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Science Teacher Professional Development Program through Lesson Study: Case of Thailand Demonstration School

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Abstract. The paper aimed to clarify science teacher professional development program through lesson study in case of Khon Kaen University Demonstration Secondary School. The lesson study professional development program was proposed based on a specific Thailand school context – a university demonstration school. Methodology regarded qualitative research. Participants included 3 school administrators and 12 school science teachers who were working at Khon Kaen University Demonstration Secondary School, academic year of 2017. The participant was active in making informed decisions throughout all aspects of the research process for the primary purpose of imparting school social change; a specific action for proposing the lesson study professional development program. The tools of interpretation included the methods and techniques of participant observation, focus group discussion, and document analysis. Data was analyzed and interpreted to find characteristics, patterns, attributes, and meanings of school science teachers' collaboratively working for enhancing students' learning. The findings revealed the proposed lesson study professional development program. The PD program highlighted what should be taken into account for community learning environment in order to enhance the university demonstration school science teachers to find a specific characteristic and collaboration, the pedagogical approach underlying the research lesson, and the development of studies on teaching and learning processes related to the research lesson.

Keywords: lesson study, professional development, science teachers, university demonstration school

1. Introduction

After the wave of Thailand educational reform began in 1997, attempts to move traditional teaching and learning into regards constructivism are still on the way of pushing teachers to improve. However, it appears to be on the right track, with the majority of teachers perceiving learner-centeredness as the key concept of education reform. Learner-centered education arose from the constructivist learning paradigm. Thai educational reform is based on the constructivist philosophy (Yuenyong and Thathong, 2015). Constructivism is a theory about "knowing" and "learning" that asserts that knowledge cannot be directly transmitted but must be actively constructed by learners (Bettencourt, 1993; Bodner, 1996; Colburn, 2000; Fosnot, 1996). Constructivism is

thought to be an epistemology or theory of knowledge and learning (Fosnot, 1996). Constructivism is a key learning theory that is used to guide the development of new teaching methods, particularly in science education. However, because constructivism is a learning theory rather than a teaching theory, it is frequently misapplied or misunderstood. The four essential features of constructivism are described here: eliciting prior knowledge, creating cognitive dissonance, applying new knowledge with feedback, and reflecting on learning (Baviskar et al., 2009). The ONEC (2002a) defined learner-centered approach for all Thai teachers. The learner-centered approach refers to learning processes that aim to develop people and enrich their lives. Learners should be provided with learning experiences that allow them to develop to their full potential and in accordance with their aptitude.

Unfortunately, teachers' actions in support of constructivism were scarce in the classroom. There appear to be numerous constraints on teachers' ability to construct knowledge in order to provide effective instruction. Teachers may be expected to understand both the theoretical and practical nature of theories as professionals in order to improve constructivist teaching. To become professionals, teachers may benefit from a practice-based 'know how' when experimenting with theoretical or more abstract ideas and ideals in daily practice. Pedagogical content knowledge is typically depicted as practice-based 'know how' (Phaikhumnam and Yuenyong, 2018; Udomkan et.al., 2015).

In teacher education, pedagogical content knowledge (PCK) was widely accepted and referred to as the teacher's competency. The quality of teachers was established through the teacher education and professional development programs, which resulted in the development of teachers' PCK in order to improve student academic achievement. Many studies have found that teachers have a low level of PCK due to a lack of classroom experience (Lederman et.al., 1994). Thus, recent emphasis should be placed on the incorporation of the PCK concept into teacher preparation and teacher professional development programs (Thongnoppakun and Yuenyong, 2019). An appropriate scaffolding and supporting approach for student teachers' PCK development is critical. By the way, novice teachers are required to have adequate knowledge for teaching because they practice their teaching in school for one academic year. As a result, teacher education programs should cultivate teachers' PCK in order to improve their ability to deliver effective instruction that result in productive student learning (Thongnoppakun and Yuenyong, 2018).

Lesson study provided a great community for teachers' developing knowledge for teaching, particularly PCK (Phaikhumnam and Yuenyong, 2018). There are two main views about lesson study development. A lesson study cycle is coordinated by a teacher-researcher team, which often belongs to a teacher education institution and takes on the role of developing the process in the first perspective. Lesson study is designed and carried out by a teacher group of a school institution in the second perspective, which is prevalent in the Japanese educational context, without the involvement of an external team that coordinates the process. However, in both perspectives, the lesson study entails a teacher team that collaborately plans a lesson known as a research lesson. A team member volunteers to teach the research lesson, while the other teachers observe and take notes on the students' actions (Richit, 2020; Woranetsudathip et.al., 2021). A collaborative planning of a research lesson is referred to as a lesson study. It should include small groups of four to six teachers who teach students at the same level and/or content. When planning begins, they must design the lesson with the goal of improving student learning outcomes in mind. After the lesson has been developed, a teacher from the group will teach it. The rest of the group will observe and collect data on the lesson process. Data collection may concentrate on students' learning for the specific topic taught, as well as their motivation, behaviors, attitudes, and responses to learning. These various sources and data were interpreted as individual reflections to the group. In light

of these reflections, the team must review and revise the lesson for the upcoming teaching. Another member of the team then teaches the revised lesson to a different class of students. Observations are made once more, and data is gathered for further refinement. This lesson cycle is typically taught as part of the Jugyou Kenkyu (Lesson Study) program, which is a fundamental program in Japanese school-based in-service teacher training (Fernandez and Yoshida, 2004; Matoba, 2005; Woranetsudathip and Yuenyong, 2015).

The lesson study developed in Japan has a common central structure that is adaptable to different contexts and goals. This framework was divided into three stages: research lesson planning, research lesson teaching, and discussions about the research lesson based on notes taken by teachers who observed the students' actions (Lewis, 2002). Nonetheless, the findings showed that, in numerous experiences, the lesson study cycle begins by defining the goal of the research lesson, taking into account the students' difficulties with the curricular subject to be taught. Matoba (2005) defined lesson study as a cycle of plan, do, and observe. Teachers discussed how to improve students' mathematical ideas about addition in "Plan." They also chose an open approach to improve students' learning. "Do," one of the teachers agreed to present the lesson based on the lesson plan created in collaboration with his or her colleagues. During this class session, fellow teachers were active observers who took ethnographic notes on what happened in the classroom during the lesson. "Check," after the lesson was taught, all of the teachers gathered as a group to analyze, criticize, and evaluate the lesson plan. During this session, they looked at the appropriateness of the teacher's performance, the materials used, and the issues involved in improving students' learning. “Action”, teachers argued essential revisions to the lesson plan based on their observations and reflections, suggested improvement activities.

Internationally recognized, the lesson study supported the teacher professional development through school based or classroom-based development. The teacher professional development should be happened as a self-learning process or sharing about the teacher’s learning. Consequently, teacher professional develop provides meaningful and be more efficient because the procedures of PD program will be generated from what they learned in their real life practicing as a school teacher (Cerini et.al., 2003; White, 2004).The established model has emerged from experience reports on lesson study conducted all over the world. Its framework is divided into four major stages: research lesson goal definition, planning, teaching, and lesson discussion (Lewis, 2002; White and Lim, 2008; Ponte et al., 2014). Some reports on lesson study cycles, however, propose a fifth stage that consists of reviewing, reformulating, and teaching the research lesson to new students. This fifth stage is known as follow-up (Ponte et al., 2014). The cycle of lesson study, on the other hand, could be adapted for different contexts. In Thailand, the distinguish Khon Kaen University educator Prof Maitree Inprasitha initially introduced the lesson study approach for teacher education in 2003. He suggested that teachers should learn how to teach from what their individual students’ success or failure in learning. The learning activities should be designed regarding on the nature of subjects, students’ prior knowledge, school context and curriculum, and culture. The lesson study allows teachers to find this way of seeing. He, then, shared the initially the steps of lesson study that consisted of 8 steps. 1) Problem identification, it is about identifying set the topic that will be taught that depends on the students’ needs. 2) Class planning, it is about planning the lesson regarding students and teachers. 3) Class implementation, it is about implement the lesson in the real class. The class implementation would suggest what activity foster to learn or what should be revised for better fostering students’ learning. 4) Class evaluation and review of result is about evaluating how the lesson scaffolds students’ learning. 5) Class reflection is about the collecting data from the classroom in order to find what issues should be improved. 6)

Further implementation is about implementing the revised lesson plan to other students. 7) Evaluation and revising, the lesson study team will evaluate the further implementation and improve the revised lesson plan. 8) Share the result is about sharing the last revised lesson plan to others (Inprasitha, 2003). However, in order to provide more practical approach of lesson study for Thai teachers, Inprasitha (2010) categorized the 8 steps into 3 steps. The lesson study was proposed as three basic steps including Plan – Do – See. Plan is about the activities of collaboratively designing a research lesson. Do is about the activities of observing a teacher who teach a research lesson. See is about the activities of collaboratively conducting a post-discussion or reflection on teaching practice (Inprasitha, 2010).

Literatures (Day, 1999; Fernandez and Yoshida, 2004; Inprasitha; 2010; Lewis, 2002; Ponte et al., 2014; Woranetsudathip et.al., 2021) suggested that lesson study required a teacher team collaboratively works in a school context in order to develop the specific way of teaching for students' learning in the particular subject chosen. Regarding the nature of the lesson study, which gives this process very specific characteristic and dynamics, research findings have revealed distinct aspects, such as collaboration, the pedagogical approach underlying the research lesson, and the development of studies on teaching and learning processes related to the research lesson. The author has been working in a specific Thailand school context of a university demonstration school – Khon Kaen University Demonstration School. There are approximately 20 university demonstration schools in Thailand. Those schools usually shared vision and collaboratively worked for many issues. Those activities allowed them to create a specific learning environment of Thailand demonstration school. This learning environment may provide a valuable collaborative relationship for lesson study because it has already provided somehow of sharing personal voice and accepting other voices. The lesson study probably gives them chance to understand the demonstration school classroom which it becomes rich information for the lesson study professional development, particular science teaching and learning. The study, therefore, aimed to clarify science teacher professional development program through lesson study in case of Khon Kaen University Demonstration Secondary School (KKUDS). The KKUDS lesson study PD program may provide community learning environment of a specific characteristic and collaboration for pedagogy and the development of studies on teaching and learning processes related to the research lesson.

2. Methodology

Methodology regarded qualitative research. The qualitative methods of inquiry were provided in order to suggest the researchers to understand participants' making decision on the appropriate professional development program through lesson study in context of Thailand university demonstration schools.

2.1 Participants

Participants included 3 school administrators and 12 school science teachers who were working at Khon Kaen University Demonstration Secondary School (Modindaeng), academic year of 2017.

2.2 Methods of Inquiry

The participants were trying to develop the appropriate professional development program through lesson study in context of Thailand university demonstration schools. The participant was active in making informed decisions throughout all aspects of the research process for the primary purpose of imparting school social change; a specific action for proposing the lesson study professional development program. The study adopted Inprasitha (2003 and 2010) theoretical framework of lesson study as lens of

seeing the ways of science professional development in the university demonstration school. The tools of interpretation included the methods and techniques of focus group, participant observation, and document analysis.

Participant observation was carried out by the 12 school science teachers. They kept the concept of Inprasitha (2003 and 2010) theoretical framework of lesson study in their mind. Then, they participated in the various kinds of activities that related to teacher education in Khon Kaen University Demonstration Secondary School (Modindaeng). They wrote down what the possibility of existing school teacher activities should be aligned into the lesson study. Then, the participant observer' documents were interpreted to find characteristics, patterns, attributes, and meanings of school science teachers' collaboratively working for enhancing students' learning.

Focus group discussion was organized for two rounds. Focus group discussion was organized among participants for two rounds. First round was organized in order to reflect what they learn when they read participant observer' documents about possibility of existing school teacher activities for the lesson study professional development. The first round of focus group discussion was concluded as a meeting report. The meeting report, then, was analyzed and interpreted to find characteristics, patterns, or attributes for generating some assumptions for the lesson study professional development of university demonstration schools. The second round of focus group, then, was organized in order to ask participants to share ideas for data analysis related to the proposed assumptions of the lesson study professional development program for university demonstration schools. The second round of focus group meeting report was analyzed and interpreted to find attributes of protocol for collaboratively working.

Document analysis was carried out in order to categorize the existing KKUDS activities related to teacher education. The documents (e.g. school projects, curriculum, academic and culture activities) were interpreted in the senses of teachers' learning from practicing and participating. Data was analyzed and interpreted to find characteristics, patterns, attributes, and meanings of school science teachers' collaboratively working for enhancing students' learning.

3. Findings

The participants' observing, focus group and document analysis could develop some assumptions of the lesson study professional development program for university demonstration schools. These assumptions will be presented through identifying the problems of student learning, a university demonstration school context and schedule for lesson study, and the proposal of the lesson study professional development program.

3.1 Participants' identifying the problems of student learning

Participants identified some issues of KKUDS related to the significances of science learning goal, students' scientific learning and future careers, and problem of Thailand teaching and learning. These issues were raised with aiming to determine what topics should be taught, specific pedagogy, and students' need for class planning. These issues will be clarified as following.

The significances of science learning goals were identified through focus group discussion and document analysis. The participants reviewed the literature (Toplis, 2011) about science learning related to everyday life experiences and future careers. They mentioned that scientific and technological knowledge foster human to create the new tool and appliances for convenience life. Science learning activities should be provided based on logical thinking, critical thinking, and creative thinking (Williams, 2008). Science is the culture of the modern world, a knowledge based society, which is why there needs to be development for all to understand science to be able to understand the natural world and the technology that humans have created and to morally use the

knowledge in logical and creative contexts. Scientific knowledge is not only used to develop the quality of life but also helps in providing the right knowledge and understanding concerning the use, the maintaining, as well as the sustainable and balanced development of the environment and natural resources. Furthermore, scientific knowledge have increased the economic development capability, enabling us to compete with various nations and live together peacefully in the current social world (Laurillard, 2012). Science learning activities should be provided to promote the 21st century learning skills. The science learning should also provide skills of learning and innovation (Wagner, 2008).

The participants also raised the issues of problem of Thailand teaching and learning through focus group discussion and document analysis. They mentioned Tom Corcoran reflection on issues of Thailand classroom. Tom was director of the Consortium for Policy Research in Education (CPRE), Columbia University, researcher and developer of education in the United States of America. Tom has experiences in science education management in various countries including Thailand. He has worked with Thailand educational agency (e.g. IPST, Kenan institute, etc.). His reflection about issues of education in Thailand suggested what should be concerned for planning of lesson study in a university demonstration schools. These included:

1. Teachers should not teach students to mainly memorize the content. However, teachers need to engage students to construct meaning scientific knowledge through their critical thinking skills.
2. The amount of time students in Thailand spend studying science is less than those of other countries. Thai students spend 150 minutes per week while OECD countries spend an average of 250 minutes per week.
3. The Thai science curriculum tries to input too much subject content, resulting in the students not being able to have an in-depth understanding of the subject. For example, in Hong Kong there is high level mathematics and science exam called TIMSS, and it was found that the teaching content covered only 60% of the exam topics but was taught in a profound manner. While in the US the content is 100% covered but has lower exam scores compared to Hong Kong.
4. Students lack motivation. It was found that in most classrooms teachers would tell students to write notes down or teach by the book, resulting in a lack of interaction between student and teacher. Creating motivation to study is an important aspect since not all students would want to study, but it is the duty of all teachers to create that motivation.
5. Tests mainly use memorization by evaluating the truth of the content rather than the important essence of the subject, compelling teachers to teach in that manner. For example in Phang Nga province when teachers are given extra equipment to use in class some teachers decline, afraid that there will not be enough time to teach.

All issues are interlinked. Including the curriculum that covers many topics, short lesson time, or tests that focus on memorization that becomes a condition for the way teachers teach. It is not that teachers don't wish to teach well but the context compelled them to teach in this manner. Hence, the beginning of the development of science education should start with the development of science teachers.

The Demonstration School of Khon Kaen University is a part of the demonstration schools belonging to the Office of the Higher Education Commission (OHEC), under the supervision of the Faculty of Education, Khon Kaen University, found a similar science phenomenon to that of Tom Corcoran's, especially in terms of subject content, which has been intensely input into the curriculum due to the expectations of parents and society in becoming a leader in the academic field. The target of studying is university entrance into faculties that are highly popular with high score ranges. The role of teachers tried to

transfer knowledge to students for the university entrance exams. Science teaching was more focus on remembering the science content for examinations. Consequently, there was infrequently found that the scientific inquiry was organized for science teaching. The participants reflected what KKUDS teachers should concern based on nature of science and constructivist view of learning as following aspects.

- Time limitations and management, consequently, science teaching is usually organized in order to foster students to remember the science content and exercise for the examination.
- Because of the test oriented, science pedagogy usually was provided as tutoring for university entrance examination.
- Because of the test oriented, it rarely found the learning activities that supported students' higher order thinking and practicing scientific knowledge.
- Because of the teacher center, it hardly found the learning activities that supported students' collaborative problem solving

3.2 A university demonstration school context and schedule for lesson study

Participants considered that some activities of collaboration among Thailand university demonstration schools could be recognized as teacher learning environment of lesson study. There were some cultures of collaboration among Thailand university demonstration schools such as '*Satit Samakkee*' (in Thai) and '*Satit Vichakarn*' (in Thai). The *'Satit Samakkee*' is a national sport games for students who are studying in the nationwide university demonstration schools. The *'Satit Vichakarn'* (in Thai) or University demonstration school academic forum (UDAF) is a biannually conference for sharing innovative ideas for teaching and learning. For every two year, a school of 21 university demonstration schools will be selected to host the UDAF. The first UDAF was established in 2003. The UDAF is the national academic forum for university demonstration school teachers (KKUDS, 2013). The UDAF could be developed as a part of the lesson study professional program because it would bring huge of expert teachers among university demonstration schools. The UDAF would be prepared for the national open class in the lesson study. The UDAF open class probably gives teachers chances to share about the teacher's learning from each university demonstration school. The UDAF open class would support the lesson study teacher professional development.

3.3 Proposal of the lesson study professional development program

Based on identifying the problems of student learning and a university demonstration school context, the participants came up with the proposal of the lesson study professional development program. The proposal of PD program considered how the teacher learning community should be provided in order to support a self-learning process or sharing about the teacher's learning, teachers' learning in their real life practicing as a school teacher. The proposal of PD program, then, generated the schedules regarding on literatures' suggestions (Akihiko, 2006; Inprasitha, 2009) about the lesson study teacher professional development key success. These included 1) leading to understanding educational concepts concerning teaching practice guidelines, 2) changing the thinking, teaching methods and learning, 3) learning to develop the teaching practice of teachers from the students' reflections, and 4) receiving the support and help from other teachers. An important component of doing a lesson study is the group of teachers preparing a lesson plan together then using that plan in class with a Lesson Study team and other education professionals observing the class. After that there will be a discussion after the class to analyse the teaching in that lesson/ studying the lesson will help teachers to become interested in the learning procedure occurring in the classroom, as well as an opportunity for teachers to collect teaching data by the lesson plan prepared by the Lesson Study team. While reviewing the lesson, teachers would

consider the information together in order to 1) create an understanding with the educational concepts related to teaching guidelines, 2) share thoughts and adjust views on teaching and learning, 3) consider the teaching from the students' viewpoint, and 4) exchange and learn from other fellow teachers.

Regarding on assumptions of the lesson study professional development program for university demonstration schools, the proposal of PD program was proposed. The content of PD program proposal included 1) conceptual framework, 2) purpose of the PD program, 3) lesson study professional development model for science teachers in university demonstration schools, 4) schedule of the lesson study process, 5) long plan of professional development program, and 6) expectations of changes after program.

3.3.1 Conceptual Framework

A concept of teacher development was developed by concerning self-development of teachers in a real working context through the collaboration of science teachers at the Demonstration School of Khon Kaen University. Science teachers' collaboration has to develop science instructions regarding on nature of science, constructivist view of learning, and Thailand core values and attributes. Teachers could follow the steps of lesson study in order to keep improving a quality lesson and learning pedagogical content knowledge through those lessons.

3.3.2 Purpose of the PD program

The purpose of this program was to develop the capability in instructions management of science teachers in the Demonstration School of Khon Kaen University. The lesson learned of the program may have implications for organizing the lesson study professional development in the university demonstration schools across the nation. The teachers' learning about pedagogical content knowledge would be shared through the open class within the school and "*Satit Vichakarn*" (University demonstration school academic forum (UDAF)). The model of lesson study professional development program could be shared to the networking schools or other demonstration schools.

3.3.3 Lesson study professional development model for science teachers in university demonstration schools

It is accepted that teachers have chances to develop their pedagogical content knowledge through the lesson study. The lesson study PD model aimed to enhance teacher changing their behavior about practices, attitudes, and beliefs for collaboration of organizing active learning. However, Thai teachers seem to perceive that they have to spend longer time on the lesson study comparing to their traditional way of teachers' life. Most of them seemed to worry if he or she could be success or learning something through the lesson study. The lesson study PD model, therefore, took these issues into account for model practicing. The school administrators should understand what teachers' perception about the practicing lesson study in schools. The school administrators need to empower teachers' learning by providing about learning resources, feedback, and opportunities for growth in career path. The school administrators are key persons to regulate and empower teachers' changing practicing in order to improve quality of students based on school visions and missions. And, the change of practices, then, could be drive follows the lesson study process. This could be seen as showed in the figure 1.

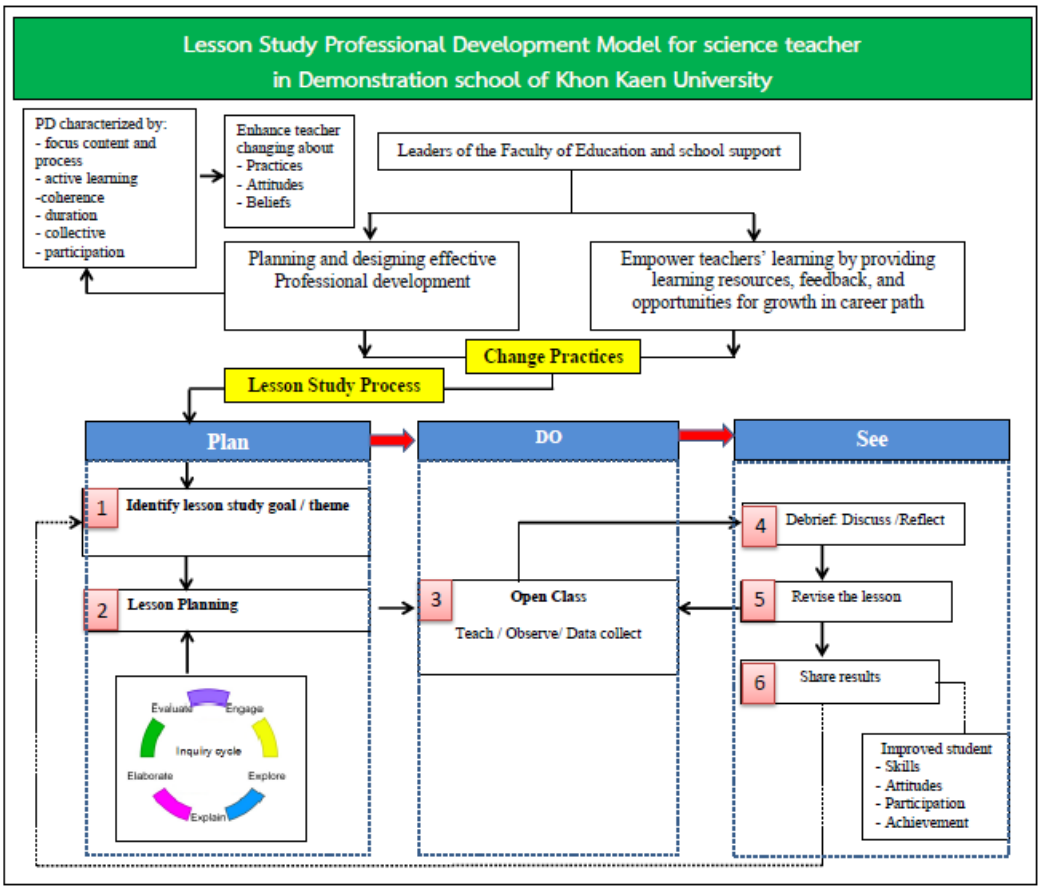

Figure 1: Lesson Study Professional Development Model for science teachers in University Demonstration schools

According to figure 1, the lesson study process follows the simply steps of Inprasitha (2010) including "Plan", "Do", and "See"). In fact, the Plan-Do-See step is the topics of categories of lesson study activities. The plan step includes the activities of 1) identifying lesson study goal / theme, and 2) lesson planning. And, the goal and theme would begin with the general perception of scientific teaching strategy – 5E learning cycle. Teacher collaboration of lesson planning would allow teachers to find the appropriate learning activities for the open class. The Do step is about the open class. Teacher could learn about how to teach science for particular students and school context. In open class, members of lesson study team would learn from teaching, observing, and data collection. The open class would be usually organized every week for the school lesson study team. And, the lesson learned from those open classes would be organized also in "*Satit Vichakarn*" (University demonstration school academic forum (UDAF)). See is about the activities of collaboratively conducting a post-discussion or reflection on teaching practice. The activities of "See" step include discussion and reflection, revise the lesson, and share the result. The discussion and reflection would suggest some issues for revising the lesson. And, the knowledge of what teacher learned from this practice would share to other for learning together. These activities were organized with aiming to report the information for improving students' skills, knowledge, attitude, and participation. Then, this information is also given back to the "Plan" step of another cycle of lesson study process.

3.3.4 Schedule of the lesson study process

Regarding on the lesson study PD model as showed in the figure 1, it suggested the lesson study team of science teachers organized the tentative of schedule of the lesson study process as the table 1.

Table 1: Schedule of the lesson Study Process

Lesson Study process	**Activity**	**Results in each step**
1. Identify lesson study Goal/ Theme	Organize the meeting to develop ideas for setting the aims of the plan	Aim and plan through Lesson Study
2. Lesson Planning	Discuss about the plan, write lesson plan up using 5E - inquiry cycle. The 5E comprises of Engage – Explore – Explain – Elaborate - Evaluate	Lesson plan and teaching media
3. Open Class - Teach/Observe/Data collect	Taught by 1 teacher, other teachers in the group observe, note and collect data	Note the observations and data evidences that shows the students' learning
4. Debrief: Discuss /Reflect	Reflect on the results/work, discuss, analyse the data, evaluate	Results of the discussion, points to improve on, suggestions, new knowledge and ideas
5. Revise the lesson	Revise the lesson plan, teaching media	Revised lesson plan
Repeat steps 3–5 (Teach, Debrief, and revise again) and there should be an expert invited to participate in each step		
6. Share results	Conclude the results, write report, present work	Lesson Study report

3.3.5 Long plan of professional development program

Regarding on the schedule of the lesson study process, the long plan of lesson study PD program was provided. Science teacher professional development program through lesson study approach for case of the university demonstration schools has been planned for 3 years as shown in Table 2. The long plan revealed how key ideas of lesson study were immersed in the school contexts of all university demonstration schools. The long plan was not only provided for teachers in the lesson study team but also included the school administrators and other teams in other university demonstration schools. The open class as one of six steps of lesson study process was scheduled to inform the team plan, school plan, and other school plan. The open class was not only organized within school but also organized in the "*Satit Vichakarn*" (University demonstration school academic forum (UDAF)). Moreover, the long plan provided teachers to learn how the original practices of lesson study was organized and behaved. The long plan provided teachers to participate in the Japan National Lesson Study at University of Tsukuba, Japan. Teachers also observed the Japanese classroom.

Table 2: Action plan of science teacher professional development program

Activity	Year 2017	Year 2018	Year 2019
1. Directors of all demonstration schools held a meeting through the coordination of the Demonstration School of Khon Kaen University	✓		
2. Summer workshops by Lesson Study experts	✓		
3. Collaboration among lesson study team members by follow the step 1 – 6 of the lesson study process	✓	✓	
4. Organize all demonstration schools open houses by using lesson plans through lesson study in "*Satit Vichakarn*" (UDAF)		✓	
5. Directors and Program leaders of all Demonstration schools hold a meeting to conclude the results		✓	
6. Teachers participated in the Japan National Lesson Study at University of Tsukuba, Japan. Teachers also observed the Japanese classroom.			✓
7. All Demonstration schools' network schools under other authorities start to hold meetings to plan Lesson Study and proceed by the Lesson Study Process in steps 2-6			✓

3.3.6 Expectations of Changes after Program

The lesson study professional development program would motivate teachers to changes in the following aspects.

1. Lesson Study provides an opportunity for teachers to see the teaching and learning in class concretely, discussing the lesson planning, writing the lesson plan, observing the class and reflecting the thoughts on the guidelines in class. Being able to observe real teaching in class enables teachers to understand and see what good teaching is, helping students' to understand what they are learning.

2. Students are the heart of the Teacher Professional Development program. This provides an opportunity for teachers to study, analyse the learning process and understanding of students through observations and discussion concerning the guidelines in teaching.

3. Lesson Study enables teachers to have an important role in changing teaching behaviours and curriculum development.

4. Conclusion

The paper clarified how the PD program was developed based on the lesson study approach. The model lesson study PD program may show how the lesson study team set up the community learning environment in order to enhance the university demonstration school science teachers to find a specific characteristic and collaboration, the pedagogical approach underlying the research lesson. The school context was clarified and taken into account for developing a model of lesson study PD program. The activities related to cycle of plan-do-see was generated based on school context. The simple pedagogy was selected for beginning of collaboration of lesson planning that would allow teachers to find the appropriate learning activities for the open class. The model also provided the long plan regarding on key ideas of lesson study. This model concerned that the lesson study activities was not only provided for teachers in the lesson study team but also included the school administrators and other teams in other university demonstration schools. The open class as one of six steps of lesson study

process was scheduled to inform the team plan, school plan, and other school plan. Regarding on the lesson study, this PD model may provide a valuable collaborative relationship. It also provided the chances for teacher to understand the demonstration school classroom which it becomes rich information for the lesson study professional development, particular science teaching and learning. This model of the lesson study professional development has implications of organizing the lesson study in Thailand schools.

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