

**PURSUING GOOD PRACTICE OF
SECONDARY MATHEMATICS EDUCATION
THROUGH LESSON STUDIES
IN INDONESIA**

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ABSTRACT

Under cooperation between Government of Indonesia (GOI) and JICA-Japan, three universities UPI Bandung, UNY Yogyakarta and UM Malang carried out project called IMSTEP-JICA for pursuing good practice of mathematics (and sciences) teaching by empowering and developing teacher education. Starting in 1999 and lasting in 2005, the extending of the project resulting piloting activities through Lesson Studies for good practice of secondary mathematics teaching in three cluster site West Java, Central Java and East Java. Results of the studies significantly indicated that there are improvements of the practice of secondary mathematics teaching learning processes in term of teaching methodology, teacher competencies, students achievements, alternative evaluation, teaching learning resources and syllabus. Directly and indirectly, the results of the project influence the national level of educational reform due to the fact that some lectures who were involved in the project also involved in national consortium for developing the new curriculum (Curriculum 2004). However, in term of the longer term for teacher development program, the result of the project can be perceived as merely a starting point. There are still many things to be done in order that Indonesian teachers can learn more how Japanese teachers develop Lesson Studies for pursuing good practice in teaching learning mathematics. One of the urgent agenda is how to build a community of teachers interested in lesson study.

Key Word: good practice, lesson study, secondary mathematics teaching learning

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A. OVERVIEW

Some philosophical backgrounds of the nature of good practice of teaching need to be discussed as the references of the efforts to put on the grounds for the long-term orientation of improving mathematics education. Those notions cover the questions to mean education whether: (a) as the investment or as the need for society?, (b) as the obligation or as the awareness of the students?, (c) as the competition or as the collaboration?, (d) as the product or as the process, etc. Although the examples of good practice differ in some contexts, there are some features common to the way the children were working such as in/formality of typifies classroom, clearness of the objectives, ethos of the school, flexibility and variety of teaching styles. The quality of teaching was the strongest feature common to all the examples of good practice; while the adequacy of good practice may outlined on the basis of the context of the ideal practices.

Brown in Riley (1992) suggested that the features of good practice include fostering a positive attitude to mathematics; emphasis on the application of mathematics; well-planned work; children formulating testing and revising hypotheses; work and pattern and relationship; a variety of approaches to calculation used; sensible use of the calculator; extensive experience of measurement and estimation; clear policies on mathematics; individual, group and whole class work as appropriate; opportunities for co-operative work; positive and well timed teacher intervention; meeting needs through the differentiation of work; use of practical and first-hand experience; cross-curricular work; appropriate reflection of cultural diversity; relevant exploratory work; stimulating working environment; effective teaching.

The Third International Mathematics and Science Study (TIMSS), from the videotaping study of classroom instruction of mathematics lessons in the U.S., Germany, and Japan, found that good practice of mathematics teachings were more likely to target mathematical thinking and seeking to teach students how to solve a particular kind of problem or carry out a specific procedure. Further, it suggested that the concepts of mathematics were far more likely to have been developed rather than simply presented as rules. It included multiple ways to solve mathematical problems and asked students to perform tasks that were not “routine.” TIMSS suggested that good practice of mathematics teaching should encourage the teachers to help students make explicit connections between parts of the lesson to previous knowledge, and/or to statements and problems from earlier parts of the lesson. Good teaching practice should be supported by the research on how children learn and, particularly, on how they learn mathematics.

While in Japanese context, on which Lesson Study has its culturally deep rooted, good practice of mathematics teaching (Masami ISODA) may perceived as it is visible, recordable in the classroom and can be showed to other people. Further, it may be known as a good approach in an economy in which there is a teacher who is well known by its approach. Accordingly, good practice of mathematics teaching should be useful for the reform of mathematics education as a whole and many teachers may have their wish to do the same approach. Good practice of mathematics teaching also should encourage the improvement of teacher training program. According to him, the challenges for the practitioners who develop good practice consist of capacity to describe the nature of good practice? Why we can say it as good practices? What kind of reform is expected by such kinds of practices? What kind of the setting in curriculum standard for explaining why it is good. And what kind of relation of good practice to the world of mathematics education research movement?

One significantly reference for Lesson Study performed by Education Development Center, Inc. (“EDC”) of Massachusetts. It organized divisions and centers of various sizes of Lesson Studies and develops Lesson Study Communities Project to

carry research to introduce teachers to lesson study, to build a community of teachers interested in lesson study, to enhance teacher knowledge of mathematics and pedagogy, and to learn how the Japanese lesson study model can be adapted to become a successful professional development model for U.S. secondary school mathematics teachers. Indonesian educationist as well as practitioners may be able to learn from Japan and other country to perform good practice of mathematics teaching in secondary schools.

B. Observable Good Practice and Ideas Values Beliefs of Mathematics Teaching Learning in Indonesia

The efforts of pursuing good practice of mathematics teaching learning in Indonesia, starting from 1994 up to present, have its ideal values beliefs, political as well as empirical and pragmatic ground. In the conceptual framework, it can be seen that observable good practice components can be directly related with educational questions 'What should children learn ?' and 'How should children learn and teachers teach ?'; and ideas values beliefs can be directly related with the questions 'Why should children be educated in this way ?' and 'What is an educated person ?'. As they are elaborated from socio-constructivists approach, that teacher is not only to implement the curriculum but also to develop it. Teaching and learning in the classroom should not always be directed teaching in which teacher dominated activities and initiations; however, teacher needs to accommodate students' initiatives and students' needs. Therefore, teacher needs to implement flexible method of teaching, in which students' performance and achievements can be assessed during the processes of learning activities. It implied that teaching learning process will be student centered rather than teacher centered, in such away that students have various experiences and opportunities to consciously uncover the nature of what they are learning.

Mixing from values beliefs and empirical evidences, there are currently demands in Indonesia, that any educational reform should handle the issues of (a) how to promote interactive curriculum rather than instrumental curriculum?, (b) how to promote student centered approach rather than teacher centered approach?, (c) how to promote students' initiation rather than teacher's domination?, and (d) how to promote simple and flexible curriculum rather than crowded and tight-structured curriculum? While in term of observable good practice, there were demands that teachers need to have a chance to reflect their teaching in such away that they may move from older paradigm of teaching to the new one. Teachers may move from emphasizing the "teaching" to emphasizing the "learning"; they may move from the act of "transferring teacher's knowledge" to "constructing students' knowledge".



Figure: Most Indonesian teachers implement Traditional Teaching (2001)

There are also demands that teachers may move from “instructing” to “serving”; they may move from “product oriented” to “processes oriented”; they may move from “classical teaching” to “individual teaching”; they may move from “single method of teaching” to “various method of teaching”; and they may move from “theoretical” to “hands on activities”. To develop the aspects of students’ life-skill teachers need to have a lot of time, passionate, and extra-efforts in such away that teachers are able to motivate their students, to give them the chance to develop their skills and experiences. In the socio-constructivist approach, teachers are expected to fully concentrated and focused at their teachings and its preparations. It made them to be able to promote their creativities in developing their various method of teaching such as discussion, investigation, laboratory practice and demonstration.

The currently studies on mathematics teaching practices in Indonesia indicated that, under the implementation of the Curriculum 1994, student’s process skill and student’s achievement are still low; contents on Mathematics were crowded; too many time consuming administration stipulation for teachers; there were mismatch among the objectives education, curriculum, and National Evaluation system. Further, National Leaving Examination assessed the children’s ability cognitively only and considered individual differences inappropriately; while University Entrance Examination system was considered to trigger school teachers apply much on goal oriented rather than process oriented. Observable practices of mathematics teaching in the period of the year 2001-2003 also indicated that many teachers still have difficulty in elaborating the syllabus; a number of mathematics topics are considered to be difficult for teachers to teach; a significant number of children consider some mathematics topics as difficult to understand; teachers consider that they still need guidelines for conducting teaching process by using science process skills approach.

C. Pursuing Good Practice of Secondary Mathematics Teaching Through Medium-Scale of Lesson Studies

In the fiscal year 2001-2003, a medium scale of piloting of Teaching Learning Model of secondary mathematics and sciences through Lesson Study has been carried out by IMSTEP-JICA in collaboration with UPI Bandung, UNY Yogyakarta, and UM Malang, in which Japan Government supported facilities, training as well as Educational Experts.

1. Method

The piloting activities were carried out in three clusters i.e. West Java (Bandung), Central Java (Yogyakarta), and East Java (Malang). Following are the sites:

	West Java (Bandung)		Central Java (Yogyakarta)		East Java (Malang)	
	Year 2001/2002	Year 2002/2003	Year 2001/2002	Year 2002/2003	Year 2001/2002	Year 2002/2003
Classes (schools)	1	2	1	3	1	1
Teacher involved	1	2	3	3	1	1
Lecture involved	4	4	4	3	4	4

Table: Three cluster sites of Lesson Studies of Mathematics Teaching (IMSTEP-JICA Project)

The Lesson Studies were developed in which the teachers, in collaboration with Lecturers and Japanese Experts, tried out some teaching models at schools. The Lecturers of Teacher Training Program and School Teachers worked collaboratively, composes some numbers of Lesson Studies. The grounds of the Lesson Study activities were reflecting and promoting the new paradigm of the secondary mathematics and science education, in which learning activities are not only perceived pragmatically and short-time oriented but also to be perceived as a long-life time purposes.

The objectives of those Lesson Study activities were to contribute the improvement of secondary mathematics education by pursuing good practice of mathematics teaching. Lesson Studies for secondary mathematics were carried out by mainly Classroom Action Research approach. They carried out to improve the teaching learning practices and to find more appropriate methods for facilitating students learning. Teachers' experiences have been shared with other teachers and the lectures. The specific objectives of Lesson Study activities are: (1) to develop instrument and equipment for teaching learning process, (2) to develop teaching method and model for teaching learning process, (3) to develop teaching material for teaching learning process, and (4) to develop teaching evaluation for teaching learning process.

Lesson Study activities let the teachers to reflect and evaluate, in cooperation with lectures or other teachers, their paradigm of teaching. Approaches of Lesson Studies covered (a) students cooperation with others in their learning, (b) contextual teaching and learning, (c) life-skill, (d) hands-on activities, (e) interactive process oriented curriculum and syllabi development, and (f) teachers and students autonomous. From those three sites of study, there can be produced the notions of educational improvement, in term of teacher, student and lecture.

2. Result

The results of Lesson Study could be inferred from the view of students, teachers, and of lecturers. Evidences were collected through observations, questionnaires and interviews. It can also be noted the strengths and weaknesses of the activities. Those are as the following:

Teacher

1. The teachers felt that the class is getting more alive. However, all the above progresses have to be paid by spending longer time for preparation.
2. The teachers have to spend longer time for preparation, have sufficient skill to run the experiments and use various tools.
3. Lesson Study gave positive results because it could improve teachers' professionalism in finding variations of teaching approaches, and teaching methods.
4. It could also improve teachers' skills in classroom management and in questioning and in developing creative ideas.
5. Through Lesson Study, many teachers were introduced some innovations in mathematics and science teaching and learning.
6. The new model was introduced to teachers to increase the variation of alternatives on how to conduct classroom teaching and learning process.
7. Teachers stated that now, they have more choice to teach certain units of studies.
8. Teachers involved in these Lesson Study activities developed their competencies in teaching mathematics and science.
9. In Mathematics, the competencies developed for teachers are realistic approaches (RMA), authentic assessment, and constructivist approach.
10. Teachers involved in these Lesson Study activities felt that they have to think and develop new ways on how to let students learn and construct their own concepts.
11. They expressed their impressions that their creativity was improved.
12. There were indication that teachers' skill to communicate, to deliver questions, to carryout discussion method was improved e.g. in order to stimulate students to think, teachers asked questions and by doing these, questioning skills were improved.
13. There were also evidences that teachers' perceptions of their students' learning in Lesson Study activities were positive.
14. Teachers stated that Lesson Study activities needed to be continued or to be extended in order that they could continue to develop mathematics and or science teaching.
15. Teachers stated that Lesson Study activities were useful to support the implementation of competence-based curriculum.

Student

1. Good responds were heard during the meeting, especially the students' enthusiasm, students' involvement in doing experiment and discussion.
2. The students respond to the contextual teaching and learning approach during Lesson Study period may be indicated by their participation in experimentation, discussion, and presentation.
3. More than 80% of the number of respondents were actively involved in the experimentation, approximately 75% involved in discussion, and more than 75% involved in presentation.
4. It can be concluded that nearly 3 out of 4 students were actively involved in the contextual teaching and learning process.
5. Nearly 70% students were happy with the teaching learning process using a lesson plan.
6. More than 57% of them were happy with the lesson plan and the involvement of teacher during teaching and learning process is still high, more than 95%.
7. Students could develop responsibilities in their learning and be more active in finding learning resources out of the classroom.

8. Students get more skillful in sharing ideas and communicating their mathematics activities
9. Innovations practice tried out at Lesson Study schools could also improve students' enthusiasm, motivation, activities, and performance.
10. The innovation in approaches and media of learning bring good results for students. Most students in each class were enthusiastic in learning using the new media, methods, or approaches.
11. It was indicated that most of students expressed their happiness during the Lesson Study activities; the reason were: (a) the lesson was not so formal, (b) the contents were easier to learn, (c) they were able to express their ideas, (d) they got much time to discuss with their classmates.
12. The reasons of improving students' motivation were: (a) they were able to detect their competencies any time, (b) contextual teachings made them understand the usage of learning certain subject-matter, (c) realistic teaching made them not be boring.
13. There were more activities done by students in science laboratories, especially activities to improve their process skills.
14. Most of the students stated that they liked to learn with hands-on activities, discussion, demonstrations, teaching aids and worksheets.

Lecturer

1. Lecturers got experience in developing teaching materials for schools and know more about problems faced by teachers.
2. They could also develop more creative ideas to find better methods of instruction with teachers and better hands-on activities by utilizing local materials.
3. Through Lesson Study activities, lecturers were also benefited in knowing more about the problems faced by teachers and schools in conducting mathematics and science teaching and learning.
4. Lecturers' experiences were improved due to the fact that in Lesson Study activities, they in cooperation with teachers, should develop teaching guide, teaching materials and assessment methods.

Constraint

1. Those are the tendency of teachers to keep on doing "teacher centered activities" instead of trying new ways of teaching which need thought, energy and time to develop, to plan, and to implement.
2. These resistances for change are caused by the "crowded curriculum" that have to be finished and the fact that there were too many students in a classroom.
3. Lecturers and teachers should also need time to introduce and learn new innovations. They should be very patient in developing new things; they could only develop one thing at a time.
4. Based on their experience in conducting processes, there were different perceptions of those lecturers and teachers on new paradigm.
5. Some teachers tend to skill use the "old" orientation in teaching and learning processes, which is to try to achieve the highest possible score in final examination.
6. In order to do that they usually practice "teacher centered" and "product oriented" teaching and learning processes and forget to develop students' thinking processes skills.
7. Based on the implementation of Lesson Study activities, it was found that some aspects of Lesson Study activities have difficulties to implement in term of

teachers, students, class management, equipment or facilities, and schooling system.

8. Number of students in each Lesson Study class was relatively high i.e. 35 or more; this made the teachers have difficulties to facilitate their needs in learning activities. With a large number of students in the class, it was difficult for the teachers to monitor and supervise their activities.
9. Due to the fact that we do not implement moving class, it needs more time for the teachers to prepare equipments and other facilities.
10. Another difficulties faced by the teachers related to the development of students' worksheets was that teachers have some problems on how to prepare many kinds of worksheets, to decide the topics to be piloted and to prepare teaching guides.



Figure: Group discussion in piloted teaching practice (2003)

D. DISCUSSION AND CONCLUSION

There were strong evidences that Lesson Studies activities improved students' enthusiasm, motivation, activities, and performance. It also improved teachers' professionalism in terms of teaching performance, variation of teaching methods/approaches, collaboration. Lecturers got knowing more about the problems faced by teachers. It was take time for teachers to shift from teacher-centered to student-centered. Teachers developed teaching methods based upon more hands-on activities and daily life utilizing local materials. Students were active learning and involved in discussion to share ideas among classmates. Students enjoyed learning science and math during Lesson Study activity due to some reasons. According to students' respond, the lesson was not so formal, the contents were easier to learn, students able to express their ideas, students got much time for discussion with their classmates, more experiment science and math. Teachers got alternative method to let students learn and construct their own concepts. However, teachers took time to get used to develop teaching model by their own.

The Lesson Study project was proven to be very effective in lifting students' enthusiastic in learning science, helping students to develop their experimental and discussion skill, giving opportunities to students in developing their own scientific concept by themselves. It was also reported that by using constructivism approach, the students may find out their best style of learning. Competition rises among groups of students in presenting the results of their work and defending their presentations. This forces students to learn theory more on their own. As a result of Lesson Study activities there were many teaching material developed either by lecturers and teaching together or by lecturers or teachers themselves. Those materials were either developed by lecturers

or teachers in their own classroom or by lecturers and teachers together during Lesson Study activities. In general lecturers and/or teachers developed the teaching materials after thinking extensively what and how to develop teaching materials for a certain topic, and then develop the materials. Further they try out the teaching materials in their classroom and revise those according to the result of the try out.

The results of Lesson Study activities and exchange experiences come to a suggestion that to improve mathematics and science teaching in Indonesia; it needs to deliver obvious messages to the government, teachers and head-teachers or schools. Learning from study, it was also suggested that to promote good practice of mathematics and sciences teaching, the teachers need to en-culture their efforts in inovating teaching learning processes which meet to academic students needs, encouraging students to be active learners, developing various strategic of teaching, developing various teaching materials, and in developing teaching evaluation. In developing teaching learning methods, the teachers need to: plan the scenario of teaching, plan students activities, plan teachers' roles, distribute the assignments, develop assesment methods, and monitor the progress of students achievements.

To develop their experiences, the teachers also need to participate frequently in such kinds of workshops or seminars. By using those teaching materials teachers could conduct the teaching and learning process more efficiently. Students enjoyed their learning process because they were involved in observing and doing things. Those teaching materials also improve students' motivation and interest in learning the materials. Although there were may kinds of teaching materials that have been developed through those Lesson Study activities, there still more topics that need to have or to have better teaching materials. Therefore lecturers from three universities need to have further collaborative work to develop more teaching materials in the future.

The study also recommended that to encourage educational innovations, the head-teachers need: (1) to make good atmosphere for teaching and learning, (2) to promote to implement various teaching methods and teaching learning resources, (3) to give the chances for the teachers and their students to perform their initiatives, (4) to promote cooperative learning, (5) to promote research class as a model for educational innovations (as Japanese teachers do), (6) to support the teachers to be the developer/maker of the curriculum, (7) to promote teachers' autonomy in developing model of teaching learning activities, (8) to implement school-based management, (9) to encourage students' parents participations, and (10) to promote cooperation with other educational institutions.

Further, the study also recommended that to improve the quality of mathematics and sciences education, the central government needs to: (1) implement more suitable curriculum i.e. more simple and flexible one, (2) redefine the role of the teachers i.e. teachers should facilitate students' need to learn, (3) redefine of the role of principals; principals should support the professional development of teachers by allowing them to attend and participate in scientific, meetings and trainings, (4) redefine the role of schools; schools should promote school-based management, (5) redefine the role of supervisor; the supervisors need to have similar background with the teachers they supervise in order to be able to do academic supervision, (6) improve teachers' autonomy to innovate mathematics and science teaching and learning, and (7) promote better collaboration between school and university; communication among lecturers and teachers should be improved; these could be done through collaborative action researches and exchange experiences through seminars and workshops, (8) redefine evaluation system, and (9) to extend project for promoting new paradigms and educational innovations.

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