

Professional Development for Mathematics Teachers Through Lesson Study

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Abstract: Lesson study is known as an effective Japanese professional development approach for teachers, since 1999. After that, this approach used dramatically as a way for improving teaching and learning in classroom through many countries and by many researchers. Review the literature of lesson study show that there is one common effort between the researchers to apply this approach. That is to make local model for using this Japanese approach as a localized one to release the unavoidable challenges of applying the method of another educational culture.

This paper first reviews the literature on lesson study as a way of teachers' professional development, which has been conducted since Meiji Period in Japan and is conducting for today's teaching in classroom. Then it clarifies how Iranian mathematics teachers encountered with this method. Finally, the finding of this research addresses a general translated model of lesson study that is preferred to apply lesson study for Iranian culture of education.

Keywords: Lesson Study- Mathematics Education- Professional Development

What is Lesson Study?

Many recent studies show the teachers' role in promoting students' learning. One of the most important studies about mathematics education is TIMSS. As two American researchers conducted a video study on some classroom which contributed in TIMSS, they noticed that the differences between students' results in different countries depend on education culture; and one of the most important elements of education culture is teacher professional development. Then after studying deeply about this important element, they noticed lesson study as a way of teacher professional development in Japan. So many researchers wanted to know if lesson study has good effect on their education culture. Lesson study has been a hot topic since 1999 in many countries. Many researchers used this Japanese approach to enrich classroom practices and provide opportunity of teacher professional development, so improve students' learning as a result (see: Stigler & Hiebert, 1999; Fernandez et al, 2003; Lewis et al, 2004; Takahashi & Yoshida, 2004; Sarkar Arani, 2006).

Lesson study is one of those professional development strategies that are deceptively simple on the surface and remarkable complex as you begin to probe beneath the surface (Richardson, 2004). Lesson study is a process consists of the study or examination of teaching practices. Teachers engage in a well-defined process that involves discussing lessons that they have first planned and observed together. These lessons are named study lessons or research lessons (Fernandez & Yoshida, 2004). These types of lessons are different from normal ones, they regarded not as an end in themselves but as a window on the larger vision of education shared by the group of teachers, one of whom agrees to teach the lesson while all the others make detailed records of the learning and teaching as it unfolds. These data are shared during a post-lesson colloquium, where they are used to reflect on the lesson and on learning and teaching more broadly (Lewis et al, 2006).

Lesson study, the major form of professional development in Japan, is a teacher-led instructional improvement cycle in which teachers work together to:

- Formulate goals for student learning and long-term development;
- Collaboratively plan study lessons designed to bring to life these goals;
- Conduct the lessons, with one team teaching and others gathering evidence on student learning and development;
- Discuss the evidence gathered during the lesson, using it to improve the lesson, the unit, and instruction more generally;
- If desired, teach, observe, and improve lesson again in one or more additional classrooms (Lewis & Tsuchida, 1998; Yoshida, 1999; Perry et al. 2002).

History of Lesson Study

Japanese education has changed dramatically in the decades since World War II. While rote, lecture-style 'teaching as telling' may have been common prior to World War II, recent observers are struck by the emphasis on 'teaching for understanding': on eliciting students' ideas sparking debate and discussion, and building comprehension through hands-on activities and reflections (Lewis & Tsuchida, 1997). One of the major influences on this educational reform was creating lesson study as a traditional but unknown approach in Japanese educational culture. According to Isoda (2000), lesson study was a way to improve teaching process which applied in Meiji Period for first time.

Otherwise, although *konaikenshu* (School-based In-service Teacher Training Programs in Japan) is a newer practice, dating back only to the beginning of the 1960s, the strategy of combining *konaikenshu* and lesson study was already well stabilized by middle of the 1960s. A decade later the Japanese government, seeing the value of *konaikenshu*, began to encourage schools to engage in this practice, which at the time was solely a grassroots activity. It is estimated that today the vast majority of elementary schools and many of middle schools conduct *konaikenshu* especially *Jugyoukenkuu*(lesson study) as the most important feature of it (Fernandez& Yoshida, 2004).

Research Implementation

This research was done with cooperation of 12 mathematics teachers in middle schools of Kerman, Iran from October 2006 to March 2007. After the process of lesson study and aims of this project had been discussed generally for mathematics teachers in a meeting, these 12 teachers submitted engaging in project. Teachers divided to two groups except one, who wanted to contribute in two groups. So because of researcher contribution one group consisted of 5 partners, and the other, 10.

In each group partners chose a topic to concentrate on it: Linear Equation and Pythagoreth Theorem. These topics were selected because of students' misconceptions in understanding them.

Partners planned a lesson plan after introducing their methods of teaching these topics, and exchanging their experiences. A volunteer teacher taught this cooperative lesson plan in class and the other members of group were active observers, who had a role in class, like recording the process, examining students' group work, considering mutual communication between students and teacher, level of understanding each student and so on.

After this, partners came together in reflection meeting, which the group shared what they had seen in real classroom and provided their reactions and suggestions about lesson plan. They revised lesson plan to re-teach.

Above circle was rehashed three times about Pythagoreth Theorem and five times about Linear Equation. Outside advisors, like members of the other group of this research, other teachers, and mathematics education students in Kerman universities came in some sessions and gave their suggestions. In some classes teachers wanted students to write their opinions about teaching-learning process and what they had learned. The entire reflection meeting was recorded and teachers' ethnographic notes were collected. Interviews were done with partners especially teacher who taught in real class about what they thought before engaging lesson study and what they think now and what has been changed through this process.

Research Findings

Analyzing data of this research showed three main trends which are as indexes of teacher professional development: teacher understanding, teacher practices, teacher assumptions. These indexes have their variables and each variable perceived through some indicators which would discuss at follow. Considering enhancing of all variables show that professional knowledge is create in school through applying lesson study in mathematics education.

1. *teacher understanding*: developing knowledge which cause increasing understanding of teacher about herself or himself, her or his students and her or his colleagues for knowing the professional environment with object of professional development is done, called teacher understanding. Subject content knowledge and teaching knowledge are also in this description. Teacher understanding have two main variables: teacher knowledge and evaluation knowledge.

Teacher knowledge is perceived through these indicators:

- Partners question about the content of lesson study process.
- Partners question about teaching methods in mathematics curriculum.
- Partners predict about students' thinking and problem solving in teaching process.
- Partners report from process of teaching in her or his class and her or his colleagues' classes.
- Partners study frequently in different references concerned lesson study and its delivering in the other cases and countries.

Evaluation knowledge is perceived through following indicators:

- Partners note in classes and analyze education process and cooperative lesson plan in meetings.
- Partners observe teaching process in real situation and evaluate the students' level of understanding.
- Partners analyze her or his implementation and others'.
- Partners evaluate effect of lesson study in her or his work.

2. *teacher practices*: practices which are done by teachers to expand professional development. These practices contain of collaborative ones to integrate theory and action in real teaching-learning situation. This index has two variables through this study: collaboration and proceeding.

Collaboration is perceived through theses indicators:

- Partners collaborate continuously in meetings, teaching session and other concerning programs.

- Partners make collaborative programs.
- Partners accept responsibility in collaboration implementations.
- Partners dialogue about implementation collaboratively.

Proceeding is perceived through following indicators:

- Partners theorize and act through theory to see the impact of it in real action.
- Partners apply lesson plan in different class and different situation.

3. *teacher assumptions*: attitudes and assumptions of teachers about professional development, professional improvement, cooperative learning, and abilities of criticize and accepting critiques which make her or him researchable person and independent thinker are in this index. Also teachers' assumptions through learners and nature of science are all variables of this index. So this study clarifies teacher assumptions as an index consists of five variables: acceptance her or his ability, acceptance learning from others, acceptance critiques, attitudes through learners, and attitudes through nature of science.

Acceptance her or his abilities are perceived because of following indicators:

- Partners making ideas and decisions and share them through others.
- Partners pioneer for implementations like teaching in class.
- Partners accept their colleagues in class with openness.

Acceptance learning from others could be appearing by:

- Partners accept that cooperative learning is more effectual.
- Partners come to colleagues' classes to learn, eagerly.
- Partners research others' experiences.
- Partners observe her or his teaching process, simultaneous others' and learn open-minded.

Acceptance critiques are also perceived through these indicators:

- Partners give opportunities to others to criticize.
- Partners hear others' views and criticize open-minded.
- Partners deal logical with critiques.

Attitudes through learners are perceived through following indicators:

- Partners try to develop learning environment to which learners could make decisions without stress and not fear from making incorrectness.
- All the meetings, dialogues, critiques, efforts and implementations are concentrating on students.
- Partners try to make connections between previous knowledge and new lesson.
- Partners let students make decision about general teaching process and even the admission of other teachers in class.

And attitudes through nature of science are perceived through:

- Assumptions about nature of mathematics.
- Assumptions about nature of education.

All described above embody in a coherence model to analyze data in this study, so authors claimed professional knowledge enhanced through applying lesson study in mathematics classrooms in Iran.

Review of literature show, engaging lesson study is not without challenges and naturally partners of the present study dealt with them. Authors characterized these challenges to three main indexes: time, assessment system, and support.

Time: this index has some parameters which caused time is a challenge in engaging lesson study in Iran:

- Some problems administratively like: limited time for teaching mathematics curriculum.
- Partners could not timetable for long-time, so they did it session by session.
- Partners could not adjust time because of circular work shifts.
- Accidental vacations caused time lag.

Assessment System: this index divides two main parallel parameters:

- Teacher assessment system.
- Student assessment system.

Support: main thing for continuing improvement in initiation and along a work, especially in education, is support of it. This support contains following main domains sponsor teacher to be independent thinker and researcher:

- Parents' support.
- Principals' support.

- Professors' support.
- Administrators' support.

Discussion and Conclusion

The results of this study provide evidence for the claim that lesson study can help teachers appreciate the importance of attending to students' thinking, as one of the partner acknowledged in interview:

I think this was the first time that I know prediction of students' thinking is too important and I feel all our work was concentrated to this topic. I noticed students' thinking is the most important part of teaching-learning process.

Also partners acclaim lesson study because it made opportunity for them to meet each other, exchange experiences, observe themselves through different perspectives and learn in secure environment and with real situation. They accept abundant changes in their professional knowledge by applying this approach. A teacher said:

It was like I could see myself in mirror. I could see my teaching problems and I could know I can learn in school and from teaching process. I can understand my students, my class and my teaching better. In addition I could know this topic of mathematics better and I can evaluate my knowledge resources and way of increase them from observing others and my work deeply.

From this case teachers could communicate with their students and their colleagues more affably.

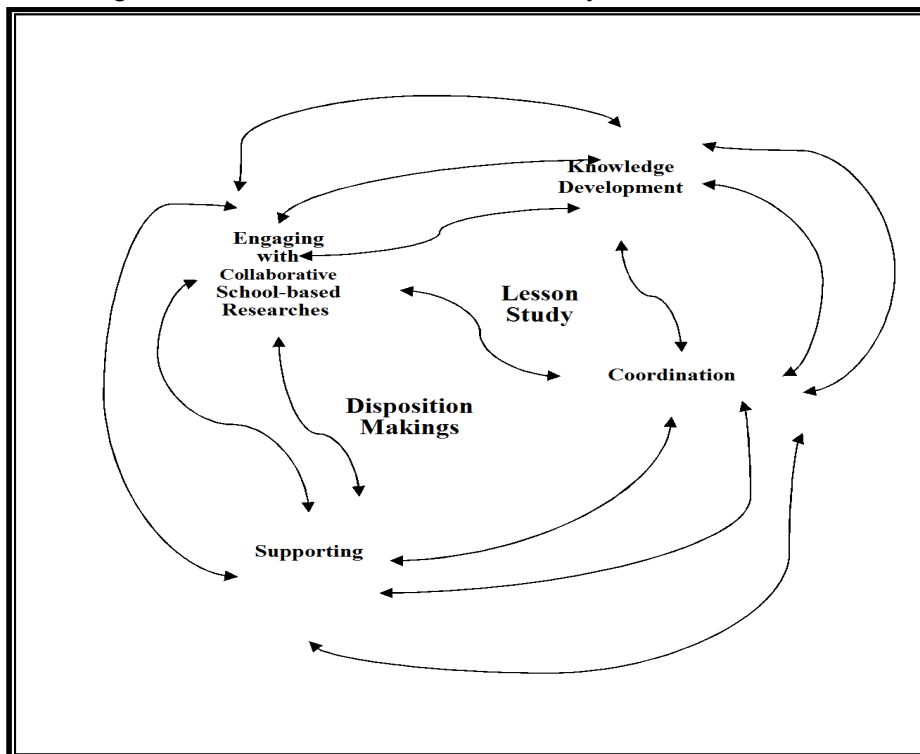
Evidences also show partners learn through lesson study as a collaborative research. Partners know their abilities and knowledge and improve them through collaboration tasks. As a teacher described this result:

Lesson study rescued us from self-satisfaction in our drill in classroom. I did not like someone observe my class; first time I thought it is difficult for my students and me to open our class door on other teacher, even I concerned if it would drop students' concentration and confused me. Now everything has changed and I think my students and I could learn flexibly by cooperation with others.

She confessed:

I thought I would drop it in small time incredibly I continue and I feel this was because of confederate spirit which is inseparable in lesson study as a collaborative research.

Figure1. Translated Model of Lesson Study to Iranian Culture of Education



Considerations of this research exhibit critical discussions with concentration on learning between partners which enhance self-assessment and cooperation assessment simultaneously that caused professional learning environment in school.

All this changes convert teachers from an individual person in work to shared professional person, from acquiescent about educational politics to active, acute and independent about professional life, from biased one to open-minded thinker and from a teacher only to a professional learner that spend professional life in a security professional learning organization, named school.

As said above, authors receive their first question of this research, and they claim lesson study made a sensational professional atmosphere in school through cooperative spirit as an inseparable part, which enhanced professional knowledge and caused enriching mathematics education in this research.

Although lesson study had its challenges and problems, and even more with Iranian educational culture because of absence of cooperative spirit, but partners respond positively to this innovation.

From this study, authors address a translated model of lesson study that is preferred as a model more conformable to Iranian culture of education, which is shown in figure 1.

This model suggests a spiral notion with no beginning and no end. The parameters of this model are not subsequent which could be described as stages so start point of description should not be perceived as first stage.

For converting community to cultivated one that could be refined through cooperation, engaging in collaborative research in any cases is too important. As Stigler & Hiebert (1999) declared a part of teaching gap is between academic researches about school education and real situation that teachers are facing every day in schools in U.S, this gap is perceived dramatically in Iranian educational system too. As literature has shown researches specially lesson study those have cooperation as inseparable part, may be an effective approach to develop cooperative culture, so this model suggests engaging with lesson study. But it would be considered that Iranian education system have had many innovations those forgot after little time, so supporting collaborative researches like lesson study should be followed by administrators.

This model prefers lesson study for engaging collaborative research, because as the results of this study showed, it could ready its makings and reactivate to use them again as disposition makings. Indeed lesson study could make its resources and apply them to develop and create knowledge, like a knowledge management process.

The created knowledge in this model should be shared to develop, so lesson study makes meetings for exchanging knowledge. Otherwise, open houses, outside advisors and information technology are three main apparatus in lesson study to develop knowledge by making connection between partners in all partners throughout world. When this created professional knowledge develops, it would be revised and revitalize learning. Consider that this model is spiral not circular, because it would develop not limited.

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