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Comparing Reflective Teaching Skills of Experienced and Inexperienced Physics Teachers at Different Reflection Levels

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Abstract
The main goal of this paper is to compare reflective teaching' skills such as observation, communication, judgment, decision making, and team working between experienced and inexperienced physics teachers at different levels of reflection (technical, contextual, and didactical level). The sample of this study consists of 60 physics teachers from 31 secondary schools in Malaysia. The quantitative and qualitative methods used to investigate the experienced and inexperienced physics teachers' reflective teaching skills are questionnaire survey, open-ended questionnaire and semi-structured interview. Results revealed that the experienced teachers were able to reflect mostly at the contextual level and inexperienced teachers reflect mostly at the technical level. Findings indicated that experienced teachers to reflect on their teaching applied reflecting teaching skills in 3 levels of reflection more than inexperienced teachers. Understanding the characteristics and differences of reflective teaching skills at different levels between experienced and inexperienced physics teachers can lead to find ways to improve these skills among physics teachers.

Keywords
reflection levels; reflective teaching; reflective teaching skills; physics teachers

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Introduction
Over the past two decades, research on physics education has demonstrated that many students face severe difficulties in learning physics (Kong 1993; MOE 1998; Williams et al. 2003; Ornek, Robinson, and Haugan 2008; Erinosho 2013; Adolphus and Aderonmu 2013; Camarao and Nava 2017; López and Pintó 2017). Physics is one of the most fundamental natural sciences and many researchers are trying to find ways to support students' learning. Various factors may contribute to these difficulties. Some factors are considered to be intrinsic to the students and other factors are considered to be intrinsic to the way in which physics is taught. Teachers play an important role in supporting students' ability to overcome their difficulties in the learning of physics. However, teacher educators have indicated that there is growing concern related to getting teachers prepared for educating future generations of students (Richards 2004).

The dynamic nature of teacher education necessitates an ongoing learning process. In the Ninth Malaysian Plan (2006-2010) under the Education Division and Training Ministry of Education Malaysia has aimed at increasing the number of trained teachers, especially in Mathematics, Science and English at primary and secondary levels (Siti Eishah et al. 2009). The learning process for an educator is concerned with their practices and is based on their experiences in the classroom (Harrison et al., 2006). Donald et al. (2006) stated that teaching is a complicated process and teachers must constantly reflect on their actions. This perspective is supported by several other researchers including Oser et al. (1992), Swain (1998), and Mayes (2001).

It is believed that "reflection" is a constructive teacher practice (Husu, Toom, and Patrikainen 2006). Teacher reflection promotes critical approaches to one's teaching and competent educators can increase their effectiveness through reflection (see. e.g., Weston 2015; Gross 2014; Oser et al. 1992; Swain 1998; Mayes 2001). By reflection teachers can better understand about their teaching and practice and achieve superior performance in the classroom (Gross 2014). Reflection has been defined as self-examination or the process of self-evaluation (Husu, Toom, and Patrikainen 2006). It has also been described as the practice of recalling an experience, considering what happened and evaluating how that experience contributed to a larger goal (Danielson 1996). It is a response to past experience and involves conscious recall and examination of the experience as a basis for evaluation and decision-making and as a source for planning and action. With experience, teachers become more discerning and can evaluate their successes as well as their errors.

Dewey (1933) was the first to introduce the concept of reflection; he stated the premise that teachers should be encouraged to become thoughtful and alert students of education, and argued that teachers should continue to grow in reflection. A great amount of research has been done on the content of reflection, its principles, how teachers think about their practice, and the features of reflection of various teachers (Impedovo and Khatoon Malik 2016; Van Manen 1977; Schön1983, 1987). Van Manen (1977) was thought to be the first to suggest a hierarchical model (Davis, 2006). Although there are controversies among scholars concerning the hierarchical nature of critical thinking, they agree upon its technical, contextual, and dialectical modes (Van Manen 1977). An initial level focused on teaching functions, actions or skills, generally considers

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teaching episodes as isolated events. A more advanced level considers the theory and rationale for current practice. A higher order is where teachers examine the ethical, social and political consequences of their teaching, grappling with the ultimate purposes of schooling.

Reflective teaching is an alternative to more traditional teaching approaches such as in-service professional development (Dewey 1933; Cruickshank 1985; Schön 1987; Sparks-Langer and Colton 1991; Mok 1994; Farrell 2001; Impedovo and Khatoon Malik 2016). The primary focus of reflective teacher education is on encouraging each teacher's ability to analyze the reasons behind why they rely on specific teaching strategies. As a result, reflective teachers can develop methods that will improve their ability to successfully work with their students. Reflective teaching is only one of the many important characteristics found in a competent educator who must also be able to rely on their abilities, knowledge and skills to conduct their lessons in an efficient and effective manner (Rosenberg, Sindela, and Hardman 2004).

Some studies have investigated teachers' reflective teaching skills and indicated the level of reflection. Impedovo and Khatoon Malik (2016) noted that teachers can reflect on their observations, knowledge and experience to develop their reflective teaching practice and skills. The reflective practice can improve teachers' self-knowledge and understanding (Sellars 2012). Larrivee (2000) argued that reflective practice moves teachers from their knowledge base of distinct skills to a stage in their career where they are able to modify their skills to suit specific contexts and situations, and eventually to invent new strategies. Encouraging the skills that allow a teacher to reflect on the process of education is becoming increasingly important along with the ability to conduct research and teach in a variety of different environments (Duthilleul 2005). Dymoke and Harrions (2008) described five core components as necessary skills for reflective teaching namely Observation, Communication, Judgment, Decision making, and Team work.

Observation is a skill through which teachers' feelings and behaviours are recorded. It also engages the user in noticing, marking and recording the distinguished issues. Noticing in this explanation involves briefly yet vividly recording the particulars of situations for further use by teachers (Dymokeand Harrison 2008). Schön (1983, 1987) explained that communication is an active and conscious process that requires the critical evaluation of past events and practices. Communication skill begins with asking questions such as, "What have I been doing?" "What am I doing? "What has happened?" and "What is currently happening?" (Dymoke and Harrison 2008). Working in a team is a skill that is required if teachers want to be reflective teachers. Collaborative learning annotation system can promote reflective physics teaching (Milner-Bolotin, 2018). The use of peer reflective groups and also mentoring motivates teachers to familiarize themselves with existing concepts and also their particular preconceived views associated with teaching whilst motivating some sort of collaborative type of professional development (Guiney 2001).

Judgment skill allows a teacher to identify the significant components of an event or situation that occurred in a classroom. This can be a difficult skill to cultivate since even clearly describing what happened during the course of an event can be problematic. The ability to remain impartial also plays a role and the more impartial a judgment is the more effective it is (Dymoke and Harrison 2008). The ability to make decisions or decision making skill is the ability to develop a plan of action in order to obtain a specific goal. Decision making skills help teachers cope with difficulties in the classroom and develop solutions. In judgment skill, in order to analyze a classroom, event or situation, teachers should try to be absolutely clear what that event or situation consists of.

These five skills of reflective teaching are applicable to all stages of a teacher's career. Experienced and inexperienced teachers differ in their ability and skills to learn from reflection on experience. Experienced teachers could develop great knowledge based on students, and different aspects and contexts of classrooms. These teachers are careful in planning and teaching practice and utilize instructional and management routines more often (Borko and Livingston 1989; Borko and Shavelson 1990). The main goal of teacher education programs should be to enable the inexperienced teachers as a reflective practitioner to learn from and learn through experiences in sustaining their professional development for lifelong learning. Inexperienced teachers need to gain experience alongside the more experienced cooperating teachers in a real classroom environment to develop insights into their teaching through the interaction between personal reflection and theoretical ideas (Walkington 2010).

In the case of Malaysia, although many studies have examined factors that influence science and physics learning, the studies are not related to the ways of supporting science and physics teachers' reflective teaching. Moreover, most studies in Malaysia focused on pre-service physics teachers' reflection (Nor Hasniza2006; MohdZaki 2008). Understanding the characteristics of reflective teaching among experienced and inexperienced teachers and the differences between them can help to find ways to support and improve teachers' reflective teaching. In this paper, we first identify the reflection levels of experienced and inexperienced teachers. Then, the characteristics of reflective teaching of experienced and inexperienced teachers at different levels of reflection will be discussed. Finally, the differences of reflective teaching skills including observation, communication, team working, judgment, and decision making between experienced and inexperienced teachers are put forward.

Method

Participants

The participants of this study consisted of 60 physics teachers from 31 secondary schools in Malaysia. These teachers were purposely selected to reflect different teaching experience. Teachers were informed about the nature and purpose of the research project that data collected may be published in a journal, and that they could withdraw from the project at any time. In this

research, an experienced teacher is a teacher with more than 7 years teaching experience and an inexperienced teacher is a teacher with less than 7 years teaching experience (Curtis and Szestay 2005). The quantitative phase was comprised of 30 inexperienced physics teachers and 30 experienced physics teachers. In the qualitative phase, open-ended questionnaire was given to all participants; while for interview, 12 teachers were selected, 6 experienced teachers (2 males and 4 females) and 6 inexperienced teachers (2 males and 4 females) from three levels of reflection (2 experienced teachers and 2 inexperienced teachers from each level). The average years of experience for experienced teachers was 16 years whilst the inexperienced teachers had 4 years experiences.

Procedure

This study attempted to identify and compare the reflective teaching skills employed by physics teachers in secondary schools. There are two phases in this study, which are a quantitative phase followed by a qualitative phase. In the quantitative phase, a survey via Profile of Reflective Attributes (PRA) questionnaire was used to measure the level of reflection among 30 experienced and 30 inexperienced physics teachers. In the qualitative phase, open-ended questionnaire and interview methods used to collect data. All teachers' responses reported as anonymous. An open-ended questionnaire that has been designed to identify the characteristics of reflective teaching of experienced and inexperienced teachers at three levels of reflection, Technical, Contextual, and Dialectical.

We compared the reflective teaching skills such as observation, communication, team working, judgment, and decision making between inexperienced and experienced physics teachers at three levels of reflection. In this study, 6 experienced and 6 inexperienced physics teachers (2 experienced teachers and 2 inexperienced teachers from each level) were selected to answer the semi-structured interviews. The semi-structured interviews are audio-taped and transcribed. To ensure that the data was accurately captured, audio-tapes of the interviews and transcription of the responses immediately after each of the interviews were completed. The interviews last approximately 30-35 minutes to explore reflective teaching skills of experienced and experienced physics teachers.

Instruments

In the quantitative phase, since the levels of reflection in this study are based on the theory of Van Manen (1977), the Profile of Reflective Attributes questionnaire is proposed to measure experienced and inexperienced teachers' reflection levels. This instrument was designed by Taggart and Wilson based on the theory of Van Manen (1977). The profile illustrates three levels of reflection, Technical, Contextual, and Dialectical, as a self-evaluation tool designed to explore an individual's current level of reflection. The instrument consists of 30 items presented in a four-point Likert-style format. For each statement, the teachers circle the number of the indicator that best reflects their agreement on a situation or in lesson preparation.

Open-ended questionnaire survey and semi-structured interview were employed in the qualitative phase of study. The open-ended questionnaire was used to ask respondents about how reflecting teaching skills were used in their classrooms. There are 6 open-ended questions in the open-ended questions that are listed in Appendix A. The semi-structured interview questions were constructed based on reflective teaching skills which include observation, communication, team working, judgment, and decision making as well as tools that support these skills. The semi-structured interview questions include 29 questions in five parts based on the five reflective teaching skills and tools. A list of questions including a five part semi-structured interview can be found in Appendix B.

Reliability and Validity

Reliability means that scores from an instrument are stable and consistent (Creswell 2003). For the reliability of "Profile of Reflective Attributes" questionnaire in this study, a pilot study was carried out at the beginning of the school year of 2013/2014. The participants were 20 physics teachers from the 8 secondary schools in Johor, Malaysia whose schools were selected using simple random sampling from among the schools. Cronbach's alpha coefficients for the survey was 0.96 that implying that the reliability of the instrument is high (DeVellis 2003).

Brown (1996, p.231) defined validity as "the degree to which a test measures what it claims, or purports, to be measuring". In this study, content validity is used to show goodness of measurement. Content validity is the extent to which the questions on the instrument and the scores from these questions are representative of all the possible questions that could be asked about the content or skills (Creswell 2003). The kinds of evidence in support of content validity involve (a) the judgments of experts within the field of study; (b) conceptualization of the behavioural field; and (c) indirect way high internal consistency reliability (Sekaran 2003). In this study, for determining the content validity, expert's opinions were sought. For this purpose, a set of instruments, open-ended questionnaire and interview protocol have been distributed to two experts in the field of teacher education to validate the contents of the research instrument. To validate the instruments, we discussed the purpose of the instruments regarding the objectives of the study with two experts. After two discussion sessions, we came to the conclusion that some questions should be broken down into more detailed questions. The main reason was gaining more precise answers from the participants of the study.

Data Analysis

Data analysis procedures for qualitative and quantitative data are given separately. In this study, the process of data analysis begins with "Profile of Reflective Attributes" questionnaire as quantitative parts of the study.To analyze the PRA questionnaire, tally the number of circled indicators, multiply by the indicator number, then add the subtotals to reach an overall score (Taggart and Wilson 2005). Reflection levels of the profile are described as dialectical level (from 105 to 120), contextual level (from 75 to 104), and technical level (Below 75).

The qualitative data analysis begins with the open-ended question responses. This is followed by analysing semi-structure interview responses by teachers. For analysing qualitative data, open-ended questionnaire data and interview data, Miles and Huberman guidelines are used. According to Miles and Huberman (1994), a qualitative data analysis consists of three stages: data reduction, data display, and conclusion drawing.

After 60 inexperienced and experienced physics teachers had responded to the open-ended questionnaire, the process of analysing qualitative data begins. The first step involves reading the written answers and then developing a table of sources that can be used to help organize the materials. The table includes 5 questions of the open-ended questionnaire and all responses to these questions. The next step is to explore the data and to code it. This involves reading through the database and then employing the steps involved in coding. These steps are to identify text segments and then to assign code labels to the segments based on the meaning in the text segment. These codes are then used in forming a description of the central phenomenon or of the context of the study. Codes are also grouped together to form broader themes that are used in the study as key findings. From this analysis, the data in the findings through a table and a detailed discussion of the themes are represented.

The interview data analysis was also carried out after transcribing all the interviews into written dialogues for every participant (MacLean, Meyer, and Estable 2004; Wellard and McKenna 2001).The first step was the transcription of the audiotapes from the interview. Coding data to build description and themes was the next step of the data analysis. Making representation and reporting and an interpretation of qualitative findings were the final steps of the data analysis. This procedure was followed for each transcript analyzed. A summary of all transcripts was compiled in which sub-themes were compared to come up with overall themes that were later used to report the finding of this study.

Results and Discussions

This section presents and discusses the data findings for this study. First, teachers' reflection levels are identified based on the quantitative data. The qualitative data, including open-ended questionnaire results and semi-structured interview results are utilized to compare reflective teaching skills between experienced and inexperienced physics teachers.

Analysis of Quantitative Data

The reflection levels attained by the 30 experienced physics teachers and 30 inexperienced physics teachers are illustrated in **Table 1**. From 30 experienced teachers, 3 teachers (10%) were in the technical level (Level 1), 19 teachers (63%) in the contextual level (Level 2), and 8 teachers (27%) in the dialectical level (Level 3). It means that almost two-third of experienced teachers were reflected at the contextual level. Experienced teachers who are reflected at Level 1 reported a mean of 69 with a standard deviation of 6.25. The mean of scores for experienced teachers at Level 2 is 88.43 with a standard deviation of 6.95. The mean for experienced teachers at Level 3 is 105.13 and the standard deviation is .99. The total mean of experienced teachers is 90.93 and with a standard deviation of 11.93, hence this means that experienced teachers are reflected at the contextual level.

From 30 inexperienced teachers 14 teachers (47%) were at Level 1, 12 teachers (40%) were at Level 2, and 4 teachers (13%) at Level 3. It shows that almost have of inexperienced teachers were reflected at the technical level. An overview of the distribution of reflection levels of experienced and inexperienced teachers is presented in **Table 1**. The mean of the score for inexperienced teachers at Level 1 is 73.64 with a standard deviation of .84. Inexperienced teachers are reflected at Level 2 reporting a mean of 95.25 with a standard deviation of 8.42. The mean for inexperienced teachers at Level 3 is 107.75 and the standard deviation is 3.86. The total mean of inexperienced teachers is 86.83 with a standard deviation of 14.23, which means that the inexperienced teachers are also reflected at the contextual level. The letter of F is used to present the frequency of teachers.

Table 1. An overview of reflection levels of the experienced and inexperienced physics teachers

Reflection Levels	Experienced Teachers					Inexperienced Teachers				
	F	%	Sum of Scores	Mean	Std. D	F	%	Sum of Scores	Mean	Std. D
Level 1	3	10	207	69	6.25	14	47	1031	73.64	0.84
Level 2	19	63	1680	88.42	6.95	12	40	1143	95.25	8.42
Level 3	8	27	841	105.13	0.99	4	13	431	107.75	3.86
Total	30	100	2728	90.93	11.93	30	100	2605	86.83	14.23

Analysis of Qualitative Data

In this section, the open-ended questionnaire and semi-structured interview data obtained from the 6 experienced and 6 inexperienced physics teachers at the 3 levels of reflection are analysed. The teachers' reflective teaching skills such as observation, communication, team working, judgment, and decision making skills among 3 levels of experienced and inexperienced teachers are compared.

Findings from the Open-Ended Questionnaire Data

Table 2 represents the distribution of the use of reflective teaching skills by experienced and inexperienced teachers in 3 levels of reflection in their physics classes based on their claims. According to experienced and inexperienced teacher responses, both groups of teachers at Level 1 had the lowest percentage in using all reflective teaching skills except the inexperienced teachers for decision making skill. Not all experienced teachers at Level 1 used judgment skill in their physics class. Experienced teachers at Level 2 had the highest percentages in using reflective teaching skills except communication skill while inexperienced teachers at Level 3 had the highest percentages in using reflective teaching skills except observation and judgment skills.

Communication was the skill that was used by all experienced teachers at Level 3. Using decision making skills had the lowest percentages for both groups of teachers at Level 3.

Table 2. The distribution of using reflective teaching skills by experienced and inexperienced teachers in 3 levels

Reflective Teaching Skills	Teachers											
	Experienced						Inexperienced					
	Level 1		Level 2		Level 3		Level 1		Level 2		Level 3	
	F	%	F	%	F	%	F	%	F	%	F	%
Observation	2	67	16	84	6	75	12	86	11	92	2	50
Communication	2	67	18	95	8	100	12	86	12	100	4	100
Team working	2	67	17	89	7	88	12	86	11	92	4	100
Judgment	-	-	16	84	6	75	10	71	11	92	4	100
Decision Making	2	67	16	84	4	50	10	71	8	67	1	25

Observing students' understanding was the way of using observation skill noted by 5 experienced and inexperienced physics teachers (almost 30%) at Level 1. Observing students' understanding, observing students' behavior and writing the reflection via observation skill are implemented by a high proportion of experienced teachers (84%) at Level 2 (16 teachers from 19 experienced teachers at Level 2) and 8 teachers from 12 inexperienced teachers (67%) at Level 2. Moreover, observing students' behavior and observing students' understanding were the ways of using observation skill by inexperienced teachers at Levels 1 and 2. Observing students' behavior, using survey questions and observing students' ability when doing the experiments by taking photos as well as writing notes about students are other ways of using observation skill by physics teachers in the class noted by 75% of experienced teachers at Level 3 (6 teachers from 8 experienced teachers at Level 3).

Discussion with experienced teachers was the way of using communication skill noted by 33% of teachers at Level 1 (1 teacher from 3 experienced teachers), 26% of experienced teachers at Level 2 (5 teachers from 19), and discussion with students and experienced teachers mentioned by 63% of teachers at Level 3 (5 teachers from 8). Furthermore, minority of experienced teachers (33%) at Levels 1 (1 teacher from 3) and (11%) at Level 2 (2 teacher from 19) believed that communication skill can be used for asking questions from the students. A vast majority of inexperienced teachers (92%) at Level 2 (11 teachers from 12 inexperienced teachers at Level 2) also implemented the communication skill to discuss with experienced teachers and also discuss with students to determine students' understanding. Discussion with students and experienced teachers were the ways of using communication stated by all inexperienced teachers at Level 3.

Minority of experienced teachers (33%) at Level 1 (1 teacher from 3 experienced teachers at Level 1) and (5%) at Level 2 (1 teacher from 19 experienced teachers at Level 2) used teamwork skill to discuss problems with other physics teachers. For inexperienced teachers at Level 1, producing teaching and learning modules was a way of using teamwork skill. Discussing the issues in teaching physics and producing questions were also the ways of using teamwork skill asserted by 58% of inexperienced teachers at Level 2. In addition, sharing the issues in teaching physics and producing teaching and learning modules are the common ways of using team working skill by a quarter of experienced teachers at Levels 2 and 3. A quarter of inexperienced teachers at Level 3 used team working skill in producing teaching and learning materials among all teachers in the 3 levels of reflection.

Not all experienced teachers at Level 1 used judgment skill in their physics classes. Implementing judgment skill to assess students to check students' weaknesses was noted by a quarter of teachers at levels 2 and 3. Five inexperienced teachers at Level 2 (42%) also by assessing students used judgment skill to identify students' weaknesses in order to understand the successfulness of the teaching method. Only 17% of experienced teachers and inexperienced teachers at Level 3 (2 teachers from 12) used judgment skill for asking questions of students to determine student weaknesses.

Discussion with the school principal in order to make decisions is used by 33% of experienced teachers at Level 1(1 teacher from 3 experienced teachers at Level 1). However, inexperienced teachers (14%) at Level 1 (2 teachers from 14 inexperienced teachers at Level 1) used decision making skill to punish students. A quarter of teachers at Level 2 and only 13% of teachers at Level 3 (2 teachers from 12) used judgment skill to assess the teaching method and to solve student weaknesses by analyzing student results. Solving teachers' weaknesses by discussing problems with other physics teachers is another way of using decision making skill used by 16% of experienced teachers (3 teachers from 19 experienced teachers) and 67% of the inexperienced teachers (8 teachers from 12 inexperienced teachers) at the Level 2. Students' understanding, reflection after each class, observing students' behavior, discussion with other physics teachers and students' punishment were other ways of using decision making skill to assess teaching method in the class by 33% of teachers at Level 3 (4 teachers from 12).

All experienced teachers at Level 1 were the teachers that obtained all 5 reflective teaching skills from the teaching experience. Almost half of the inexperienced teachers at this level believed that all skills can be obtained from both teaching experience and training courses. Experienced teachers at Levels 2 and 3 believed in the important role of experience to obtain reflective teaching skills compared to training. Inexperienced teachers at Level 2 were the teachers that illustrate low percentage (25%) in utilizing training to obtain observation, judgment and decision making skills with the teaching experience. Half of the inexperienced teachers at Level 3 acquire communication and team working skill from training, and the percentage is higher compared to teachers from other levels. **Table 3** represents experienced and inexperienced teachers' responses in 3 levels in order to understand how they acquire the 5 reflective teaching skills, whether from

teaching experience or training courses. The words of "Exp" and "Train" are used to represent teaching experience and training course.

Table 3. The distribution of using training courses and teaching experience by experienced and inexperienced teachers to get reflective teaching skills

Levels	Teachers	Reflective Teaching Skills																			
		Observation				Communication				Teamwork				Judgment				Decision Making			
		Exp.		Train.		Exp.		Train.		Exp.		Train.		Exp.		Train.		Exp.		Train.	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
L1	Exp.	3	100			3	100			3	100			3	100			3	100		
	Inexp.	5	36	5	36	7	50	4	29	5	36	4	29	5	36	4	29	5	36	3	21
L2	Exp.	10	53			10	53	2	11	8	42	4	21	7	37	2	11	10	53	1	10
	Inexp.	5	42	3	25	6	50	4	33	7	58	4	33	4	33	3	25	4	33	3	25
L3	Exp.	4	50			3	38	2	25	4	50	2	25	4	50			4	50		
	Inexp.	1	25			1	25	2	50	2	50	2	50	2	50	1	25	2	50		

All experienced teachers at Levels of 1 and 2 and a vast majority of teachers (88%) at Level 3 (7 teachers from 8) agreed on the effective role of experience in order to acquire reflective teaching skills. Inexperienced teachers at Levels 2 and 3 and the majority of the teachers (79%) at Level 1 (11 teachers from 14) agreed on the effective role of experience in developing reflective teaching skills. For 32% of experienced teachers at Level 2 (6 teachers from 19) and 12 % of teachers at Level 3 (2 teachers from 19), experience plays a role to improve teaching skills. A vast majority of experienced and inexperienced teachers agreed on the effective role of experience on having reflective teaching skills. However, experience plays an important role on having reflective teaching skills and the open-ended questionnaire results for inexperienced teachers revealed that training also can have an effect on supporting these skills among teachers.

A considerable minority of experienced teachers (33%) at Level 1 (1 teacher from 3 experienced teachers at Level 1), 11% of teachers at Level 2 (2 teachers from 19 experienced teachers at Level 2), and 25% of teachers at Level 3 (2 teacher from 8 experienced teachers at Level 3) believed that there are gaps between their reflective teaching skills that they have and the reflective teaching skills that they need for teaching in a physics class. On the other hand, half of inexperienced teachers noted there is the gap between their current skills and the skills that they need in class. From the opinion of both the experienced and inexperienced teachers, teaching experience plays a role in improving teaching skills and makes an effective learning process. The majority of teachers in both groups believed that there are differences between experienced and inexperienced teachers in terms of reflection.

Findings from the Semi-Structured Interview Data

To have a better understanding of the skills that the experienced and inexperienced teachers used in their teaching in different levels of reflection, the results of the semi-structured interview are categorized according to the five reflective teaching skills.

- ***Observation Skill***

Not all of 12 experienced and inexperienced teachers in the 3 different levels of reflection used observation tools such as video- and audio-recording, writing, drawing, and photography in their classes. In the opinion of both groups, the importance and benefits of these tools are detecting the weakness and strengths of teaching in the classroom to improve them. One experienced teacher at Level 3 believed that "recording the lesson also helps students to assess the soft copy of teaching by going back to the content and relearning the content." This teacher explained that:

> "When you can go back and see how you teach, how I teach, so actually it is going to help in terms of reflecting and improving the lesson because I can see exactly where I can improve my phasing and my timing and the way I explain makes it easy enough for my students to understand."

All experienced teachers in all levels assessed the relevance of teaching methods in the classroom observation based on students' understanding except inexperienced teachers at Level 1 who assessed based on student behavior. For experienced teachers at Levels 2 and 3 of students' understanding, issuing quizzes and student feedback to survey questions were used to assess the relevance of teaching methods. Most inexperienced teachers in 3 levels of reflection assessed their teaching by students' behavior and getting feedback and emotion from the expression on the students faces

- ***Communication Skill***

All experienced teachers and some inexperienced teachers asked questions of themselves about the particular teaching episode. These teachers believed that "asking questions helps teachers understand their teaching is on the right track and seek to improve it." The greatest success and the biggest difficulty were the characteristics of teaching in the classroom observation that were assessed by experience. However, for inexperienced teachers the characteristics of teaching to assess was the biggest difficulty.

Experienced and inexperienced teachers from 3 levels of reflection agreed that lesson plans, learning journal, diary or portfolio as tools of communication skill can support their teaching; however, they only used the lesson plan in their classes. They believed that "the advantage of the lesson plan is the role it plays as a guideline for their teaching." This is supported by Fisher (2005) who noted in reflective teaching, personal communication performs through specific practices such as lesson planning, implementation and evaluation. Time consumed preparing lesson plans was the disadvantage of lesson plans in the opinion of all teachers. One experienced teacher explained the advantages and the disadvantages of lesson plan to improve her teaching as:

> "… advantage is we have the guideline, the thing we need to give to the student, and the disadvantage is that we get too much, too much burden on the student ..."

Experienced teachers in 3 levels and inexperienced teachers at Level 3 communicated with other physics teachers about their teaching. These teachers believed that communicating with other physics teachers contributes to their teaching because experience teachers have very wide

experience to share with other teachers. Most experienced teachers asked other physics teachers about certain methods, activities, experiments, difficult topics, and certain physics problems and they never asked any questions from students in contrast to inexperienced teachers. Most experienced teachers believed that the best way to communicate successfully with other physics teachers is to use technology tools such as video conference, phone, Facebook, and blog. Stiler and Philleo (2003) reported the successful using of blogs as technology tools for reflective practice in communication among pre-service teachers.

- ***Team Working Skill***

Not all experienced and inexperienced teachers had any co-teaching with other physics teachers because teachers in Malaysia do not have co-teaching in their schools. Experienced teachers believed that by "co-teaching they can share their experience with other teachers, involve the class more, guide inexperienced teachers on how to teach and do experiments, and to get more feedback on how they can do these things." Helping the teacher control the class, teaching by way of other methods, easy management of the class by teachers, and reaching students in a more detailed way are the benefits of co-teaching based on inexperienced opinion. Almost all experienced and inexperienced teachers believed that "team working with other physics teachers about their teaching support their teaching." Sharing understanding and helping each other prepare teaching materials were other benefits of team working in their opinion.

- ***Judgment Skill***

Some experienced teachers evaluated their teaching method in the classroom by asking questions of themselves. One experienced teacher at Level 1 noted the questions to evaluate teaching are: "how do my students understand?", "do the students know the importance of the lesson that I am teaching?", and "how I can teach the student with an easy method?" All experienced teachers and most inexperienced liked to have their teaching evaluated by students and they asked students questions about this in their class. The majority of experienced teachers did not like their teaching to be evaluated by other physics teachers. One inexperienced teacher at Level 2 liked to be evaluated by the students and not teachers because of shyness. This teacher explained that:

> "Because of shy… because of shy... My colleagues like to expose my weakness to guide us. But I am willing that my students give feedback".

Student laziness and lack of time were the judgment of most inexperienced teachers if students did not finish their homework. For experienced teachers lack of understanding, weak student background and personal problems in the family were the reasons students did not finish their work. The judgment of experienced teachers was based on student results, their perceptions and asking questions of students, and their observation in the classroom and students' homework while inexperienced teachers' judgment was based on comparing student answers to the questions in the class and their homework. Self-reflection is an important element to form a teachers' judgement that is the basis of reflective teaching (Pollard and Tann 1987; Eby 1992). One experienced teacher at Level 3 believed that the students' inability to complete the work can be related to teachers and students. This teacher explained:

> "So, I always see if it comes personally from me, the mistake came from me, so that I can be a bit lenient to my student. But, if it is from the student, I am not giving them. I am not mercy to them because I stated".

- ***Decision Making Skill***

All experienced and inexperienced teachers believed that understanding the weakness and strengths can help them to make decisions for future action and to improve their teaching. Students understand by asking questions from other students and their results, student reactions, and looking at the students' behavior were the ways that experienced teachers probe and solve the strengths and weakness of a teaching method through reflection. Inexperienced teachers knew about the strengths and weakness of their teaching method based only on students' understanding by asking questions from students. Asking other physics teachers when they faced problems in the classroom setting was used by experienced teachers except teachers at Level 3 and all inexperienced teachers to overcome their difficulties. Experienced teachers at Level 3 tried to solve the problems in the classroom. Appendix E shows 24 themes for experienced and 13 themes for inexperienced teachers that emerged from the semi-structured interviews.

Conclusions

Findings revealed that almost two-third of experienced teachers were reflected at the contextual level and almost half of inexperienced teachers were reflected at the technical level. However, based on the total mean the reflection level of both experienced and inexperienced teachers were at the contextual level. Comparing the differences in reflective teaching skills between experienced and inexperienced physics teachers in different levels of reflection can help to find a way of supporting inexperienced teachers' reflective teaching skills to be the same with the experienced teachers. Results showed that there are differences in using reflective teaching skills between experienced and inexperienced teachers at different levels of reflection. Moreover, the gap between the acquired and required reflective teaching skills of inexperienced teachers is bigger than the gap between the acquired and required reflective teaching skills of experienced teachers.

Experienced teachers used observation skill to reflect on their teaching based on observing students' understanding and behavior. Whilst the inexperienced teachers tried to reflect on their teaching only by observing students' behavior. Inexperienced teachers preferred to use communication skill to discuss with students. However, most of experienced teachers used communication skill to discuss with experienced teachers. A minority of experienced and inexperienced teachers used team working skill to discuss about the issues of teaching physics and producing teaching and learning materials. Experienced teachers applied more comparing to inexperienced teachers in using judgment and decision making skills to reflect on their teaching. Minority of experienced teachers used judgment skill to assess students. Experienced teachers also preferred to make decision based on discussion with other teachers to solve any problems that happened in the class but comparing inexperienced teachers are remarkable.

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