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The Implementation of Higher Order Thinking Skills (Hots) in Malaysia Secondary School: Post PISA 2009

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Abstract--- *In 2009, Malaysia decided to take part in Programme for International Student Assessment (PISA) for the first time. PISA is an international survey that is conducted by Organization for Economic Cooperation and Development (OECD) which aims to provide information regarding performances in education across countries, particularly in Reading, Mathematics and Science through a special assessment. PISA is conducted every three years for groups of 15-year-olds in both OECD and non-OECD countries. Unfortunately, Malaysia showed poor performance in PISA 2009, as it was ranked the bottom third in the overall ranking. This indicates that Malaysian secondary education students are lacking in terms of higher order thinking skills (HOTS). The outcome of PISA 2009 has left a significant impact to Malaysia Ministry of Education (MOE) in improving the current national education system. In 2011, the MOE has launched Malaysia Education Blueprint which put greater emphasis on HOTS. This concept paper utilizes literature review for data collection. It will specifically discuss (1) various approaches outlined by the MOE in implementing HOTS in secondary education, (2) the on-going progress as well as (3) the feedbacks from the stakeholders on the implementation of HOTs.*

Keywords--- *Higher Order Thinking Skills (HOTS), 21st Century Learning Skills, International Student Assessment (PISA), Malaysia Secondary Education.*

I. INTRODUCTION

Malaysia education system has successfully accomplished sound reputation in its tertiary education. Universiti Malaya is ranked 70th in the latest QS World University Ranking 2020, followed by, Universiti Putra Malaysia, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia and Universiti Teknologi Malaysia with ranking of 159th, 160th, 165th and 217th respectively. There is no doubt that Malaysian higher education system has soared upwards and been recognized internationally [1].

However, in terms of primary and secondary levels of education, Malaysia struggle to perform and to be recognized globally [2]. There are numerous international surveys that have been conducted to provide information regarding performances in education across countries, internationally. Amongst the most well-known surveys are Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS). These three international surveys examine

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learning in Reading, Mathematics and Science as well as rank countries in order of their performances [3].

PISA was first conducted back in 2000 by Organization for Economic Cooperation and Development (OECD) and it is repeated every three years. It examines learners who are approaching the end of compulsory secondary education, i.e. 15-year-old students. It tests performance in Reading, Mathematics, Science and Problem Solving. Each year, the assessment will be focusing on one of these four areas [4,3].

1.1. Malaysia in PISA

Malaysia first took part in PISA assessment on 2009. Unfortunately, in its first participation, Malaysia was ranked the bottom third out of the total participating countries in the world [2,4]. The poor performance in PISA 2009 indicates that Malaysian students are weak in problem solving and higher order thinking skills [5,2,4]. Table 1.1 summarizes the Malaysia scores in PISA 2009 by subjects (i.e., Reading, Mathematics and Science). Malaysia scored 414 in reading, 404 in Mathematics and 422 in Science. The scores are far below the OECD average, 493 for reading, 496 for Mathematics and 501 for Science, resulting in the low ranking in the overall PISA performances.

Table 1.1: PISA Results in 2009 [2,4]

Scores	**Reading**	**Mathematics**	**Science**
PISA 2009	414 (493)	404 (496)	422 (501)
Malaysia Ranking in PISA 2009	56	52	50

*(*number in parentheses are the OECD average score*)

Table 1.2 demonstrates the comparison of Malaysia's scores in PISA 2009 to the developed countries such as Netherlands, United States and United Kingdom as well as Malaysia's neighbouring country, Singapore. It was revealed that Singapore outperformed Malaysia and even the other developed countries in PISA 2009. Singapore is scoring comparatively higher than the OECD averages and Netherlands, United States and United Kingdom scores in all three subjects. This indicates that 15-year-old Singaporean students manage to apply the knowledge in problem solving and decision making as well as engage in higher order thinking.

Table 1.2: Comparison of Malaysia's PISA Results in 2009 with Other Countries [4]

	Reading	**Mathematics**	**Science**
Mean score in PISA 2009 (OECD average)	**493**	**496**	**501**
Singapore	526	562	542
Netherlands	508	526	522
United States	500	487	502
United Kingdom	494	492	514
Malaysia	414	404	422

Adapted and modified from Source: OECD, PISA 2009 Database.

1.2. Transformation of Malaysia Education System: Post PISA 2009

Malaysia performance in PISA 2009 has been a wake-up call for Malaysia to review its education system. PISA 2009 has significantly impacted our education system. Therefore, starting from October 2011 until December 2012, Malaysia Ministry of Education carried out a comprehensive review on the existing education system to make a

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major transformation in education. As a result, the ministry has launched the Malaysia Education Blueprint (Preschool to Post-Secondary Education) (2013-2025). MEB has outlined eleven shifts to transform Malaysia education system. In the first shift, the ministry targets to provide equal access to quality education of international standard. In addition, the ministry would also like to ensure that every student is well-versed in both their national language, i.e. Bahasa, as well as English language. On top of that, they are encouraged to acquire additional language such as Mandarin or Japanese in other to compete with the global world. The Ministry also inspires to develop values-driven Malaysian with strong national identity, integrity, leadership and spirituality. This is consistent with National Education Philosophy that aims to produce harmonic and well-balanced students in terms of physical, emotional, spiritual and intellectual. The highlight of MEB is that it put great emphasis in 21st century learning, higher order thinking skills and character building rather than merely focusing on the students' academic achievements.

1.3. The 21st Century Learning

The 21st century learning framework emphasizes the importance of content knowledge in key subjects. The key subjects consist of 3Rs, which stands for Reading (e.g., English and foreign languages), wRting (languages and arts such as History and Geography) and aRithmatic (e.g., Science, Technology, Engineering, Mathematics). In terms of skills, the 21st century learning can be divided into three categories, (1) life and career skills, (2) learning and innovation skills, (3) information, media and technology skills [6].

Life and career skills consists of five key elements known as FLIPS, which stands for Flexibility, Leadership, Initiative, Productivity, and Social. Meanwhile, learning and innovation skills consists of four key elements known as 4Cs, which stands for Critical Thinking, Creativity, Collaboration and Communication. On the other hand, literacy skills consist of three key elements known as IMT, which stands for Information, Media and Technology. In short, the 3Rs act as an umbrella for the core and additional subjects, while the 4Cs are the essential skills needed to succeed in university, career and life. In order to equip the students with essential knowledge and skills for 21st century, the education system have to have standards and assessments, curriculum and instruction, professional development as well as learning environment which are tailored to the 21st century needs [6]. Therefore, MEB put emphasis on the two key elements which are HOTS and character building in ensuring students are capable to compete in this 21st century world.

Table 1.3: The Three Categories of Skills in the 21st Century Skills [6]

Learning & Innovation Skills (The 4C's)	**Digital Literacy Skills (IMT)**	**Career & Life Skills (FLIPS)**
Critical thinking	Information	Flexibility
Creative thinking	Media	Leadership
Communication	Technology	Initiative
Collaboration		Productivity
		Social interaction

1.4. Higher Order Thinking Skills (HOTS) in Malaysia Context

The 21st century learning skills emphasize more on the development of critical and creative thinking skills. Critical thinking skill helps an individual to solve problems, whereas, creative thinking skill helps an individual to

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generate fresh and authentic ideas as well as to be able to think outside the box. It is predicted that 21st century world has a very high demand for creative thinkers and critical problem solvers [7]. In the Revised Bloom's Taxonomy [8], a revised version of multi-tiered model of classifying thinking processes according to the level of cognitive complexity which was first developed by Bloom (1956), there are six levels of cognitive processes. The lowest three levels, which also known as Lower Order Thinking Skills (LOTS) consist of remembering, understanding and applying. Meanwhile, the highest three levels, which also known as Higher Order Thinking Skills (HOTS) consist of analysing, evaluating and creating [8,9].

The Ministry has outlined seven components in implementing HOTS in Malaysia education system. The three main components are curriculum, pedagogy and assessment; while the other four components which are co-curriculum, community and private supports, capacity building and resources, are considered as the supporting elements [10]. In terms of curriculum, the ministry has come out with revised curriculum known as KSSR (for elementary school) and KSSM (for secondary school) which promote and enhance the development of HOTS in learning process. In terms of pedagogy, teachers are trained to use effective approaches and thinking tools. In 2012, the Ministry has launched i-THINK program. i-THINK program is inspired by The Thinking Schools International (Kestrel Education, UK). i-THINK program is a practical approach to inculcate higher level thinking processes in teaching and learning methods amongst teachers and students by using thinking maps developed By David Hyerle. In this program, teachers and students are trained to use effective thinking strategies and tools to develop their HOTS. It involves learning a few key thinking concepts such as Thinking Maps, Habits of Mind, Thinking Hats and Q-Matrix Charts [11,2].

In terms of assessment, the ministry has refined the standard of assessment in evaluating the development of HOTS among students (from preschool level to Form 5 level). In assessing HOTS, the ministry incorporated the elements of HOTS in both school-based as well as national examinations assessments. In school-based assessments, School Assessment (PS), Central Assessment (PP), Psychometric Assessment (PPsi) as well as Sports and Curriculum Assessment (PAJSK) are implemented [12]; while in national examinations such as UPSR and SPM, the percentage of HOTS questions are increased gradually across the years as shown in the following table 1.4: -

Table 1.4: The Increment of Percentage of HOTS Questions in UPSR and SPM from 2013- 2016 [12]

Percentage of HOTS Questions	**2013**	**2014**	**2015**	**2016**
UPSR	10%	20%	30%	40%
SPM	10%	20%	30%	50%

In addition, the ministry also provided the manual and guidebook to help teachers to construct HOTS questions based on the HOTS items and constructs. The example of construct includes stimulus, non-repeated item, real-life context and various cognitive level [13]. In terms of co-curriculum, the ministry has introduced a toolkit for decision making and problem solving and encouraged the students to involved in 1Student 1Project (1M1P) [14]. 1M1P involved students starting from Year 4-6 students (in elementary schools) and all Form 1-5 students (in secondary school). The Year 4-6 students have to work collaboratively in smaller groups and each group is required to produce a project within the three-year-period. Meanwhile, the Form 1-5 students have to work individually to produce a project within the five-year-period [14].

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Next, in terms of community and private supports, the ministry has provided various platforms for community and private bodies to implement and enhance HOTS in schools by introducing the adopted school concept. In this system, private companies adopt selected schools and provide financial support, expertise and skills to the students. *Pintar Foundation*, *ASTRO*, *Bank Negara* and *Khazanah Nasional* are the examples of private and government agencies that involve in this adopted school program [15]. In addition, in terms of capacity building, the ministry provided professional development trainings to boost teacher's competency in HOTS. Examples are internal training (school level), mentoring program with colleagues and experts as well as online exercise (e-learning) [16]. Furthermore, in terms of resources, the ministry provided structured materials such as textbook, digital resources, *EduWeb TV* as well as *Frog VLE*. In fact, teachers also provided the unstructured materials such as newspaper cut, journal, video, audio and website needed for teaching and learning processes [17].

II. METHOD

This study utilized a systematic document analysis technique which is under one of the branches of qualitative method. This was seen to be a suitable method as this study analysed a collection of data as defined by the following:

"Document analysis is just what its name implies – the analysis of the written or visual contents of a document. Textbooks, essays, newspapers, novels, magazine articles, cookbooks, political speeches, advertisements, pictures – in fact, the content of virtually any type of written or visual communication can be analyzed in various ways. A person's or group's conscious beliefs, attitudes, values, and ideas are often revealed in the document they produce."

(Fraenkel dan Wallen, 1993)

Qualitative data in descriptive form, pertaining human behaviour or current events (Taylor dan Bogdan, 1984; Jasmi, K. A. 2012) are issues related to HOTS in Malaysia education which have given impact to the teachers' and students' behaviour. Therefore, this research employed references like journals, books, articles, seminars, and research articles on HOTS. After data from different resources were collected, they were analysed and served as reference for this research and hope to assist future researches as well.

III. RESULT & DISCUSSION

From the paper found on the topic of implementation of HOTS in Malaysia, it can be seen that teachers play a vital role in implementing HOTS although the ministry has come out with many efforts and initiatives in implementing HOTS. This is because teachers are the ones who execute the plans in the real education settings. Therefore, it is very important to explore and investigate the teachers' perception in implementation of HOTS in classroom.

In one study, Sulaiman[18] did a qualitative study to explore the Science teachers' perceptions in the implementation of HOTS in classroom in terms of the application, assessments and the constraints. The three participants were from various types of school; government public school, private school and private tuition center. Based on the interview, it was found that all teachers reported high awareness in the needs of implementing HOTS in classroom. However, teachers mentioned that the constraints that hinder the HOTS implementation were the mastery of content knowledge and pedagogical content knowledge.

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According to Kamarudin et al.[19], it was found that most of the teachers showed little concern on the implementation of HOTS in teaching and learning processes especially among teachers with age range of 40-59 years old. More senior teachers tend to stick to their traditional way of teaching as they have been used to it for years. Therefore, they did not feel the need to change their teaching styles. In addition, it was found that some teachers were too worried of academic performance and achieving good grades. Therefore, they tend to teach the students ways to successfully pass the subject instead of having proper understanding of the content knowledge and its application. Lastly, Kamarudin et al.[19] found that most teachers reported that they didd not know how to infuse HOTS in their teaching method as they themselves have not acquired HOTS.

Apart from that, Abdul Aziz et al.[5] also did a qualitative study on 140 English teachers in 48 regular government-funded secondary schools, Johor to investigate the English language (L2) teachers' awareness and practices in promoting HOTS in English Language classrooms in Malaysia. The researchers also wanted to investigate the practices and challenges in the implementation of HOTS in the L2 Malaysian classroom. Based on structured observation in the classrooms, it was found that, out of 928 academic questions asked by the teachers in the total of 1,550 minutes English lesson, only 4% of the academic questions triggered students' curiosity and stimulated their thinking processes, while the remaining 96% of the academic questions asked was considered low level questions, which only require literal and surface information without having to think critically. In addition, the researchers revealed only 25% of the verbs used in classroom triggered higher order thinking skills, while 55% of the verbs used by the teachers in classroom only triggered lower order thinking skills, and 20% of the verbs used were considered as ambiguous questions as those verbs only require students to follow orders (i.e., read the text, write the sentences). This showed that the teachers were having difficulty in stimulating students' thinking process.

On top of that, based on the interview with the teachers, Abdul Aziz et al.[5] found that there were three factors that made the implementation of HOTS became more challenging for the teachers; which are student, pedagogical and institutional factors. For student factor, the teachers reported that teaching in regular public secondary schools were challenging as the students have not even reached the basic proficiency level. Therefore, the teachers were not confident to include HOTS elements in the classroom as the students did not even acquired the LOTS and basic skills for that subject. Meanwhile, for the pedagogical factors, most of the teachers reported their hesitancy in applying HOTS in classroom because of their own limitation in terms of planning, implementation and assessing HOTS in English classrooms, especially when they have student with various proficiency levels. If they were to ask any HOTS questions, it often be that the same high-achieving students who would be answering the questions while the rest of the class would keep silent. In terms of institutional factor, teachers reported that large class size and time constraints were the factors that hinder them from applying HOTS in classrooms. They could not facilitate all of them as the student to teacher ratio was too large. To make things worse, teachers are required to complete the syllabus within a certain time period. Since the implementation of HOTS seem to consume more time, they refused to apply it and opted to stick with their existing teaching methods instead. In conclusion, it can be seen that challenge in implementation of HOTS in school can be divided into two part which were internal and external factors from teacher's perspectives and these factors were summarize in chart 1.1.

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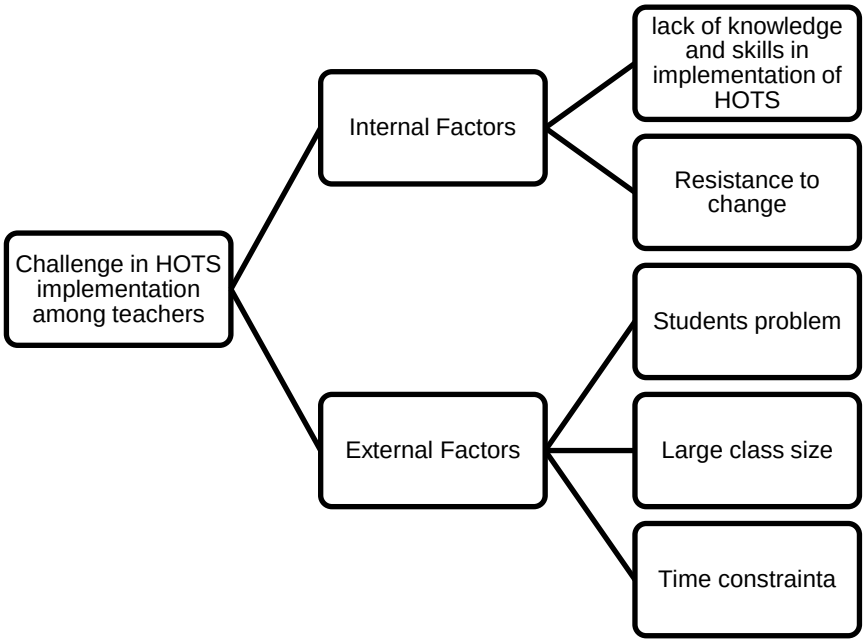
Chart 1.1: Challenge in Implementation of HOTS in School



IV. CONCLUSION

In conclusion, although various plans and initiatives in applying HOTS in classroom has been done by the government, there is more room for improvement. This paper would recommend the development of modules/approaches that guide teachers on how to apply HOTS in their specific subjects based on Malaysia standard syllabus. It is important to take into account the reality of Malaysia education setting, i.e big class size, diverse learners and limited teaching period; in applying HOTS.

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