



Effect of Lesson Study Continuous Professional Development on Mathematics Teachers' Pedagogical Competence and Perceptions of Changes in Their Classroom Practices

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ABSTRACT: The purpose of this study was to investigate the effect of lesson study on mathematics teachers' pedagogical competence and find out teachers' perception of the impact of lesson study activities on their teaching. In all, 7 mathematics teachers were involved in the study. Questionnaire, observations of classroom teaching and Lesson Study meetings as well as reflective writings were the instrument used for data collection. The items in the questionnaire were analyzed using statistical tools such as percentages, mean and standard deviation from Excel 2016 Analysis Tools. The descriptive statistics indicated that there was a significant difference between Lesson Study cycles. The questionnaire given to the teacher participants to elicit their response on the perceptions of mathematics teachers towards the impact of Lesson study activities revealed a positive response. Based on the findings of the study, for this group of mathematics teachers, Lesson Study has effectively enhanced their pedagogical competence and promoted professional development.

KEYWORDS: Classroom Practices, Continuous Professional Development, Lesson Study, Pedagogical Competence.

INTRODUCTION

Planning a lesson to be taught is the sole work of the teacher. The teacher decides how to deliver a lesson using differentiated instructional strategies, select better manipulative to incorporate in the lesson and decide when to assess students' conceptual understanding. Effective lesson delivery depends on the teachers' competence level. Hakim (2015) defined teacher competence as when a teacher is able to perform a task that is based on skills, knowledge and attitudes in accordance with the demands of the job. He further stated that the success of the students in the classroom learning process cannot be separated from the role and competency of the teaching staff. Competence is basically a picture of what a person should do on the job. Blomeke and Delaney (2012) claim that teachers' competences include the professional knowledge, professional beliefs, attitudes, skills and motivational variables that support the mastery of effective teaching and learning. In general, competence entails all bits and pieces of knowledge, skills and understanding required to undertake work satisfactorily. There is compelling research evidence that the competence level of a teacher in lesson delivery impact positively on students' academic performance as well as life – long success (Chetty, Friedman & Rockoff, 2014; Nye, Konstantopoulos & Hedges, 2004). Nabie (2009) also opines that, children's interest in mathematics is stimulated when mathematics investigative task is properly designed by the teacher. This can be achieved if the teacher is competent, inspiring and well – rounded in the subject matter.

The 2008 Education Act of Ghana established the National Teaching Council (NTC) and is responsible for establishing frameworks around teachers' employment, continuous professional development (CPD) and periodic review of professional practice and ethical standards (NTC, 2016). However, Professional development program for teachers' in Ghana is mostly organized when there is a new curriculum in force. This usually follows the traditional top-down professional development approaches, where teachers are taken out of their classrooms and schools and given workshops as well as lectures by outside experts.

An effective teacher professional development is the one organized in connection with teacher's own student to address issues of concern, provide opportunities for the addition of value to teachers' pedagogical content knowledge, brings teacher's under one umbrella to enhance collaborative teaching, uses student learning outcomes to assess effectiveness and takes place over an extended period of time (Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2003; Rhoton & McLean, 2008). However, much of the professional development programs available to teachers in Ghana has been single session which requires teachers to leave students

for periods of time and requires financial support to enable them to travel to another location. Continuous Professional Development (CPD) program in Ghana in the past couple of decades mostly focused on helping participants to pass their promotion examinations and was organized by the Ghana National Association of Teachers (GNAT) for its members (Essel, Badu, Owusu-Boateng, & Saah, 2009). Furthermore, there were some of the CPDs that were organised for enhancing teacher proficiency and according to Essel, Badu, Owusu-Boateng, and Saah (2009) such training for improved teaching and learning were rare for the most part and did not take on any organized pattern. Lesson study is one example of CPD which is highly collaborative, enable teachers' to learn while continue with their teaching and also help teachers' to learn ways of differentiating classroom activities to cater for heterogeneous group of student in a regular classroom.

According to Makinae (2010), lesson study has been the main professional development tool for both prospective teachers and teachers who are already on the job since the Japanese public education system started. It involves groups of teachers meeting regularly over a period of time to work on the design, implementation, testing, and improvement of one or several "research lessons" (Stigler & Hiebert, 1999). Moreover, Fernandez (2010) added that lesson study model is school – based collaborative activity which brings about active learning among teachers, improves conceptual understanding through dialogue and changes in teaching practices which can be facilitated through continuous reflection process as well as analyzing familiar performed teaching practices. Lesson study involves small group of teachers with heterogeneous abilities that seek to work collaboratively to add value to their teaching methods and to critique one another's method of teaching (Isoda, Stephens, Ohara, & Miyakawa, 2007). Lesson study details the struggle teachers' go through to understand how to gather ideas to implement in the classroom and also helps them develop new ideas for improving teaching and learning (Takahashi, 2015). With these aforementioned views, this study will investigate the effect of Lesson Study CPD on teachers' pedagogical competence and the perceived changes it could bring in their classroom practices. The study sought to answer the following research questions:

- i. What is the effect of lesson study on mathematics teachers' pedagogical competence?
- ii. What are mathematics teachers' perception of the impact of lesson study activities on their teaching?

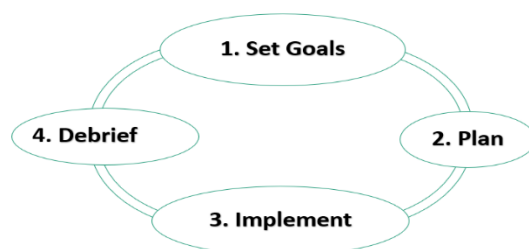
UNDERSTANDING LESSON STUDY

Lesson Study has been applied broadly in several countries across the world. Most of these countries are excelling in Science and Mathematics education. Such glories can be seen in their students' performance in the Trends in Mathematics and Science Study (TIMSS) where students from countries practicing LS in their classroom are excelling (Martin, Mullis, Foy, & Stanco, 2012).

Lesson study originated in Japan and is a collaboration-based teacher professional development approach where teachers with a shared interest in their students' learning collectively plan a lesson that would ensure maximum student learning (Murata, 2011, p.10). Lesson study has been used in Japan for several decades and has become the standard model of elementary teacher professional development, and is practiced within schools, regionally between schools, and nationally (Arani, Keisuke, & Lassegard, 2010; Makinae, 2010). Lesson Study is described as a classroom inquiry model which requires teachers to work together in small groups as they jointly plan, teach, observe, analyze and refine classroom lessons to improve their teaching practice (Coe, Carl & Frick, 2010; Pang & Ling, 2012; Stols & Ono, 2016). Doig and Groves (2011), also added that in lesson study, teachers collaboratively plan a research lesson, observe the teaching and learning process during the lesson, evaluate the content of the lesson and mode of delivery, use suggestions from evaluation to prepare better lessons to either develop teaching skills or add value to their conceptual understanding. In view of the above, LS is closely tied to the idea of learning from teaching (Stigler & Hiebert, 1999) and gives teachers the opportunity to systematically examine their teaching with the aim of becoming more effective.

The diagram below depicts the stages in LS cycle.

Figure 1: Lesson Study (LS) cycle





(1) Set Goals

Group of teachers first decide on a research focus. That is, they set goals based on desired objectives, which involves considering life-long goals for learners' learning and progress, studying guidelines and syllabus. The group then chooses what subject area to work in. Often the group chooses a subject that is difficult for students to learn and/or for teachers to teach, or a subject with a new curriculum. The group finally decides on a specific topic to teach in that subject area;

(2) Planning the lesson

This involves the development of the lesson plan, anticipating learners' responses, and gathering evidence of learners' learning. At this stage, detail outline of the instruction that will be carried out with the students is produced. Moreover, the group will collaboratively come out with details of what observers should focus on and what data they should collect regarding student outcomes. In most cases, the group will invite a knowledgeable other (e.g., a teacher or researcher knowledgeable about the topic) to join the group to help focus the lesson, to provide resources, and to serve as a discussant after the lesson is taught;

(3) Implement

Teaching of research lessons by one of the group members while others observe the lesson and collect data on learners' learning. The observers will be given specific tasks, in particular to collect data during the lesson. It is important that the observers not help students or interfere with the flow of the lesson, but the group may agree that observers can ask the students clarifying questions. A variety of data may be collected, including evidence of student motivation, engagement, and attitudes, student social behavior and attitudes toward learning, and evidence for student learning. The lesson is usually videotaped for future analysis;

(4) Debriefing the teaching of the lesson.

This occurs soon after the lesson is taught and follows a standard protocol. The teacher who taught the lesson will first give his comments based on his reflections, difficulties encounter and the way forward. The lesson study group and any other observer will gather to discuss in detail what transpire during the lesson, the impact of the lesson on students and how students engaged as well as how the teacher managed the classroom and utilized the available resources. Based on the lesson reflections and discussions during this stage, the group will create a revised version of the lesson that incorporates the changes that they believe will improve upon the original version;

It is common for lesson study groups to share their lessons and what they have learned. There are two main ways in which this sharing is done. The first way is for the group to write a report, called a "Summary of the Study" or a "Research Bulletin", in which they document the lesson they have completed together and the insights that they have gained. These reports are often published in book form, and may be distributed to other schools and educational authorities. The second way of sharing is to invite teachers from other schools to observe the teaching of the revised lesson.

RESEARCH METHODS

The model for this study is mixed method case study design. A mixed method case study design is a type of mixed methods study in which the quantitative and qualitative data collection, results, and integration are used to provide in-depth evidence for a case(s) or develop cases for comparative analysis" (Creswell & Plano Clarke, 2018, p.116). Seven (7) mathematics teachers participated in the study. Multiple sources of data collection comprising questionnaire, observation of classroom teaching, field notes, narrative accounts, documents such as participants' initial lesson plans as well as reflective writings were employed. The use of multiple sources of data collection affords the researcher the opportunity to gather in-depth knowledge about the Lesson Study model, in a way that encourages convergent lines of inquiry (Nieuwenhuis, 2014), to support trustworthiness.

RESULT AND DISCUSSION

Results were presented in the following tables.

Table 1 depicts the demographics of the participants on age, gender ,teaching experience, mathematics background and TPD they have engaged in.



Table 1: Demographics of the teacher participants

Description	Participants (n=7)	Percentage (%)
Gender		
Male	6	85.7
Female	1	14.3
Age		
20-29	2	28.6
30-39	3	42.9
40-49	1	14.3
50+	1	14.3
Years' of Teaching		
0-4	3	42.9
5-15	2	28.6
16-25	2	28.6
TPD Program Attended		
None	4	57.1
Once	3	42.9

From Table 1, the participants were male (85.7%) dominated with just a female (14.3%) mathematics teacher participating in the study. The participants (71.5%) were composed of relatively young mathematics teachers with only two (28.6%) of them having forty and above years. With regards to teaching experience, three of the participants (42.9%) had four years and below years of teaching experience and two of the participants (28.6%) had between five to fifteen years of teaching experience. Two of the participants (28.6%) had more than fifteen years of teaching experience. This purports that, the participants were made up of more of teachers with teaching experience below five years. Also, four of the teacher participants (57.1%) had never tasted any TPD program before, however, three of the participants (42.9%) who had the opportunity to attend a TPD program also admitted that the program lasted for a day or two and a maximum of three days with a resource person selecting mathematics topics and lecturing throughout the TPD program.

1) Effect of lesson study on mathematics teachers' pedagogical competence

The major research question raised was to examine the effect of lesson study activities on mathematics teacher's pedagogical competence. To accomplish this, participants were tasked to engage in lesson study activities which included planning lesson(s), implementing the lesson in the classroom and partaking in post classroom discussions. During the implementation phase of the research lesson I and II, the two Assistant Observers (AOs) were tasked to observe and rate the participants' teaching skills. The AOs assessed the teacher participants on the four (4) components of teacher pedagogical competence. Teacher pedagogical competence includes lesson preparation or planning, content presentation, classroom management and lesson closure as well as evaluation of students based on the set objectives. Table 4.2 shows the mean ratings of scores obtained by the AO's on participants' lesson planning skills.

Table 2: Mean ratings of lesson planning skills demonstrated by the participants

Lesson Plan Preparation skills	Score
a) References for books were clearly stated.	5
b) Set out clear, measurable and appropriate objectives.	5
c) Teaching activity stated clearly.	5
d) Indicating teaching material that may involve students active learning.	4
e) Availability of teaching evaluation	5
Mean	4.8

1 = Weak, 2 = Below Average, 3 = Average, 4 = Above Average and 5 = Excellent



From Table 2, it will be noted that the LS group excellently stated the identity of the syllabus as well as reference books used in the lesson plan. Setting out specific and measurable objectives during lesson preparation is one of the key criteria for assessing the authenticity of lesson plan. In line with this, the LS group was able to abide by this criterion to excellently set out clear, measurable and appropriate objectives for the lesson. Moreover, activities to be followed as well as teaching evaluation were stated clearly. On the average, the LS group scored a mark of 4.8 in the lesson preparation stage indicating an excellent performance in the preparation of lesson plan for implementation in the classrooms.

Table 3 shows the mean ratings of scores obtained by the AO's on the effectiveness of participants' teaching skills during the content presentation stages of the two LS cycles.

Table 3: Mean rating of effectiveness of teachers' activities during LS Cycle I and II content presentation

Content Presentation	LS Cycle I Score	LS Cycle II Score
a) Presenting interesting and captivating introduction.	3	4
b) Showing learning gap by merging previous skills with new skills.	2	4
c) Implementing teaching chronologically.	4	5
d) Uses appropriate teaching methods to achieve set objectives.	2	4
e) Uses appropriate teaching resources and differentiated activities to cater for students' differences.	2	4
f) Involving students in using teaching resources.	3	4
g) Demonstrate knowledge of subject matter.	4	4
h) Implementing teaching based on provided time allotment.	2	4
Mean	2.75	4.13

For content presentation (Table 3), the participants in LS cycle I scored a mean of 2.75 indicating a moderately good performance in content presentation. However, in LS cycle II, the participants scored a mean of 4 indicating good performance on such skills as using interesting and captivating introduction, involving students in using teaching resources, demonstrating good knowledge of subject matter and implementing teaching based on provided time allotment. The score of 4 indicates a higher or above average mark. The content presentation for LS cycle II was rated a mean of 4.13 indicating an above average rating. This performance is corroborated by comments made by the group members during the post lesson discussion. For instance, Edem is of the view that:

fertile ground should be created for conceptual understanding of interpretation of quadratic and trigonometric graph by introducing lessons using challenges from real life to engage learners. We can do this by using the Adomi Bridge as a classical example of quadratic graph because of its parabolic nature.

Dede also remarked "let us encourage students to be part of the learning process; in fact, the students should be at the centre of the activity". Such comments and suggestions from the post lesson discussions reshaped the lesson delivery competence in the subsequent research lesson.

Table 4 shows the mean ratings of scores obtained by the AO's on the effectiveness of participants' teaching skills, during the classroom management and lesson closure stages of the two LS cycles.

Table 4: Mean rating of effective teacher activities during LS cycle 1 and II classroom management and lesson closure

Classroom management and lesson closure	LS Cycle I Score	LS Cycle II Score
a) Distribute questions evenly to students.	1	4
b) Handles students' questions in a professional way.	2	4
c) Welcomes diversity of ideas from students.	1	3
d) Doing reflective teaching and summarizing material.	1	4
e) Closing the teaching by keeping the students on task.	3	5
	1.6	4.0



From Table 4, in the LS cycle I, the participants scored a mean mark of 1.6 which is below the average mark. This was attributed to poor distribution of questions to students and the unprofessional way of handling students' questions without involving the students in the teaching and learning process. On the contrary, in LS cycle II, the participants scored a mean mark of 4.0 which is above the average mark. This was attributed to evenly distribution of questions to students and professional way of handling students' questions and involving students in the teaching and learning process. However, in both LS cycle I and II, the participants excellently kept students on task by giving them exercises to bring the teaching process to an end and therefore obtaining a mean score as high as 4.0.

Table 5 shows the mean ratings of scores obtained by the AO's on the effectiveness of the five participants' teaching skills during the lesson evaluation stage.

Table 5: Mean rating of effective teacher activities during the lesson evaluation stage

Lesson Evaluation	LS Cycle I Score
a) Evaluate students based on set objectives	5
b) Each item is formulated clearly using easy -to- understand sentences	5
c) The difficulty level of the problem is evenly distributed from easy, medium and difficult	5
d) There is a scoring guide in every step of the question	5
Mean	5

From Table 5, it can be seen that the participants scored an excellent mark of 5 in all the rated items for evaluation. Students were evaluated based on set objectives; each evaluated question was easy to understand because of the usage of simple and easy to understand sentences. Also, the difficulty level of the questions ranges from easy to medium, then to difficult. Lastly there is a scoring guide or rubrics to each question. This stipulates that LS group members were excellent in setting questions for students.

Table 6: Descriptive statistics of LS cycle I and II scores compared

Indicator	LS cycle I		LS cycle II	
	\bar{X}_1	SD	\bar{X}_2	SD
Content presentation	2.75	0.89	4.13	0.35
Classroom management and lesson closure	1.60	0.89	4.00	0.71
Overall	2.18	0.89	4.07	0.53

Table 6 indicates that there was a significant difference in LS cycle I and LS cycle II scores with respect to the mean and standard deviation with the latter better than the former (i.e. with LS cycle I, the participant had a mean score of 2.18 and SD of 0.89 and LS cycle II a mean score of 4.07 and SD of 0.53 were obtained). Also, content analysis of interview and field notes indicated that, participants' knowledge about lesson planning, lesson implementation, classroom management as well as assessment of students, based on stated objectives have improved tremendously. For example, Abio remarked:

"The planning session has been very helpful in sequencing of sub – topics for easy grasp of concept by students."

This indicates that the collaborative planning session had a positive impact on Abio's lesson planning competency. Emma also added that:

the entire LS process has brought us together as one family and it has also bridge the concept gap inherited from our various tertiary institutions before being in active teaching service."

2) Teacher's perception of the impact of Lesson Study

The second research question was to find out the perceptions of mathematics teachers on the impact of lesson study activities. In order to accomplish this, a questionnaire was given to teacher participants to illicit their response after partaking in LS activities. Tables 7 and 8 show the participants' responses to each of the eighteen statements on their perception of the impact of Lesson Study.



Table 7: Teacher’s perception on Lesson plan competency

	Statement	SD	D	U	A	SA
1	Planning together broadened my knowledge of the mathematics content/ subject matter				5 (71%)	2 (29%)
2	Planning and preparing to teach the topic we have chosen caused me to engage in mathematical reasoning and problem solving			2 (29%)	4 (57%)	1 (14%)
3	Planning together did not helped me understand more on students’ way of thinking and learning mathematics concept	6 (86%)	1 (14%)			
4	Planning in a group did not broadened my knowledge of mathematics teaching ideas and pedagogy	7 (100%)				
5	The collaborative lesson planning is beneficial for me in order for me to be a better mathematics teacher				4 (57%)	3 (43%)

SD strongly disagree, *D* disagree, *U* undecided, *A* agree, *SA* strongly agree

Table 7 shows the information gathered from the questionnaire distributed to respondents to elicit their response on the perception of lesson plan competency. The responses indicate a positive perception from the teacher participants’. Specifically, 71% agreed and 29% strongly agreed that planning together broadened their knowledge of mathematics subject matter. Whereas 29% were undecided, 57% agreed and 14% strongly agreed that planning and preparing to teach the topic chosen caused them to engage in mathematical reasoning and problem solving. To find out whether lesson study helped participants to understand more students’ way of thinking and learning mathematical concepts, it came to light that 86% agreed and 14% also strongly agreed. Also all the teacher participants strongly agreed that planning in a group broadened their knowledge of mathematics teaching ideas and pedagogy. From these responses, it indicated that lesson study activities improve the lesson planning competencies and has also increased the knowledge content and teaching competencies of the participants.

Table 8 shows the participants’ responses to statements on their perception of classroom and reflective practices.

Table 8: Teacher’s perception on Classroom and reflective practices

#	Statement	SD	D	U	A	SA
6	Observing and analyzing others’ lesson did not help me think more deeply about mine	5 (71%)	2 (29%)			
7	Teaching and observing the research lessons made me more critical in choosing the right teaching activities that help students to understand and think mathematically			2 (29%)	4 (57%)	1 (14%)
8	The reflective comments made me more aware of my general weaknesses and strengths of my own mathematics teaching				6 (86%)	1 (14%)



9	The comments and feedback can help me to be a better mathematics teacher					7 (100%)
10	My teaching has improved after taking part in the Lesson Study			2 (29%)	4 (57%)	1 (14%)
11	I have become more conscious and sensitive to students' learning needs and difficulties and have a deeper understanding of how students learn				5 (71%)	2 (29%)
12	The Lesson Study contributes to teachers' professional development					7 (100%)
13	The Lesson Study has improved my understanding of students' learning				3 (43%)	4 (57%)
14	I did not learn any better way to teach the topic	7 (100%)				
15	I learnt that it is important to provide activities that encourage students to think critically and creatively					7 (100%)
16	Lesson Study cannot be implemented and sustained in my school	7 (100%)				
17	The experiences and knowledge I gained during the Lesson Study is very valuable and important in order to make me a better mathematics teacher				3 (43%)	4 (57%)
18	I am willing to take part in the Lesson Study					7 (100%)

The teacher participants also showed positive response on reflective practice about their teaching during the implementation and post lesson discussion of the lesson study activity. Five (71%) of the respondents strongly agreed and two (29%) agreed that observing and analyzing others lesson helped them to think more deeply about theirs. It was also revealed that while 29% of the respondents were undecided, 57% agreed and 14% strongly agreed that teaching and observing others lesson made them critical in choosing the right teaching activities to bring about desirable teaching and learning in the classroom. In the wake to find out whether reflective comments made during the post lesson discussions of the lesson study activities made them aware of their strength and weaknesses of mathematics teaching, the teacher participants have positive response to such statement. Indeed, all the participants strongly stressed that comments and feedback can help them become better mathematics teachers.

Furthermore, all the participants strongly agreed that lesson study as a CPD model contributes to teacher professional development, expressed their willingness to partake in the lesson study activity if organized again in the future and agreed that lesson study can be sustained in their school.

DISCUSSIONS

On the question of effect of lesson study on mathematics teachers' pedagogical competence, the results revealed LS cycle II mean score of 4.07 (Standard deviation of 0.53) is higher than the mean score of 2.18 (Standard deviation of 0.89) in LS cycle I. This shows that the use of LS as a CPD model has brought about a desirable change in teachers' classroom practices. Also, content analysis of interview and field notes indicated that, participants' knowledge about lesson planning, lesson implementation, classroom management as well as assessment of students based on stated objectives have improved tremendously. This supports the findings by Ogegbo, Gaigher and Salagaram (2019) who investigated four physical science teachers in the teaching of electricity and magnetism during a lesson study intervention, it was found out that collaboration through lesson study enhanced teachers professional teaching strategies, networking skills, lesson plan preparation, classroom management, self-efficacy and positive



attitudes towards teaching. It is also in line with a study carried out by Gutierrez (2015), which used lesson study as a professional development model to form a classroom – based learning community and by so doing teachers pedagogical practices improved. Analysis of the field notes further revealed that, Kato seldom use student centred approach of teaching in addressing learners' difficulties. However, in his presentation in the LS cycle two, it was observed by the AOs that, he actively involved students in the teaching and learning process. This indicates that Lesson study has enhanced the critical assessment of teachers on their lessons. This has validated the findings of the study conducted by Yakar and Turgut (2017) to find out the effectiveness of Lesson study approach on pre service science teachers beliefs, and it was determined that through micro teaching with lesson study approach, preservice science teachers' beliefs improve in a positive way such that their beliefs significantly changed towards more students centred approach of teaching. This also confirms the study conducted by Lee (2008), where Secondary English Teachers collaboratively develop teaching strategies aligned to students effective learning and become more attuned to students needs because of collaborative sharing. Moreover, Cheng and Yee (2011) affirms that Lesson study became the agent of change for Singaporean mathematics teachers to reconstruct and use models to students thinking in their lesson planning practices after series of constant, collaborative and through examination of lesson implementation.

On the participants' perceptions of the impact of lesson study activities on their teaching, the results indicated that, teacher participants made positive response about the impact of lesson study activities. From the teacher participants' response, it was revealed that lesson study activities have improved the lesson planning competencies, changed their classroom practices and has made them mathematics reflective practitioners. The findings on perceptions of mathematics teachers on the impact of lesson study activities in this research is in line with the findings made by Ulep and Obille Jr. (2013) where the Collaborative Lesson Research and Development (CLRDR) Project of the University of the Philippines National Institute for Science and Mathematics Development (UP NISMED) introduced LS to mathematics and science teachers as well as administrators of elementary and secondary schools in the National Capital Region (NCR) to promote teaching of mathematics through problem solving and teaching science through inquiry. The project report showed that teachers have positive response on the effects of LS, for the opportunities created for them to actively engage themselves as learners rather than information gatherers. The report further indicated that, teachers found students to be more responsive and interested to learn science and mathematics and acknowledged that LS influence their instructional practices and enhance their knowledge and skills through sharing of ideas during planning and post-lesson discussions.

CONCLUSION

Lesson Study has effectively enhanced Teachers' pedagogical competence and promoted their professional development. Teachers positively perceived Lesson Study to be beneficial for them to become better mathematics teachers. In summary, the findings from this study reinforce the importance of teacher collaboration in lesson study in building teacher knowledge and confidence, and as a key component of effective teacher professional development.

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