TEACHING OF HIGHER ORDER THINKING SKILLS IN THE MATHEMATICS CLASSROOM AMONG PRIMARY SCHOOL MATHEMATICS TEACHERS IN TEMERLOH, PAHANG, MALAYSIA

By

TAMILARASI A/P CHANDRAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

January 2022

IPM 2022 12

DEDICATION

To my parents, sister, brother, husband and my lovely kids
I am truly grateful for all your love, care, guidance and support.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia, in fulfilment of the requirement for the degree of Master of Science

TEACHING OF HIGHER ORDER THINKING SKILLS IN THE MATHEMATICS CLASSROOM AMONG PRIMARY SCHOOL MATHEMATICS TEACHERS IN TEMERLOH, PAHANG, MALAYSIA

By

TAMILARASI A/P CHANDRAN

January 2022

Chairman : Nurzatulshima Binti Kamarudin, PhD
Institute : Mathematical Research

Higher order thinking skills act as crucial component skills to face worldwide competition in this rapid information era. Ministry of Education (2013) defined higher order thinking skills (HOTS) as the capability to apply knowledge, problem solving, reflection, value reasoning, reasoning skills, innovating something new and decision making. Teachers are responsible to instill the learning of HOTS to instigate activities which requires deeper thinking among students in the pedagogy of 21st century. Nevertheless, not much research has been conducted pertaining to the teaching of Higher Oder Thinking Skills, and the factors that may influence in teaching of HOTS among teachers as not many comprehensive studies have been done in relation to this. The purpose of this study is to determine factors influencing to the teaching of HOTS in mathematics classroom. This study looked at teachers' knowledge of HOTS; teachers' pedagogical skill; teachers' attitude; barriers in teaching higher order thinking skills in mathematics class.

This study used a correlation research design carried out on 71 primary schools in Temerloh district. Cochran's formula stratified random sampling technique was used to select 269 teachers for this study. The respondents were selected by using proportional stratified random sampling technique. Data were collected using a set of questionnaire, which was adapted from previous studies and validated by a panel of expert. The obtained data were analyzed using SPSS statistical software version 19. Descriptive statistics were used to assess the demographic profile of the Mathematics teachers of Temerloh district. Subsequently, Pearson-Product moment correlation was used to identify the relationship between independent and dependent variables. The multiple regression analysis was also employed to predict the factors influencing to the teaching of HOTS in mathematics classroom.

The results revealed that the majority of mathematic teachers self-reported a moderate to high level of teaching HOTS. The analysis showed that majority of the teachers agreed that how to stratify the learning components to the level of the students for teaching HOTS (M = 3.79, SD = 0.38). In addition, the teachers' reported that they are able to use different strategies and techniques to teach HOTS in mathematics classroom (M=3.94 , SD=0.43). Moreover, the teachers were found to have a positive attitude towards teaching of HOTS (M=3.74,SD=0.49). In terms of barriers, the finding revealed that the teachers merely faced slight problem due to the teachers related barriers, students related barriers, and external related barriers. Positive significant correlations existed between the level of HOTS usage and the four factors. The multiple regression analysis revealed that all the four factors influencing were found to be significant in predicting the level of teaching HOTS among mathematics teachers.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Master Sains

PENGAJARAN KEMAHIRAN BERFIKIR ARAS TINGGI DALAM BILIK DARJAH MATEMATIK DALAM KALANGAN GURU MATEMATIK SEKOLAH RENDAH DI TEMERLOH, PAHANG, MALAYSIA

OLEH

TAMILARASI A/P CHANDRAN

Januari 2022

Pengerusi : Nurzatulshima Binti Kamarudin, PhD
Institut : Penyelidikan Matematik

Kemahiran berfikir aras tinggi bertindak sebagai kemahiran komponen penting untuk menghadapi persaingan di seluruh dunia dalam era maklumat ini. Kementerian Pendidikan Malaysia (2013) mendefinisikan kemahiran berfikir aras tinggi (KBAT) sebagai keupayaan untuk mengaplikasikan pengetahuan, penyelesaian masalah, refleksi, penaakulan nilai, kemahiran menaakul, menginovasi sesuatu yang baru dan membuat keputusan. Guru bertanggungjawab untuk menanamkan pembelajaran KBAT untuk mencetuskan aktiviti yang memerlukan pemikiran yang lebih mendalam di kalangan pelajar dalam pedagogi abad ke-21. Walaupun begitu, tidak banyak kajian dilakukan berkaitan dengan pengajaran kemahiran berfikir aras tinggi dan faktor-faktor yang mempengaruhi pengajaran kemahiran berfikir aras tinggi dalam kalangan guru kerana tidak banyak kajian komprehensif yang dilakukan berkaitan dengan ini. Tujuan kajian ini adalah untuk mengetahui factor-faktor yang mempengaruhi pengajaran kemahiran berfikir aras tinggi di kelas matematik. Kajian ini meninjau pengetahuan guru mengenai KBAT; kemahiran pedagogi guru; sikap guru; kekangan dalam pengajaran kemahiran berfikir aras tinggi dalam kelas matematik.

Kajian ini menggunakan reka bentuk kajian korelasi yang dilakukan di 71 buah sekolah rendah di daerah Temerloh. Teknik persampelan rawak berstrata formula Cochran digunakan untuk memilih 269 orang guru untuk kajian ini. Responden dipilih dengan menggunakan teknik persampelan rawak berstrata berkadar. Data dikumpulkan menggunakan satu set soal selidik yang disesuaikan dari kajian sebelumnya dan di sahkan oleh panel pakar validasi.data yang diperoleh dianalisis menggunakan perisian statistik SPSS versi 19. Statistik deskriptif digunakan untuk menilai profil demografi guru matematik daerah Temerloh. Selepas itu, korelasi momen pearson-product digunakan untuk mengenal pasti hubungan antara pemboleh ubah bebas dan bersandar. Analisis regreasi berganda juga digunakan untuk meramalkan factor-faktor yang mempengaruhi pengajaran KBAT dalam kelas matematik.

Hasil kajian menunjukkan bahawa sebagian besar guru matematik melaporkan tahap pengajaran KBAT aras sederhana hingga aras tinggi. Analisis menunjukkan bahawa majority guru bersetuju bahawa bagaimana untuk mengelompokkan komponen pembelajaran ke tahap pelajar untuk mengajar KBAT (M= 3.79, SD=0.38). Sebagai tambahan, para guru melaporkan bahawa mereka dapat menggunakan strategi dan teknik yang berbeza untuk mengajar KBAT di kelas matematik (M= 3.94, SD= 0.43). dari segi kekangan, penemuan menunjukkan bahawa guru hanya menghadapi sedikit masalah kerana halangan yang berkaitan dengan guru, halangan yang berkaitan pelajar dan halangan berkaitan dengan luaran. Juga didapati korelasi signifikan yang positif wujud di antara tahap pengajaran KBAT dengan kesemua empat faktor tersebut. Analisis regresi menunjukkan bahawa keempat-empat faktor yang mempengaruhi didapati signifikan dalam meramal tahap pengajaran KBAT dalam kalangan guru matematik.

ACKNOWLEDGEMENTS

I would like to convey my sincere gratitude to my main supervisor, Dr. Nurzatulshima Binti Kamarudin, for her enthusiastic assistance and guidance throughout the work. Her admirable endeavor on the front line of education and research work is gratefully appreciated. I am also deeply grateful to Prof. Madya Dr. Sharifah Kartini Binti Said Husain as member of my supervisory committee. Thank you for her valuable advice, continuous support and interest in this study and ensuring that I am able to complete my research on time. It is indeed to work with both such dedicated supervisors.

A special thanks to the staffs of the Institute for Mathematical Research (INSPEM) for providing me their kind assistances during my study. Furthermore, this study would not have been possible without the kind assistance and cooperation of the mathematics teachers who voluntarily participated in my research. Thank you for the help of everyone that contributing to the success of my study either directly or indirectly.

Lastly, I could not have accomplished my goals if it had not been for the love and support from my lovely family member especially my parents, my husband, my sister and my brother. Thank you for their relentless and unceasing support, patient and understanding shown throughout my entire candidature.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Nurzatulshima Binti Kamarudin, PhD
Senior Lecturer
Faculty of Educational Studies
Universiti Putra Malaysia
(Chairperson)

Sharifah Kartini Binti Said Husain,PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date :10 November 2022

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

HOTS	Higher Order Thinking Skills
AIM	Agensi Inovasi Malaysia
MMP	Modern Mathematics Programme
KBSR	Kurikulum Baru Sekolah Rendah
KBSM	Kurikulum Baru Sekolah Menengah
PPSMI	Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris
ICT	Information and Communication Technology
KSSR	Kurikulum Standard Sekolah Rendah
KSSM	Kurikulum Standard Sekolah Menengah
PPPM	Pelan Pembangunan Pendidikan Malaysia
IEA	International Association for the Study of Educational Achievement
TIMSS	Trends in International Mathematics and Science Study
MOE	Ministry of Education
PISA	Programme for International Student Assessment
UPSI	Universiti Pendidikan Sultan Idris
USM	Universiti Sains Malaysia
UPM	Universiti Putra Malaysia

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Higher order thinking skills act as a crucial component skill to face worldwide competition in this rapid information era. Ministry of Education (2013) defined higher order thinking skills (HOTS) as the capability to apply knowledge, problem solving, reflection, value reasoning, reasoning skills, innovating something new and decision making. Teachers are responsible to instill the learning of HOTS to instigate activities which requires deeper thinking among students in the pedagogy of 21st century. This is in line with the aspiration of the Malaysian Education Blueprint 2013-2025. Nessel & Graham (2007) stated the most fundamental skill which can developed in the classroom is thinking skills and it plays crucial role in making a student to achieve higher. Higher order thinking skills concept originated from Bloom (1956) cognitive domain taxonomy (Forehand, 2010). Pappas *et al.* (2012) stated that these cognitive domains requires knowledge and intellectual skills development and in hierarchically ordered from concrete knowledge to abstract. Marshall & Horton (2011) stated that HOTS consist of reasoning skills, logical thinking and critical thinking which are fundamental skills for daily life and also for academic achievements.

HOTS application in assessment and pedagogy such as learning based on inquiry and high-level questioning in assessment and pedagogy, could promote HOTS among the students and directly enhance the achievement of a student. Correspondingly, Vygotsky (1962) stated that process of learning may benefit the students if they are involved in the process of thinking directly. Sener *et al*. (2015) stated that consequently, 21st century's learning and teaching must concentrate more on independent learning and student-centered, collaborative learning and learning based on project, and authenthic assessment as well. The above approaches enhance cognitive development and HOTS of students. Teachers should include various teaching strategies in learning process, such as problem solving activities, learning based on project, thinking tools, questioning techniques, discussions, role play, simulations and difficulty level of tasks should be increased gradually. Weimer (2002) stated that an effective approach to improvised student's learning experience is student-centered learning. It can be done by various methods application such as assessments and assignments to understand a single concept (Bishop *et al*., 2014) and this is apt to grasp the science concept "an environment that allows students to take some real control over their educational experience and encourages them to make important choices about what and how they will learn" (Doyle, 2008).

Yahya *et al*. (2012) and Clark (2010) stated that intellectual behavior has been catogorised by Bloom into six levels of thinking, knowledge, comprehension,

application, analysis, synthesis and evaluation. The hierarchical progression identifies the lower level to higher level of cognitive processing (Clark, 2010).

Yahya *et al.* (2012) and Forehand (2010) stated that the first three levels of Bloom's taxonomy needs fundamental recognition such as knowledge, comprehension and application, while the rest three levels requires HOTS of students. Thus, HOTS of analyses, synthesis and evaluation will be applied by students in their learning process of mathematics. Gradually, students able to excel in problem solving, thoughtful decision making and life-long learning through that experience. Noor (2008) stated that higher order cognition is also playing an important role in process of turning a student into an independent learner. This process helps students to incorporate the new knowledge with the existing ones for deeper understanding in a meaningful way. Higher order thinking skills has been firstly highlighted by Benjamin Bloom through his taxonomy a few decades ago. Duron *et al.* (2006) stated that higher order thinking is perceived as a higher level of cognitive ability. A study suggests that HOTS need not to be taught to students as it is a natural process which is carried by human (Sternberg & Williams, 2002). In spite of that, a study conducted by three researchers argued that thinking is a natural process; on its own it can often be biased, distorted, partial, uninformed and potentially prejudiced (Duron *et al*., 2006). Hence to excel in thinking, it must be cultivated by a student. Black (2005) conducted a study and the results shows students may improve their thinking skills, if teachers teach them how to think. The same study suggested teachers may teach the strategies and terms which can be used in higher order thinking and provide students with the criteria to judge information.

Thus, we can conclude that it is crucial that teachers should guide the students in order to improve their skills even though higher order thinking is a natural ability. A lot of efforts have been made by the Ministry of Education to develop students' higher order thinking skills. As an example, Ministry of Education and the Agensi Inovasi Malaysia (AIM) joints to develop the i-THINK programme in order to enable schools to teach thinking skills to students and to encourage them to be lifelong learners. The main aim of this project is to produce creative workers who are innovative and those who able to solve problem which is complex. In order to implement HOTS in teaching and learning, eight thinking tools is used by students and teachers in this project. On Friday July 13, 2012, The Star Online reported, Malaysian Prime Minister Datuk Seri Najib Abdul Razak at the launching of the Premier Rally Excellent Teachers 2012 in Putrajaya, talked about the importance of HOTS among students. Quoting his words that:

"Rapid progress in technology has created jobs that did not even exist 20 years before. This trend will become more prevalent in years to come. The question is, how do we prepare them to take on jobs that don't exist yet? The answer is, we can't because we don't know what will come in the future. What we can do is prepare them with higher order skills, with the ability to not only think at a deeper level but also creatively" (The Star Online, 2012).

Attitudes, behaviors and perceptions of teachers sometimes limits the improvement of thinking skills (Paul, 1990). Currently attention to the improvement of higher order thinking skills increased by recognizing the importance of HOTS and the deficiencies exhibited by the youth in thinking. Several studies carried out in some developed countries on various aspects of HOTS along with the constraints on it.

In a nutshell, it is vital for teachers to obtain skills in the usage of HOTS in mathematics teaching and learning. Thus, this study aims to explore the teachers' knowledge to teach HOTS, their pedagogical skills, their attitudes and the barriers in teaching HOTS in their respective mathematics classrooms.

1.2 Mathematics Education in Malaysia

Mathematics is known to be a mandatory subject at all levels in Malaysian schools since independence. This subject is taught from year one to year six in primary level and form one to form five in secondary level. There are significant changes in teaching Mathematics curriculum in Malaysia. The changes include content transformation from traditional Mathematics mainly emphasising on computation skills to Modern Mathematics Programme (MMP). In early of 70's, MMP was introduced in Malaysian primary and secondary schools. The primary aim of this programme was to bring in some 'modern topic' into the Malaysian mathematics curriculum. This programme concentrated on a concepts' understanding rather than gaining computational efficiency. Teachers were encouraged to utilise the inquiry method in their teaching and students were exposed to the mathematics processes to produce certain results in mathematics during the implementation of MMP. The fund for MMP programme given by the Asian Foundation. American Peace Corps members was the invited advisers for this programme.

There was another major update in the content of mathematics curriculum from primary level right up to upper secondary level in Malaysian national schools in the 80's. In 1983, the New Curriculum for Primary School (KBSR) was implemented to replace MMP following the international trends on "students-centered learning" and the ideology of an "all-rounded development of the individual". Lee (2002) stated that KBSR in mathematics focused on the addition of primary skills and knowledge through direct experiences, motivate students to actively involve in different types of learning activities, using a variety of instructional materials and practicing a variety of students' groupings. The syllabus of mathematics was separated into two levels in KBSR. Level one (year one until year three) and the level two (year four until year six). Level One focused more on mastering the primary concepts of basic skills to solve the Mathematics problems. The aim of KBSR in mathematics was to give an equal chances for all students to obtain skills, knowledge, rules, attitudes and desired common social practice in community.

As a continuation of curriculum, KBSM (Integrated Curriculum for Secondary School) was introduced to improve efforts at secondary level in 1989. The major goal of the mathematics KBSM was to develop individuals who has ability to think mathematically and also apply the mathematical knowledge in daily life. Based on this, the content of the curriculum is arranged to the common occurrence in our daily lives specifically in three areas: Numbers, Shapes ad Relations and Space (Curriculum Development Centre, 2004). Some aspects of mathematics are stressed in secondary mathematics curriculum. According to Bishop (1991), these aspects are the balance between understanding of concepts and the mastery of basic skills, the usage of mathematics in real-life contexts, problem solving skills development, history of mathematics appreciation and human spiritual and societal values inherent in the subject.

In 2001, the curriculum of mathematics underwent a total review. As a result, in 2003, the Teaching and learning of Mathematics in English (PPSMI) was implemented in 2003 as a result of the total review done in 2001. Firstly it was implemented for Primary One, Secondary One and Secondary Lower Six. Progressively, it was implemented in all other level and in 2008 it was completed. Extensive usage of Information and Communication Technology (ICT) was expected in order to deliver the Mathematics education in English language. Moreover, the students get more opportunities to improve their knowledge and skills when they learn mathematics in English median assisted by ICT.

As a replace for New Curriculum for Primary School, Integrated Curriculum for Primary School (KBSR) was introduced in 1993. The goal of KBSR is to produce students with better communication skills, critical thinking skills, collaborative and creative thinking skills. In 2011, KSSR (Standard-based Curriculum for Primary School) was introduced as a replacement for KBSR in 2011. The aim of KSSR is to serve all students irrespective of their social background, and offer them an opportunity to discover their capabilities, mainly for those with special needs. KSSR also enables teachers and students to improve their creativity and thinking capacities. In 2016, KSSR were fully implemented where year six students evaluated based on their overall performance and participation in the classroom rather than public examination results. Standard-based Curriculum for Secondary School (KSSM) for all subjects will be ready to roll out to form one students in 2017 (Kementerian Pelajaran Malaysia, 2012). Currently, KSSM is still in use.

In 2010, new curriculum was launched under the National Key Area Result for education after the announcement and introduction of this new curriculum in 2009 by the sixth Prime Minister of Malaysia, Dato' Seri Najib Bin Tun Abdul Razak. The goals of the new curriculum are to provide equal education without any partiality between students in the city and the students in the village. The introduction of this new curriculum is to encourage students to think, know, understand and act like what they have learn from the new curriculum's modules and also to lessen the focus in exams in school. This new curriculum also encouraged the students to think critically (Amalina & Nik, 2012).

1.3 Teaching of Higher Order Thinking Skills in Malaysia

Over the years, the major educational goal was to improve and develop the HOTS of the students (Zohar & Schwarter, 2005; Fisher, 1999). As Resnick in 1987 said, "scaling up the 'thinking curriculum' in a way that will foster proficiency for all students is currently a major educational challenge" (as cited in Zohar, 2013, p. 234); and a primary glance at the perspectives of the teachers conveys that most teachers accept that teaching HOTS to students is crucial, mainly to lead their idea generation (Yee *et al*., 2012). Focusing on HOTS is crucial in order to enhance the worldwide economic growth, the development of information and communications technology (ICT), a knowledge-based economy and a fast-paced world. In reality, most important skill for every individual in any educational setting is HOTS. Fisher (1999) thought that the development of students' HOTS is complementary with the inculcation of lifelong learning among them. Moreover, Vijayaratnam (2012) stated that we need "thinking" students who can constantly respond to real-world demands.

We know what is important and what we expect from our education system, from our teachers and from our students; but how well are they responding to the challenge of teaching and learning HOTS? Ivie (1998) stated that HOTS teaching receiving little or no attention in most of the classrooms. She also stated that according to previous findings when HOTS does occur in the classroom, teachers seldom put effort to maintain students' flow of higher-level thoughts, perhaps due to teachers' incompetency or disinterest in pursuing learning outcomes other than learning content-specific goals. Unfortunately, this classroom scenario happens worldwide. Contrastingly, Zohar (2013) stated that in spite of contrary reports, fair development has occurred in improving the teaching and/or learning of HOTS; it is just that in terms of realizing the educational ideal of having 'thinking' students in a 'thinking' classroom within the 'thinking' curriculum where active cognition is a routine, yet we should put in more effort. Ivie (1998) stated that in the planning and implementation levels attention is needed because reoccurrence of inconsistencies in the development of curriculum and enforcement will continue to keep the effective teaching of HOTS in the classroom as pure rhetoric.

A steady increasing influence of thinking skills in our education system is notable within Malaysia. In order to improve effective teaching of higher order thinking skills, the Ministry of Education (MOE) implemented a stretch of structural reforms through the Integrated Curriculum for Secondary Schools (KBSM) which introduced critical thinking skills, in 1988, the Vision 2020 in 1991, the Critical and Creative Thinking Skills (KBKK) in 1996, and the concept of "smart school" in 1997, with the aim of producing students with high thinking capacity. MOE released the Preliminary Report of the Malaysia Education Blueprint 2013-2025 in 2012 and the contents clearly emphasized higher order thinking skills in three key aspects of education: The written curriculum, the taught curriculum, and the examined curriculum (assessment). One may wonder, even though so much of attention given to higher order thinking skills in our curriculum through many educational policies, does problem of ineffectiveness in

teaching higher order thinking skills in schools still occur specifically in Malaysia? "Yes, of course". It has been proved by previous studies.

A study in the Preliminary Report of the Malaysia Education Blueprint 2013-2025 has found out that most lessons in schools fails to sufficiently engage students in constructive thinking where teachers depends on lecture format and most importantly, the learning concentrate on recalling facts or achieving surface-level content understanding instead of developing HOTS (Malaysia Ministry of Education, 2012). Two earlier studies which was conducted in Malaysia by Zohar (2013) and Ivie (1998) portrayed lower-order thinking, instead of HOTS, still dominates teaching methods and learning outcomes.

Research shows that the teaching and learning of HOTS does not follow a coherent path. A study stated that policy documents from all over the world insists the importance of teaching the skills of 21st century (Zohar, 2013). HOTS is one of the crucial component of 21st century skills. Soo *et al*. (2015) stated that the education curriculum transformation in the Malaysia Education Development Plan (PPPM) 2013-2025 concentrates more on HOTS concept which targets to produce knowledgeable students who are able to think critically and creatively can compete at the global level. The teaching strategies of teachers are hoped to change or at least be adapted and adopted to fulfill what has been outlined in the Malaysia Educational Blueprint 2013-2025, the National Education Strategic Plans 2007-2020 documents and the Malaysia Education Blueprint 2013-2025 (Ministry of Education, 2013). Along with the principles of the National Philosophy of Education Malaysia, reform efforts by the government in the 1990s were concentrated on the demands of the Vision 2020. These efforts included restructuring the education system in Malaysia which brought about many outcomes, one of which was the introduction of a significant and explicit attempt to teach HOTS in schools.

1.4 Factors Related in Teaching Higher Order Thinking Skills

Previous studies have shown that several factor influencing in teaching HOTS in classroom. The following factors are identified based on several studies that concentrated on teaching HOTS.

The first factor is barriers in HOTS teaching. First barrier is teacher-related barrier. Teachers are often unsure of how to teach HOTS (Vijayaratnam, 2012; Dooley, 2003; Rajendran, 2001; Sparapani, 1998). Teachers are always have an thought that HOTS is only meant for well performing students (Zohar & Dori, 2013; Zohar & Schwartzer, 2005). Afifah & Retnawati (2019) stated that students having difficulty in understanding the HOTS concept if apperception is not given by teachers. A study conducted in Malaysia found out that level of thinking ability among secondary and primary school teachers is low (Zulkipli *et al.,* 2017). Thus results in inability to reach optimal student learning achievement (Altun & Akkaya, 2014). Seman *et al*. (2017) stated that heavy curriculum content and less time results in inability to teach HOTS during class hours.

Second barrier is student-related barrier. Zohar (2013) stated that several students (even the smart ones) usually choose easy way; they tend to neglect the importance to go through the hassle if there are any easier ways available to complete their tasks in or out of the classroom. Some students do not prefer and have less or no motivation to think. Some students think it is easier and faster to be given a direct answer rather than thinking out of box and give rationale for it. A study stated some students were too dependent on teachers as their cognitive ability is low (Seman *et al*., 2017).

Second factor is pedagogical knowledge in HOTS teaching. Teachers lack of the appropriate pedagogical knowledge to teach HOTS to students. A descriptive explorative research showed that the knowledge of HOTS teaching is still lack among teachers due to less HOTS related training is provided (Afifah & Retnawati, 2019). Some teachers having difficulty in delivering material based on HOTS (Afifah & Retnawati, 2019).

Third factor is teachers' attitude in teaching HOTS. Teachers' perceptions suggest that they demonstrate better attitude and belief in teaching higher order thinking skills (Nagappan, 2015; Rajendran, 2001).

1.5 Problem Statement

Malaysia continues to put in plenty of efforts to enhance Science and Mathematics achievement to enable Malaysian students to compete globally. Last year (2021), more than 44,000 Malaysian students were participated in Kangaroo Math Competition. Only 10% of them were able to become winners (Kangaroo Math Malaysia, 2021). This shows that majority of our Malaysian students still having difficulty in solving Mathematics questions which is related to HOTS.

Sadly, students' performance in mathematics subject in Malaysia has dropped in recent years even though so much efforts put in by our Ministry of Education to uplift Mathematics achievement.

Mullis *et al*. (2012) stated that based on the report prepared by International Association for the Study of Educational Achievement (IEA), achievement in Mathematics by Malaysia in international exams such as the Trends in International Mathematics and Science Study (TIMSS) which is conducted quadrennially showed a notable decline either in ranking or average score for mathematics. Kementerian Pelajaran Malaysia (2012) stated that the above issue debated in parliament and pressured the Ministry of Education to look for a solution to overcome this problem so that it would not happen again. Out of 45 countries, Malaysia achieved 26th rank in TIMSS 2011 assessment. In year 2007, Malaysia achieved 20th rank. Moreover in 2011, Malaysia participants gathered 440 scores in average. In 2007, average scores gathered by our participants were 474. The average score dropped from 474 (year

2007) to 440 (year 2011) (see Table 1.1). The above situation became a major issue which was debated in parliament and the MOE was pressured to find a solution to avoid this from occurring again in future (Kementerian Pelajaran Malaysia, 2012).

Table 1.1 : Malaysia's TIMSS ranking and average scores in mathematics from 1999 to 2019

Subject /Year	1999	2003	2007	2011	2015	2019
Ranking	16	10	20	26	18	8
Average Scores	519	508	474	440	473	702

(Source : IEA, 2019)

The unexpected result was very disappointing. Analysis for this issue was done and it showed that one of the factor for this decline was due to the lack of HOTS among Malaysian students as a result of an examination oriented educational system (Kementerian Pelajaran Malaysia, 2012). Hence, current learning and teaching of mathematics as well as assessment system needed to be revised. Nevertheless, it is acknowledged that figures only give a brief picture regarding the performance of those students. To improve the quality of education, there are more important aspects to look into. Those aspects include students' physical, emotional and spiritual growth. It is also a fact that students who do not master the core intellectual skills such as literacy and numeracy, as well as HOTS, will have less chance to succeed in a rapidly changing economy as well as to compete in today's global society Susuwela-Banda (2015) stated that to compete in current global society in this rapidly changing economy, students should master the core intellectual skills such as numeracy, HOTS and literacy.

Malaysian primary schools are still practicing conventional teacher-centered approaches that concentrates on information provider, algorithms, as well as drill and practice (Tan & Arshad, 2014). Teachers recognise their main role as the information provider and instruction, and hence possess high intention to implement teacher-centered learning in their classrooms. In the classroom while the lesson is going on, students pay attention passively to the teacher and questioning only happens once in a while. Most of the students depend on the information, explanation, and instructions which they gain from the teacher during lesson. Consequently, less participation rates, memorisation, and lack of higher-order thinking occur among the Malaysian primary school students. One of the prominent and important aspect in a classroom is teacher's questioning. There are several functions of questioning such as reinforce factual knowledge, to evaluate student understanding, reinforce, stimulate student thinking, elicit prior knowledge and promote student participation as well as classroom interaction. Nevertheless, in conventional classrooms in Malaysia, lesser usage of questioning is evident and most of the teachers questions are in low order, which does not includes the thinking skills application (cited in Tan & Arshad, 2014). A study conducted by Zamri & Lim (2011) found out that in an hour only 24 questions are asked on average by the teacher, which is significantly lower compared to 69 questions asked by their Western counterparts (Graesser & Pearson, 1994). In addition, our

Malaysian teachers are still behind in questioning skills and techniques that could promote HOTS.

A study shows that the teachers and students did show a practice of asking HOTS questions, even though high order questions are still low in frequency (Tan & Arshad, 2014). Over a long period of time, teachers and students might improve their technique of questioning and high order thinking with the practice of more problem based learning lessons. This study found out the factors which influence the Mathematics teacher's teaching higher order thinking skill during Mathematic class. The main aim of this study is to investigate factors which influence the Mathematics teacher's teaching HOTS in learning and teaching process in mathematics subject.

The goal of this study is to investigate factors influencing Mathematics teachers' teaching HOTS in learning and teaching process in mathematics that can help improve the ranking of Malaysia in TIMSS and PISA assessment.

1.6 Objective of the Study

The motive of this study is to find out factors which influencing the teaching of HOTS in Mathematics class. Specifically, this study sought to determine the factors which influencing the teaching of the HOTS in their mathematics class among mathematics teachers in Temerloh district.

i. To identify the level of teaching HOTS in mathematics classroom

ii. To identify teachers' views of their knowledge to teach HOTS, teachers' views of their pedagogical skill to teach HOTS, teachers' attitude towards teaching HOTS, to determine barriers in teaching HOTS in mathematics classroom.

iii. To investigate the relationship between the selected factors (teachers' views of their knowledge to teach HOTS, teachers' views of their pedagogical skill to teach HOTS, teachers' attitude towards teaching HOTS, barriers in teaching of HOTS) with the level of teaching HOTS among Mathematics teachers.

iv. To identify the proportion of the variance in the level of teaching HOTS in mathematics classroom that can be explained by using the selected predictors.

1.7 Research Questions

The research questions are as follow based on the objectives of the study.

Objective 1:

RQ1 : What is the level of teaching HOTS in mathematics classroom among Temerloh district teacher?

Objective 2:

RQ2.1: What are teachers' views of their knowledge to teach HOTS in mathematics classroom?

RQ2.2: What are teachers' views of their pedagogical skills to teach HOTS in mathematics classroom?

RQ2.3: What are teachers' attitude towards teaching HOTS in mathematics classroom?

RQ2.4: What are the barriers in teaching HOTS in mathematics class?

Objective 3 :

RQ 3.1: Is there any relationship between knowledge to teach HOTS with teaching of HOTS?

H3.1 : There is a significant relationship between knowledge to teach HOTS and teaching of HOTS.

RQ 3.2: Is there any relationship between pedagogical skill to teach HOTS with teaching of HOTS?

H 3.2 : There is a significant relationship between pedagogical skill to teach HOTS and teaching of HOTS.

RQ 3.3: Is there any relationship between teachers' attitude with teaching of HOTS?

H 3.3 : There is a significant relationship between teachers' attitude and teaching of HOTS.

RQ 3.4: Is there any relationship between barriers with teaching of HOTS?

H 3.4 : There is a significant relationship between barriers and teaching of HOTS.

Objective 4 :

RQ 4 : What is the proportion of variance in the level of teaching HOTS in mathematics classroom that can be explained by using the selected predictor?

1.8 Significance of the Study

As mathematics teacher in primary schools assess their instructional practices, it is likely that they may be encouraged to consider concentrating on higher order thinking skills goals as an alternative to teaching. In the recent mathematics teacher-centered method and the large-sized classes of passive learners, it has not been common for teachers to involved their students in discovering the reasons for learning or the anticipated outcomes, since teaching towards examinations has been the standard. This study may be significant in collecting information about recent mathematics teachers in primary schools about factor influencing to the teaching of HOTS. Moreover, this study may be helpful to Malaysian mathematics teachers who seek to uplift the use of learning and teaching strategies that emphasise higher order thinking skills outcomes, aid the Malaysian MOE in making effective policy decisions, educational strategies

application with greater certainty, and establish expectations for hiring new mathematics teachers.

This study would benefit the Malaysian teacher, the Ministry of Education, and future researchers to understand teachers' perception of constraints on improving students' HOTS. This study is a research to investigate factors influencing teachers' teaching strategies in teaching HOTS in mathematics classroom among mathematics teachers in Temerloh, Pahang and volunteered teachers who want to take part in the study via questionnaire. The result from this study provides practical implication for teachers. The result of this study can be used by teachers to re-examine and redesign their instructional models to allow students to employ multiple thinking. The findings of this study will give broad implication for learning and teaching in Malaysia especially in implementation of HOTS in teaching of Mathematics and other subjects to promote better learning. This study would benefit both teachers and students because it provides the investigation of the barriers and difficulties that students face when their teachers are trying to teach them. Primary schools teachers in Temerloh chosen as sample of this study in order to improvise the knowledge level of HOTS in teaching mathematics. This study could help the Department of education Temerloh district to provide appropriate courses related to teaching HOTS in mathematics. Hence, it could improve the teachers' knowledge level of teaching HOTS in mathematics.

1.9 Limitation of the Study

The scope of this study is the respondents involved in this study which were mathematics teachers in Temerloh district of Pahang. The study has its own limitations. Firstly, data from this study were acquired from 71 schools in Temerloh. The respondents involved in this study were mathematics teachers who are teaching mathematics in primary schools in Temerloh distrct. Therefore, findings drawn from this study may be not be generalized to all mathematics teacher population in Temerloh district. It is because there is less study based on primary schools. Other than that, Temerloh district choose to find respondents for conduct this study. The main reason is Temerloh district as many rural school.

On the other hand, this study limits the research design. In this study I am as researcher use correlation research design. A correlational research design was chosen because no manipulation of variables involved in this study, and it was carried out in an attempt to obtain the information on the present scenario on barriers in teaching HOTS, teachers' attitude in teaching HOTS, teachers' knowledge about teaching HOTS, and teachers' confidence level in teaching HOTS.

1.10 Definitions of Terms

Every important key term or variable used in this study is crucial to be defined theoretically and operationally in order to give a clear understanding and guidance in conducting the study. The clearly defined key terms or variables are valuable for data collection, data analysis, and the generalization of the research findings. The key terms or variables used in this study are as follow:-

1.10.1 Higher Order Thinking Skills

A collection of skills or complex skill known as higher order thinking skills. Nickerson *et al*. (1996) stated that HOTS can be considered as a skill which might be done well or poorly, efficiently or not efficiently and it can be improvised with proper instructions. Higher order thinking skill is actually a process of applying, analyzing, synthesizing and assessing knowledge (based on Bloom's taxonomy of educational objectives).

1.10.2 Attitude towards Higher Order Thinking Skills

Attitude described as a combination of feelings, beliefs and tendencies that influence an individual to act towards other persons, groups, ideas, or object (Schafer & Tait, 1986). Conversely, Ajzen & Fishbein (1980) defined attitude as an individual's degree to act in a favorable or unfavorable way with respect to a psychological objects. In the context of this study, attitude toward teachers' in teaching HOTS refer to the combination of feelings, beliefs, and tendencies of teacher in teaching HOTS in mathematics class in a favorable or unfavorable way.

1.10.3 Barriers in Teaching Higher Order Thinking Skill

Betts (1999) describes as factors that would inhibit individuals from participating in education. On the other hand, Thomas (2005) defined barriers as obstacles that would inhibit teachers to fully participate in teaching. In this study, the barrier refers to the obstacles that hinder teachers from teaching HOTS in mathematics classroom.

1.10.4 Knowledge of Higher Order Thinking Skills

The researchers who conducted study based on higher order thinking skills agrees that background knowledge plays a crucial role. Specifically, Willingham (2007) see background knowledge as necessity if students are to demonstrate their HOTS. McPeck (1990) stated that basic knowledge is needed for students when they need to think higher. Domain-specific knowledge is crucial to HOTS because the kinds of

evaluations, explanations and evidence that are most highly valued differ from one domain to another.

1.10.5 Pedagogical Skill in Teaching Higher Order Thinking Skills

Pedagogical skill is known as discipline that deals with the theory and practice of teaching. Pedagogical skill informs strategies in teaching, actions of teacher, decisions and judgements of teacher by taking into consideration of learning theories, student's understanding, the needs of the students and the interests and background of individual students. Pedagogical skills includes the way of teacher interacts with students and the intellectual and social environment the teacher seeks to develop.

REFERENCES

Abrams, L., Pedulla, J., & Madaus, G. (2003). Views from the classroom: teachers' opinions of statewide testing programs. *Theory into Practice*, 42(1), 18-29.

Adams, P. (2006). Exploring social constructivism: theories and practicalities. Education 3-13. *International Journal of Primary, Elementary and Early Years Education*, 34(3), 243-257.

Afifah, R, I., & Retnawati, H. (2019). Is it difficult to teach higher order thinking skills?. *Journal of Physics Conference Series,* 1320(1), 1-7.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitude and predicting social behavior*, Englewood Cliffs. New Jersey: Prentice Hall.

Alesandrini, K., & Larson, L. (2002). Teachers Bridge to Constructivism. *Journal of Educational Strategies, Issues and Idea*, 75(3), 759-773.

Aliakbari, M., & Sadeghdaghighi, A. (2013). Teachers' perceptions of the barriers to critical thinking. *Procedia - Social and Behavioral Sciences*, 70(2), 1-5.

Altun, M., & Akkaya, R (2014). Mathematics Teachers' Comments on PISA Math Questions and Our Country's Students' Low Achievement Levels. *Journal of Education,* 29(1), 19-34.

Alwadai, M. A. (2014). Islamic Teachers' Perceptions of Improving Critical Thinking Skills in Saudi Arabian Elementary Schools. *Journal of Education and Learning*, 3(4), pp. 37 – 48.

Amalina, S., & Nik, M. (2012). Critical thinking in education . *Journal of Education*, 42 (3), 237-249.

Anderson, L.W., & Krathwohl, D.R. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A revision of Bloom's Taxonomy of educational objectivist*. New York: Longman.

Ary, D., Jacobs, L.C . & Sorensen, C. (2010). *Introduction to research in education* (8th ed.). Wadsworth: Cengage Learning.

Bartlett, J. E., Kotrlik,, J. W. & Higgins, C. C. (2001). Organizaional Research: Determining Appropriate Sample Size in Survey Research. *Information Technology, Learning and Performance Journal,* 19(1), 43-50.

Benson, R. (1999). Field Theory in Comparative Context: A new paradigm for media studies. *Journal of Theory and Society*, 28(3), 463-498.

Bernama. (2011). *The Year of Success for Information Technology Sector*. Retrieved 12 Jun 2017 from https://www.theborneopost.com/2011/01/03/201.

Betts, K.S. (1999). *Factors influencing faculty participation in distance education in post secondary education in the United State: An institutional study*. The George Washington University: Washington D.C.

Bishop, A.J. (1991). Teaching mathematics to ethnic minority pupils in secondary schools. In D.Pimm & E Love, eds, *Teaching and learning school mathematics*. London: Hodder and Stoughton.

Bishop, C.F., Caston, M.I., & King, C.A. (2014). Learner -centered environments: Creating effective strategies based on student attitutes and faculty reflection. *Journal of the Scholarship of Teaching and Learning,* 14(3), 46-63.

Bissell, A.N., & Lemons, P.P. (2006). A new methods for Assessing Critical Thinking in the Classroom. *Journal of Bio Science,* 56 (1). 66-72. Black, S. (2005). Teaching students to think critically. *The Education Digest*, 70(6), 42-47.

Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives, Handbook I: The cognitive domain*. New York, NY: McKay.

Cano, J., & Newcomb, L.H. (1990). Cognitive level of instruction and student performance among selected Ohio production agriculture programs. *Journal of Agricultural Educatio*n, 31(1), 146-161.

Chai, C.S., & Tan, S.C. (2003). Contructing knowledge Building Communities in Classroom. *Journal of Research Studies*, 22(2). 91-101.

Chiu, M.S., & Whitebread, D. (2011). Taiwanese teachers' implementation of a new "constructivist mathematics curriculum". How cognitive and effective issuses are addressed. *International Journal of Educational Development*, 31(2), 196-206.

Clark, E. (2010). Communities of learning and thinking. *Journal of Child Development*, 21(1), 108-126.

Coakes, S.J., & Ong, C. (2011). *SPSS Version 18.0 for Windows: Analysis without anguish Milton*: John Wiley & Sons. Australia, Ltd.

Cochran, W.G. (1977). *Sampling Techniques* (3rd ed.). New York: John Wiley & Sons.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). New Jersey: Lawrence Erlbaum Associates.

Cohen, L., Manion, L., & Marison, K. (2011). *Research methods in education* (7th ed.). New York: Routledge Taylor & Francis Group.

Cotton, K. (2003). *Principals and Student Achievement: What the research says*. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).

Crowl, T.K., Kaminsky, S. & Podell, D.M. (1997). *Educational Psycology Windows on Teaching* (pp., 49-80). United States, America: Brown & Benchmark.

Curriculum Development Centre. (2004). *Integrated Curriculum for Primary School: Syllabus Mathematics*. Kuala Lumpur: Ministry of Education.

Dhindsa, H.S., & Shanmuganathan, V. (2002). Cultural environment of upper secondary science students. *Journal of Applied Research in Education*, 6(1), 14-26.

DeVellis, R.F. (2003). *Scale development* (2nd ed.). Thousand Oaks: Sage Publications.

Dooley, G. (2003). Teacher - efficacy: a construct validation. *Journal of Educational Psychology*, 76(1), 569-582.

Doyle, T. (2008). *Helping Students Learn in a Learner - Centered Environment: A Guide to Facilitating Learning in Higher Education*. Sterling, VA: Stylus Publishing.

Duron, R., Limbach, B., & Waugh, W. (2006). Critical Thinking Framework for Any Discipline. *International Journal of Teaching and Learning in Higher Education*, 17, 160-166.

Ennis, R. (1987). A taxonomy of critical-thinking dispositions and abilities. In J. Baron, & R. Sternberg, *Teaching thinking skills: Theory and practice* (pp.9-26). New York : Freeman.

Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). London: Sage Publication Ltd.

Fisher, R. (1999). Thinking skills to thinking schools: Ways to develop children's thinking and learning. *Journal of Early Child Development and Care,* 153(7), 51-63.

Forehand, S. (2010). *Taxonomy of educational objectives, Handbook I: Cognitive domain*. New York: Longmans.

Fraenkel, J.R., Wallen, N.E., & Hyun, H. (2011). *How to design and evaluate research in education* (8th ed.). New York: McGraw Hill.

Gall, J.P., Gall, M.D., & Borg, W.R. (2005). *Applying educational research: A practical guide* (5th ed.). New York : Pearson Education.

Gay, L.R., Mills, G.E., & Airasian, P.W. (2009). *Educational research: Competencies for analysis and application* (9th ed.). New Jersey: Merill, Pearson Education.

Graesser, A.C., & Pearson, N.K. (1994). Question asking during tutoring. *American Educational Research Journal*, 31, 104-137.

Hair, Jr. J.F., Black, W.C., Babin, B.J., Anderson, R.E., & Tatham, R.L. (2006). *Multivariate data analysis* (6th ed.). New Jersey: Prentice Hall, Pearson Education.

Harris, J.R. (1998). *The Nurture Assumption: Why Children Turn Out the Way They Do*. New York: The Free Press.

Hennessey, M.N., Higley, K. & Chesnut, S.R. (2011). Persuasive Pedagogy: Anew Paradigm for Mathematics Education. *Educational Psychology Review*, 24(2), 187-204.

Henson, K.T. (2004). *Constructivist Teaching Strategies for Diverse Middle-Level Classroom.* New Jersey : Pearson Prentice Hall Publisher.

Huitt, W. (2011). Social Development: Why it is important and how to impact it. *Journal of Educational Psychology*, 3(1), 156-168.

Hwang, Y.S., Bartlett, B., Greben, M., & Kirstine.H. (2017). A systematic review of mindfulness interventions for in-service teachers: A tool to enhance teacher wellbeing and performance. *Journal of Teaching and Teacher Education*, 64, 26-42.

Ibrahim, M. (2019). Exploring Teachers' Experiences in Integration of HOTS. *Journal of Science Education*, 45(2), 169-178.

IEA. (2019). International Results In Mathematics (pp.35-82). Retrieved March 10, 2021 from http://timssandpirls.bc.edu/timss2019/international-results-mathematics.html.

Ivie, S. D. (1998). Ausubel's learning theory: An approach to teaching higher order thinking skills. *The High School Journal,* 82(1), 35-42.

Kalina, C., & Powell, K. (2009).Cognitive and Social Constructivism: Developing Tools for an Effective Classroom. *Journal of Education*, 130(2), 241-251.

Kangaroo Math Malaysia. (2021). *Kangaroo Math Competition 2021 Result*. Retrieved 19 October 2019 from www.kangaroomath.com.my/kangaroo-result/.

Kementerian Pelajaran Malaysia. (2012). *Pelan Pembangunan Pendidikan Malaysia 2013-2025* (pp.1-248). Wilayah Persekutuan Putrajaya.

Kowalczyk, N., Hackworth, R. & Case-Smith, J. (2012). Perceptions of the use of Critical Thinking Teaching Methods. *Journal of Radiologic Technology*, 83(3), 226-236.

Krejcie, R.V., & Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*. 30(1), 606-619.

Lee, J.A. (1999). Understanding the determinants of environmentally conscious behavior. *Journal of Psychology*, 16(5), 373-392.

Lee, M.N.N. (2002). The Impacts of Globalization on Education in Malaysia. In M.N.N.Lee (Ed.), *Educational Change in Malaysia* (1st ed., pp.45-64)

Leech, N.L., Barrett, K.C., & Morgan, G.A. (2008). *SPSS for intermediate statistics*. New York: Taylor, and Francis Group, LLC.

Lipman, M. (1991). *Thinking in education*. Cambridge: Cambridge University Press.

Lodico, M.G., Spaulding, T.D., & Voegtle, K.H. (2006). *Methods in educational research: From theory to practice*. Jossey-Bass, A Wiley Imprint.

Maiorana, V. P. (1992). *Critical thinking across the curriculum: Building the analytical classroom.* Bloomington, IN: ERIC Clearinghouse on Reading and Communication.

Makgato, M. (2012). Identifying Constructivist Methodology and Pedagogic Content Knowledge in the Teaching and Learning of Technology. In *Procedia- Social and Behavioral Sciences*, 47, 1398-1402.

Marshall, R., & Horton, D. (2011). Higher order thinking skills. *Journal of the Learning Sciences*, 12(2), 145-181.

McMillan, J.H., & Schumacher, S. (2010). *Research in education: Evidence-based inquiry (7th ed.)*. Boston: Pearson.

Mcneil, J.D. (1990). *Curriculum: A comprehensive introduction*. Los Angeles, CA: Harper Collins.

McPeck, J.E. (1990). Critical thinking and subject specificity: A reply to Ennis. *Educational Researcher*, 19, 10-12.

Md. Yunus, A.S., Mohd Ayub, A.F., & Hock, T.T. (2019). Geometric Thinking of Malaysian Elementary School Students. *International Journal of Instruction*, 12(1), 1095-1112.

Ministry of Education Malaysia. (2013). *Malaysia Education Blueprint 2013-2025.* Retrieved 19 October 2019 from http://www.moe.gov.my/userfiles/file/PPP/Preliminary-Blueprint-Eng.pdf

Ministry of Education Malaysia. (2012). *Malaysia Education Blueprint 2013-2025:Preliminary report*. Retrieved 19 October 2019 from www.moe.gov.my/userfiles/file/PPP/ Preliminary-Blueprint-Eng.pdf

Mullis, I.V.S., Martin, M.O., & Foy, P. (2012). *TIMSS 2011 International Results in Mathematics* (pp.35-85). Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Nachmias, D. (1981). *Research methods in the social sciences*. New York: St. Martin's Press Inc.

Nagappan, V. (2015). Critical thinking: What every person needs to survive in a rapidly changing world. *Journal of Education*, 9(3), 45-56.

Nathan, D.W. (2009). *An Investigation Into Teachers' Perception of the Value of Assessment for formative purpose in secondary schools in Solomon Islands.* Mater Thesis, University of Waikato, New Zealand.

Neil, M. (2003). High stakes, high risk: The dangerous consequences if high – stake testing. *American school Board Journal*, 190, 18-21.

Nessel, S., & Graham. H. (2007). How classroom teachers approach the teaching of thinking. *Journal* of *Theory into Practice*, 32(3), 154- 160.

Newcomb, L.H., & Trefz, M.K. (1987). Towards Teaching at Higher Levels of Cognition. *NACTA Journal*, 31(2), 26-30.

Nickerson, R. S., Perkins, D. N., & Smith, E. E. (1996). *The teaching of thinking*. New Jersey: Pearson Press.

Noor, A. (2008). Higher order thinking skills: Teachers' perceptions. *Journal of Education*, 12 (4), 538-541.

Onosko, J.J. (1988). Promoting students' thinking through thoughtful classroom discourse: An analysis of teachers' thoughts and practices. *Journal of Education*, 12(2), 145-152.

Oxman, W.G., & Barell, J. (1983). Reflective thinking in schools: A survey of teacher perceptions. *American Educational Research Association,* 67(4), 1-30.

Ozkal, K., Tekkaya, C., Cakiroglu. J., & Sungur, S. (2009). A conceptual model of relationships among constructivist learning environment perceptions, epistemological beliefs, and learning approaches. *Learning* and Individual Differences, 19(1), 71-79.

Ozkan-Akan, S. (2003). Teachers' perceptions of constraints on improving student thinking in high schools. *Journal of Education,* 1(9), 32-44.

Pallant, J. (2010). *SPSS survival manual: A step by step guide to data analysis using SPSS version 12 (4th ed.).* United Kingdom: Open University Press.

Pappas, E., Pierrakos, O., & Nagel, R. (2012). Using Bloom's Taxonomy to Teach Sustainability in Multiple Contexts. *Journal of Cleaner Production*, 23(1), 39-56.

Paul, R. (1990). *Critical thinking: How to prepare students for a rapidly changing world*. Santa Rosa, CA: Foundation for Critical Thinking.

Pejabat Pendidikan Daerah Temerloh. (2017). *Bilangan Guru Mengikut Sekolah dan PPD Temerloh.* Retrieved 13 Jun 2017 from https://www.data.gov.my/data/ms_MY/dataset/bilangan-guru-temerloh.

Pennington, J.L. (2004). *The colonization of literacy education: A story of reading in one elementary school*. New York: Peter Lang Publication.

Piaget, J. (1953). *The development of thought: Equilibration of cognitive structures*. New York : Viking Press.

Pogrow, S. (1990). Challenging at-risk learners: Findings from the HOTS program. *Journal of Phi Delta Kappan*, 71(4), 389-397.

Raje, F. (2007). Using Q methodology to develop more perceptive insights on transport and social inclusion. *Transport Policy*, 14(6), 467-477.

Rajendran, N. (2000). Language teaching and the enhancement of higher-order thinking skills. *Journal of Language Curriculum & Instruction in Multicultural Societies,* 42(4), 2-38.

Rajendran, N. (2001). The Teaching of Higher Order Thinking Skill in Malaysia. *Journal of Southeast Asian Education*, 2(1), 1-21.

Ramli, M., Ayub. M., & Salim, M. (2019). Teachers' Challenges in Teaching HOTS. *Journal of Education*, 67(2), 5-13.

Raudenbush, S. W., Rowan, B., & Cheong, Y. F. (1993). Higher order instructional goals in secondary schools: Class, teacher, and school influences. *American Educational Research Journal,* 30, 523-553.

Resnick, L. (1987). *Education and learning to think*. Washington : National Academy Press.

Richardson, V., & Placier, P. (2002). *Teacher change. Handbook of research on teaching.* Washington D.C.: American Educational Research Association.

Russell, T. (1995). *Returning to the physics classroom to rethink how one teaches physics.* London: Falmer Press.

Schafer. E., & Tait, K. (1986). A guide for understanding attitudes and attitude change. *North Central Regional Extension Publication,* 138, 1-11.

See, M.G. (1998). Developing students' problem solving skill. *Journal of International Studies*, 12(1), 127-134.

See, M.G., & Lim, Y.K. (2003). Teaching critical thinking: Eight easy ways to fail before you begin. *Journal of Phi Delta Kappan,* 68, 456-459.

Seman, S. C., Yusoff, W. M., & Embong, R. (2017). Teachers challenges in teaching and learning for Higher Order Thinking Skills (HOTS) in Primary school. *International Journal of Asian Social Science,* 7(7), 534-545.

Sener, N., Turk, C., & Tas, E. (2015). Improving science attitude and creative thinking through science education project: A design, implementation and assessment. *Journal of Education and Training Studies*, 3(4), 57 – 67.

Skolnick, J. (1999). *Urban Crime Control Theory*. London: SAGE Publication.

Smith, A.D. (1991). The Nation: invented, imagined, reconstructed?. *Journal of International Studies*, 4(2), 155-167.

Soo, L., Haniza, N., Rohani, N., & Nuur, S. (2015). The teaching of thinking. *Journal of Science Education*, 6(3),238-249.

Sparapani, E. F. (1998). Encouraging thinking in high school and middle school: Constraints and possibilities. *Journal of The Clearing House*, 71(5), 274-276.

Sternberg, R.J. (1986). A Triangular Theory of Love. *Psychological Review*, 93, 119-135.

Sternberg, R.J., & Williams, W.M. (2002). *Educational psychology*. Boston, MA: Allyn & Bacon.

Susuwela-Banda, W.J. (2015). Classroom Assessment in Malawi: Teachers' Perception and Practice in Mathematics. *Journal of Virginia Polytechnic Institute and State University*, 12(2), 137-143.

Tabachnick, B.G., & Field, L.S. (1996). *Using multivariate statistics* (3rd ed.). New York: Harper Collins.

Tan, K.S. (2002). Reflective Learning in the Classroom. *Journal of Research Studies*, 21(2), 101-109.

Tan, Y.P., & Arshad, M.Y. (2014). Teacher and Student Question: A case study in Malaysian secondary school problem-based learning. *Journal Asian Social Science*, 10(4), 147-153.

Taylor, K. E. (2001). Summarizing multiple aspects of model performance in a single diagram. *Journal of Geophysical Research*, 106, 7183-7192.

The Star Online. (2012). *The Premier Rally Excellent Teachers 2012.* Retrieved 15 July 2017 from https://thestar.com.my/2012/07/13/premier-rally-excellent-teachers.

Thomas, S.H. (2005). Students perceptions of support services designed to overcome barriers in the online learning environment of Illinois community colleges. *Journal of Education*, 24(1), 566-578.

Torff, B. (2003). Developmental changes in teachers' use of higher-order thinking and content knowledge. *Journal of Educational Psychology*, 95(3), 249-261.

Torff, B. (2005). Developmental changes in teachers' beliefs about critical-thinking Activities. *Journal of Educational Psychology*, 97(1), 13-22.

Torff, B. (2006). Expert Teachers' Beliefs about Use of Critical-Thinking Activities with High- and Low-Advantage Learners. *Journal of Teacher Education Quarterly*, 33(2), 37-52.

Torff, B., & Sessions, D. (2006). Issues Influencing Teachers' Beliefs about Use of Critical-Thinking Activities with Low-Advantage Learners. *Journal of Teacher Education Quarterly*, 33(4), 77-91.

Vijayaratnam, P. (2012). Developing higher order thinking skills and team commitment via group problem solving: A bridge to the real world. *Journal of Social and Behavioral Sciences,* 66(2012), 53-63.

Vygotsky, L.S. (1962). Interaction Between Learning and Development. In M. Gauvain & M. Cole (Eds), *Mind and society: Readings on the Development of Children* (2nd ed., pp. 79-91). Cambridge,MA: Harvard University Press.

Warburton, E. C., & Torff, B. (2005). The effect of perceived learner advantages on teachers' beliefs about critical-thinking activities. *Journal of Teacher Education*, 56, 24-33.

Whittington, M.S., Stup, R.E., Bish, L., & Allen, E. (1997). Assessment of cognitive discourse: A study of thinking opportunities provided by professors. *Journal of Agricultural Education*, 38(1), 46-53.

Weimar, R. (2002). Lessons learned: How collaboration helped middle - school science teachers learn project-based instruction. *Elementary School Journal*, 94(1), 539-551.

Wilingham, D. (2007). Promoting thinking in your classroom II: Inconsistencies between means and ends. *Journal of Childhood Education*, 60 (4), 229-233.

Wilson, B. (1996). *Constructivist learning environments: Case studies in instructional design.* (B. Wilson, Ed.) Englewood Cliffs, New Jersey: Educational Technology Publications.

Woolfolk Hoy, A., & Murphy, K. (2001). Teaching educational psychology to the intuitive mind. In B. Torff, & R. Sternberg (Eds.), *Understanding and teaching the intuitive mind: Student and teacher learning* (pp. 145-186). Mahwah, New Jersey: Erlbaum.

Yahya, A. A., Toukal, Z., & Osman, A. (2012). Bloom's Taxonomy - Based Classification for Item Bank Questions Using Support Vector Machines. In *Modern Advances in Intelligent Systems and Tools*. Berlin, Germany: Springer.

Yee, M. H., Md Yunos, J., Othman, W., Hassan, R., Tee, T. K., & Mohamad, M. M. (2012). The needs analysis of learning higher order thinking skills for generating ideas. *Journal of Social and Behavioural Sciences,* 59(2012), 197-203.

Zakaria, E., Chin, L. C., & Daud, M. Y. (2010). The effects of cooperative learning on students' mathematics achievement and attitude towards mathematics. *Journal of Social Science,* 6, 272-275.

Zamri, M., & Lim, N.R. (2011). Kepelbagaian kaedah penyoalan lisan dalam pengajaran guru Bahasa melayu: kaedah pemerhatian. *Jurnal Pendidikan Bahasa Melayu,* 1(1), 51-65.

Zohar, A., Degani, A., & Vaaknin, E. (2001). Teachers' beliefs about low-achieving students and higher order thinking. *Journal of Teaching and Teacher Education*, 17(4), 469-485.

Zohar, A., & Schwartzer, N. (2005). Assessing teachers' pedagogical knowledge in the context of teaching higher-order thinking. *International Journal of Science Education*, 27(13), 1595-1620.

Zohar, A., & Dori, Y. J. (2013). Higher order thinking skills and low-achieving students: Are they mutually exclusive?. *The Journal of the Learning Sciences,* 12(2), 145-181.

Zohar, A. (2013). Challenges in wide scale implementation efforts to foster higher order thinking (HOT) in science education across a whole wide system. *Journal of Thinking Skills and Creativity,* 10(12), 233-249.

Zulkipli. Z., Mohamed, M., & Abdullah, A.H. (2017). Assessing mathematics teachers' knowledge in teaching thinking skills. Sains Humanika, 9(1),83-87.