

IMPROVING THE QUALITY OF SECONDARY MATHEMATICS TEACHING THROUGH LESSON STUDY IN YOGYAKARTA, INDONESIA

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There are many ways to improve the quality of mathematics teaching in Indonesia. Evidence and experiences from other countries indicate that Lesson Study can be one of the methods for supporting teachers' professional development. From 2004 to 2005, in collaborations with the IMSTEP-JICA Project, the Faculty of Mathematics and Science, the State University of Yogyakarta introduced and implemented lesson study activities in two districts, Sleman and Bantul. The results of lesson study activities indicated that there were significant improvements of teaching and learning of secondary mathematics in term of teachers' competencies and students' motivation. Amongst the successful results there were also difficulties with how to support financially the continuing implementation of lesson study.

Introduction

Many factors contribute to the quality of mathematics teaching and learning in schools, including the role of the teacher and learner, facilities, equipped laboratories, the general environment, management, and so on. This paper focuses on the teacher as the most important factor in influencing the improvement of teaching. In Indonesia, the improvement of teaching quality has been carried out by various programs such as in-service training, seminars or workshops. After completing the training, teachers are expected to implement what they learned in teaching their students.

Teacher training conducted by the Indonesian government needed a large budget, which was funded by the national budget or through international loan. There was adequate feedback resulting from those trainings toward the improvement of teaching quality. Following the programs for teachers' professionalism development, they used monitoring activities to assess the impacts of the improvement in teaching quality. The program for in-service teacher training had as its aim the improvement of teacher quality, however, it was difficult to provide trainees with "concrete experience of teaching." There was some evidence that the trainees disseminate the results of their training through teachers' clubs.

Since 2002, Indonesian education system has become more decentralized, which has introduced new challenges to improving their quality of teaching autonomously. Schools and teachers now have to develop their own curriculum with a few and flexible guidelines from the central government. Currently, the national curriculum is simply developed, containing the outline of competency standards, basic competency, and

achievement indicators. Teachers have their right to translate them into detailed syllabi based on students' characteristics, school resources, and environment.

In this decentralization era, teachers have to be more active and creative to create and develop their ideas without unintended interventions from central government. Teachers now have a chance to deconstruct their old paradigm of teaching. They are no longer just the implementer of curriculum but also the developer of curriculum. Teachers now have freedom to explore their role professionally in class. Teachers are challenged to have trained competency to prove their merit as professional teachers. Briefly, now, teachers are the implementer of what has been decided by bureaucrats as well as challenged to think logically, critically, creatively, and reflect on improving teaching quality. However, the central government still has the important role in facilitating teachers' professional development. One of the ways to support the teachers is to introduce lesson study to improve the quality of their teaching.

Lesson Study

Japanese experts indicate that Lesson study is considered as: 1. initiative of a group of teachers to improve themselves in teaching, and to get any input to make innovation based on the result of good plan and implementation (open for other teachers/observers to visit their class); 2. medium for learning of teacher or other participant including the teacher as presenter; 3. medium for discussion or sharing experience to improve teaching quality.

Meanwhile, we define Lesson Study as an activity carried out by a number of teachers of a certain subject in collaboration with educational experts to improve the quality and content of their teaching. Lesson Study has three (step) main activities: planning, implementing (teaching & observing), and reflecting and revising.

1. Planning

During the lesson study planning phase, the participants first identified the problems found in the classroom. The identification of the problem accompanied by the solution taken are related to the teaching material, schedule, students' characteristic, class condition, teaching method, teaching media, experiment kits, and evaluation toward the teaching process and result.

They discussed the choice of teaching material, method, and media based on students' characteristic and evaluations to be used. There are suggestions/input from teachers and content experts. Experts or senior teachers would give opinion about new things to be applied by teachers in the classroom, including using the teaching approach of constructivism, contextual teaching and learning, life skill, realistic mathematics education, or using the newest teaching material.

Additional discussion focused on the collection of data on the observation sheet, especially about determining the indicator of good teaching-learning process seen from the aspect of teacher and students. Those indicators were written based on the lesson plan and approaches used to reach out to students during the teaching-learning process.

Based on the identification and solution of the problems above, it was carried out into a set of steps consisting of:

- a. Lesson Plan
- b. Teaching Guide
- c. Students' worksheet
- d. Teaching media
- e. Evaluation sheet of teaching process and result
- f. Observation sheet

The lesson plan can be written by one or more teacher who agreed with the aspects of the planned teaching. To increase the effectiveness of the lesson, the result is then discussed with other teachers and experts of their group.

2. Implementation and observation

In this phase, a teacher implemented the lesson plan while other teachers and expert observed the process using the prepared observation sheet. To support it, the observer videotaped the lesson.

3. Reflection

In this phase, the teacher who implemented the lesson plan was given time to state his feeling during the implementation both for himself and his students. Next, time was given to observers, both expert and other teachers, to share the data they collected on the students' activity during the implementation followed by showing of the video. The teacher of presentation, then, was asked to respond the observers' comments. The important thing in reflection is to reconsider the lesson plan developed as the basis to make improvements for the next teaching.

Is the lesson plan fit and able to improve students' active learning? If not, where does it not fit? Is that about teaching method, student's worksheet, media or other teaching aids? This consideration is taken as input for improving the teaching in the next phase. Seeing the aspect of planning, implementing, and reflecting on lesson study, it makes lesson study look similar to Classroom Action Research (CAR) (reference?).

Methods

In cooperation with the IMSTEP-JICA Project, in Yogyakarta, lesson study activities were carried out in some schools that we called pilot schools. In the 1st phase, starting in 2004 in the district of Sleman, Yogyakarta, the activities of lesson study were already

conducted by some mathematics teachers from 21 secondary schools. The school selection was made by school representatives from senior and junior high schools in villages and towns in each regency of Yogyakarta province, with the support of the headmaster. In conducting lesson study we also involved the role of teachers club. There are 3 cycles of activities in the 1st phase of lesson study.

The results of the pilot program in the 1st phase were enhanced in the 2nd phase of the lesson study activities. In the 2nd phase, starting in the year of 2005, still in the district of Sleman, Yogyakarta, lesson study was carried out in 42 schools – is this in addition to the 21 schools from the 1st phase, or does it include the 21 schools? Did the 21 schools from the 1st phase continue with lesson study during the 2nd phase (as the extension from the schools in the 1st phase). The use of many schools was aimed at disseminating the results of lesson study activities to other teachers in other schools. However, because of the limitation of the budget, in the next phase we should decrease the number of schools to concentrate on carrying out lesson study activities in 3 junior high schools and 3 senior high schools. In each lesson study activity, there are 5-6 teachers in collaboration with university lecturers and Japanese experts to carry out the steps of the activities. The following phase of lesson study activities is the result of the previous reflection and the results of improvement based on the inputs from teachers, lecturers and experts. There are 3 cycles of activities in the 2nd phase.

In the 3rd phase, starting in the 2005, lesson study activities were extended to other teachers club from a different district, i.e., Bantul district of Yogyakarta. In this district, lesson study activities were carried out in 3 junior high schools and 3 senior high schools. In each lesson study activity, there are also 5-6 teachers in collaborations with university lecturers and Japanese experts to carry out the steps of the activities. There are 4 cycles of activities in the 3rd phase. In the 3rd phase we involved more intensively the teachers club.

Results and Discussion

Results of lesson study implementation summarized from the activity reports of pilot program are presented in the following table.

Table: The Condition of Student, Teacher, and Supporting Teaching Aids

Aspect	Before Pilot Activity	After Pilot Activity
Student	<ul style="list-style-type: none"> ○ Low learning motivation, mathematics and physics were seen as difficult subjects ○ Passive participation / involvement ○ Low ability in using laboratory kits ○ Low ability in organizing data 	<ul style="list-style-type: none"> ● Improved learning spirit and happy during the learning process ● Active participation / involvement during the teaching learning process ● skillful in using laboratory kits ● able to organize data and draw conclusion ● able to pose question and argument

	<ul style="list-style-type: none"> ○ Not skillful in drawing conclusion ○ Low ability in posing question and argument ○ low cooperation in group 	<ul style="list-style-type: none"> • during discussion • able to cooperate with friends in group
Teacher	<ul style="list-style-type: none"> ○ High domination during the teaching/learning process ○ Speech-based instruction ○ Low collaboration with other teachers in teaching activities ○ Low preparation of teaching material 	<ul style="list-style-type: none"> • Low domination during teaching/learning process • Student-based instruction • High collaboration with other teachers in teaching activities • High preparation of teaching material
Supporting Media	<ul style="list-style-type: none"> ○ Low use of teaching media/aids 	<ul style="list-style-type: none"> • Improved use of teaching media/aids

The results further stated that there were indications that in lesson study activities :

1. Students improved in learning motivation, skill-process, knowledge, enthusiasm about engaging in cooperation, and good communication.
2. High motivation of teacher to follow teaching process since preparation, implementation, and reflection.
3. Most MGMP teachers made good preparation (planning) and teaching performance (implementation) in front of students, university students as well as lecturers.
4. Improved student' role in learning, good teacher's role, available hands-on activity, available minds-on experience reflecting three main characteristics of ideal sciences and mathematics (MIPA) teachings such as: hands-on activity, group work, and discussion.
5. Teachers accepted any suggestion and critique of their teaching activity.
6. Headmaster supported the implementation of lesson study.
7. There was a complete teaching set in each pilot class.
8. Lecturers played a positive role as facilitator and motivator for all participants since planning, implementing, and reflecting followed by good understanding about school, collaboration with teachers, and feedback data for their lecturing.

Some problems found in the pilot activity was the need for teachers to work longer and harder to make preparations in collaboration with another pilot team. The question, then, was how to help teachers internalize the practice so they will happily run the pilot activities.

Other problems for scheduling lesson study activities team were:

1. many different schedule across pilot schools causing some activities to be postponed or canceled;
2. all member of pilot team were busy people who found it difficult to attend all pilot activities on time.
3. How to develop good communication and coordination between the pilot team and the school as well as among teachers would be the key to finding good solutions for these problems.

Some key solutions were found during the implementation:

1. the development of a good system and good communication among schools, and between schools and LPTK in conducting lesson study.
2. the support of policy and finance from government, both national and local, or other sponsors.
3. commitment from teachers, especially the headmaster, as crucial support for conducting lesson study.

Recommendation

In training, teachers learn how to do lesson study, while lesson study already implemented was the collective work of groups of MGMP teachers, university students, and lecturers. In developing lesson plan, it was done collaboratively, implemented by one chosen teacher, and evaluated together through reflection. Lesson study means learning a learning activity. Teachers can learn how to do learning activity through teaching activity (live/real or video). Teachers can adopt/adapt, for their own classes, the method, technique or teaching strategy, teaching media used by the teacher. Other teachers or observers need to make minute by minute analysis or evaluation of the classroom. The resulting analysis is important as input for the teacher to improve his/her teaching, while for observers, they can learn about the innovation in teaching.

Considering deeply the meaning of the lesson study activity, it is important to develop it among MGMP teachers. Teachers or schools can open their innovative class to other teachers. In the future, lesson study is expected to be one model of teacher's training with good planning, by inviting a number of teachers to attend an innovative class. It is necessary, therefore, to improve teacher's competence as a teaching agent in creating innovative teaching activity based on students' characteristics and the demand of the progress of science and technology.

The thorough activities of lesson study lead to the following recommendations:

1. Lesson study is in line with teachers' motivation to improve their quality of teaching. It needs to be introduced more effectively in order for teachers to implement lesson study.

2. Lesson study, with its preparation, implementation, and reflections activities, encourages the teachers to improve their teaching method; therefore it needs to improve those steps.
3. The policy of education decentralization which places teacher as the central key having wide responsibility becomes a vital aspect in developing the teaching conducted. Therefore, it needs to consider lesson study as the way to improve mathematics teaching quality.
4. The existence of MGMP in each regency has its strategic role to socialize lesson studies activities and its results.
5. The heterogeneous quality of teachers seen from the aspect of commitment, motivation as a teacher and competence enables the improvement of quality from teacher to teacher which automatically improves teacher collegiality in struggling together to improve the teaching quality.
6. Lesson study can be carried out in each Institute Teacher Training
7. Lesson study can be a model for teachers' ongoing professional development.

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