Mathematics Education and Graph Theory

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Proceedings of International Seminar on Mathematics Education and Graph Theory

These proceedings contain the full texts of paper and talks presented in the International Seminar on Mathematics Education and Graph Theory on June 9, 2014

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PREFACE

These proceedings contain the full text of papers and talks presented in the International Seminar on Mathematics Education and Graph Theory. This seminar was held in conjunction with the International Workshop on Graph Masters. The workshop was held on June 7–8, 2014, while the seminar was on June 9, 2014. These events were organized by Islamic University of Malang (Unisma) in cooperation with Indonesian Combinatorial Society (InaCombS).

The workshop and the seminar would not have been possible without the time and energy put forth by the invited speakers. The invited speakers of the workshop were: **Mirka Miller**, University of Newcastle, Australia; **Joseph Miret**, Universitat de Lleida, Spain; **Christian Mauduit**, Institut de Mathematiques de Luminy, France; **Edy T. Baskoro**, Bandung Institute of Technology, Indonesia; **Surahmat Supangken**, Islamic University of Malang, Indonesia; **Tri Atmojo**, State University of Semarang, Indonesia; and **Purwanto**, State University of Malang, Indonesia.

The invited speakers of the seminar were: **Juddy Anne Osborn,** University of Newcastle, Australia and **Abdur Rahman As'ari**, State University of Malang, Indonesia. The seminar was held on the area of mathematics education and graph theory. The main themes of the mathematics education seminar include topics within the following areas (but not limited to): philosophy of mathematics education, curriculum development, learning methods and strategies, learning media, development of teaching material, and assessment and evaluation of learning. The main themes covered in graph theory seminar include topics within the following areas (but not limited to): degree (diameter) problems, ramsey numbers, cycles in graphs, graph labeling, dimensions of graphs, graph coloring, algorithmic graph theory, and applications of graph theory in various fields.

We would like to thank you to the invited speakers and all presenters who have submitted papers, for their valuable and inspiring presentation. A special appreciation goes to: **Surahmat Supangken**, Rector of Unisma and **Kiki Ariyanti Sugeng,** the President of InaCombS, who have made a lot of efforts to prepare this seminar.

We also do not forget to express our gratitude to Islamic University of Malang (Unisma) for providing financial support, and to the Indonesian Combinatorial Society (InaCombS) for the support. We hope that you had a great time and valuable experience during the seminar in Malang.

Malang, July 22, 2014

Editors

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IMPLEMENTATION OF THE FIRST YEAR LESSON STUDY TO IMPROVE THE LEARNING QUALITY IN MATHEMATICS EDUCATION STUDY PROGRAM UNIVERSITY OF JEMBER

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Abstract

Teaching and learning in Mathematics Education mostly expository method, which combines lectures, question and answer, discussion and assignments. However, these methods have weaknesses, for example students can't combine concepts in one course to the other subjects. This is a problem that must be resolved by a team of lecturers teaching courses so the quality will increase. But in fact, the principle of collegiality among faculty has not grown optimally. Hence the need an approach which is able to create collegiality relationship is established, so the issue of students that result in improving the quality of learning outcomes will be resolved. Lesson study is a model of professional development of educators through collaborative learning and ongoing assessment to build a learning community. This study aimed to describe the improvement of the quality of mathematics learning that implemented by lesson study in the learning process. Implementing Lesson Study was conducted on subjectsof algebra structure and calculus 2 on the even semester 2010/2011, calculus 3 and numerical methods on the odd semester 2011/2012. The results showed that there ar ean increase ingrade point average on a Calculus 2 is 12.8%, 5% for algebraic structure, 12.4% for calculus 3, and 14.5% for numerical methods. It can be concluded that in the first year of Lesson Study in mathematics education study program to improve the learning quality.

Keywords: *Lesson Study, Learning Quality*

INTRODUCTION

The teaching learning in the mathematic education study program mostly uses an expository method, namely the combination of lecturing, question-answer, discussion and giving exercise. However, there are still weakneses in the method, such as the unability of the students to combine the concept in one course to the othe courses. It is a problem that should be solved by the lecturer of the lesson in one kind in order to solve the student's problem. Indirectly, the learning quality in mathematics education will improve. However, in fact the collegality concept among the lecturers have not maximal build yet. So the disscusion among the lecturers can not be done continously. So that, it is necesseary to provide an approach that is capable to make a relation between students and the lecturer in order to solve thestudents problem that affects the improvement of the achievement. One of the method taht can be used to improve the colegality and professioanlity concept of the lecturer is Lesson Study.

Lesson study is a model of lecturer learning through collaborative and continously learning analysis based on coleggality and mutual learning concept to build a learning community. There are some reasons why lesson study was choosen as one of the method to improve the professionality and collegality of the lecturer, such as: 1. Lesson study is designed collaboratively within a certaion time through an intensive study towards the teaching materials, students characteristic, and learning tratégy, 2. Lesson study offers a process in developing students' motivation, 3. Lesson study provides an encouragement to give a certain purpose in the mindset of the students through class observation, 4. Lesson study emerges new prespective about teaching and learning.

Based on the explanation above, this reserch is intended to describe the

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improvement of the mathematics learning quality in using lesson study in the teaching learning process at mathematic education programme in the faculty of teacher traing at Jember University. The implementation of lesson study was conducted for Algebra structure lesson, calculus lesson in the even semester 2010/2011 and calculus 3 and numeric method in the odd semester of 2011/2012.

LITERATURE REVIEW

Lesson study is a model of teacher training through the study of collaborative and continously learning based on the priciples of collegality and mutual learning to build learning community (Sumar Hendayan, et all:2006). Lesson study is a comprehensive approach that aimed to the professional learing and to support the lecturer to be an all time educator in the effort of developing and improving the quality of learning in the classroom.

Lesson study is conducted together with tthe lecturers in the classroom with a purpose to understand the students better (Rahayu, 2005). Thorugh the lesson study activity, the learning activity is developed together by choosing a lecturer to conduct the learning activity, meanwhile, the other lecturers are observing the students learning achievement during the process. At the end of the session, the lecturers are come togehther and disscuss about the theacing and learning activity done, revise and arrange the following lesson plan based on the result of the disscussion. So that every problem that came up during the teaching learning process can be solved.

Lesson study gives encouragement to the lecturer to be an all time lecturer about how to improve and revise the teaching learning process in the classroom. Through lesson study the lecturer will be assited in some ways, such as: 1. Developing a critical thinking about the teaching learning process, 2. Designing a good lesson plan, 3. Observing the mindset of the student in learning and choosing the suitable action, 4. Disscussing and doing reflection about the learning activity and 5. Identifying knowledge and skill that needed to improve the activty of learning. Related with this, the lecturer tries to do some revision of teaching learning continously through the lesson study activity. The lecturer tries to predict the students' response in the 'Plan' phase. In the 'do' phase, the lecturer tries to facilitate the students to learn in a fun and chalnggind way through thinking exercise by solving problems and build a new knowledge. The sensitivity of the lecturer towards the students' difficulties is trained through the 'do' phase. Phase 'see' trains the lecturer to do self reflection to not to be easily satisfied with the usual work. After all the phases are done, the professioanlity of the lecturer will improve and the students achivement of the students in the certain lesson will improve and the GRP will also improve in every semester.

According to Lewis, Perry and Murata (in Herawati, 2010:4), the cycle of lesson study can be seen in the picture 1.

METHOD

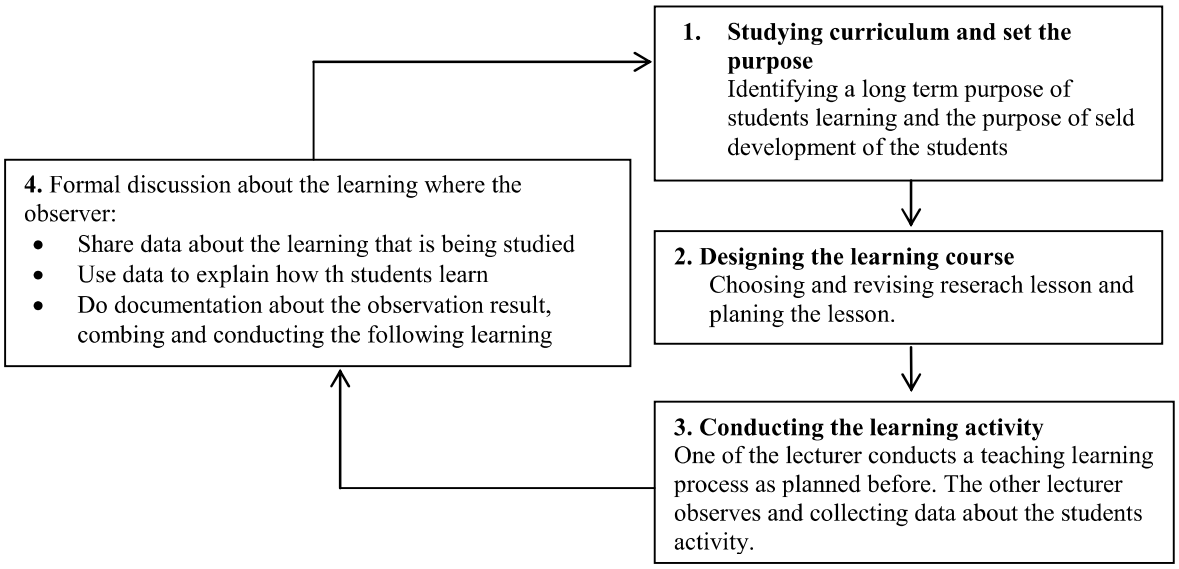
The implementation of lesson study at mathematic education programme at teacher training faculty of Jember University

The improvement of the learning quality through lesson study is expected to be more optimal if the implementation are well designed. Morover, the implementation of lesson study at mathematic education programme at teacher training faculty of Jember University are done as the following procedure.

a. Following the socializsation of lesson study programme.
   The preparation of lesson study at the science major is started by doing socializsation to the all of the lecturers to harmonizing the preception of lesson study and implementation in the lecturing process in LPTK. Each lecturer in mathematic education programme have to follow the socializsation. The socialzsation is conducted at the faculty level by inviting an expert form dikti to explain some principles and the implementation of lesson study. A workshop is conducted in the level of major and

expected to provide comprehension about the steps and the mechanism of the lesson study implementation in the mathematic education programme together with the team.

a) Coordinating the mathematic lecturers in designing the plan
b) Designing monitoring and evaluating instruments, doing monev and arranging report.
c) Doing documentation of the whole activity of lesson study in each mathematic lesson or course.



Picture 1. The cycle of lesson study according to Lewis, Perry and Murata (in Herawati, 2010:4)

b. The slection of course to use for lesson study and the lecturer model
The selection of the course that is being implemented with lesson study and the model of the lecturer are selected by the chief of mathematic education programme
c. Following workshop
The workshop covers the syllabus arrangement, SAP, virtual laboratory arrangement, and the other learning instruments such as handout, teaching media, and observation list. Specifically, in workshop, SAP is implemented with innovative learning process to answers the global challange.
The workshop engages all the lecturers in mathemathic education and inviting expert from dikti. A group that selected for lesson study is involved in designing SAP for lesson study by considering these following aspects:
(1). Students' individual learning ability
(2). The cognitive aspect achievemnet at the highest level namely: analisys, eva;uation, and creativity.
(3). The development of the braveness in conveying responsible opinion, confidence, and the other effective aspects.
(4). The implementationa and the development of innovative learning process.
(5). Enggagement in facing the global chalange by developing local potential.
(6). Improving a contextual teaching material with the reality of life.
(7). The implementation of the research relusts that is related with the development of learning or teaching materials.
(8). Developing students competence at psychomotoric aspect.
d. Open class application.
The open class activity is scheduled for four cycles and each cycle consists of

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four phase activity, namely a. Open lesson planning, b. Lesson study implementation and observation in the classroom, and c. Lesson study reflection

(a) Designing
At this phase, the activity done is giving final touch for the SAP of the llesson that is going to be implented using lesson study, preparing instrumnets and teaching media and observation instrument. The learniing instrument is designed by the model lecturer and disscussed during the planning activity by the other lecturer who become the observer.

(b) The implementation of lesson study in the classroom
SAP and teaching media from the discussion are implemented in the classroom by a model lecturer, meanwhile the other lecturers are observing the process. Obeservation focuses on the students activity in tecahing learning process by using a recorder (handycam) that will be used as the disscussion material in reflection stage or can be used to planning the following lesson plan. When the lesson study is being implemented, beside the two observer, the are also two people recording the activity of the students in teaching learning process.

(c) Lesson study reflection
The reflection is done as the implementation finished. Lead by chief, the process of implementation is started by giving first chance to the model lecturer to convey some impression and distraction in implementing the lesson plan. Then, the other lecturers convey the observation results together with the analisys for some revision about lesson plan or as a consideration in arranging the following lesson plan. The implementation and reflection activity are scheduled for four cycles.

e. Monitoring and evaluation
The activity of monitoring and avaluation of lesson study implementation are aimed to identify the condition and the implementation of lesson study an to find some support taht is needed to develope it. Monev is done during the plan, do, and see phase for four cycles. This activity is done by two team from BPM of Jember University and Malang University as the expert in lesson study.

RESULT AND DISSCUSSION

The result of this reserach shows that:

1. The studets grade point average at the calculus II score at 2010/2011 academic year was 3,4. So there was an improvement of students' GPA from the previous academic year for 12,8%
2. The studets grade point average at the algebra structure score at 2010/2011 academic year was 3,27. So there was an improvement of students' GPA from the previous academic year for 5%
3. The studets grade point average at the calculus II score at 2010/2011 academic year was 3,31. So there was an improvement of students' GPA from the previous academic year for 12,4%
4. The studets grade point average at the numeric methodology score at 2010/2011 academic year was 3,44. So there was an improvement of students' GPA from the previous academic year for 14,5%

The improvement of students' GPA in four course that are implemented with lesson study at the first year was not optimal. The average improvement belongs to the low category, that is 11,75%. It was because the lesson study was new and implemented in the mathematic education for the first time. So he lecturer was not yet familiar with lesson study. Besides, the students were not accostumed to get observed while teaching learning process being conducted. The other factor was the lesson study activity was just implemented for four cycle for each course in one semester. However, by implementing lesson

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study, the collaborative and collegality priciple among the lecturers were improve, so the lecturer can solve the students' problem in comprehensing the materials. This thisng was directly affected the students' GPA in Calculus II, algebra structure, calculus III and numeric method that improve from the GPA in the previous semester.

SUGGESTION AND CONCLUSSION

1. **Conclussion**
   The conclusion of this research states that at the fisrt year the extension of lesson study in mathematic education programme is able to improve the quality of learning especially in the students' GPA in the certain course that the lesson study is being implemented. The corses are Calculus II, algebra structure, calculus III and numeric method.
2. **Suggestion**
   The suggestion of this research is lesson study is necessary to be continously implemented in the mathematic education programme for the other lecturer and other courses.

Acknowledgement

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REFERENCES

Depdiknas. 2009. *Program Perluasan Lesson Study untuk Penguatan LPTK.* Jakarta: Direktorat Ketenagaan DIKTI.

Hendayana, S. dkk. 2006. *Lesson Study: Suatu Strategi untuk Meningkatkan Kepropesionalan Pendidik.* Bandung: UPI.

MIPA FKIP UNEJ. 2011. *Laporan Hibah Lesson study Jurusan MIPA FKIP UNEJ Tahun 2011.* Laporan Hibah LS BATCH III. Tidakditerbitkan.

Rahayu, Sri. 2005. *Lesson Study Sebagai Model Pengembangan Profesi Guru dalam Upaya Meningkatkan Pembelajarn MIPA.* Makalah disampaikan dalam seminar dan workshop Lesson Study di FMIPA UM, 21 Juni 2005.

Susilo, Herawati dkk. 2010. *Lesson Study Berbasis Sekolah, Guru Konservatif Menuju Guru Inovatif.* Malang: Bayumedia Publishing.

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