Exploring the quality of teaching practices of Lesson Study research lessons

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Introduction

Students' learning is strongly related to the quality of teaching practices. However, teacher is the key factor to improve the quality of teaching practices. In order to improve teaching practices, there is a need to improve a teacher's profession (Darling-Hammond, Wei, Andree, Richardson & Orphanos, 2009). Researchers had been in search for professional development models that could help improve the quality of teaching practices. Darling-Hammond et al. (2009) mentioned that a professional development model should: a) be intensive, ongoing, and connected to practice; b) focus on student learning and address the teaching of specific curriculum content; c) align with school improvement priorities and goals; d) build strong working relationships among teachers. Lesson Study (LS) is a school-based professional development model whereby the teachers plan, conduct, observe and reflect on the lesson collaboratively by focusing on the students' learning (Lewis, Perry, Friedkin & Roth, 2012). Hence, LS, which fulfills the characteristics suggested by Darling-Hammond et al. (2009) is being introduced to all the participating schools in this study.

This study was part of the bigger project that aimed to improve the Malaysian mathematics and science teachers' teaching practices in seven primary schools through the implementation of LS. In this paper, we focused our discussion on three mathematics LS groups from three project schools who had undergone three LS cycles. Each LS group had five participating mathematics teachers. All the 15 participating teachers were from three Chinese vernacular primary schools in Malaysia. This paper aims to explore the characteristics of the teaching practices of nine research mathematics lessons planned and conducted by the LS groups.

Literature review

Quality of teaching practices

As reported by Lim (2006), from the Malaysian teachers' perspective, good teaching practices or a good lesson should include the following six criteria:

a) Student-centred activities that promote conceptual understanding;
b) Related to students' daily life experiences;
c) Students understand what is being taught and can apply what they have learned to solve problems;
d) Well planning of student activities;
e) Students' active participation in interesting and meaningful activities; and
f) Use of teaching aids that promote students' conceptual understanding.

In addition, Lim and Kor (2012) conducted a study to examine the characteristics of good teaching practices espoused and enacted by six excellent teachers in Malaysia. They found that these teachers shared similar criteria of good mathematics lessons as:

achieving teaching objectives; cognitive development of pupils; pupils' affective achievement; focusing on weaker pupils; and pupils' active participation in activities. In this paper, teaching practices refer to the teacher's process of conducting the lesson, pupils' engagement, arrangement of content and type of resources used.

Lesson Study (LS) and research lesson

Lesson Study (LS) is a professional development model that originated in Japan. In this model, a group of teachers collaboratively studies their own lessons using the cycle of LS (Baba, 2007; Fernandez, 2002; Lewis et al., 2012; Lewis, Perry & Murata, 2006). The cycle of LS consists of four main phases, which include: setting the goal, planning and refining the lesson plan, conducting and observing the lesson and reflecting on the lesson. The lesson that is studied collaboratively by the LS group is known as research lesson (Lewis et al., 2006; Lewis & Tsuchida, 1998). A research lesson is an actual lesson that is collaboratively planned, conducted and observed in a real classroom situation and reflected on at the end of the lesson by the LS group members.

Methodology

Participants

This study was part of a bigger project involving seven primary schools and 45 mathematics and science teachers. Our analysis focused on three mathematics LS groups from three Chinese vernacular primary schools located in semi-rural and rural areas of North Malaysia. There were five mathematics teachers who participated in each of the LS group. Hence, there were a total of 15 mathematics teachers involved in this study.

Data Collection

Qualitative data were collected mostly through video recordings of the whole LS process, which included the phase of: refining lesson plan, lesson observation and post-lesson reflection. Figure 1 shows the process of data collection. For each of the LS groups, three cycles of LS were conducted and a session of individual teacher interview was conducted after.

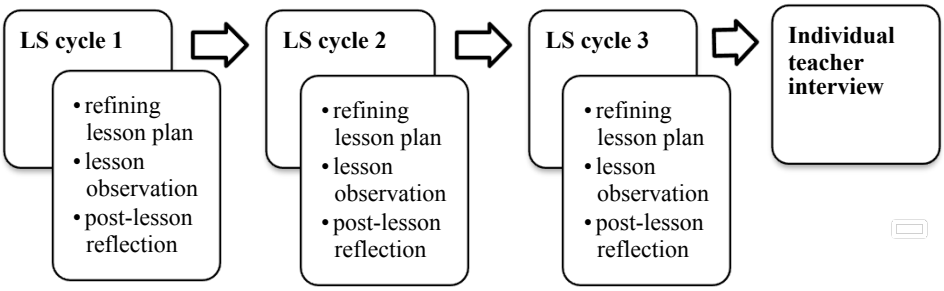

Figure 1. The process of data collection

Data Analysis

In this study, the focus of our analysis was on the nine video-recorded lesson observations. For each lesson, two major aspects of the teaching practices were examined: a) teacher's activities including type of questions posed and accuracy and clarity of content representation and presentation and suitability of the resources used

and b) pupils' participation in the activities. The nine video-recorded research lessons were analysed using NVivo 10 software for qualitative data analysis.

Findings and Discussion

We acknowledged that different topics of the lessons could have different examples posed, different activities conducted and different types of classroom resources used. However, our intention was to reveal how LS could be one of the potential professional development programmes to improve the teachers' teaching practices. Table 1 shows the summary of characteristics of teaching practices of research mathematics lessons in the three project schools.

Table 1. Characteristics of the teaching practices of research mathematics lessons in school S, school C and school P

Characteristics	School S			School C			School P		
	LS 1	LS 2	LS 3	LS 1	LS 2	LS 3	LS 1	LS 2	LS 3
1.The teacher arranged the content with increasing difficulty	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.The teacher gave examples related to daily life or real life situation	∘	✓	∘	✓	✓	✓	✓	∘	✓
3.The pupils participated in three or more types of pupils' activities	∘	∘	✓	∘	✓	✓	✓	✓	✓
3.1. Board work	∘	∘	✓	✓	✓	✓	✓	∘	∘
3.2. Individual seatwork	✓	✓	✓	∘	∘	✓	✓	✓	✓
3.3. Group work	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.4. Presentation	∘	∘	∘	∘	∘	∘	✓	✓	✓
4. Most of the pupils actively engaged in group work	∘	✓	✓	∘	✓	∘	✓	✓	✓
5.The were four or more types of resources used	✓	✓	∘	∘	∘	✓	✓	✓	✓

School S

The topic for LS 1 lesson in school S was on division of whole number for Grade 3. The teacher arranged the examples from concrete objects (counting number of scissors) to abstract (writing of the division). From observations, some of the pupils did not engage actively in the group work session. This could be due to having too many pupils (eight to nine pupils as in Figure 2) in a group and the task assigned was not challenging for them. There were four classroom resources used during the lesson: scissors, *mahjong* paper, blackboard and worksheet.

The LS 2 lesson was a Grade 2 topic on length. The teachers arranged the examples presented from the different types of measuring tools (concrete objects) to writing of the measurement in metre and centimetre (abstract). In the group work session, five pupils actively engaged in measuring and recording the lengths of different objects found in the classroom as in Figure 3. There were 13 or more resources used in the LS 2 lesson. These are measuring tools, six items assigned by the teacher for the pupils to measure in group, steel cupboard, blackboard, tissue box and so on.

Figure 2. Nine pupils in a group to solve the questions

Figure 3. The pupils actively engaged in measuring the length of the objects

Figure 4. Four pupils engaged in solving the question formed by the other group

The LS 3 lesson was on a Grade 5 topic -- multiplication of whole numbers. The teacher arranged the examples from simple multiplication tasks to more difficult ones. The analysis showed that the pupils actively engaged in a group of four forming and solving a question of a four-digit number multiplied by a two-digit number (as in Figure 4), which was challenging for them. However, there were only three resources used in the LS 3 lesson, which were cardboard, blackboard and worksheet.

Observations showed that in the LS 1 to LS 3 lessons in school S, the participating teachers focused on the arrangement of the examples from simple to difficult. They even used concrete objects in LS 1 and LS 2 to help the pupils' learning. They tried to improve the group work sessions so that most of the pupils actively engaged during the session. During the third post-lesson reflection, one of the participating teachers, Madam M said that, "…the comments given you all (the knowledgeable others) helped us to improve our teaching practices." Another teacher, Madam P commented, "LS had provided all the teachers a chance to sit down together, and discussed how to teach a topic, how to solve the problems faced during a lesson." Similarly, Madam L found that "Each individual teacher taught the lesson differently. We could observe how other teachers teach the lesson and learn from them." In the post LS individual teacher interview, one of the teachers, Madam L mentioned that, "Like those weaker pupils, they can master [the concept] too, slowly, from simple [examples] to difficult [examples]." Thus, for school S LS members, they found that the LS provided a platform for the teachers to discuss how to improve their teaching practices with each other and the knowledgeable others. Furthermore, through observations they could learn teaching practices that helped the pupils to learn especially, the weaker ones from each other.

School C

In school C, the LS 1 lesson was a Grade 4 topic on time. The teacher arranged the examples from a simple example on addition of time (the pupils' previous knowledge) to two difficult examples that involved addition of time and conversion of the units related to time. In the LS 1 lesson, the teacher invited the pupils to give the time they spent on homework and assigned word problems, which related to the pupils' daily life experiences. From the analysis, the resources used mainly were cardboard and blackboard.

In the LS 2 lesson of school C, the lesson involved the Grade 5 topic on whole numbers. The teacher gave examples related to floods, began by showing a picture of a flood (iconic), followed by a newspaper cutting about flood (symbol) and then word

problems related to the number of victims and relief items (symbol). At the same time, the teacher tried to make connections between mathematics and the flood (real experiences). The pupils engaged more actively in the challenging task that required them to form a word problem and solve it by themselves in groups. There were three resources used: pictures related to flood, a newspaper cutting, and blackboard.

The LS 3 lesson was the Grade 2 topic on fractions. The teacher gave examples with increasing difficulty. She began the lesson by cutting the cake in two equal parts (concrete objects) and posed questions that related to the pupils' daily life experience. Then, the pupils solved the fraction puzzles (concrete objects) and matched the fractions with the respective words and numbers (pictorial). The pupils then wrote the related fraction on the blackboard (abstract). There were seven resources used. These are a cake, fraction puzzle, fraction diagram, cardboard written with fraction in words and numbers, colour papers, blackboard and workbook.

Based on the observations, the participating teachers in the LS 1 to LS 3 lessons in school C appeared to arrange the examples from simple to difficult. They even used examples related to pupils' real life experiences in all the LS lessons. There were more resources used during the lessons. They tried to involve the pupils in activities such as group work. In the post-LS teacher interview, one of the teachers, Madam W mentioned that, "The other [teachers] might see things that we not able to see. What they see might be our weakness [in teaching]." Thus, through LS, it helped the teachers in school C to improve their teaching practices by realising where the weakness of the practices was from comments given by others.

School P

In the LS 1 lesson of school P, the Grade 4 topic on time was the focus. The teachers arranged the examples by posting videos related to real life situations tsunami (simple), to conversion of hours to days and conversion of weeks to hours (golden time), and challenging word problems involving the computation of the period between golden time and rescue time (difficult). The pupils were more actively engaged in the forming and solving of a word problem. There were four resources used, which were the video about tsunami, smartboard, newspaper cutting and worksheets.

The topic for the LS 2 lesson was on Grade 4 volume of three-dimensional (3D) shapes. The teacher gave examples from a cube model and two cuboid models (concrete objects), then a picture of the Rubik's cube (pictorial), and then introduced the formula of area and volume (abstract). Most of the pupils engaged actively in the second group work session whereby they were asked to build and record the multiplications of models with the volume of $60cm^3$ in pairs. There were seven resources used: a big dice, a cube model, cuboid models, small cubes, the pictures of different types of cubes and cuboids, smartboard and worksheet.

The LS 3 lesson involved the Grade 5 topic on volume of 3D shapes. The teacher began the lesson by posing questions about the pupils' past experience in the old school building. The teacher arranged the examples from using concrete objects such as tissue box (simple examples), and followed by the formulas of area and volume on the smartboard (abstract examples). In the LS 3 lesson, there were eight resources

used: pictures of different types of building, cardboard, Rubik's cubes, tissue boxes, short ruler, small cubes, smartboard and worksheet.

The lesson observations showed that the participating teachers focused on the arrangement of the examples from simple to difficult for the LS 1 to LS 3 lessons in school P. They used concrete objects and hands-on activities in the LS 2 and LS 3 lessons to help the pupils in learning the concept of volume. In the LS 1 and LS 3 lessons, examples related to the pupils' real life experiences were given. In all the LS lessons, the participating teachers tried to engage the pupils in more activities such as presentations and group works. Throughout the LS 1 to LS 3 lessons, there was an increase in the number of resources used. During the first post-lesson reflection, Madam T said that, "We could realise where our problems were [in our teaching practices]. If we taught the lesson by ourselves, we would not know where the problems were." Similarly, another teacher, Mr. K agreed with Madam T whereby through sharing and discussing the teaching practices with each other, they could understand themselves better and improve their own teaching. In the post-LS teacher interview, one of the teachers Mr. Y mentioned that. "…because of LS, we will do research about what is tsunami, golden time, then, we try to give real life examples [in the lesson]." The teachers would search for new ways or real life examples to help the pupils in learning the concept. Hence, through LS, the teachers in school P found they have opportunities to discuss and realise their problems in teaching practices and then helped each other to improve their teaching practices.

Conclusion

The analyses of the nine research lessons showed that there were observable changes in the choice of examples and tasks given by the teacher; variation in the use of teaching resources; and more pupil-focused learning. Instead of random examples, examples were sequenced from simple to difficult. There was increasing use of various kinds of teaching materials such as concrete objects and newspaper cuttings. Learning became more pupil-focused, with pupils actively participating and engaging in groups. As reported by Chiew and Lim (2005), group work was one of the pupils' activities in the LS lessons. Similarly, Lim, Chiew and Chew (2010) assessed the improvement of teaching and learning process through LS and found that LS lessons consisted of more pupils based activities. Teaching practices might not change in a short span of time. As mentioned by Stigler and Hiebert (1999), teaching is a cultural activity that requires time to change. However, the results of this study indicated that the implementation of LS could have a positive impact on the teaching practices of teachers and hence, enhance the quality of mathematics lessons.

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