a range of average to high levels of experience in teaching recorded a high level of understanding while teachers with low in experience displayed a low level of understanding. The results also revealed that the overall mean of teachers' readiness in constructing higher order mathematics items was also moderate. Teachers with average to high levels of teaching experience had a high level of readiness while teachers with lesser experience displayed a low level of readiness. The findings of the survey have practical implications, whereby the school headmasters, the District Education Department, the State Education Department and the Ministry of Education should take the initiative to enhance the teachers' level of understanding and readiness in constructing higher order Mathematics items. Theoretically, the findings support Bloom's Taxonomy and the theory on teachers' readiness.

INTRODUCTION

It is vital for children to acquire thinking skills and problem-solving skills to enable them to think, solve daily problems and to be more productive at their respective workplace in the future. In consistent with Malaysia's vision 2020 and the Malaysian Education Blue Print (2015-2025), Malaysia needs to cultivate a generation that has thinking skills and problem-solving skills to face the challenges of the future (Ministry of Education, 2013). It is crucial for teachers to master the inquiry-based learning or discovery learning as one of the teachers' readiness in the teaching of Mathematics (Keown, 2016). Activities in the teaching of Mathematics enable teachers to motivate themselves with positive practices. In relation to this, teachers make students active in the subject taught through discovery learning activities in Mathematics. In this situation, teachers must be prepared to enhance their mathematical knowledge and employ effective pedagogy in classroom teaching. In addition, mathematics teacher's understanding and readiness in constructing higher order thinking skills (HOTS) is crucial in implementing HOTS in classrooms such as evaluating, reasoning, reflecting, decision making and thinking innovatively.

HOTS is defined as an ability to apply the knowledge of mathematics, skills and values, in reasoning, making of reflections on problems, making decisions and innovative thinking.

Teachers' understanding of HOTS in Mathematics is very important in the teaching and learning process and in the construction of mathematics HOT items. Additionally, the effectiveness of teaching and learning mathematics also lies in teachers' readiness in HOTS and their ability to construct HOTS item. The mathematics teachers' readiness in implementing HOTS is crucial in enhancing students' performance in Mathematics and developing students' thinking skills and innovations (Gomez, 2013).

The commitment and efforts of teachers to improve the quality of education are part of the main investment of the Ministry of Education (MOE) towards ensuring the well-being of Malaysians in the future (Ministry of Education, Malaysia, 2013). At the same time, various initiatives have undertaken by the Malaysian Ministry of Education to identify the challenges and gaps in the national education system, and further formulate the best solution to address them.

Research Questions of the Study

Following are the research questions of the study:

i.   What is the teachers' level of understanding in the process of constructing HOTS Mathematics items in Penang Tamil Primary schools?
ii.   What is the teachers' level of readiness in constructing HOTS Mathematics items in Penang Tamil Primary schools?

LITERATURE REVIEW

Supiah (2016) in his study has identified teachers' views and roles played by authorities in the implementation of HOTS in preschools. The data were obtained through interviews from respondents consisting of 10 teachers from 10 schools in Malaysia. The data were analysed using the hermeneutic method which is interpretation of text to meta text. The results show that the authorities involved in the implementation of HOTS in preschools have taken the necessary steps in introducing HOTS in preschool but it is still at an early stage. Findings also revealed that preschool teachers need special guidance through courses and workshops to improve the implementation of HOTS in preschool. This study suggested that, the Ministry of Education, the State Education Department, the District Education Office and the Headmasters should take the initiative to improve the preschool teachers HOTS through service courses and workshops to ensure that teachers can implement HOTS effectively in preschool teaching and learning.

Through the activities in teaching mathematics, teachers are able to motivate students with positive practices. In addition, they are able to encourage students to participate actively in the proses of learning and engage students in HOTS activities. Gomez (2013) highlighted that teachers' readiness in constructing HOTS mathematics items is important in developing HOTS and innovative thinking among students. Findings from a preliminary study carried out by the researcher among 10 mathematics teachers from 10 Tamil primary schools in Malaysia indicated that 80% of teachers have low level of understanding and low level of readiness in constructing higher order Mathematics items. The findings also show that teachers require more in-service training, workshops, and guidance on higher order thinking skills to enable them to implement it in schools. As such, current study is important as it is focused on teachers understanding and their readiness in constructing HOTS Mathematics items at primary level.

Unal and Unal (2019), identify differences between beliefs and practices in assessment based on teachers' experience. Assessment is a critical factor in the teaching and learning process. This is due to the fact that HOTS items in each subject have increased since 2013. Teachers have difficulty assessing student comprehension as well as applying comprehension in sequential assessment (Calveric, 2010; Campbell, Murphy & Holt, 2002). In this case assessment is a

measure of student achievement in teaching and learning as usual. This activity takes 1/3 of the time and energy of the teacher in the implementation of the assessment (Brookhart, Walsh & Zientarski, 2006). In this study researchers have studied the differences between new and experienced teachers in trust in assessment. The researcher used quantitative methods in this study. A sample of 87 respondents from 6th year teachers answered the questionnaire. The test was used to analyse the data. The findings show that experienced teachers have a higher confidence in assessment practices. Where most items are HOTS items, students may have difficulty responding to HOTS items. However, teachers have confidence that assessment can enhance student learning and identify teachers' weaknesses and strengths. While the new teachers contend that the assessment does not provide much benefit, it is an increase in the workload for teachers.

Sivapakkiam (2017) investigated teachers' levels of knowledge and interest on higher order thinking skills (HOTS) according to the subjects taught and categories of schools. The quantitative study consists of 100 teachers from five secondary and five primary schools. The teachers are from the field of Languages, Science, Mathematics and Humanities. Sivapakkiam (2017), findings revealed that teachers' knowledge on HOTS is only at an average level. However, 50% of the teachers agreed that the knowledge of HOTS is very important in the process of teaching and learning. The findings also indicated that there is a positive relationship between teachers' knowledge in HOTS and their interests in HOTS. In addition, the findings showed that the primary school teachers exhibited higher level of knowledge and interests in HOTS compared with their secondary school counterparts. Her conclusion was there were limited reference materials in HOTS for teachers to use as guides in implementing HOTS in the classroom. According to Yousef (2016), the effort to enhance HOTS among students should be carried out collectively by teachers. One subject teacher alone will not be able to enhance students' HOTS. Lawson, (1993) and Shellens and Valcke (2005) also asserted that all the subject teachers must work collaboratively to enhance student's HOTS.

In addition, Benjamin (2008) opined that HOTS can be developed in a cumulative manner among students through the subjects taught and various learning experiences from the institutions. Besides that, students HOTS can be improved through elements such as problem solving, critical thinking and decision-making activities in the learning subjects. The researcher also analysed the mathematics test papers on fractions among grade 8 and grade 9 students to ascertain the quality of the items constructed by teachers and whether they agree with Bloom's Taxonomy. The findings revealed that all the questions were at lower level of Bloom's Taxonomy namely, comprehension knowledge and application. These findings are parallel with findings by Stiggins, Griswold, dan Wikelund (1989) which also indicated that 57.14% of the items constructed by mathematics teachers were at the level of application and 28.57% were at the level of comprehension.

Similarly, studies by Boyd (2008) also indicated most of the evaluation items constructed by teachers are at lower levels of Bloom's Taxonomy. It shows that, most of the mathematics teachers are not aware of the importance of HOTS. Their understanding and readiness towards constructing HOTS items is still at the low level. Boyd (2008) concluded that 87% of teachers who took part in his study only used lower order thinking skill (LOTS questions).

METHODOLOGY

According to Gay, Mills and Airasian, (2009), the population is the target group of researchers, the group of whom the results of the study will be generalized. There are 28 Tamil primary schools in Penang. The sample of the study consisted of 209 Mathematics teachers teaching year 4, 5 and 6 from all the 28 Tamil Primary schools in, Penang. Among them 25 (12%) were male teachers, while 184 (88%) were female teachers. Stratified sampling was adopted in selecting

the sample. The questionnaire on teachers' understanding and teachers' readiness in constructing HOTS Mathematics items was adapted (Halim, 2017). The questionnaires were distributed to the teachers through their headmasters. The quantitative data were analyzed using IBM SPSS Windows version 23. In this study descriptive statistics were employed for the purpose of answering the research questions.

The distribution of mean score of the overall level of teacher's understanding in constructing HOTS items is between 15 (1x15 items) to 75 (5 x 15 items). Similarly, the overall mean score distribution of teacher's readiness in constructing HOTS items is also between 15 (1x15 items) to 75 (5 x 15 items). Hence the mean score of teachers' understanding and their readiness in constructing HOTS items were divided into 4 categories which are high (mean score = 61 to 75), average (mean score = 46 to 60), low (mean score = 31 to 45) and very low (min score = 15 to 30). Teachers experience in teaching mathematics were divided into 3 categories. Which is low experience (5-10 years), average experience (11-15 years) and high experience (16 – 25years)

FINDINGS AND DISCUSSION

In answering research question 1, the findings from descriptive analysis in Table 1 indicate that overall mean of the teachers' understanding in the process of constructing HOTS Mathematics items is only at a average level of (Mean = 54.63, N = 125, SD = 12.19). Teachers with high experience in teaching exhibited high level of understanding in constructing HOTS Mathematics items (Mean = 62.93, N = 30, SD = 7.72). Teachers with average experience also indicated high level of understanding (Mean = 61.05, N = 43, SD = 7.79) but their mean score is lower than the teachers with high experience. On the other hand, teachers with low experience showed average level of understanding (Mean = 44.54, N = 52, SD = 9.92). These findings also show that the overall mean level of understanding of teachers with high experience and average experience is at the high level and the understanding of low experience teachers is at the low level. None of the mathematic teachers in the category of average listed low level of understanding in constructing HOTS mathematic items.

Table 1 Teachers' level of understanding in constructing HOTS Mathematics items

Teaching Experience	Mean	N	Std. Deviation
Low	44.54	52	9.92
Average	61.05	43	7.79
High	62.93	30	7.72
Total	54.63	125	12.19

In answering research question 2, the findings in Table 2 indicate that overall mean of the teachers' readiness in the process of constructing HOTS Mathematics items is only an average level of (Mean = 58.22, N = 125, SD = 9.69). Teachers with high experience in teaching exhibited high level of understanding in constructing HOTS Mathematics items (Mean = 64.43, N = 30, SD = 6.6). Teachers with average experience also indicated high level of readiness (Mean = 62.67, N = 43, SD = 8.84) but their mean score is lower than the teachers with high experience. On the other hand, teachers with low experience showed average level of readiness (Mean = 50.96, N = 52, SD = 6.76) which is encouraging and motivating the low experience teachers. These finding also shows that the overall mean level of readiness of teachers with high experience and average experience is at the high level and the understanding of low-experience teachers is at the average level. In addition, none of the categories indicated poor level of teachers' readiness in constructing HOTS mathematics items.

Table 2 Teachers' level of readiness in constructing HOTS Mathematics items

Teaching Experience	Mean	N	Std. Deviation
1.00	50.96	52	6.76
2.00	62.67	43	8.84
3.00	64.43	30	6.60
Total	58.22	125	9.68

DISSCUSSION

The purpose of this research is to explore primary school teachers' understanding and readiness towards constructing HOTS mathematics items. The findings show that, high experience teachers are having high level of understanding and readiness in constructing HOTS mathematics items compare with average experience teachers and low experience teachers. In the other hand, mean of low experience teacher show that the level of teachers is average in level. This is also indicated, the findings of this research motivating the low experience teachers. Although their level of HOTS understanding is at low level, but their readiness towards HOTS in constructing mathematics items is at the average level.

This finding is also consistent with Unal and Unal (2019), which identifies teachers' beliefs and practices in assessment. According to them, experienced teachers have a greater confidence in the practice of assessment. While less knowledgeable teachers think that, assessment is about increasing the burden of teachers. Current findings and Podolsky (2016), also emphasize that teachers' experience enhances student achievement. Experienced teachers support student learning as well as deliver better teaching. Highly experienced teachers have a higher level of understanding and readiness in each activity of the teaching and learning process of constructing HOTS mathematics items.

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