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Teachers' Beliefs on the Benefit of Collaboration in Lesson Study

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Abstract: Lesson study is being actively implemented in many countries as one of the continuous professional development programs for school teachers. Since collaboration is an important element of lesson study, it is deemed necessary to investigate teachers' beliefs about collaboration in lesson study. Data were collected through both qualitative and quantitative methods, where teachers were surveyed via questionnaire, interviewed, observed and asked to keep a journal. Thirty-one teachers and a school administrator were involved. The results showed that most teachers agree with the benefits of lesson study, espeially that it improved cooperation and collegiality. Other benefits include: lesson study provides a platform for sharing collaboratively; knowledge is enhanced in terms of content, pedagogy, student-centered instructions , and curricula – ability to design constructivist lessons. Negative comments were centered around time constraints and heavy workload – leading to absence from shceduled meetings. Overall, the effect of collaboration in lesson study has led to more improved teachers compared to other professional development approaches.

Keywords*:* Lesson Study, Teachers' Collaboration, Mathematics Research Lesson, Continuous Professional Development

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Introduction

Some studies suggest that teachers' beliefs influence instructional behaviour, while some suggest that instructional practices influence teachers' beliefs (Earnest, 1988; Barkatsas & Malone, 2005; Cross, 2009; Lucas & Wright, 2009). Barkatsas and Malone (2005, p. 71) conclude that 'mathematics teachers' beliefs have an impact on their classroom practice, on the way they perceive teaching, learning, and assessment, and on the way they perceive students' potential, abilities, dispositions and capabilities'. Therefore, investigating teachers' beliefs or perceptions about the teaching and learning of mathematics has its advantages. This study investigates teachers' beliefs and views on the benefits of collaboration among teachers involved in a lesson study project. The benefits of collaboration among teachers are not restricted to just better school environment but a small and growing body of evidence suggests a positive relationship between teacher collaboration and student achievement (Goddard, Goddard & Taschannen-Moran, 2007).

Collaboration is working together to achieve a goal. It is a recursive process where two or more people or organizations work together to realize shared goals (Encarta, 2009). In fact, most of the current major educational reforms call for extensive, meaningful teacher collaboration (Inger, 1993). Despite the calls for collaboration, it can be said that teacher collaboration is still much desired. It was noted that although they might collaborate in performing some duties (e.g in extra- curricular activities and school functions), they work individually when it comes to planning and preparing their lessons and materials, and struggle on their own to solve their instructional and curricular problems (Ade Shahren, 2010). Inger (1993) supports this by saying that in most schools, teachers are colleagues in name only. However, it has been proven that considerable improvements in student achievement, behavior, and attitude were noted when teachers collaborate (Inger, 1993). A study by Barrett, Riggs and Ray (2013) shows improved engagement and achievement of students in geometry, when school teachers collaborate with university mathematics education faculty. Graham (2007) stressed the role of management structures and practices in facillitating the foundation of collaboration within a school.

The complexities introduced by a new curriculum or by the need to refine an existing curriculum are challenging. Teacher teamwork stimulates new ideas, promotes coherence in a school's curriculum and instruction and makes

these complex tasks more manageable. This is especially appropriate for teachers dealing with curriculam that advocate reform in instructional designs, which requires a change in their conceptions and attitudes towards students' learning process. Such changes would develop when teachers work together in a non-threatening setting where they can exchange ideas, discuss new materials, develop and design lesson plans, test the agreed lesson plans in real classrooms, receive feedback from colleagues, and repeat the cycle until they have achieved the desired outcomes. The process described is synonymous with lesson study.

Lesson study is a long term teacher-led professional learning approach developed in Japan. Teachers work collaboratively and systematically to conduct research on teaching and learning in classroom with one goal in mind which is to enrich and improve students' learning experiences and improve teaching methods (Yoshida, 2005). Lesson Study promotes collaborative work among teachers, starting from developing and researching a lesson through a "design-implement-reflect-revise" cycle until it reaches a form that is believed to be ideal to the teachers. According to Wai Ming Cheung & Wing Yee Wong (2014), collaboration to the Japanese was a path of life, not only a technique borrowed for certain meetings or projects. During their research, they noted that the spirit of collaboration and collective ownership among teachers during lesson study was highly articulated and felt, as they (teachers) felt free to depend on each other to form and direct development of well-outlined lesson plan.

Many countries have adopted Lesson Study in order to enhance teachers' content and pedagogical content knowledge which led to development of capacities for designing and researching their own lessons. As an example, Lesson study has gained popularity in Brunei since 2007 due to the aggressive enforcement by the Department of Schools, Ministry of Education, both at Primary and Secondary levels (Ade Shahren, 2010). At the Primary level, the Department of Schools has made lesson study a compulsory continuous professional development program for teachers. The number of teachers and schools involved in lesson study has steadily increased year by year.

When a new education system is being implemented, continuous professional development (CPD) programs in the form of briefings or workshops relating to the new education system and the new curriculum were carried out regularly. Although numerous workshops have been conducted by the Curriculum Development Department and other departments from the

Ministry of Education, it can be said that most teachers yearn for something practical on matters concerning the new curriculum and the related elements such as the assessment framework and the recommended teaching methods (Ade Shahren & Khalid, 2010). For effective changes to take place, teachers would need the supportive surrounding that helps them with the changes, as was asserted by Briscoe and Peters (1996, p 63), "collaboration [is] not only essential, but very desirable to support the change". This was echoed by Chassels and Melville (2009) in their study of 60 teacher candidates in Ontario, Canada, where collaboration and dialogue became a valued aspect of lesson study practice as teacher candidates took initiatives to create their own professional learning communities.

Lesson study, being the platform for collaboration and collegiality, is an appropriate setting for teachers to acclimatize themselves into professional learning communities. Taking into account the benefits of lesson study, which can be associated with active participation and collaboration among teachers, the researchers feel the necessity to examine the beliefs of the teachers involved in Lesson Study, particularly on the benefits of collaboration.

The Present Study

Gearing more towards Vygotsky's socio-cultural constructivism, collaborative work allows the teachers to arrive at a shared understanding of product – in this case, ideal or exemplary lesson as a result of active social interactions (Rink, 2001). Through collaborative work, teachers' knowledge (especially pedagogical content knowledge) is enhanced and extended through participation in the social interaction, which is maximized when people with different ideas, conceptions, and opinions interact (Putnam & Borko, 1997). New knowledge can also be created through this process. Being aware of collaboration and believing in its benefit will bring about advantages and also impact on teachers' classroom practices as stated earlier. Hence, the researchers decided to embark upon this study, to examine the teachers' beliefs on the benefits of collaboration during lesson study project. This study will be guided by the following research questions: 1. What are the teachers' beliefs on collaboration during lesson study project; 2. Does collaboration among teachers help in furthering their knowledge better than other forms of professional development?'

Methodology

This study employs both quantitative and qualitative data to answer the research question. Twenty-eight teachers from fourteen elementary schools in Brunei Darussalam were surveyed via questionnaires. Four of the respondents (teachers A, B, C, D) were interviewed to further clarify and explain the extent of their collaborative work during their involvement in a lesson study project for mathematics. These four teachers were also asked to keep a journal during their involvement in lesson study. Besides that, data from observation were also collected where checklists were used to rate various aspects of the research-lesson especially on students behaviour. Video recordings during the lesson planning and reflection stages were transcribed. Furthermore, data was also collected from another school through interviews with three teachers (A1, B1, C1) and a school administrator who were all involved in lesson study. The different types of data collection method were to ensure that data triangulation was achieved. As for the instruments used in this study, the Cronbach alphas of the questionnaire and checklist were found to be 0.910 and 0.821 respectively which suggest high reliability for both instruments. However, this paper will only report on the questionnaire and interview data.

The whole process of research on this particular lesson study cycle took three and a half months to complete, and may be adequate to satisfy the validity and reliability criteria of prolonged engagement and persistent observation made during the period. Other criteria that the researchers tried to satisfy were triangulation, peer debriefing, member checks and negative case analysis (Lincoln & Guba, 1985). Initially, teachers were given workshops on how to conduct lesson study although some of them had already attended similar workshops earlier. This is to ensure that all teachers involved knew about important aspects of lesson study and what it entails. This is followed by lesson planning which takes up to a month to produce a satisfactory research lesson plan. The implementation of the research lesson and reflection took another four to five weeks depending on the number of schools in each group. During this period, lesson plans were rewritten and different classes were taught using the new lesson plan until a satisfactory lesson was accomplished. Later, the teachers from each group meet to discuss report writing.

The quantitative data were analysed using IBM SPSS v20 and results were presented in the form of descriptive statistics. Qualitative data were

analysed by examining the emerging themes and interpretations were made from these to clarify and support the results.

Findings and Analysis

As specified earlier, only the findings and analysis from questionnaire and interview data are reported here. The survey questionnaire used the Likert scale of 1, 2, 3, and 4 for strongly agree, agree, disagree and strongly disagree respectively. For the purpose of this particular paper, only items related to collaboration are presented. The presentation of findings from quantitative data is followed by qualitative data according to the themes that emerged. Where available, data from quantitative data will be presented first, followed by the qualitative data. In some particular cases, quantitative data was well supported by the qualitative data. Teachers' perceptions of collaboration (during as well as before and after lesson study) is presented first, followed by the benefits that teachers believed are the outcome of collaboration during lesson study. Finally, teachers' opinions and frustrations are presented at the end.

Teachers' perceptions about collaborative work

Item 1 in Table 1 was about perceptions about collaborative work in the lesson study project. With a mean of 1.61 (S.D = 0.629), most teachers seemed to agree that working collaboratively improved when they engaged in the lesson study project. They did not agree that feedback and comments from working collaboratively were not helpful and agreed that they hold back some comments because of concern for other teachers' feeling.

These were also reflected from comments made by the teachers and a school administrator within the same school of the working group, during interview. Having worked together as a team prior to the project, the group agreed that they collaborate better both during and after lesson study was practiced.

> School administrator: 'Before Lesson Study, collaboration already existed among them but only at a minimum level. However, after Lesson Study, collaboration among them really amazes me. They are always collaborating and showed good team work in whatever they do or plan, especially for Lesson Study'.

> Teacher A1: 'Before the Lesson Study Project, our group collaborate well with each other. We do not have any problems. But after the Lesson Study Project, it seems that collaboration between us steadily improve with time'.
>
> Teacher C1: 'We used to talk about lessons before but it was not as much as now.'

Table 1: Descriptive Statistical Data of Teachers' Perception of collaborative work

Items	N	Min	Max	Mean	SD
1. The lesson study has improved my perceptions on collaborative work practices to design lessons that engage students with their learning	28	1	3	1.61	.629
12. Concern for others' feelings influenced my feedback and comments	28	1	4	1.86	.756
13. Feedback and comments from group members and other teachers were not helpful.	28	1	4	3.48	.685

The following excerpts indicate that the teachers appreciate collaboration during lesson study project. Their perceptions improved as they spend time working together, in the presence of their headmistress (knowledgeable other cum researcher), on the project. In general, they all agree that working together made them work better.

> Teacher A1: 'I guess everyone was worried and anxious with the unknown tasks waiting before the Lesson Study Project. But after, it seems that everyone gets along really well, able to work as a team, open minded and confident.'
>
> Teacher B1: 'I believe that when the researcher spends time with the team and discuss with the team in a closed environment, it encourages a certain feeling of appreciation and value towards each other. The team collaborates well with the researcher because of this.'

> Teacher C1: 'I can say that our relationship was already good. We are really open-minded and we can say almost anything that we want in front of each other. After the Lesson Study Project, we discussed more on professional development that really improve us as teacher-leaders as we accept good and bad comments from each other. As we work together in this research, the more time we spend talking and discussing, the more at ease and comfortable I become. I have never experience any sharing session like this one. I can open up, accept criticisms on our work, understands our weaknesses and also build our knowledge. I always believe that everything happens for a reason, knowing her (the researcher) and being a part of this team, makes me see that collaboration is far better than handling things all by myself.'

Benefits of collaboration during lesson study

Platform for Sharing

The benefit of working collaboratively in lesson study is the opportunity for teachers to contribute and share their teaching ideas, knowledge, opinions, assessment and reflections. The lesson study processes provide a platform for teachers to share their experiences with each other and this seems to be the essence of collaborative work that the teachers are proud of, which is strongly reflected in the following excerpts:

> Teacher B: 'Group work among teachers means sharing ideas, and sharing methods...discussion.'

> Teacher C: 'When observing, I can reflect myself, I got to know my weaknesses and strengths'

> Teacher D: 'I can compare my teaching with the other teachers and think of my own teaching… consider my weak points and strong points'.

> Teacher A1:' I became more understanding although I see things differently. I cannot compare myself to others. I cannot think that they have the same thinking as mine.'

> Teacher C1: 'My first valuable lesson is that working together is far better than working alone… with this collaboration I

> seek challenges since I know I have my friends to work with. My greatest lesson is accepting critics or comments.'

When the team worked on a lesson, the teachers are able to share their ideas and methods of teaching during lesson planning. During observation, teachers observing the lesson would self-reflect on their own teaching and later share their thoughts on teaching methods observed at the implementation stage of lesson study with other team members during reflection and discussion stage. Furthermore, the act of sharing was even suggested to the extent of sharing a successful lesson to the national level.

> Teacher A: 'Make the lesson plan as teachers' guide, it will benefit a lot of teachers.'

The teachers mostly disagreed that the feedbacks and comments made by their team members were not helpful (Table 1: M = 3.48 and S.D = 0.685). When questioned on a valuable lesson learned in lesson study, teacher B1 answered " listening to others, objective and on task and empathy for others." Thus from the interview transcripts, the opportunity to share their knowledge, whether during planning, implementing and reflecting stages of lesson study, is one of the valuable benefits from collaboration. However, not all kinds of knowledge sharing and comments are helpful in collaborative work. It needs to be done in a manner where everyone is on the same objective and mindset. Even though the teachers agreed on the positivity of voicing their opinions, they were aware of the sensitivity of sharing their opinions as reflected in item 12 (Table 1: M = 1.86 and S.D = 0.756). Teacher A and teacher C reflected different scenarios where concerns for others' feelings can have different effect to the teachers' collaboration.

> Teacher A: 'And sometimes it was a kind of competition, not collaboration. Like...who was better... or worse. During lesson planning... everything was okay... so we were happy with it. But after the teaching of the research lesson, the comments were mostly from her. So I was really upset. For me as a team member, we should support each other. She never give us any help during planning, and then she commented a lot. Why not help us during planning? Collaboration was OK with the other two teachers, but the fourth teacher, ...'

> Teacher C: 'It all depends on the group members. Some group members were not expressive, maybe because they didn't understand about lesson study, it's not their fault. For me, the more 'competitive' the teachers were, the better the collaborative work.'

Sharing of knowledge and experience are crucial for the effectiveness of collaboration. In addition, teachers also highlighted the importance of sharing responsibilities and commitment to the project. The common perception that the teachers seemed to agree and committed upon is focusing their attention towards the development of students' mathematical thinking.

Student-centred teaching

Table 2: *Teachers' perception of collaborative work towards students' learning.*

Items	N	Min	Max	Mean	SD
5. Planning together helped me understand more on students' way of thinking and learning mathematics concepts.	28	1	2	1.57	.504
10. Teaching and observing the research lessons made me more aware of the importance of asking probing questions that make students think mathematically.	28	1	2	1.46	.508
11. Teaching and observing the research lesson make me more critical in choosing the right teaching activities that help students to understand and think mathematically.	28	1	2	1.43	.504

Items 5, 10 and 11 are concerned with the benefits of collaboration towards students' learning. All the teachers chose between strongly agree and agree on these items and the means for these items are 1.57 (S.D = 0.504), 1.46 (S.D = 0.508) and 1.43 (S.D = 0.504) respectively. These show that all the teachers involved in Lesson Study agreed with the fact that the planning and implementing of (research) lessons with other colleagues helped them to understand their learners' needs and be critical of their pedagogy that focuses on students' learning.

These are also reflected in the interview transcripts where the teachers were more aware in gearing their instructional practices to cater students' needs. Lesson Study has made teachers more inclined to understand their learners and try new ideas or methods according to students' needs and thus making the lesson more student-centred.

> Teacher A: …'lesson study would be useful to teachers as lesson study exposed teachers to student-centred rather than teacher centred-teaching method. It also allows pupils to think independently and express their ideas to teachers and other students.'
>
> Teacher B: Now 'I'm more in favour of student-centred teaching.'
>
> Teacher C: 'I realized it is important to understand our own students, their learning difficulties and the way they learn. Now I can see that it is important to develop their mathematical thinking, to find the reason and rationale of a concept.'
>
> Teacher D: 'For our lesson study, I have to find those activities that encourage students to think. It's important to know my students' prior knowledge and relate them to the new topic.'

Professional development

Items 2, 3, 4, 6, 7, 8, 9, 14 and 15 are related to teachers' beliefs about the benefit of collaboration in enhancing their professional development (concerning content knowledge, curriculum, instruction etc.) as a teacher. In general, the mean for each statement is 1.54 or less and for positive statements, this signifies that teachers agree to strongly agree to all of the statement while the opposite is true for negative statements. Statements 2, 3, and 4 clearly indicated that teachers believed that their knowledge was improved due to planning together. Statements 6 and 14 indicated that they believe their pedagogical content knowledge was enhanced; statements 8 and 9 indicated that they learn to assess lessons and self-reflect through observation and analyzing while statements 7 and 15 indicated that they belief they are better mathematics teachers; because

of the collaborative nature of lesson study and also from giving and receiving comments and feedback.

Table 3: *Items from questionnaire related to professional development*

	Items	N	Min	Max	Mean	SD
2.	Planning together do not broaden my knowledge of the mathematics content/subject matter	28	3	4	3.71	.497
3.	Planning and preparing to teach the topic we have chosen caused me to engage in mathematical reasoning and problem solving	28	1	3	1.50	.577
4.	Planning together helped me to be aware of the new mathematics curriculum.	28	1	2	1.50	.509
8.	Observing and analyzing others' lessons helped me think more deeply about mine.	28	1	3	1.50	.577
9.	Observing and analyzing each other's lessons do not help me learn to assess lessons.	28	3	4	3.66	.508
6.	Planning in a group broadened my knowledge of mathematics teaching ideas and pedagogy	28	1	2	1.46	.508
14.	The reflective comments made me more aware of my general weaknesses and strengths of my mathematics teaching.	28	1	3	1.54	.576
7.	The collaborative lesson planning is beneficial for me in order for me to be a better mathematics teacher	28	1	2	1.39	.497
15.	The comments and feedback do not help me to be a better mathematics teacher.	28	2	4	3.43	.577

The interview data below seem to support the quantitative data where the teachers felt that they have improved in terms of delivering the contents, especially their communication skills such as questioning techniques and in giving clear instructions. The Lesson Study also strengthens teachers' readiness by forcing them to be well prepared for a topic content since they are required to contribute ideas.

> Teacher B: 'I developed my communication skills; I'm more open and accepting to other teachers' ideas. In terms of teaching, I improved the way I give instructions to pupils.'
>
> Teacher C: 'I have to be well prepared to teach a topic. And my questioning technique has also improve.'
>
> Teacher D: 'I have to survey for the content in the Internet, for example the activities on fraction, I have to choose the activities that are fun.'

Pedagogical content knowledge (PCK)

Shulman (1987) defined pedagogical content knowledge (PCK) as "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (p. 8)

During professional development, teachers tend to focus on PCK. The collaboration work among teachers provided an avenue for them to share their pedagogy or mathematics teaching as an important aspect to be discussed. These were reflected from the interview transcripts when questioned about which aspect were discussed during lesson study project.

> Teacher A: 'Mathematics content, 30% maybe...teaching method...50% and classroom management...i think about 20%.'
>
> Teacher B: 'Mathematics content 20%, teaching method 70%, classroom management 10%.'
>
> Teacher C: '60% for Pedagogy, 30% for mathematics content, 10% for classroom management.'
>
> Teacher D: 'Mathematics content 5 %, pedagogical 90%, classroom management 5%...we didn't look at the management aspect.'

On average, it was found that teachers spent more time to discuss the methods of teaching, followed by mathematics content and to a lesser degree, classroom management. Pedagogy is the main area being discussed, however,

not all sharing of ideas on contents and instructions were received with interest.The teachers voiced out that collaboration work also gave way to conflicting of ideas on contents and how to deliver these contents. Different teachers brought in their own individual pedagogical content knowledge on the table of discussion, which is often different from each other. Each teacher has their own teaching experience and their own understanding on what the learners needs. For instance, a teacher found it difficult to give ideas that are out of her comfort zone of routine mathematics teaching. Furthermore, a teacher felt insecure to share his/her ideas based on their inferior qualifications.

> Teacher A: 'When we meet to write the lesson plan, sometimes compiling different ideas make the lesson plan worse rather than better.'
>
> Teacher B: 'It's hard for me to try to find and suggest teaching methods that are not routine.'
>
> Teacher C: 'Since I only have certificate compared to the other teachers who have degree or even masters, I sometimes felt small in the presence of these teachers. I felt that I have no right to criticize them and give opinions during the planning session.'
>
> Teacher D: 'If too much ideas and people...then it will be cramped...it would be chaos**.'**

Although the teachers felt this way, from our observation, at the end of each stage of lesson study, (i.e. planning, implementing and reflection stages) the teachers would come together and agree to the ideas, in the spirit of collaboration.

Commitment

Favourable perception combined with commitment towards collaboration is what we desire in our teachers. Therefore, during interview, teachers'

commitment was discussed. To have a supportive environment for collaboration, teachers felt that their members should allocate their time to meet each other and be committed to the group meetings, at all stages. Teachers felt that the most challenging and problematic aspect of lesson study is to rearrange their schedule and to meet up for the planning and discussion in developing a lesson. It did not help that the teachers were from different schools and each had their own individual school obligations.

> Teacher A: 'We need time to meet and plan a lesson. Sometimes, the time chosen is not suitable for other teachers from other schools.'
>
> Teacher B: 'I'm in favour...but it was kind of time consuming...sometimes we have other work to think about...and meetings. Sometimes there were clashes of meetings.'
>
> Teacher C: 'There were problems. Sometimes when the date was already decided, we couldn't go to the lesson study meeting because we have to attend another workshop. That was the main problem. I was only involved in 2 meetings so I missed many things. For me, we have to find out how all group members can attend the meeting at the same time.'
>
> Teacher D: 'During planning, we have difficulties. We have to fix our time with other teachers.'

It was much more complicated for them to work their schedule around observing each other's lessons as this involved school administration and their own individual teaching hours.

> Teacher A: '…but it's just the time when we need to observe at other schools, we need to discuss with our headmasters, and sometime, we can't go...three of us from the same school...can't go missing at the same time. And then one day

> during that time, I was allowed to go but my timetable was full. So I didn't go because if I go, and if I swap my subjects with other teachers, I would have replace the lessons on other days.'
>
> Teacher D: 'I don't like to leave my students. I don't know whether there were relief teachers looking after my students when I was missing. I love to observe other teachers but I have to think about my students. The administration should not only provide relief teachers to look after my students but teachers that actually teach my student.'

The teachers expressed their feelings and sometimes frustrations on how much time was consumed during the process of lesson study. They also said that their commitment to the project was the main reason it was on track. However, it can be improved.

Discussion and Conclusion

The first conclusion that can be drawn from our findings with regards to the research question – 'What are the teachers' beliefs on collaboration during lesson study project and whether collaboration among teachers help in their professional development' – is that, teachers believed that lesson study has improved their collaborative work and this has benefited them in many different ways. This was also noted in a reasearch conducted by Wai Ming Cheung & Wing Yee Wong (2014) where they found that lesson study and learning study are the energetic instruments that could assist teachers to investigate their practices and enhance student learning. Their nine studies also revealed that lesson study and learning study have positive effects on teaching, learning or both.

Teacher collaboration during lesson study breaks the isolation of the classroom and leads to increased feelings of effectiveness and satisfaction, although there were some uneasiness and ill-feelings among teachers (or knowledgeable other) in the beginning. Annamari Ylonen and Brahm Norwich

(2013) also perceived the same difficulties that teachers come accros when engaged in lesson study.

Over time, the feeling of collegiality is better and more intense. It is understandable for this to happen in the beginning because the teachers who were immersed in the project have their individual professional beliefs and school norms that promoted different forms of sharing of ideas (Little, 1990 cited in Kelchtermans 2006). Ultimately, they work more closely than before and became more understanding and were able to adapt themselves to different people.

The second conclusion is that teachers realized the many benefits of collaborative setting that lesson study offered. They point out that lesson study provided them a platform for sharing ideas such as it offers the right environment for them to discuss, reflect, criticize and learn. This was where they can test- out student-centred teaching as was demanded by the new curriculum reform, where aspects of mathematical thinking, reasoning, communication and problem-solving was emphasized in each lesson. In other words, they were more aware of the constructivist way of teaching and could understand the importance of knowing students' prior knowledge before teaching a topic. Overall, they realized that working together had developed them professionally because they believed they became better mathematics teachers, due to the content knowledge (about 20%) and especially PCK (about 70%) that they gain. This fact differ from the finding of Meirink, Meijer and Verloop (2007) where they reported more changes in cognition rather than behavior in their research on teachers' individual learning in collaborative setting. Teachers, especially certificate teachers, might feel more comfortable discussing pedagogy rather than content because of feeling of inferiority and most of teachers felt they need to discuss pedagogy because they were still quite traditional in their teaching (teacher-centred). Some were even not confident with their knowledge.

The themes that emerged from the open-ended part of the questionnaire where teachers were asked whether or not lesson study was useful, and for them to list down their reasons: – 9 out of 28 teachers mentioned pedagogical

knowledge and skill as the main aspect that were developed during the lesson study project. This is followed by development and understanding of students' learning (n=7), the valuable experiences and knowledge gain as a results of positive collaboration with peers and the 'knowledgeable others' (n=5) and the development of subject matter/content knowledge (n=2).

On the other hands, for the same open ended question, 6 out of 28 teachers mentioned heavy work load and time constraints as the negative aspect of lesson study. This reflected on how far and to what extend a teacher would commit to the project. Some teachers take the extra work load in a stride and participated without complaining while a few would complain and missed a few meetings. A study by Johnson (2003) on teacher collaboration in Australia also found a minority of teachers to be negative about collaboration asserting that the changes had led to an increase in their workloads, a loss of professional autonomy, and the emergence of damaging competition between teams for resources, recognition and power. However, collaboration could help teachers to reduce overload (Hargreaves, 1994) as teachers would not need to carry the work demands on their own. In our opinion, perhaps collaboration for teachers within schools would help to elevate the problems on scheduling.

Teachers' commitment is important in the success of a collaborative project like lesson study and if they can see the benefits, then they would be willing to allocate their time and energy to the project. However, support for teacher collaboration can be given through these suggestions; endorsement and rewards, better planning on the school part (like making sure classes are covered), time for staff development must be free from the distractions of school responsibilities, task-related training and assistance to help teachers master the skills of collaboration and human and material support (Inger, 1993). In the same vein, Annamari Ylonen & Brahm Norwich (2013) also raised the issue of wider support for the Lesson Study process in schools for its successful implementation.

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References

Ade Shahren, Hj. Suhaili (2010). *Enhancing primary mathematics instructional practices via lesson study.* Unpublished MEd Dissertation, Universiti Brunei Darussalam.

Ade Shahren, Hj Suhaili. & Khalid, Madihah (2011). Mathematics teachers' perceptions of lesson study as Continuous Development Programm., *Journal of Science and Mathematics education in SEA, 34* (1), 67-89.

Annamari Ylonen & Brahm Norwich, (2013). Professional learning of teachers through a lesson study process in England, *International Journal for Lesson and Learning Studies*, 2(2), 137 – 154.

Barkatsas, A. & Malone, J. (2005). A typology of mathematics teachers' belief about teaching and learning mathematics and instructional practices. *Mathematics Education Research Journal*, *17*, 69-90.

Barrett, D., Riggs, L, Ray, J (2013). Teachers' Collaborative Use of the Lesson Study Approach to Foster Student Achievement in Geometry. *International Journal of Social Science & Education*, Vol.3 Issue 4, 1188 – 1192.

Briscoe, C. & Peters, J. (1997). Teacher collaboration across and within schools: Supporting individual change in elementary science teaching. *Science Education, 8* (1), 51 – 65.

Collaboration. (2009). In Microsoft Encarta (version 2.1) [software]. Pedmond, WA: Microsoft Corporation.

Cross, D. I. (2009). Alignment, cohesion, and change: examining mathematics teachers' beliefs structures and their influence on instructional practices. *Journal of Mathematics Teacher Education 12(5),* 325-346.

Ernest, P. (1988). The Impact of Beliefs on the Teaching of mathematics. In P. Ernest (Ed.), *Mathematics Teaching: The State of the art*, (pp. 249-254). London: Falmer. http://www.ex.ac.uk/~PErnest/impact.htm (pp. 1-5)

Goddard, Y. L., Goddard, R. D. & Tschannen-Moran, M. (2007). A theoretical and empirical investigation of teacher collaboration for school improvement and student achievement in public elementary schools. *Teachers College Record, 109(4),* 877-896.

Hargreaves, A. (1994). *Changing teachers, changing times: Teachers' work and culture in the Postmodern Age.* Toronto: OISE Press.

Inger, M. (1993). Teacher Collaboration in Urban Secondary Schools. Berkeley, CA: National Center for Research in Vocational Education.

Johnson, B (2003). Teacher collaboration: good for some, not so good for others. Educational Studies. Vol. 29, Issue 4, pp. 337 – 350.

Lincoln, Y. S., & Guba, E. (1985). *Naturalistic enquiry*. Beverley Hills, CA: Sage.

Little, J.W. (1990). The persistence of privacy: Autonomy and initiative in teachers' professional relations. Teachers College Record 91, pp. 509-536. In Kelchtermans, G. (2006). Teacher collaboration and collegiality as workplace conditions. *Zeitschrift für Pädagogik, 52*(2), 220–237.

Lucas, S. & Wright, V. (2006) *Who Am I? The influence of teacher beliefs on instructional technology incorporation, Phase II.* Presentation for the international meeting of American Educational Research Association (AERA), San Francisco, CA.

Meirink, J. A., Meijer, P. C. & Verloop, N. (2007). A closer look at teachers' individual learning in collaborative settings. *Teachers and Teaching: Theory and Practice, 13(2)*, 145-164.

Putnam, R. T. & Borko, H. (1997). Teacher learning: implications of new views of cognition. In B. J. Biddle, T. L. Good & I. F. Goodson (Eds), *International handbook of teachers and teaching* (1223-1296). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Rink, J. (2001) Investigating the Assumptions of Pedagogy. *Journal of Teaching in Physical Education.* 20 (2) 112-128.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1-22.

Wai, Ming Cheung & Wing Yee Wong (2014). Does Lesson Study work? , *International Journal for Lesson and Learning Studies*, 3 (2), 137 – 149.