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PERCEPTIONS OF MATHEMATICS TEACHERS ON SCHOOL-BASED ASSESSMENT USING Q-METHODOLOGY APPROACH

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BY

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

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

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LIM CHING YEE

December 2014

Chairman : Associate Professor Rohani Ahmad Tarmizi, PhD
Faculty : Institute for Mathematical Research

This study explored the views of Malaysian lower secondary school mathematics teachers who were the implementers of a new assessment reform, School-Based Assessment (SBA). Teachers are crucial implementers and main change agents for any new innovation. Therefore, teachers perceptions may have an impact on underpinning the success or failure of the educational reforms. Furthermore, many studies related to SBA have been conducted on other subjects but none was found pertaining to mathematics teachers. Therefore, there is a research gap pertaining to mathematics teachers' perceptions on SBA.

Fullan's Educational Change Model were adopted and provided as the theoretical base for this study. Q-methodology was employed due to its appropriateness and relevant means of exploring human subjectivity such as perception.The procedures of the methodology include collecting concourse, developing Q-sample, identifying P-set, conducting Q-sort as well as analysing data. There were 72 Form One and Form Two mathematics teachers who were volunteered to participate in this study. Each participant was required to rank 44 statements about the implementation of SBA according to how closely the statements align with their personal beliefs, experience and perceptions.

Factor analysis was performed to identify the commonalities and patterns in their perceptions. Three significant factors were revealed from PQMethod analyses, namely: *Relevance and Complexity*, *Readiness and Resources*, *Readiness and Complexity*. Three factors extracted represented the different perceptions of three groups of mathematics teachers. Firstly, 57% of teachers did not acknowledge the benefits and advantages that SBA can bring to them and their students, teachers also found it was complex. The second emerging factor was *Readiness and Resources*, whereby, 18% of the teachers were ready and committed towards SBA, however, lack of resources had demoralised their spirit. The third factor, *Readiness and Complexity*, whereby, 25% of teachers perceived lack in readiness and preparation thus found that SBA was complex to handle in their classes.

The findings drawn from this study might provide some insights to Malaysian government to explore more practical options to implement better assessment. Malaysian teachers are more willing to accept the changes when they discovered that there are positive changes which can benefit them and their students.

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

PERSEPSI GURU MATEMATIK TERHADAP PENTAKSIRAN BERASASKAN SEKOLAH MENGGUNAKAN PENDEKATAN KAEDAH-Q

Oleh

LIM CHING YEE

Disember 2014

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Kajian ini menerokai pandangan guru matematik sekolah menengah rendah terhadap pembaharuan pentaksiran yang dikenali sebagai Pentaksiran Berasaskan Sekolah (PBS). Guru merupakan pelaksana yang penting bagi setiap pembaharuan. Justeru itu, persepsi guru memberi impak dalam penentuan kejayaan sesuatu pembaharuan dalam pendidikan. Tambahan pula, kajian mengenai PBS telah giat dijalankan dalam subjek lain namun tidak bagi matematik. Maka, wujud peluang kajian mengenai persepsi guru matematik dalam pelaksanaan PBS.

Model perubahan pendidikan daripada Fullan telah diterapkan sebagai asas kerangka konsep dalam kajian ini. Kaedah-Q telah digunakan dalam kajian ini kerana kesesuaian kaedah-Q dalam menerokasi pandangan bersifatkan subjektif. Prosedur Kaedah-Q adalah seperti: mengumpul '*concourse*', menghasilkan '*Q-sample*', mengenalpasti '*P-set*', menjalankan '*Q-sort*' dan menganalisis data. Terdapat 72 guru matematik Tingkatan Satu dan Tingkatan Dua telah mengambil bahagian dalam kajian ini secara sukarela. Setiap guru dikehendaki untuk menyusun 44 penyataan yang melibatkan pelaksanaan PBS berkait rapat dengan kepercayaan peribadi, pengalaman dan persepsi mereka.

Analisis faktor telah dijalankan untuk mengenalpasti persamaan persepsi guru. Tiga faktor yang signifikan telah dianalisa dengan program '*PQMethod'* dan faktor dinamakan sebagai '*Relevance and Complexity*', '*Readiness and Resourcess*' dan '*Readiness and Complexity*'. Faktor yang dikenalpasti mewakili persepsi guru matematik dari tiga kumpulan yang berasingan. Terdapat 57% guru tidak mengakui manfaat dan kelebihan PBS, kumpulan ini juga mendapati bahawa pelaksanaan PBS adalah sukar. Faktor kedua adalah '*Readiness and Resources*', terdapat 18% guru telah bersedia dan komited dalam pelaksanaan PBS namun kekurangan sumber yang dibekalkan telah mematahkan semangat mereka dalam melaksanakan PBS. Faktor ketiga adalah '*Readiness and Complexity*', terdapat 25% guru matematik menegaskan bahawa mereka masih tidak bersedia terhadap pelaksanaan PBS, mereka mendapati pelaksanaan PBS dalam kelas adalah sukar.

Hasil penemuan kajian ini dapat memberi sedikit pandangan kepada pihak kerajaan Malaysia agar melaksanakan perubahan yang ketara dalam melaksanakan pentaksiran yang lebih baik. Guru Malaysia adalah lebih bersedia untuk menerima perubahan apabila mereka mendapati bahawa sesuatu perubahan yang positif dapat memberi manfaat kepada mereka dan pelajar mereka.

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

I certify that a Thesis Examination Committee has met on 15 December 2014 to conduct the final examination of Lim Ching Yee on her thesis entitled "Perceptions of Mathematics Teachers on School-Based Assessment using Q-Methodology Approach" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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LIST OF ABBREVIATIONS

AAT	Academic Aptitude Test
AFL	Assessment for Learning
AOL	Assessment of Learning
BCA	Basic Competency Assessment
BKP	Curriculum Development Centre
CENT	Centroid Analysis
CSD	Curriculum Standard Document
CTL	Contextual Teaching and Learning
DSP	Performance Standard Document
EMB	Education and Manpower Bureau
EPRD	Educational Planning and Research Department
HKCEE	Hong Kong Certificate of Education Examination
HKEAA	Hong Kong Examinations and Assessment Authority
IEA	International Association for the Evaluation
JPNS	Selangor State Educational Department
KBSR	New/ Integrated Curriculum for Primary School
KBSM	Integrated Curriculum for Secondary Schools
KSSR	Standard-based Curriculum for Primary School
KSSM	Standard-based Curriculum for Secondary School
MES	Malaysian Examinations Syndicate
MOE	Ministry of Education
NBE	National Board of Education
NKRA	National Key Result Area
NZQA	New Zealand Qualifications Authority
OECD	Organisation for Economic Co-operation and Development
PAJSK	Assessment of Physical, Sport and Co-curricular Activities
PCA	Principle Components Analysis
PISA	Programme for International Students Assessment
PKBS	Standardised Common Assessment Tasks
PMR	Lower Secondary Assessment
PP	Centralised Assessment
PPPM	Malaysia Education Development Plan
PPsi	Psychometric Assessment
PS	School Assessment
QSA	Queensland Studies Authority
SBA	School-based Assessment
SBOA	School Based Oral Assessment
SPM	Malaysian Certificate of Education
SPSS	Statistical Package for the Social Sciences
SQA	Scottish Qualifications Authority
SPPBS	School-based Assessment Management system
SPPK	National Education Assessment System
STPM	Malaysian Higher Education Certificate Examination
TIMSS	Trends in International Mathematics and Science Study
UPSR	Primary School Achievement Test

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Public examinations normally come at the end of a school term after a long period of instruction and its purpose is to evaluate the students' response to the instruction (Chistie & Forrest, 1981). In the past few decades, examination oriented culture has firmly embedded in most countries such as Hong Kong, Singapore, China and others; evidently many teachers still have strong reliance on traditional methods of assessment such as tests, quizzes and examinations (Yung, 2012; Ohlsen, 2007). Malaysia is also one of the countries that practiced examination oriented educational system since independence (Chan & Gurnam, 2011).

The examination oriented education system distorts motivation and corrupts the learning process by over emphasising the importance of scores as outcomes and measures of students' abilities (Murphy & Torrance, 1988). In this manner, teachers tend to focus only on contents and skills that will be tested in the public examinations. Both teachers and students are not interested in exploring new knowledge or skills which are not within the syllabus and not tested in the examination (Lim, 2006). Furthermore, it is common for school principals to use students' performance as a yard stick to determine and evaluate the teaching competency of a teacher. Consequently, this has reinforced teachers' belief that the priority in education is to ensure students achieved excellent results and pass in the examination (Lim, 2006). Therefore, many teachers prepared students to get through the public examination by drilling them with past years papers and testing them relentlessly. Most of the teaching contents are focused on meeting the requirements of the examinations and this has defeated the real purpose of assessment (Berry, 2011a) . Further to that, students learn because of the extrinsic motivation of achieving a good grade rather than intrinsic motivation of acquiring mastery knowledge. Moreover, students are taught to score in examination without much underlying learning (Lim, 2006).

In addition, the public is also influenced by this culture and only recognise the capable students as those who scored the most number of "A"s. Consequently, other affective characteristics such as attitudes and values, which are also imperative components in developing well-rounded students with respect to intellectual, emotional, spiritual, and physical development subject to the National Education Philosophy, are irrelevant in this context (Ong, 2010). Hence, the purposes of learning have been distorted and the rigid format in examination has failed to produce and develop creative and critical thinking students in learning mathematics.

The overemphasis in examination and grades has created an unhealthy culture in the learning environment which caused adverse effect to the learning process. In time, people became aware of the problems of high-stakes and examination oriented culture. Thus, most countries have embarked on the educational reform and there have been waves of assessment reforms around the world. There are signs of growing recognition on assessment for learning (formative) agenda. The highlights of this agenda are i) reducing excessive use of tests and examinations, ii) using

assessment to understand and support learning, and iii) using student information to improve teaching and learning (Berry, 2011b).

1.1.1 Mathematics Education in Malaysia

Since independence, Mathematics is a compulsory subject at all levels in Malaysian schools. It is taught from Year One to Year Six in the primary level and Form One to Form Five at the secondary level.

The mathematics curriculum in Malaysia has undergone some significant changes. These changes include content transformation from traditional mathematics emphasising mainly on computation skills to Modern Mathematics Programme (MMP). MMP was introduced in early 70's in both primary and secondary schools with the main aim to bring in some 'modern topics' into the curriculum. MMP focused on an understanding of concepts rather than attaining computational efficiency. During the implementation of MMP, teachers were encouraged to use the inquiry method in teaching and students were exposed to the processes of mathematics to produce certain results in mathematics. This programme was funded by the Asian Foundation and advised by American Peace Corps members who were the invited advisers.

In the 80's, content of mathematics curriculum experienced another major revamp from primary level right up to upper secondary level in all Malaysian national schools. Following the global trends on "students-centered learning" and the philosophy of an "all-rounded development of the individual", the New Curriculum for Primary School (KBSR) was implemented to replace Modern Mathematics Programme in 1983. KBSR in mathematics emphasised on the acquisition of basic skills and knowledge through direct experiences, encouraging active involvement of students in various learning activities, using a variety of instructional materials and practicing a variety of students' groupings (Lee, 2002). The mathematics syllabus in KBSR was divided into two levels: Level One (Year One to Year Three) and Level Two (Year Four to Year Six). Level One emphasised on mastery the basic concepts of numbers and four basic operations whereas Level Two emphasised on application of basic skills in solving mathematics problems. KBSR in mathematics was aimed to provide an equal opportunity for all students to acquire knowledge, skills, attitudes, rules, and desired common social practice in society.

In 1989, KBSM (Integrated Curriculum for Secondary School) was introduced as a continuation of curriculum reform efforts at secondary level. The main aim of the mathematics KBSM was to develop individuals who are able to think mathematically, and able to apply mathematical knowledge in real-life contexts. Related to this, the content of the curriculum is arranged to the common occurrence in our daily lives specifically in three areas: Numbers, Shapes and Relations, and Space (Curriculum Developement Centre, 2004). Several aspects of mathematics are emphasised in secondary mathematics curriculum. These aspects are: (a) The balance between understanding of concepts and the mastery of basic skills, (b) The use of mathematics in real-life situations, (c) The development of problem solving skills, (d) The appreciation of history of mathematics, and (e) Human spiritual and societal values inherent in the subject (Bishop, 1991).

The mathematics curriculum underwent a total review in 2001. As a result, in 2003, the teaching and learning of Mathematics in English (PPSMI) was implemented starting with Primary One, Secondary One and Secondary Lower Six and was to progressively encompass all other levels which was to be completed by 2008. In delivering Mathematics education in English, Information and Communication Technology (ICT) is expected to be extensively used. Further, studying mathematics in English median assisted by ICT will provide greater opportunities for students to enhance their knowledge and skills.

In 1993, Integrated Curriculum for Primary School (KBSR) was introduced to replace New Curriculum for Primary School. It is aimed to produce students with critical thinking skills, communication skills, collaborative and creative thinking skills. Currently, there was another mathematics curriculum reform in primary schools, KSSR (Standard-based Curriculum for Primary Schools) was introduced in place of KBSR in 2011. The purpose of this reform is to cater all students irrespective of their social background, and provide them a chance to discover their abilities, especially those with special needs. KSSR also designs to enrich the creativity and thinking capabilities of the students and teachers. According to Ministry of Education (MOE), KSSR will only be implemented fully in 2016 where Year Six students will only be evaluated based on their overall performance and participation in the classroom rather than public examination results. However, 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, 2012a).

The change at both primary and secondary levels is in line with the philosophy and goals of mathematics education. The syllabus is designed to strike a balance between skills and understanding of current mathematics education. Although the educational change as well as curriculum reform is a complex process, it can be simplified through a few powerful theories and models in educational change such as Fullan's Educational Change Model, Diffusion of Innovation (DOI), Concern-based Adoption Model (CBAM) and so on. These models will be further explained in Chapter 2.

1.1.2 Malaysian Mathematics Examination System

The Malaysian educational system provides 11 years of free compulsory education to every child in the country. Every student has to go through six years of primary education, three years of lower secondary education and two years of upper secondary education. Like many countries in the world, Malaysia so far has solely focused on the public examination results to determine students' performance and progression to higher level of education. There are three major public examinations throughout the 11 years of schooling.

After completing six years of primary education, students need to sit for Primary School Achievement Test (*Ujian Penilaian Sekolah Rendah*, UPSR). Subsequently, students sit for Lower Secondary Assessment (*Penilaian Menengah Rendah*, PMR) after completed three years of study in lower secondary school. After another two years of study, students will then sit for Malaysian Certificate of Education (*Sijil Pelajaran Malaysia*, SPM) or equivalent to GCE 'O' Level examination to conclude

their 11 years of schooling. Nevertheless, SPM is the most decisive examination in Malaysia. Students have the options to either further their post-secondary education in Form Six or matriculation, private colleges or universities locally or overseas based on their SPM results. However, if students were accepted to continue study in Form Six, they have to sit for Malaysian Higher Education Certificate Examination (*Sijil Tinggi Pelajaran Malaysia*, STPM) or equivalent to GCE 'A' Level examination after two years of study. Lately, STPM has become an entrance yardstick into local or private universities (Kementerian Pendidikan Malaysia, 2013).

In Malaysia, public examinations are normally based on norm-referenced rather than criterion-referenced tests. Therefore, the passing mark for every public examination is set according to the performance of the norm and not individual students. Consequently, the examination results published tend to reflect the norm rather than the real ability and students' actual performances (Lim & Zhao, 2005). Moreover, students with excellent results in public examinations are highly valued and offered scholarship by government or multinational organisations. Therefore, public examinations become progressively high-stake in the eyes of students and public (Cheah, 2010).

In addition, mathematics is taught as one of the compulsory subjects (core subjects) throughout 11 years of education. Further, it is also a compulsory passing subject in all Malaysia major public examination as mentioned above. With regard to this, it is highly competitive for the students to enter into residential schools, control schools or high performance schools during their secondary years. Therefore, student's achievement in mathematics has a great impact towards the overall performance especially in public examination. Table 1.1 shows the components of mathematics in public examination UPSR, PMR and SPM.

Table 1.1. The Components of Mathematics in Public Examination UPSR, PMR and SPM

Component		Distribution of Marks		Duration
UPSR	Paper 1 (40 Objective Questions)	40	100%	1 hour
	Paper 2 (20 Subjective Questions)	40		40 min
PMR	Paper 1 (40 Objective Questions)	40	100%	1 hour 15 min
	Paper 2 (20 Subjective Questions)	60		1 hour 45 min
SPM	Paper 1 (40 Objective Questions)	40	100%	1 hour 15 min
	Paper 2 (16 Subjective Questions)	100		2 hour 30 min

Beside public examination, school assessment also constitutes a major part of mathematics teaching and learning in most Malaysian schools at all levels (Lim, 2010). Since primary school, summative tests are often perceived to be more important than formative test in mathematics (Cheah, 2010). Students are assessed in

school with monthly tests and end of term test. Majority of secondary schools require students to sit for at least three sets of tests throughout a year. Students have to sit for first monthly test in March or earlier, Midyear Examination in May (before midterm school holidays in June), second monthly test is usually held in August and Final Examination is in October (before schools end for that particular academic year). Since there are two semesters in one academic year and each semester consists of 20 to 22 weeks, the amount of time spent for summative assessment is quite substantial as each test is scheduled with at least one week for revision, one week for conducting the test and one week for discussion. This phenomenon has been sustained for quite a long time in the Malaysian Educational System.

1.1.3 Assessment Reform in Malaysia

According to Yu (2009), students' generic skills are inadequately measured by the current examination system. Thus, this matter is seriously taken into consideration and our government also noticed that current examinations system failed to produce all-rounded students either mentally or spiritually. Furthermore, the grading system adopted in Malaysia is only designed to permit for a few students to succeed; those at higher ranking are being recognised by the public whereas those at lower ranking are considered failure and this has caused many students to give up on their study or even drop out of school (Stiggins, 2005). Therefore, a proposals for a new assessment system based on Malaysian National Education Philosophy has been released in year 2007 by Malaysian Examinations Syndicate (MES) which focused on academic achievement, character development and involvement in extra-curricular activities (Ong, 2010). Since then, assessment reform has become one of the important plans and listed as one of the National Key Result Area (NKRA) agenda (Norzila, 2013).

In line with the Malaysian Education Development Plan to produce world-class human capital, the government of Malaysia has carried out a series of reforms to reduce the number and modify the format of public examination (Faizah, 2011). The MOE in Malaysia has put in continuous effort to reform teaching, learning and assessment. With the awareness and concern for future generation, MOE has introduced School-based Assessment (SBA) into Malaysian educational system to improve UPSR in year 2016 and to fully replace PMR in 2014. According to Stoll (2006), the ultimate purpose of educational change has to be benefiting the students. The purpose of this newly revised assessment is to ensure all students can learn and able to succeed. However, the format of SPM still remained the same, with most subjects assessed through national examinations and centralised assessments (Kementerian Pelajaran Malaysia, 2012b).

SBA is not new in Malaysia. It has actually started in 1997 and was commonly known as *Penilaian Kendalian Berasaskan Sekolah* (PKBS) or standardised common assessment tasks for certain subjects except mathematics. PKBS has been integrated under the New Integrated Curriculum for Secondary Schools (KBSM) in Malaysia (Kementerian Pendidikan Malaysia, 2001). For instance, PKBS in lower secondary levels involves oral reading test for English and Malay Languages, practical for Science and project work for subjects such as Integrated Living Skills, Geography, History and Religion Studies. Besides that, PKBS in upper secondary levels has

adopted 'PeKA' (*Penilaian Kerja Amali Sains*) for students who study science subjects such as Biology, Chemistry, Physics and General Science in year 2004 and School Based Oral Assessment (SBOA) for English and Malay language since 2002 (Kementerian Pelajaran Malaysia, 2012b; Chan, Gurnam, & Azleena, 2011). Some of the PKBS results were submitted to the MES for grading of external examinations.

Mathematics is a core subject compulsory for all students from Form One to Form Five. However, it was not incorporated as one of the subjects in integrated curriculum assessment system in 1997. However, under the new integrated curriculum (KBSM) a project-based assessment was introduced to Additional Mathematics which is only taken by a limited number of students who mostly studied in science stream. Project-based assessment in Additional Mathematics aims to produce individuals who are competent in science and technology and knowledgeable in solving real life problems (Faridah, 2006). On the other hand, credits obtained in Additional Mathematics project is not included in SPM examination results but students will obtain a certificate of appreciation after the completion of their project.

The newly implemented SBA has a slight difference compared to the previous PKBS. SBA better known by its Malay acronym PBS (*Pentaksiran Berasaskan Sekolah*) is a holistic form of assessment which assesses the cognitive, affective and psychomotor domains encompassing intellectual, emotional, spiritual and physical aspects. Other than to achieve the aspiration of the National Philosophy of Education towards developing learners' physical, emotional, spiritual and intellectual abilities; the rationales of introducing SBA into Malaysian Assessment System are as follows:

- to reduce examination oriented learning among learners.
- to evaluate learners' learning progress, striving to change from assessment of learning to assessment for learning.
- to enhance teachers' integrity in assessing, recording and reporting of learners' learning.
- to provides teachers with more regular information to take the appropriate remedial actions for their students (Kementerian Pelajaran Malaysia, 2012b).

SBA covered all the subjects learnt and is implemented across the whole primary and lower secondary curriculum. Moreover, SBA is a totally brand new assessment design for mathematics. In this new era of assessment reform, the initiative of SBA should be seen as an integral part of teaching and learning process, not form a separate activities (Berry, 2011c). Structure of SBA encompasses two main components namely academic and non-academic components. Components in academic area include School Assessment (PS) and Centralised Assessment (PP) whereby for non-academic area, it involves Psychometric Assessment (PPsi) and Assessment of Physical, Sport and Co-curricular Activities (PAJSK) (Kementerian Pelajaran Malaysia, 2012b). Further explanations regarding mathematics in SBA are discussed in Chapter 2.

1.2 Problem Statement

Like most of the developing countries, Malaysia has put in a lot of efforts to improve Mathematics and Science achievements to enable Malaysian students to compete globally. Unfortunately, it has been reported that the mathematics performance in the country has dropped in recent years. According to the report presented by International Association for the Study of Educational Achievement (IEA), mathematics achievements for Malaysia in international exam such as the Trends in International Mathematics and Science Study (TIMSS) which is held every four years showed a significant decline either in ranking or average score for mathematics (Mullis, Martin, & Foy, 2012). In TIMSS 2011 assessment, Malaysia achieved the ranking of 26 out of 45 countries compared with the ranking of number 20 in year 2007. Furthermore, average scores gathered by Malaysia participants were 440 in year 2011, drop from 474 in year 2007 which was also below the mean score of 500 (see Table 1.2). This situation has become a major issue debated in parliament and the ministry is hard pressed to find ways to avoid this from occurring again in the near future (Kementerian Pelajaran Malaysia, 2012c).

Table 1.2. Malaysia's TIMSS Ranking and Average Scores in Mathematics from 1999 to 2011

Subject/ Years	1999	2003	2007	2011
Ranking	16	10	20	26
Average Scores	519	508	474	440

(Source: IEA, 2011)

On top of that, results of the Programme for International Students Assessment (PISA) showed that mathematics achievement for Malaysia is in the 57 placing among 74 participating countries and Malaysia is far behind some other Asian Countries (Kementerian Pelajaran Malaysia, 2012c). More critically, 60% of 15-year old Malaysian participations failed to meet the minimum skill levels in mathematics (Kementerian Pelajaran Malaysia, 2012c). Malaysia is considered at the bottom group compared to Organisation for Economic Co-operation and Development (OECD) and international average (Table 1.3).

Table 1.3. Comparison between the Mathematics Achievements in PISA within the Countries in 2009

Position	Country	Mean Score
1	Shanghai-China	600
2	Singapore	562
3	Hong Kong	555
4	Korea	546
5	Taiwan	543
20	Australia	496
52	Thailand	419
57	Malaysia	404
	***International Average**	**458**
	***OECD Average**	**496**

The results were unexpected and very disappointing. Post-mortem showed that one of the factors was due to the lack of critical thinking and higher order thinking skills among Malaysian students as a result of an examination oriented educational system (Kementerian Pelajaran Malaysia, 2012c). Thus, the present teaching and learning of mathematics as well as assessment system need to be revised. However, it is acknowledged that figures only give a brief picture regarding students' performance. There are more critical aspects to look into to enhance the quality of education. Those aspects include students' spiritual, emotional and physical growth. It is also a fact that students who do not master the core intellectual skills such as literacy and numeracy, as well as higher order thinking skills, will have less chance to succeed in a rapidly changing economy as well as to compete in today's global society (Susuwele-Banda, 2005). Further to that, SBA was introduced into primary school Year One students in 2011 and for the secondary Form One students in the subsequent year. Introduction of SBA has changed the traditional assessment practices towards more formative type of assessment (Kementerian Pelajaran Malaysia, 2012b).

Due to the paradigm shift of assessment reform initiatives, it has triggered different responses. Many mathematics teachers heavily criticized on the implementation of SBA. Some claimed that SBA system is killing teachers' passion in teaching and learning (Koya, 2013; Habisah, 2013; Siti, 2013; Azwin, 2012). Moreover, some argued that without examination, students will not take the subjects seriously (Yu, 2009). This issue also leads to the problem of teacher's integrity, instruments validity and reliability as well as fairness in conducting SBA (Stillman, 2001). Furthermore, Faizah (2011) raised issues concerning the reliability of data on students performances gathered from non-traditional assessment compared to invigilated written test. Thus, the introduction of SBA has caused wide spread reverberations among the stakeholders.

Educational change as well as assessment change depends on what teachers do and think (Fullan, 1991). Teachers at the grassroots level play an important role in the implementation of new curriculum initiatives and teachers are the invisible hands that turn vision into action (Tan, 2010; Rogers, 1983). This is also in accordance with Fullan's (1993) views whereby teachers are crucial implementers and main change agents for any new innovation. To establish good assessment practices in classrooms, it requires most teachers to make significant changes (Black, Harrison, Lee, Marshall, & William, 2003). However, teachers are likely to resist change because it is human nature to prefer routines that they are more comfortable with than to attempt change or trigger the unknown unless they are convinced that the change will significantly benefit themselves and their students (Ornstein & Hunkins, 2009; Christou, Eliophotou-Menon, & Philippou, 2004). Since teachers are playing an important role in implementing SBA in school, thus, it is important to explore teachers' subjective world and to recognise their negative working conditions so as to understand problems in the assessment reform.

On top of that, the study of perceptions has attracted a great deal of interest (Christou et al., 2004). Moreover, most of the studies were conducted to investigate School-based Oral English Assessment or other subjects. There were limited studies on SBA in mathematics especially in mathematics teachers' perceptions on current

assessment reform in mathematics SBA (Faizah, 2011; Li, 2010; Malakolunthu & Sim, 2010; Mei & Evelyn, 2009; Hamzah & Paramasivan, 2009; Lam, 2006). Therefore, there is a need to research and to examine teachers' perception on new assessment method in mathematics. This view is in line with Remesal (2011) who opines that teachers' perceptions must be properly recognised because it underpins the success or failure of an innovation. Otherwise, teachers will maintain their hidden agendas in the classroom and the implementation process will result in a self deceiving public exercise of educational reform. Furthermore, it is also to avoid the implementation of SBA being carried out for the sake of fulfilling the administrative directives (Hamzah & Paramasivan, 2009). According to Malakolunthu & Sim (2010), the aims of SBA could be achieved well with proper policy implementation strategies. Thus, understanding teachers' perceptions towards an assessment is crucial for any attempt to develop a better policy and practices on school-based assessment (Kyriakides & Campbell, 1999).

1.3 Purpose of the Study

The purpose of this study is to examine views or perspectives of mathematics teachers on SBA issues in teaching and learning mathematics. Specifically, the study sought to determine the factors that influence teachers in conducting SBA in their mathematics classrooms.

The specific objectives of this study are as follow:

i. To determine the main emerging factors perceived by mathematics teachers on school-based assessment based on Fullan's educational change model.
ii. To identify general perspectives or perception of lower secondary mathematics teachers on the implementation of school-based assessment (SBA).
iii. To ascertain the relationship between the identified factors.
iv. To determine the association between demographic characteristic with teachers perceptions on the implementation of SBA.

1.4 Research Questions

Research questions investigated for this study are:

i. What are the main emerging factors perceived by mathematics teachers on school-based assessment in initiation and implementation stages based on Fullan's educational change model?
ii. What are the general perspectives or perceptions of lower secondary mathematics teachers on the implementation of school-based assessment (SBA)?
iii. What are the relationships between the identified factors?
iv. What is the association between demographic characteristics with teachers' perceptions on the implementation of SBA?

1.5 Significance of the Study

This study is imperative to provide some insights on the implementation of SBA in mathematics teaching and learning. The findings of this study are meant to provide feedback and could be referred by the MOE. The recommendations of this study help

to highlight essential suggestions for more effective implementation of SBA in Malaysian assessment system. A well-planned policy will lead to a successful implementation. When there is an innovation in the educational system, government expects the innovation will bring an encouraging result and benefit to the stakeholders such as teachers, students, as well as parents. Based on the findings, the MOE will be aware of the teachers' perceptions regarding SBA and make necessary improvement to avoid failure or waste of money, time and energy due to failure in planning and implementing SBA. Furthermore, with contribution from this study, it is hoped that MOE will provide appropriate supports and make essential modifications in order to facilitate a smooth expansion of SBA as an official component into other curriculum areas.

The study also depicts local mathematics teachers' perceptions of SBA, a deep understanding of mathematics teachers' perceptions towards SBA in classrooms may also provide some insights, reflection of valuable experience and significant implication in carrying out SBA for other subjects. It is envisioned that the findings of this study can be used to develop a better assessment system in Malaysia.

Through this study, it is hoped that the findings may also contribute some useful points and provide different dimensions to the existing literature in a unique way from teachers' perspectives by using Q-methodology to describe participants' subjective views about their professional roles. This study also explored a new method (Q-methodology) of conducting educational research especially in Malaysia. Q-methodology provides a foundation for a systematic study of subjectivity. It is a tool that combined both qualitative and quantitative methods to investigate the subjective view of those directly involved in this research topic. Thus, this study is a breakthrough in local educational research and can be one of the references for Malaysian researchers who are interested in Q-methodology approach. Nevertheless, it also fills the gap for a general absence of literature on the study of secondary school mathematics teachers' perceptions on SBA in Malaysia. It can be a rich source of information or guideline for other researchers, teachers or education practitioners who involved in educational reform.

1.6 Limitation of the Study

This study concentrates on investigating the perceptions of mathematics teachers who have experience in handling SBA in school. This study used Q-methodology approach which includes quantitative method in factor analysis and qualitative method in collecting the Q-sort. The results of this study may not be generalized to other types of schools in other districts because of the small sample size. The participants of this study are limited to current Form One and Form Two mathematics teachers who teach in public secondary schools of Petaling Perdana District located in Selangor State. Petaling Perdana District is the largest district among the 10 districts in Selangor state. It has 43 public secondary schools which comprised a total of 290 Form One and Form Two mathematics teachers (Jabatan Pendidikan Selangor, 2013).

There are four components in SBA: Centralised Assessment (PP), School Assessment (PS), Psychometric Assessment (PPsi) and Assessment of Physical,

Social and Co-Curricular Activities (PAJSK). This study only focuses on School Assessment (PS) whereby mathematics subject in school assessment is planned, constructed, administered, examined, recorded and reported by mathematics teachers (Kementerian Pelajaran Malaysia, 2012b). It is different when compared to the rest of the components of SBA which are not conducted by subject teacher. Moreover, school assessment is a new trend of assessment reform (focus more on formative assessment) in mathematics and it is important to check on the teachers' view in this new implementation.

1.7 Definition of Terms

The definition of terms is defined as follows to avoid any confusion on the terminology utilised in this study.

School-based Assessment (SBA)
SBA is an assessment carried out by the schools as part of the teaching and learning process. Students are assessed by their subject teachers and their performances will be counted towards the end of each academic year (Yu, 2009). SBA refers to a new form of assessment system implemented in Malaysia and SBA is to fully replace the public centralised examination PMR in year 2014. There are four components in SBA: Centralised Assessment, School Assessment, Psychometric Assessment and Assessment of Physical, Social and Co-Curricular Activities. However, SBA in this study only focuses on school assessment which emphasises more on formative assessment.

Perceptions
Perception is a way in which an individual responds to any sense or impression which he or she detects (Rogers, 1983). In this study, perceptions refer to teachers' point of views towards two aspects of educational change which was adopted from Fullan's educational change model. The two aspects are categorised as Initiation and Implementation conditions. Initiation condition (the process and decision to adopt changes) related to three main factors of considerations: Relevance, Readiness and Resources whereas implementation condition (the process of putting into practices an idea for people attempting or expected to change) encompasses with four crucial factors: Clarity, Complexity, Support and Quality.

Initiation Condition

Relevance
Relevance involves factors such as the need, clarity and utility of an educational innovation (Stuckey, Hofstein, Mamlok-Naaman, & Eilks, 2013; Fullan, 1991). In this study, relevance refers to teachers' understanding about the change and their concern about the usefulness and advantages of an innovation for the students.

Readiness
Readiness generally indicates an openness or willingness to engage in a particular process or adopt a particular behaviour and represents a more focused and pragmatic view of motivation as preparedness (DiClemente, Schlundt, & Gemmell, 2004; Brummelhuis, 1995). In this study, readiness refers to the capacity of the teachers for

the change. Teachers have the desire and willingness or openness to adopt a particular change. Readiness also involves the availability of the prerequisite knowledge and skills at the individual teacher's level, essential for a successful implementation of SBA.

Resources
Resources refer to the support for adopting an educational innovation (Pitiyanuwat, 2007; Fullan, 1991). In this study, resources refer to the availability of trainings, technical support, equipment and appropriate materials that should be provided in accordance to the intended change. Resources are also concerned with the accumulation and provision of support as part of the initiation phase before the implementation of SBA.

Implementation Condition

Clarity
Clarity refers to how a particular innovation differs from what they are already doing (Ornstein & Hunkins, 2009; Fullan, 1991). In this study, clarity refers to teachers' thorough understanding of the principles and practices of SBA in the classroom and what is needed to be done to improve assessment during implementation phase. Teachers are supposed to be completely clear about their tasks in the classroom.

Complexity
Complexity refers to the difficulty of change, change can be quite challenging and implementers need to recognise the level of difficulty and take adequate measures (Fullan, 1991). In this study, complexity refers to the degree of which the implementation of SBA is perceived as difficult and challenging to be used in the classroom. These complexities might affect teachers' performance and should be taken into consideration.

Quality
Quality includes processes and activities designed to assure its communities about the quality of its activities. It also provides mechanisms to enable and facilitate continuous improvement, as well as provide the opportunity to systematically discover areas where new guidelines and innovation are required (Cother & Parnell, 2002; Newton, 1990). In this study, quality refers to the standards in maintaining and determining the quality of the implementation of SBA in accordance to the guidelines. It also encompasses quality assurance and quality improvement in SBA.

Support
Support refers to assistance provided by government especially state educational departments, school administrators and colleagues for teachers in school to ensure successful implementation of a programme or activity (Braun & Kanjee, 2006). In this study, support refers to assistance and help which include providing professional development, constructive feedback, encouragement, sharing and recognition the accomplishments during implementation of SBA.

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