CHEMISTRY TEACHERS' UNDERSTANDING OF MODELS OF TEACHING AND LEARNING IN PRACTICAL WORK

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1.1 INTRODUCTION

For most Malaysian chemistry teachers, practical work is part of teaching and learning chemistry. The chemistry curriculum has been designed since 2005 to produce active learners through hands-on activities and experimentations (Curriculum Development Centre, 2005). Nonetheless, the teaching and learning strategies in the curriculum emphasis thoughtful learning, which can occur through various models of teaching and learning such as inquiry, constructivism, contextual learning and mastery learning (Curriculum Development Centre, 2005). In fact, the government of Malaysia has allocated enormous amount of money during last few decades to ensure the highest quality of science education for Malaysian schools (Norfariza et. al, 2013). Besides preparing teachers for professional advancement as agents of change with the introduction of new programs, teachers who are not adequately trained will be sent for special in-service training, *"The Cascade Training"* (IBE, 2001). Instructional materials such as teachers' guide book for the respective subjects and teaching-learning modules were disseminated to all schools.

In addition, a new curriculum for secondary levels will be launched in 2017 to embed a balanced set of knowledge and skills such as creative thinking, innovation, problem solving and leadership (MOE, 2013).

Even though the new curriculum for secondary levels still stress student-centered and differentiated learning, it has a greater emphasis on problem-based and project-based work, a streamlined set of subjects and themes, and formative assessments. According to the Educational Technology Division of the Ministry of Education, Malaysia (2006), there is a need to use multi-faceted approaches to deliver content as outlined in the national curriculum, and to develop soft skills among students. To fulfill this need, the Ministry has prepared a Project-based Learning Handbook, which gives a brief overview of Project-based Learning, how it can be used to achieve 21st century skills, and activity-based learning to encourage self-directed, self-paced and self-accessed learning among students. In addition, the Ministry of Education also has implemented "*Program Pembestarian Sekolah"* or "Making Schools Smart" Programme for all Malaysian schools under the Ninth Malaysian Plan (RMK-9). This programme calls for innovation in areas of teaching and learning by integrating technology.

However, the practice of secondary school science practical work has remained somewhat different in the Malaysian school system (Subahan et al., 2005) as well as in other countries (Hofstein & Lunetta, 2004; Hofstein, 2004; Lunetta et al., 2007). At the secondary level, the integration of practical work generally follows the phenomena of posing and answering questions within closely-defined limits. Unfortunately, students seldom experience freedom in their thinking or solving a given problem. In most cases practical work does not go beyond observing demonstrations carried out mainly by the teacher. In a recent survey among secondary school Chemistry teachers in one of the Malaysian States, half of the teachers listed time, examination-oriented, class sizes, or costs as a justification for not employing student practical work in their practical class (Aziz & Lee, 2010; Sharifah, 2000). Furthermore, a shock after the publication of the 2011 TIMSS, claimed that Malaysian students spent less of their lesson doing practical activities compared to students in other countries (TIMSS, 2011). To this end, in most cases, it was found that science

teachers in Malaysia tend to adopt a more 'cookbook recipe-style' experimental activities in their practical class. Using textbooks as basis for instruction in their teaching is much preferably compared to science equipment materials (TIMSS, 2011).

In fact, studies have shown that in most Malaysian schools science, teacher-centered approach was still being the most dominant to teaching (Tay & Mohamamad Yusof, 2008). In a similar study of Sim and Mohammad Yusof (2010), they commented that majority of secondary school science teachers still adopting the traditional models of teaching and learning. Moreover, even though the Ministry of Education has suggested various forms of models of teaching and learning, there is still limited research reported on problem-based implementation in Malaysian secondary schools (Tan & Mohammad Yusof, 2014). In fact, studies revealed that most of the secondary school teachers in Malaysia have never come across problem-based learning models in schools (Faaizah & Halimah, 2007). In spite of this, although the Ministry of Education in Malaysia has spent more than RM6 billion on information and communication technology (ICT) over the past decade in education initiatives such as smart schools, one of the most capital-intensive investments the system has undertaken, but the ICT usage in schools continues to lag expectations, both in terms of quantity and quality (MOE, 2013).

Questions to which researchers try to find answers are, for example "What are the chemistry teachers' understanding of models of teaching and learning in practical class?" "Upon what criteria should be considered in selecting a model of teaching and learning? This paper seeks to gauge Malaysia chemistry teachers' understanding about model of teaching and learning in practical work.

1.2 RESEARCH OBJECTIVE

To answer the research questions, the focus of this study was to

ascertain chemistry teachers' understanding of models of teaching and learning in practical work.

2.1 METHODOLOGY

This is a qualitative descriptive research. A qualitative descriptive research is used to describe population or phenomenon being studied (Shields et al., 2013). The ultimate goal is to improve practice. Such study design is seen useful to build an in-depth and contextualized understanding about complex issues in the social context (Yin, 2003).

2.1.1 Research Samples

The participants of the study were twenty chemistry teachers from urban and non-urban secondary schools in the Southern West Coast Division of Sabah, Malaysia who taught chemistry in their respective schools. These chemistry teachers were selected using purposive sampling technique. Their age were ranged from 30 to 46 years old. The participants selected were expected to have literacy levels sufficient enough to understand questions and articulate their feedbacks. Other criterion for selecting the participants is they must also have at least one year experience in teaching chemistry. Information of each chemistry teacher is shown in Table 1.

Table 1 Participant's Gender, Age, School and Experience in Teaching

Chemistry

Chemistry Teacher (pseudonym)	Gender	Age	School	Experience in teaching chemistry (years)
1 (Awang)	Male	46	SM Lok Yuk	14
2 (Calicia)	Female	34	SM Maktab Sabah	11
3 (Christina)	Female	31	SM Stella Maris	7
4 (Chua)	Male	35	SM La Salle	12
5 (Cornelia)	Female	30	SM Tinggi	7
6 (Erisiah)	Female	38	SMK Taman Tun Fuad	9
7 (Faiyani)	Female	30	SMK Kolombong	6
8 (Jamu)	Female	40	SMK Bandaraya	
9 (Lendah)	Female	46	SM St. Peter Telipok	14
10 (Norhafiza)	Female	31	SMK Likas	7
11 (Nurul)	Female	36	SM Sains Sabah	2
12 (Pang)	Female	39	SMK Lok Yuk	15
13 (Rosna)	Female	32	SMKA KK	10
14 (Sharleen)	Female	31	SMK bandaeya	2
15 (Sim)	Male	30	SM La Salle	4
16 (Siti)	Female	30	SM Stella Maris	7
17 (Tai)	Female	34	SM Tinggi	11
18 (Tan)	Female	48	SMK Tebobon	20
19 (Wilfred)	Male	46	SMK St. Francis Convent	18
20 (Yong)	Female	46	SMK Shan Tao	20

2.1.2 Research Instrument

In this study, a semi-structured interview was conducted with each participant. Each interview session took about approximately 45 minutes. A consent form was given to each participant before the start of the interview. The interview instrument consists of a set of questions as shown in Table 2, which focused on chemistry teachers' understanding of models of teaching and learning in practical work. The instrument aims to elucidate chemistry teachers' understanding about several aspects of models of teaching and learning which include 'meaning of models of teaching and learning' and 'type of models of teaching and learning. All interviews were audiotaped and transcribed. All transcripts were in English except three in Malay. The Malay transcripts were then translated into English. The English transcripts were sent back to all the participants to check the accuracy. The transcripts were then coded for emerging themes as suggested (Strauss & Corbin, 1990) and the themes were then grouped based on the research questions.

Table 2 Interview Questions

1. What do you understand about models of teaching and learning in practical work? Can explain the meaning of models of teaching and learning in more details?
2. Have you heard of inquiry-based learning, problem-based learning, project-based learning and blended learning? What model you use during practical work?
3. What makes models of teaching and learning useful and important in practical work?

2.1.2 Data Analysis

Data were analysed using content analysis. Content analysis is the procedure for categorization of verbal data for the purpose of classification, summarization and tabulation. The content can be analysed on two levels descriptive and interpretative.

3.1 FINDINGS AND DISCUSSIONS

In this section, chemistry teachers' understanding of models of teaching and learning in practical work will be discussed in detail, in terms of teachers' understanding related to meaning and teachers' understanding related to type work.

3.1.1 Teachers' Understanding Related to the Meaning of Models of Teaching and Learning

In this study, 20 chemistry teachers have been interviewed to ascertain their understanding of models of teaching and learning in practical work. Overall, based on the analysis of the findings, 60% or 12 chemistry teachers (Awang, Christina, Chua, Faiyani, Jamu, Norhafiza, Nurul, Rosna, Sharleen, Siti, Tan and Yong) do not understand the meaning of models of teaching and learning in practical work while only 40% or 8 chemistry teachers (Calicia, Cornelia, Erisiah, Lendah, Pang, Sim, Tai and Wilfred) understand and can explain the meaning of models. This finding is slightly higher than expected.

In detail, among the 12 chemistry teachers who do not understand the meaning of models of teaching and learning in practical work, 5 of them (Chua, Faiyani, Norhafiza, Nurul, Rosna and Sharleen) claimed that they were not clear with the meaning of models of teaching and

learning while the other 7 teachers (Awang, Christina, Chua, Jamu, Siti, Tan and Yong claimed that they have forgotten the meaning of models of teaching and learning. However, when examined the background of these teachers, all of them possessed at least a Bachelor's Degree of Science in Education and major in chemistry. Hence, we can said that although these teachers have sufficient knowledge in chemistry but their knowledge of models of teaching and learning still low. Following are examples of transcripts on the interview related to understanding of models of teaching and learning:

Interviewer : *What do you understand about models of teaching and learning in practical work?*

Chua : *I'm not sure about the model in practical work. I usually followed the procedures given in the practical book…*

Faiyani : *Em… I don't know oh. I didn't use models in my practical class.*

Norhafiza : *Don't know… never heard of it…*

Nurul : *I am not clear… I don't understand what you ask…*

Rosna : *No idea… cause never use it…*

Sharleen : I don't know… *I just follow chemistry text book…*

Awang : *Don't know oh… forgot…*

Christina : *I can't really remember… long time didn't heard of this…*

Jamu : *Huh? I can't remember now…*

Siti : *What? Models? Can't remember… never use, too…*

Tan : *I don't use model, so can't remember what it means…*

Yong : No time to use models… so didn't

memorize the meaning…

The findings also shown that among 8 chemistry teachers who understand the meaning of models of teaching and learning, only 1 chemistry teacher (Sim) who able to give accurate definition. Sim expressed that a model of teaching and learning is a guidelines with underlying framework and theory which can assist teacher in both planning and guiding students to achieve the desired learning outcomes. Whilst, 5 chemistry teachers (Cornelia, Pang, Tai and Erisiah, Lendah) expressed that models of teaching and learning refers to ways to engage students in practical work. Despite this, Wilfred expressed that a model of teaching and learning is a framework which emphasis on the scientific skills. Both Calicia and Pang expressed that models of teaching and learning should be focus on learning outcome and students' interest. From the findings, it can be seen that lack of understanding among chemistry teachers about the meaning of models of teaching and learning. Following are examples of transcripts on the interview related to the meaning of models of teaching and learning:

Sim	**:**	*As far as I understand, it is a guidelines with underlying framework and theory which can assist teacher in both planning and guiding students to achieve the desired learning outcomes.*
Cornelia	**:**	*I think it is more to student engagement…*
Pang	**:**	*A model to motivate students to engage higher-order learning, cognitive development, …*
Tai	**:**	*A model where there is involvement of the students…*
Erisiah	**:**	*Well, we can see the students engage with one another…*
Lendah	**:**	*An effective ways to have students experience hands-on activities…*
Wilfred	**:**	*A model which emphasis on the scientific*

skills…

Calicia : *A model whereby learning outcomes achieved …*

Pang : *A method to enhance students' higher order thinking*

3.1.2 Teachers' Understanding related to Type of Models of Teaching and Learning

Although working under centralized curriculum, the 20 chemistry teachers adopt different models to teach practical work in the laboratory. Based on the data analysis, it is found that inquiry-based learning is the most popular (50%) among chemistry teachers in the Southern West Coast of Sabah, followed by the blended learning, 30% and, problem-based learning and project-based learning, 5%, respectively. The data analysis also indicated that 20% of the chemistry teachers did not adopt any models of teaching and learning during practical work. Findings revealed that most chemistry teachers choose inquiry-based learning because within a conceptual framework, inquiry learning and active learner involvement can lead to important outcomes in the practical class. This finding is similar to data obtained by Sim and Mohammad Yusof (2013). Students who actively make observations, collect, analyze, and synthesize information, and draw conclusions are developing useful problem-solving skills.

Despite this, findings also indicated that inquiry-based learning promote students' interaction and creative thinking in the practical class by asking high order questions. However, findings proved that very few chemistry teachers choose problem-based and project-based learning because of some reasons: (i) lack of expertise, and (ii) requires students to be more independent.

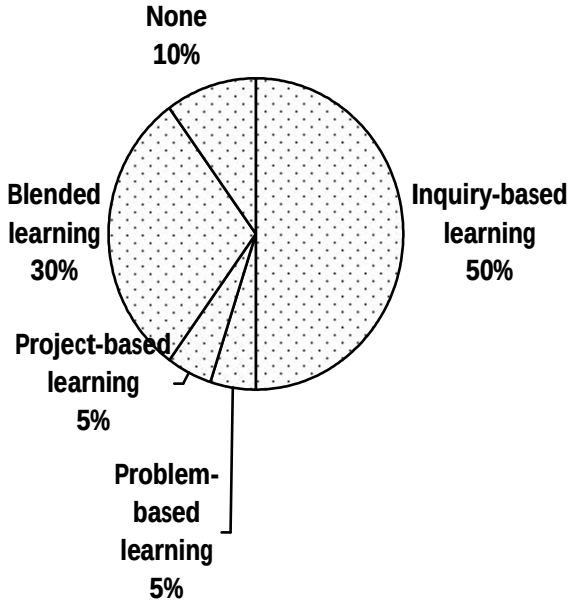

Figure 1 Type of Models of Teaching and Learning in Practical Work

4.1 CONCLUSION

As a conclusion, the quality and effectiveness of practical work in school science in Malaysia still lags behind other developed countries (Che Nidzam Che Ahmad, Lilia Halim, T. Subahan Mohd Meerah, Kamisah Osman & Arbaat Hassan, 2010; Sharifah Maimunah Syed Zin, 2000). Undoubtedly, practical content and equipment may have change over time, but some secondary schools in the Southern West Coast of Sabah, Malaysia still practices traditional models of teaching and learning such as "cookbook style", or more specifically involving whole class demonstration (Sharifah Maimunah Syed Zin, 2000). Therefore, to achieve Vision 2020, Malaysia needs an education reform by considering the educational challenges in 21st century with the rapid social, economic and technological changes in the world. In

particular, Malaysia should establish a great model of teaching and learning in practical work that are needed to meet the educational challenges of the future, as well as seize new opportunities such as offered by information and communication technology (ICT).

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