SHIFTING MALAYSIAN PRIMARY SCIENCE TEACHERS' ASSESSMENT LITERACY FOR A WORLD CLASS EDUCATION

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Abstract : *One of the challenges for science teachers in the 21st Century is to ensure high standards in the process of student assessment. Assessment literacy is important because teachers spend up to 50% (Plake, 1993) of time in their profession assessing students. Assessment literacy does not only cover the technical aspects of testing but has moved on to encompass almost all interactions that teachers have with their students, school authorities and parents. This paper will describe part of bigger study conducted to ascertain the assessment literacy of selected Malaysian primary science teachers. Using qualitative data collection techniques such as teacher journals and interviews with five primary school science teachers, the findings showed that teachers' knowledge on assessment literacy stemmed more from the behaviourist perspective and that external examinations still dominated what drives teachers' ideas about their practices. It was also found that in-depth knowledge on how to conduct formative assessment practices were limited. The study indicated clear implications on how teachers would conduct their assessment practices in their classrooms and how their knowledge on assessment would affect their students' understanding of scientific concepts. Based on these findings, how primary science teachers' assessment literacy can be shifted to a world class level is put forward.*

Keywords: *Assessment literacy, formative assessment, assessment, students' understanding,* *theoretical knowledge*

INTRODUCTION

Teachers spend up to 50 % of the working lives preparing assessment tasks for their students (Plake, 1993) and dire consequences would occur if teachers' knowledge on assessment is not addressed (Wagner, 1987 as cited in Leat & Lin, 2003). The word 'assessment' itself invokes different ideas because of the various roles that assessment plays. The questions on 'how', 'why' and 'when' the assessment data was collected, changes the role of that assessment accordingly (McKellar, 2002). Many researchers had raised concerns that the lack of correct basic definition on assessment would be rather confusing for teachers (Marion, 2005; Shepard, 2005 as cited in Frey & Schmitt, 2007; Taras, 2005); because without a basic definition on assessment, what working theories/ knowledge are the teachers going to anchor their practices to (Yorke, 2003). Moreover, assessment is now central to all the teaching and learning processes (Black & Wiliam, 1998). Fundamentally, assessment is a process of observing students where teachers collaborate with their students to collect and interpret data of students' interests and preferences (Carter, 2005). Equipped with these data, teachers need to modify their teaching to ascending levels and accept the challenges to meet the learning goals of each

student. Therefore it is important for teachers to know the current theories/principles and knowledge on assessment (Darling-Hammond, 2000; Stiggins, 2004). If teachers' knowledge on assessment is inferior, these teachers will not be competent in producing assessment tasks that truly addresses the problems their students are facing (Metler, 2005). In Malaysia, there are many students who graduate with brilliant grades only to fail to carry of their duties successfully in the workforce (Rahim & Hanafi, 2007; Wan Ishak, Shafinah & Azhari, 2006). The researchers postulated that the weak link in the educational assessment system is that the assessment results do not truly reflect one's skills and knowledge. An ideal assessment system could exist only if the teachers have high levels of assessment literacy (Popham, 2008). What is assessment literacy? Assessment literacy covers all aspects of assessment and beyond. Assessment literacy means that teachers possess the knowledge of sound assessment practices (Paterno, 2001). For instance, an assessment literate teacher would enter the realms of assessment knowing what they were assessing, why they were doing so, how to report the results to relevant parties, and how to avoid biasness and distortions in addressing assessment results (Stiggins, 1995).

PAST RELEATED RESEARCH
Teachers' own beliefs and experiences as students influence the way they assess their students. Assessment has undergone a paradigm shift (from ranking students to supporting student learning) but many teachers had not experienced these types of assessment practices when they were students (Volante & Fazio, 2007). The teachers do not have sufficient knowledge on how to elicit information from assessment data and they are not confident on how to use that data to learn about their students' learning processes and the effectiveness of their instruction (Boudett, et. al., 2005). Teacher are still teaching using the out-dated information transmission model (Shepard, 1997) and teachers assessment practices contain assessment tasks that are inauthentic, fuelled with isolated facts and are inflexible (Birenbaum, Breuer, Cascallar, Dochy, Dori, Ridgway, Wiesemes, & Nickmans, 2006). This is because previously assessment was not considered as part of teaching (Gauce, 1993) and teachers were not suppose to know anything about assessment (Black, Harrison, Lee, Marshall & William, 2004). Since assessment has undergone a paradigm shift, assessment or more accurately formative assessment, is central to all teaching and learning processes (Black & Wiliam, 1998). Teachers need to make their assessment process transparent where students should be invited to know why and on what they will be assessed and how that assessment task is going to make them achieve their learning goals (Stiggins, Arter, Chappius & Chappuis, 2004). However, teachers hold beliefs that assessment data is used only to keep records of students' grades and marks efficiently (Brookhart, 2004). Because of this belief and the lack of knowledge on assessment, teachers tend to emphasize the 'book-keeping' of grades rather than using the assessment data to inform them about their instruction and to make pragmatic decisions from these assessment data to increase the population of students who could meet the minimum standards (Black, 2000; Impara, Plake & Fager, 1993). Furthermore, teachers believe that they are accountable for their students' success (Bolden & Newton, 2008), and because of

this teachers tend to practice 'teaching to the test' (Shepard, 2000). Test-items on external examinations which are usually multiple choice questions as it is easier to administer and cheaper to process (Willis, 1993); are used by many teachers as their daily assessment tasks where learning should be the primary concern (Carter, 1984; Fleming & Chambers, 1983; Marso & Pigge, 1988; Melter, 2005; Peček et. al., 2008). Thus, it can be said that the quality of the questions and exercises that are done in the daily classrooms are not critically reviewed in relation to what they were actually assessing (Black & William, 1998). This is because teachers rarely collaborate with their colleagues or seek help from their superiors (Boston, 2002; Bunting, 2006). Studies have shown that teachers tend to write 'great' as feedback on students written work for a wide range of different quality of work (Ruiz-Primo, Li, Ayala & Shavelson, 1999). The quality of feedback provided by teachers currently is rather dreadful because even when there are mistakes or misconceptions in the students' written work, science teachers generally do no write any comments or give feedback (Ruiz-Primo, Li & Shavelson, 2002). There seem to be no effort put by the teachers to close the gap between student performance at the time a notebook entry was produced and the desired performance. Teachers said that they hold discussions with their students and here their classroom discourses follow the rigid initiation-response-feedback (I-R-F) proposed by Sinclair and Coulthard (1975). Teachers ask questions which are low level thinking, factual or rules; students' response to the questions and teachers provided feedback which is normally evaluative. These type of classroom discourses are opposite in nature of formatives assessment were students' input and preferences should be the central concern (Stiggins & Chappius, 2006; Wiliam, 2006).

AIM OF THE STUDY
The main aim of the larger study was to investigate the assessment literacy of the selected teachers. In this paper only the knowledge of the selected Year 5 science teachers on two aspects of assessment literacy: 'assessment' and 'feedback' will be presented.

METHODOLOGY
Five teachers participated in this study. This study utilized qualitative data collection techniques; a teacher journal and interview sessions. The teacher journal required the participating teachers to pen down their knowledge, ideas and beliefs on assessment, feedback and theories/principles of assessment. The interview protocol consisted of open-ended questions where the researchers asked questions to clarify and to probe deeper into the responses that were written in the teacher journal.

Generally, the process of analysis of the journal and the transcribed verbatim were characterized with different levels of detail, beginning with broad themes (in the case of this paper, 'assessment' and 'feedback'), then identifying finer aspects of that data and then sorting them into more specific assessment literacy elements. For example, under the broad theme on 'assessment', phrases or ideas that were similar were categorized as assessment literacy elements. The assessment literacy elements

were named according to the ideas/ phrases. When the teachers' responses did not fit into the emergent elements, a new assessment literacy element would be defined.

FINDINGS

The two broad themes on assessment literacy that will be discussed in this paper are the participating teachers' knowledge on 'assessment' and 'feedback'. In this paper only four assessment literacy elements which emerged will be discussed for each theme. The four assessment literacy elements for 'Assessment' and 'Feedback' are as shown in Table 1 and 2, respectively.

Table 1

Assessment literacy elements that emerged on the aspects of "assessment'

Theme	Assessment Literacy Elements
Assessment	Assessment as an activity
	Assessment as a tool
	Assessment can be used to elicit students' weaknesses
	Assessment used by students to improve their understanding

Table 2

Assessment literacy elements that emerged on the aspects of 'Feedback'

Theme	Assessment Literacy Elements
	Feedback that are task-orientated (Evaluative)
	Feedback provided immediately
	Feedback Provided by the Peers
	Teachers Use Feedback to help students to answer questions in 'paper-and-pencil' tests.

Two of the teachers in this study envisioned assessment as an activity where they stated that teachers ask students questions on a daily basis to elicit students' understanding. In contrast, two other teachers had the knowledge that assessment could be looked as a tool to *detect* students' understanding. The teachers in this study stated that assessment could be used to elicit students' weaknesses. They all agreed that through questioning they were able to do so. The teachers within this study believed that students could use the assessment data to improve their own learning. All the teachers in this study mentioned that they would correct their students' answers if their students got the answer wrong. The teachers said that they would explain the subject matter again. One teacher mentioned that he would ask his students *'to explore the Internet'* to obtain the correct answers and then he would hold discussions. Other methods to help students to gain the correct conception included *'finding similar questions'* and *'forming smaller groups and explaining again'*. The teachers in this study also mentioned that they held

discussions with their students so that they could provide immediate feedback. However, two teachers mentioned that the feedback they gave their students were immediate because they wanted the students copy the 'correct answers' into their notebooks so that marking the students' notebooks would be a much easier task for them. The teachers also said that if a student could not answer a question, they would allow other students to do so. As one teacher mentioned *'sometimes when their friends explain, you know the way they talk, they understand.'* Two of the teachers also mentioned that they provided feedback to their students on how to answer questions in their 'paper-and-pencil' tests; however, one of the teachers was uncomfortable with this practice – *'I don't help them think. We spoon-feed them... "Teacher says this Y means this..." ... if the question changes the students will have problems.'* Through elicitation of these selected teachers' knowledge on assessment, the researchers discovered that there were some deficiencies in their understanding of assessment literacy. For example, one teacher mentioned that there were two types of assessment – formative and summative – but he had the definition mix-up *'...the difference is formative mark will give 100 but summative we just want to know about the performance of the students for that topic'*. Another teacher straightforwardly said that he does not know what 'summative' and 'formative assessment' meant. All the teachers in this study said that they do not know any theories/ principles of assessment. However, one teacher stated that she felt that assessment should be fair; but by being fair she said that all students should work on the same assessment task, for the same duration and without any additional help. She said that when students sometimes asked her about the meanings of words in the science test papers, she will not explain it to them because she said *'...I can't just tell one child and the other child don't come and ask...'* These are the current knowledge on assessment literacy for the theme 'assessment' and 'feedback' for the teachers in this study. What are the inadequacies in these teachers' knowledge in assessment literacy? From this point how can science teachers' assessment literacy take off to a higher level? The paper will now turn to this.

FROM HERE TO THERE: SHIFTING SCIENCE TEACHERS' ASSESSMENT LITERACY LEVELS

Before the discussion ventures from the current knowledge of teachers to what the ideal knowledge to attain world class education can and should be, the knowledge related to assessment literacy has to be explained explicitly. The assessment literacy knowledge that teachers have is believed to lie within the minds of the teachers as they go through their career. In other words, teachers' assessment literacy knowledge refers to the theories, ideas and knowledge of assessment that teachers have acquired during their entire educational and professional lives (Leat, 1993). Teachers are exposed to assessment practices early in their lives when they were students themselves; this experience would somehow influence their assessment practices when they become teachers (Graham, 2005). During their pre-service years, teachers have been exposed to formal techniques and theories of assessment with terms such as 'reliability', 'validity' and how to prepare assessment items using Bloom's Taxonomy (Ediger, 2003). During their in-service years, teachers' assessment knowledge gets remodelled through communication with their peers and

through gaining knowledge from their superiors (Bunting, 2006). This wide range of assessment knowledge that teachers acquire through a variety of sources could be internalized by the teachers and they may come up with their own set of assessment literacy knowledge; each teacher's assessment literacy knowledge is different and unique. Therefore, this study postulates that when teachers are asked how they would conduct certain assessment practices, they dip into their assessment literacy knowledge to illustrate their practices. From the findings of this study, clearly teachers' current knowledge on assessment have room to be shifted to more advanced levels to achieve 'world class' assessment knowledge. This certainly can be achieved because *'master teachers are not born. They become primarily by developing the habit of the mind as a way of looking critically at the work they do; by developing the courage to recognize faults, and struggling to improve'* (Common, 1989; p.385). Thus, as is the focus of this paper, how can teachers' assessment literacy knowledge be shifted to achieve world class education? The teachers in this study were unable to mention about the theories on assessment accurately and how these theories/principles guide their practices. Theories and principles of assessment are the backbone that guide assessment decisions in the science classrooms (Abell & Siegel, 2011) and without strong background knowledge on these, teachers might be practising out-dated as well as harmful assessment practices (Siegel et al., 2008). Thus, teachers need to develop their knowledge on these theories and principles of assessment. Not only should they know the theories of assessment but the teachers need to have a robust and deep understanding of these principles of assessment. For example, a teacher may say that assessment should be fair but the same teacher should also be familiar with the term 'equitable assessment practices'. The National Science Education standards had included a clause called for the test items to be modified under special conditions or for students' with linguistic difficulties so that these students would be able to demonstrate what they actually knew. In other words, equitable assessment considered changes to assessment items, procedures or even grading practices (NRC, 1996; Siegel & Wissehr, 2011) so that barriers that were preventing certain groups of students from completing the assessment were removed. Thus, teachers who had experienced as students where assessment was done uniformly should have a conceptual change to embrace the new meaning of 'fairness' in assessment. Another aspect that can be shifted is the idea teachers hold that is, assessment should be seen as a tool to elicit students' understanding might be in the danger of viewing assessment as a product. As Popham (2008) stated that formative assessment was not fully utilized in classrooms because teachers saw assessment as a product rather than as a process. Thus, teachers' knowledge on assessment should focus on how teachers help students as their students' knowledge is 'forming'. The process of assessing the students should take precedent over the production of grades. Teachers need to have a clear purpose as to why an assessment is conducted. The assessment tasks should be selected properly (Stiggins & Chappius, 2006) where teachers rely on a wide range of assessment and these assessment should be sensitive enough to collect information on all aspects of learning (Willis, 1993). At the present time it appears that teachers' knowledge on assessment is only limited to elicit students' weaknesses. However, in order for teachers to become

more assessment literate, teachers should take the opportunity to modify their teaching and to be better equipped to enhance their students' understanding (Black & William, 1998; Ediger, 2003; Stiggins, 2001). Moreover, teachers must also know how to use assessment tasks to motivate and keep the students that had already the correct understanding interested. To shift to world class standards, teachers need to have the knowledge on how to prepare enrichment activities that are challenging, stimulating and lie in the Zone of Proximal Development (Guskey, 2005, Vygotsky, 1978). The teachers in this study voiced the idea that assessment could be used by the students to learn more about their own learning progress. However, the teachers' knowledge was that if the students know the right answers, they would be able to monitor their progress. Teachers must take off from here to a different level, which is to go beyond right answers. Studies have shown that formative assessment involves students taking charge of their own learning (Frey & Schmitt, 2007) and if teachers are more knowledgeable they would be able to create suitable classroom settings where students are given autonomy in their learning process (Stiggins & Chappius, 2006). Teachers would need to show students how to acquire these skills. This means that a teacher must use assessment tasks to promptly to show students' evidence of achievement and to communicate to the students what was valued in that particular task and what was not; the teachers paths the way to show students the criteria for success. This action by the teacher in turn, opens up the possibility of students helping one another, and using assessment tasks and tests as a guide to planning their own learning (Black et al., 2004; Black & Wiliam, 2009). Teachers in this study provided feedback by giving students the right answers. However, feedback should be 'honest, specific and timely' (Gareis, 2007; p. 19). To shift to world class standards, teachers should provide process-orientated feedback where students are shown the strengths and weaknesses of their work and avoid comparing with other students' work. Moreover, teachers should give cues that would lead to better strategies and expecting the students to come up with a better end product (Hattie and Timperley, 2007). For example, a teacher can provide feedback where the teacher tells the student that five out of twenty of his/her answers is wrong. The teacher makes the student find out which ones are wrong and how to improve on their work. Feedback should be given immediately otherwise students took no interest in the feedback they had given them. As Gareis (2007) stated that feedback separated by days or weeks become useless to the students. It is not wrong for teachers to use data from students' 'paper-and-pencil' tests to help their students to improve their learning and their future performance (Black, 2000; Straits & Wilke, 2002). However, the teachers in this study provided superficial techniques that required the students to memorize steps/rules. Teachers need to use formal assessment data to elicit students' mistakes, to find ways where students learn from that and the students would be able to fill up the holes in their understanding and to correct misconceptions. If 'paper-and-pencil' tests were used as an educational tool to guide further learning, it could become a powerful tool for learning (Stiggins, 2001; Stiggins & Chappius, 2006). Thus, for teachers to shift to world class assessment literacy levels, teachers would need to acquire the relevant knowledge to do so.

TEACHERS AS WORLD CLASS ASSESSORS

It is clear that there exist a gap between the participating teachers' current knowledge on assessment literacy and the desirable assessment literacy knowledge for a world class assessment system. Teachers who know their current knowledge and what is he desired knowledge on assessment should start shifting to close the gap. How are these teachers to do so? A study by Kane, Sandretto and Heath (2004) to investigate the attributes of excellent teachers in science departments came up with a five dimensional model of attributes of excellent science teachers. They found these teachers have a wide range of subject matter expertise, interpersonal relationships with students and they also use various teaching practices. Based on the findings from the study of Kane et. al. (2004) the authors are in view that personal characteristics of teachers play a role in the assessment environments they create. The authors are currently investigating teachers' assessment knowledge and practices, and have identified six knowledge and skills that are crucial in the acquisition of higher assessment literacy levels to match the world class standards. There are to increase and deepen content knowledge, exhibiting excellent pedagogical skills, increasing experiences, desirable communication, conceptual changes of out-dated beliefs and metacognitive skills. Figure 3 show the six knowledge and skills that teachers need to increase in order to be considered assessment literate.
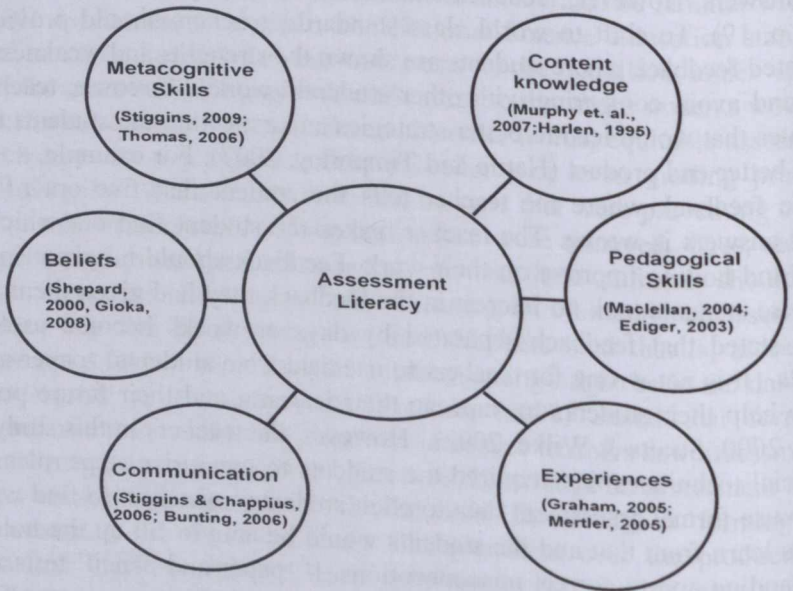

Figure 1: Diagram to Indicate the Six Knowledge and Skills that Affect Assessment Literacy that were Identified by the Authors

Teachers' subject matter knowledge for teaching (Shulman, 1987) and the training on assessment practices teachers obtain during pre and in-service are essential for the implementation of sound assessment practices. In addition to these, the teachers' beliefs, their need for structure and their willingness to take risks, also shape their assessment practices (Volante & Fazio, 2007). Teachers must collaborate with others to enhance their assessment knowledge and practices (Bunting, 2006). On-the-job experiences as well as experiences when they were students themselves mould teachers' knowledge and practices. Based on their beliefs and experiences, spiced with communication with others concerned with assessment, teachers need to use their metacognitive skills to reflect on their assessment practices and find ways on how to improve. When teachers make an attempt to acquire all these knowledge and skills, there is a higher possibility that they would acquire higher levels of assessment literacy.

CONCLUSION

Evidence from this study was that teachers' knowledge on assessment and feedback are still surface in nature and deep or more robust knowledge on assessment literacy is needed. This paper illustrates the deficiencies in teachers' assessment literacy knowledge and what is expected of the teachers to attain world class assessment literacy levels. Without a deep knowledge base of assessment literacy, teachers' assessment practices might be ad-hoc (Yorke, 2003). Moreover, what teachers say that they would do in their classroom might not be as what they actually practice in there (Pontefract & Hardman, 2005). Still, the researchers strongly believe that with acquiring the relevant knowledge and skills, primary science teachers' assessment literacy can be shifted to a world class level.

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