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Improving The Quality Of Learning In Geometry Transformation Course To Encourage Students Learning Independence Through The Lesson Study Approach

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Abstract

The quality of learning outcomes is largely determined by the quality of learning. Hence, it needs to design a learning activity that can improve the individual quality of students. One way to improve the individual quality is by supporting students to learn independently. This study aims to improve the quality of learning in Geometry Transformation course in order to encourage students to learn independently through Lesson Study approach. This study uses Classroom Action Research (CAR) which is conducted in four cycles. The result of this study shows that the independence of students learning from cycle one till cycle four are raising and priding. The quality of learning outcomes indicated by: (1) the completion of tasks is in the excellent category, (2) the average of test results is in good category, (3) the interaction study among students is very good, and (4) the interaction between students with teaching materials is very well.

Key words: learning quality, learning independence, Lesson Study

I. INTRODUCTION

Learning will be meaningful if the result of study gives benefits for the learners. Learning outcomes and learning experiences have many diverse forms. Knowledge and new experiences as a result of learning does not come suddenly. Those knowledge and new experience is built through such kind of process that is designed to enable someone associate new information with the relevant concepts which had presented in the person's cognitive structures.

In gaining the knowledge, someone has the speed and its own way. There are people who gain knowledge quickly, there is less rapid, there are even people who have difficulty in acquiring new knowledge. And so do how to acquire the knowledge, some people get it independently and others depend of another person. For those who are able to learn independently, that person has the will and skills in the learning process without any help from others. Conversely those with less or has no capable of independent learning will be slow in building the knowledge.

Educators should be encouraged the learning participants (students) to have the independence of learning. The independent learning process gives students a chance to

digest the learning materials with a bit help from lecturers. Learning should properly be designed like that so that learning become the student-centered learning, fostering intrinsic motivation, increasing the active-learning and deep-learning, enabling peer-teaching, touching prior knowledge students already possessed, reflecting on learning process, developing group learning skills, producing curriculum based on the investigation, involves timely feedback, and support self-assessment and peer-assessment. The method of learning like that by Kiley (2000) known as problem based learning. Problem based learning method has been known to be more effective than conventional method in providing the opportunity to transfer knowledge, and also provide retention results in long-term memory content higher than the conventional teaching (Liu, 2005).

Basically life is faced with certain problem. Someone has different way in facing and solving the problem. Therefore, it is important to introduce and familiarize students with various problems and its solutions, either the problem of routine and non-routine problems. Most of problems in this world is non-routine problems whose structure is irregular (ill-structured problem) and the solution allows the use of unfamiliar algorithms. Open problems model (open-ended) is known have broken the stereotype that every problem has only one correct solution (Klavir & Hershkovitz (2008).

The reality shows that learners are less familiar with the problems or issues with an open solution. Learning mathematics in schools generally emphasize routine question with regular structure (well-structured problem) which was presented clearly and contains all necessary information and require familiar algorithms to finish it (Thompson, 2008). This situation also occurs in university lecture.

Depdiknas (2009) indicate a some weaknesses in the teaching / lecturing at universities, such as: (a) lecturing process did by the majority of lecturers is limited to provide memorizing knowledge, and less emphasis on higher cognitive aspects, such as the sharpness of analysis and evaluation, development of creativity, independence of learning, and development affective aspects, which cause students become passive and the knowledge gained is often less useful in their life and work, (b) the lecturing material is lack of orientation to the fields, the results of field research, and long-term needs, the lecturers tend to use similar patterns of learning from year to year, and the changing of curriculum has no impact on changing teaching materials, methods, and

learning strategies, and (c) the competence / the lecturing objective are largely still confined to the low-level cognitive and psychomotor domain.

To overcome the weaknesses of the low quality of learning in college, the betterment of lecturing that can be implemented in college is needed. One model that might be applied is the sharing of experience among lecturers in order to knit learning community. Sharing is done collaboratively and sustainable based on principles of collegiality and mutual learning in order to build learning community. The performance of students in learning becomes the most important part in the learning process, the interaction between student-student, student-lecturer, student-teaching materials and student-environment, are matters of concern to the lecturer discussion. The model itself is known as lesson study. By using lesson study activities, collaborative learning assessment and sustainable which based on principles of collegiality and mutual learning can build learning communities. Lesson Study is a systematic process used by teachers in examining the effectiveness of learning (Garfield, 2006; Cerbin, W and Kopp. 2006). Systematic process in this case is the activity of educators (teachers) collaboratively to develop the plan and tools of learning, observation, reflection and revision of lesson plans cyclically and continuously. Each cycle of activity in the Lesson Study carried out in three stages. The first stage is the Plan (planning), the second stage is the Do (implement), and the third stage is the See (reflection). The implementation of lesson study has faring well in creating the culture of collegiality and mutual learning in the Mathematics Department of FMIPA UNNES (Iwan Junaedi, 2010).

From the backgrounds described above, a study that encourages the improvement of lecturing quality and student learning independence has been done. Results of researcher's experience when teaching Geometry Transformation course on FMIPA Unnes over the last ten years is known: (a) learning outcomes for the Geometry Transformation course has not been satisfactory, (b) students are still depended on the explanation from the lecturer in spite of teaching materials are available, (c) the interest in learning is still low, and (d) students are less independent in learning, which is indicated by incompletion of the tasks given. This lack is need to be handed, through lesson study approach and the application of variety of learning models that were examined through lesson study is expected to have a positive impact.

The study will focus on: (a) how do students complete the course assignments and the results obtained, (b) how is student learning outcomes, (c) how is the interaction among students in learning, (d) how is the interaction between students and learning materials and the environment, and (e) how is the student interaction with the lecturer.

This study aims to improve the quality of learning in Geometry Transformation course in order to encourage students to learn independently through Lesson Study approach. Benefit of this research is expected to establish learning communities as part of student learning independence.

II. RESEARCH METHOD

The method used in this study was Classroom Action Research (CAR), through the Lesson Study approach. Lesson Study approach used for each cycle, namely the stages of plan, do (action and observing), and see (reflection). In this study a total of four cycles were conducted.

Subjects in the study were students who take Geometry Transformation course, group 5 of fifth semester, academic year 2010/2011. The numbers of students as research subjects were 31 people, consisting of 14 males and 17 females. The study only focused on four subjects, namely (a) reflection, (b) isometric, (c) the times results of transformation, and (d) affinity. The selection is based on; reflection was assessed at the beginning of the semester, isometric in the middle (the continuous of reflection), and affinity was studied at the end of the semester.

The type of data in this study was quantitative and qualitative. Quantitative data were the results of student portfolio assessment and test results. The qualitative data obtained from: (1) the results of discussions at the plan, (2) observations obtained during the implementation of learning, and (3) reflections result (see). Discussion (at the time of plan and see) and observations at the time of learning were focused on student learning independence. Observations focused on: (1) interactions between students with learning materials, (2) the interaction between students and students, (3) the interaction between lecturer and students, and (4) student portfolio.

In addition to student portfolios, the researchers also collected data using tests instruments and non-testing instruments. Test instruments used to determine the

competence of students to topics that have been studied in a single cycle of action. Form of test instruments is essay questions based on lattice work items.

The assessment criteria of items are determined based on the standard used by the university, namely: (a) score of 86-100 get A, (b) the score 81-85 get AB, (c) score of 71-80 get B, (d) score of 66-70 get BC, (e) score of 60-65 get C, a score of 50-59 get D, and (e) score 50 and below get E. Furthermore, these values are categorized for: (a) The value of A and AB is in the category of very good, (b) the value of B is in good category, (c) the value of BC and C is in enough category, and (d) the value of E in the category of less.

Form of non-testing instrument used was the observation sheet. The focus of observation include: (a) the student-student interaction, (b) student-lecturer interaction, (c) students-learning sources interaction, (d) environmental-student interaction, and (e) times when students are not active / stop learning.

Data analysis techniques performed quantitatively and qualitatively. Quantitative analysis carried out on the results of tests conducted four times at the end of each cycle. From the calculation of this percentage, the researchers will be able to determine the extent of student mastery to the material taught. Thus, it can be known to what extent the level of student success in learning. Each of these test results are also compared from cycle I, II, III and IV cycle. These results will provide an overview of the percentage of increasing students' ability after joining the learning.

For qualitative data, the techniques used in analyzing the observation is determined by the indicators that explained that a person carrying out those activities or not. The criteria of each instrument were grouped in categories: (a) very good, (b) good, (c) adequate, (d) unfavorable, and (e) very poorly.

Indicators of success is determined if: (1) the student has achieved as much as 65% of individual completeness and obtaining a minimum value of C, (2) if students fulfill the classical completeness, i.e. the students have achieved at least 85% of individual completeness, (3) the research is said to be success if at least 75% of all students in each of the activities such as student-student interaction, student-lecturer interaction, students-learning source interaction, student-learning environment interaction that shows students learning independence in good category.

III.   RESULTS AND DISCUSSION

The results of the study are as follows. Results at the plan and also the discussion of reflection (see) for each cycle is a compilation of learning tools that include: (a) syllabus (designed for three cycles), Lesson Plan (LP), teaching materials / handouts, instruments of observation, instruments of assessment sheet for student portfolios, student worksheets, student assignments, and test instruments. All of these devices will be discussed with peers to obtain feedback and improvement of the device.

Following improvements to the syllabus.

Table 1. The Emendation of Syllabus Based on Results Discussion on Cycle Plan

Syllabus component before revision	Syllabus component after revision	Reasons/Discussion
1. Topics that will be reviewed as research material is chosen spreadly out from the beginning to the end of the semester	The selected topics are topics examined in the third and fourth meeting, middle semester and end of the semester.	The description of the topic of the first cycle until the end of the cycle is clearly explained so that the increasing of learning independence can be measured.
2. Time allocation has not been in accordance with the number of the material. One topic has one meeting and others has two meeting.	Each topic is allocated at least two times face to face.	Since in each topic will be measured the improvement, it would require more time to: conduct assessments and observations.
3. Clear model or learning strategy is required in creating learning independence.	Selected several models of learning, i.e. problem solving learning, cooperative learning model, and the assignment strategy (performance task).	Learning model directed to the step of learning design and the implementation become clearer.
4. Indicators of competence have not been specifically formulated.	Indicators of competence are formulated specifically.	Indicators have used operational verbs that can be measured.

Reparation of this syllabus must be done because: (a) the syllabus will be elaborated in more detail in the Lesson Plan, (b) the syllabus as a guide in making assessment including indicators. Therefore, discussion of the first plan is to discuss the syllabus on topics that will be reviewed. The four topics chosen in this study were: (a) reflection, (b) isometric, (c) the times results of transformation, and (d) affinity.

In addition to changes in the syllabus, lesson plans drawn up also have some changes. The changes of Lesson Plan based on the results of discussions at the plan, the result of reflection at the (see), and researcher's notes while doing research on the implementation of learning (do). Here is the summary of some change in lesson plan developed from cycles I, II, III and VI.

Table 2. Improvement of Lesson Plan of the Discussion Result at Plan, at the time of Do, and Discussion Reflection (See)

Components of Lesson Plan Before revision	Components of Lesson Plan after revision	Reasons/Discussion
1. Some learning objectives have not been associated with learning indicators contained in the syllabus	All indicators contained in the learning goals and added specifically about student learning independence.	Learning objectives should be broader than indicator. For example, although learning independence is not contained in the indicators but it will be included in the learning objectives.
2. Less clear link between lesson plan 1 on cycle 1 with the lesson plan in subsequent cycles.	There are improvements, especially on the pre-conditions material. The material is based on material related to the topics that will be discussed, not on the topics examined in the last meeting.	Prerequisites compiled based on a hierarchy of materials although the implementation of previous learning are also taken into consideration in preparing the lesson plan in the next meeting. Therefore, each time will perform an action / Do, lesson plan is always fixed in advance.
3. Selection of the learning model at each cycle needs to clearly defined the plan of implementation.	Lesson steps are associated with syntax learning model chosen by modifying in accordance with the case or condition which occurs.	The clarity of this step (syntax) is an important part in managing the learning.

4. Examples of instruments are not suitable with the technique, type of bill, and forms of bills.	Instruments assessment are based on the lattice first.	Gratings developed based on standards of competence, basic competence, and indicators prepared in advance so that the items created both in the LESSON PLAN and when creating test questions have a clear reference.
5. Allocation of time is not according yet to the amount of material and students' ability.	Time allocation is planned specifically for the end of each cycle test. The result planning of each cycle provided a special time for 25-30 minutes for the test.	Tests need to be done to measure the success of the action on each cycle.
6. Lesson plan designed is not associated with student worksheets	Students worksheets are created as a part of the lesson plan	All students in the learning activities in the lesson plan, including completeness of students' worksheets.

Changes or improvements of lesson plan that is shown in Table 2 is a collection of changes that occurred in four cycles of activities. Besides improvements on the syllabus and lesson plans, improvements are also made to the instructional materials (handouts). Results improved handouts for four topics (four cycles) are presented in the following table.

Table 3. Improvements of Teaching Material (Handouts) Results Discussion of Plan, Do, and See

Handout component before revision	Handout component after revision	Reasons/Discussion
1. The material begins with the "problem".	Each item on the handout begins with a question / problem before discussing about the concept.	Problem / question need to be presented to encourage students constructing their own knowledge.
2. Description of the material was still "theoretical", it should be added the contextual examples.	Handouts are added with contextual examples.	The contextual examples help students to know benefit of the material explained.

3. Handouts are not designed interactively.	Handouts are designed interactively, as there is question-answer that could be done independently by students.	Build interaction between students and teaching materials.

Handout is prepared as teaching material for students as a source of learning. Handout is designed as part of creating student learning independence.

Another improvement is on the student worksheet. Summary of students' worksheet improvement over the four cycles is described as follows.

Table 4. Revised of Student Worksheet, Results Discussion at the Plan, Do, and See

Students worksheets component before revision	Students worksheets component after revision	Discussion
1. There are no instructions on using the students' worksheets.	Instructions of using students' worksheets are given.	Directions of using students' worksheets are expected to create student learning independence.
2. MFI has not been designed as an activity to provide a learning experience, not as a test item.	Students' worksheet is structured not as a collection of question, but a series of tasks or activities such as hands-on activity.	The tasks are set as part of a student's portfolio so that the changes or improvements can be seen.
3. Students' worksheets has not been determined the time limit on doing the tasks.	Students' worksheets are given the time constraints.	To measure the effectiveness of students in working students' worksheets.

Test device is an important tool to measure student learning success quantitatively. Therefore the discussion at the plan and see, associated with the test instruments get enough attention in discussion. Here is the summary of the instrument repair result discussion of plan for four cycles.

Table 5. Reparation of Test Instrument

Test component before revision	Test component after revision	Reasons/Discussion

1. Time allocation is not proper with the amount of test items.	The amount of items is suitable with the time given.	Appropriate with the items designed theory.
2. Items has not been prepared based on the difficulty.	Created some difficult items, moderate and easy with a limited number.	Items designed theory.
3. There are items which are similar with Lesson Plan and test items.	items which is similar to the existing items in the Lesson Plan are discarded.	The items which are invalid are discarded.
4. Some questions have not been developed based on the lattice.	Problem which is not in accordance with the lattice are removed.	Questions should be developed by the lattice.

The result of observations when action given or when the "do" is focused on observation of: (a) interaction among students, (b) the interaction between students with learning materials, (c) interaction between students and lecturers, and (d) the interaction between students with learning environments. In addition to that four things, it is also focused on when students attend the learning and not.   Student   activity   data obtained from the instrument data which is filled by 2-4 person observers at each cycle. The fourth focus of the observations presented in the following table.

Table 6. Average Data of Observations Over Four Times cycle

No	Aspects	Average Score Activities LS for ...			
		I	II	III	IV
1.	**Interaction among students**				
	a. asking with friends	2.2	3.2	4	3.7
	b. giving answer	2.3	3.2	4	3.5
	c. discussion	2.1	2.8	3,2	3.6
2.	**Interaction between students and learning materials**				
	a. asking based on learning materials that are exmined.	2.2	3.3	3.3	3.5
	b. discussion based on learning materials.	2.3	2.7	3.1	3.5
	c. completion of tasks in teaching materials (including students' worksheet)	2.1	3.2	3.6	3.8
3	**Interaction between students and the learning environment**				
	a. using environment as a learning source	2.1	2.7	3.7	3.7
	b. using environment in completing the tasks	2	2.4	3.4	3.7
3.	**Interactions between students and lecturer**				

	a. asking to the lecturer	2.3	3.1	3.6	3.6
	b. giving answer	1.5	3.6	3.8	3.8
	c. discussion	2.4	3.1	3.7	3.7
Total		23.8	32.5	37.1	40.1
Category		fairly	Good	Very good	Very good

Range of scores: 34-44 = very good, 25-33 = good, 11-24 = fairly, dan 0-10 = poor

From Table 6, it appears that there was an increase from cycle I to cycle IV. The activity in cycle I is still far from expectations, because students seem have no preparation, especially at component interaction with lecturer and teaching materials. In cycles III and IV, the independence of learning is better shown by the interaction between students with learning materials, the environment, and the lecturers are getting better.

Formative tests carried out at each end of cycle. Each cycle is studied one topic of learning. Test results are presented in the following table.

Table 7. Average Test Results Per Cycle

No	Topics	Score		
		The lowest	The Highest	Class Average
1.	Topic I	65	80	70
2.	Topic 2	69	85	75
3.	Topic 3	70	90	82
4	Topic 4	70	95	84

From Table 7, it is known that the average grade of topics 1 to 4 has increased. It shows that the impact of independence learning among others, the acquisition of test scores are getting better over time (from cycle I to cycle IV).

From the results of the study observed that learning is not enough if is only produced in the form of scores from tests of learning, knowledge is not enough if only memorized and can not be applied in life, the material being studied are not capable of providing solutions to the problems of life, and knowledge is not useful for self and others. From these study have been obtained that learning designed by using problem-based, cooperative, and the portfolio as a part of authentic assessment, it can encourage students to learn independently. The impact of these learning independence the students does not depend on the lecturers and friends, or others in learning or in solving problems. From the discussion can be concluded that the student learning independence is increasing from the first cycle until the fourth cycle.

IV.   **CONCLUSION AND SUGGESTION**

The results of the study obtained that the increase of students learning independence from cycles one through cycles four is rising and rising. The quality of learning outcomes indicated by: (1) the completion of tasks is in the category of very good, (2) the average test results is in good category, (3) interaction study of students is in the category of very good, and (4) interaction between students and teaching materials is in the category of very well.

It is recommended to use the problem-based learning model, cooperative learning, and portfolios assessment which suitable to the circumstances of students and the environment can be used as a means in creating student learning independence.

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