IMPROVING LEARNING ACHIEVEMENT USING EFFECTIVE MIX AND MATCH LEARNING MODEL

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Abstract: This current study aims to examine the implementation of the mix and match of three learning models i.e. Self-directed learning, Discovery learning, and Collaborative Problem Based learning. Mix and match learning model is performed to optimize the benefits from each models and minimize the weakness. In implementation phase, the learning process was started from self-directed learning models, where students were directed to collect any information regarding the subject from many resources using Web-based Instruction. This method basically involves encouraging students to prepare for the lesson before class. To complete this session, the student make a literature review. In the next session the Discovery learning models was implemented. In this session Picture Prompt presentation technique and some interactive experiences such as asking provocative questions were applied. After this, the Collaborative Problem Based Learning is performed using mix of several techniques i.e. Make a Match, Student Team Achievement Division and Number Heads Together. The Small group discussions model is a part of the Collaborative Problem Based Learning models. In the end of Collaborative learning session, the selected student presented their work. In the last session, every student has to make summarize using their own words. Assessments were performed in end of each session. The research found that the mix and match model effectively improve the student's achievement in cognitive, affective and psychomotor aspect.

Keywords: *Mix and Match, learning models, learning achievement*

1. INTRODUCTION

Adult learning runs well when they are able to actively participate in the learning process. Everyone can learn more from each other than they could themselves. Each student has a different character and he/she has to learn a lot of matters in a limited time, so instructor needs appropriate learning models to optimize learning process as well as learning achievement.

Learning models and techniques are available for almost any learning situation. Once the objective of the lesson has been determined, the instructor can select a model that will provide the optimal learning experience for the student.

Learning method is a very important component in the learning process that must be developed creatively by instructors. Instructor is free to modify various existing learning models based on the students' needs or classes condition.

Learning models are modivied by instructor to be implemented in a lesson study that can lead to instructional improvement as instructors become more knowledgeable about how the students learn and think and how instruction affects student thinking (Bill C & Bryan K, 2006).

This lesson study aims to examine the implementation of the mix and match of three learning models i.e. Self-directed learning, Discovery learning, and Collaborative problem based learning. Mix and match learning model was performed to optimize the benefits from each models and minimize the weakness.

A central element in higher education is self-directed learning. Self-directed learning includes any learning activities that take place outside the official program/module contact hours. Self-directed activities include: Online research, Library research, and Student initiated group work ("Self",2011). In self-directed learning (SDL), the individual takes the initiative and the responsibility for what occurs. Individuals select, manage, and assess their own learning activities, which can be pursued at any time, in any place, through any means, at any age. In schools, teachers can work toward SDL a stage at a time. Teaching emphasizes SDL skills,

processes, and systems rather than content coverage and tests ("What is",n.d).

Discovery learning encompasses an instructional model and strategies that focus on active, hands-on learning opportunities for students. Discovery learning is not like traditional classroom learning. It consists of three main attributes (Bicknell-Holmes & Hoffman, 2000): (1) Through exploration and problem solving students create, integrate, and generalize knowledge, (2) Student driven, interest-based activities which the student determines the sequence and frequency, (3) Activities to encourage integration of new knowledge into the learner's existing knowledge base. The five major differences between discovery learning and traditional learning are (Bonwell, 1998; Mosca& Howard 1997; Papert, 2000): (1) learning is active rather than passive, (2) learning is process-based rather than fact-based, (3) failure is important, (4) feedback is necessary, (5) understanding is deeper. Discovery learning can be facilitated through various strategies, or architectures, in the classroom (Castrova, n.d.).

A significant advantage of the discovery learning method is its capacity to motivate students. Discovery learning allows learners to seek information that satisfies their natural curiosity. It provides the opportunity for students to explore their desires and consequently creates a more engaging learning environment. Simply put, discovery learning makes learning fun (Schank& Cleary, 1994).

Problem-based learning (PBL) is an instructional method where relevant problems are introduced at the beginning of the instruction cycle and used to provide the context and motivation for the learning that follows. It is always active and usually collaborative or cooperatives (Prince, 2004).

Collaborative learning is an educational approach in teaching and learning that involves groups of students working together to solve a problem, complete a task, or create a product. There are many methods or techniques in collaborative learning approach. Slavin develops the STAD method (Student Teams-Achievement-Divisions) where the teacher presents a lesson, and then the students meet in teams to complete a set of worksheets on the lesson. Each student then takes a quiz on the material and the scores the students contribute to their teams are based upon the degree to which they have improved their individual past averages. The highest scoring teams are recognized in a weekly class newsletter (Panintz, 1999)

Make a match is a learning technique using card. It consists of questions card and the other consists of answer from this question. This model can generate student learners to engage actively in the learning process. The division of the group make a match and there are two groups of problems and holding group answers. Make a match can be made for all subjects and at all levels of education (Suprijono, 2009).

Numbered Heads Together is a collaborative learning technique that holds each student accountable for learning the material. Students are placed in groups and each person is given a number (from one to the maximum number in each group). The teacher poses a question and students "put their heads together" to figure out the answer. The teacher calls a specific number to respond as spokesperson for the group. By having students work together in a group, this strategy ensures that each member knows the answer to problems or questions asked by the teacher. Because no one knows which number will be called, all team members must be prepared ("Cooperative", n.d.).

2. RESEARCH METHOD

The Lesson study used in this study was a form of classroom inquiry in which several teachers collaboratively plan, teach, observe, revise and share the results of a single class lesson. This lesson study was organised in Steel Structure subject with 34 students as participant, in Teacher Training and Educational Faculty of Sebelas Maret University at September 2015. The study was performed through a series of activity as presented in figure1(Cerbin & Kopp, 2011).
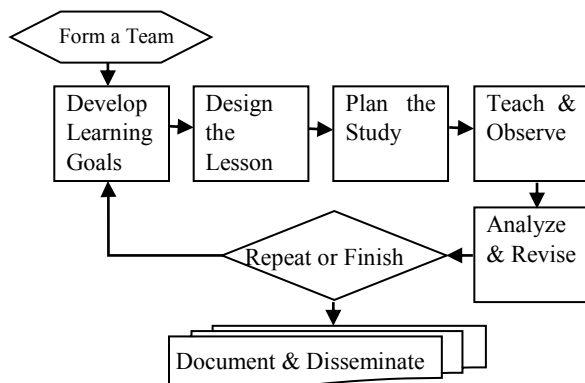
Figure 1. Steps in the lesson study

After team teaching was formed, the team members articulate learning objective of the lesson as standard of competences stated in the syllabus. The standard of competences was then outlined in a number of basic competencies as well as indicators of achievement.

In the next step, the team designed a lesson to achieve the learning goals. This lesson was designed using mix and match of three learning models i.e. Self-directed learning, Discovery learning, and Collaborative problem based learning, completed with summarization. Mix and match (M&M) learning model was performed to optimize the benefits from each models and minimize the weakness. In implementation phase, the learning process was started from self-directed learning models, where students directed to collect any information regarding the subject from many resources using Web-based Instruction. This method basically involves encouraging students to prepare for the lesson before class. To complete this session, the student made a literature review. ("Teaching, n.d.).

In the next session the Discovery learning models was implemented. In this session Picture Prompt ("Interactive, n.d.) presentation technique and some interactive experiences such as asking provocative questions were applied. In answering questions, students could access information from a variety of sources.

After this session, the Collaborative Problem Based Learning was performed. Collaborative Problem Based Learning is an educational approach in teaching and learning

that involves groups of students working together to solve a problem. Mix of several techniques i.e. Make a Match, Student Team Achievement Division and Number Heads Together was used in this session. The Small group discussions models is a part of the Collaborative Problem Based Learning models. Each student was given a random card. The group's number and the problems that must be solved were listed on the card. Students with the same group's number were gathered in one group. The problems that must be solved were different for each group's member. All the problems discussed with team members, although each member of the group responsible for solving the problems stated in each card. All the members in the group should be ready if selected to present the results of their work in class in the end of the session. Assessment for discussions and presentations were taken during the session. Then the students were given a quiz individually. This quiz was performed to see the effectiveness of the learning model as well as part of the achievements of the each group. The group with highest scores came in the best group, and given a reward.

In the last session every students had to make summarize using their own words. And then final test was performed.

Next step on lesson study was plan the Study. In this phase, teams identify the types of evidence to collect and decide how to observe and gather evidence of student learning. Teams also prepare "Observation Guidelines" that indicate how to observe the lesson, whom to observe, what to focus on, and how to record observations. Observers follow the guidelines to gather evidence when the lesson is taught (Cerbin & Kpp, 2011). The evidences were divided in two categories. The first were evidences that came from student assignment i.e paper work, presentation materials, summarization, quiz, and final test. The other evidences came from student activity observation sheet.

While on Teach and Observe step, one member of the lessons team teaches the lesson, and other members attend the class to observe and collect evidence of student learning, thinking and engagement. After that, the team

discusses the results and assesses student progress toward learning goals in the Analyze step**.** If it is necessary, team will make a revise in lesson's design to find out the proper design based on analysis result.

3. FINDINGS AND DICUSSIONS
3.1. Learning process

Learning process started with self-directed models. During self-directed models session, students were directed to collect any information regarding the subject, and then composed them in an article. The articles they were stacking actually include a lot of information, but because most students did not really read the literature then they still found difficulties when accomplished the quiz after this session.

Learning process in the classroom with Discovery learning models run dynamic shown by the liveliness of the students in a discussion. Free wifi facilities in the class environment sufficient to support students to be able to access information from many sources on the internet. However, because of the nature of open-ended questions, not all students were actively involved in the discussion. Some introvert or shy students tend to be passive.

The next session was Collaborative Problem Based Learning. This session begins with the distribution of cards to each student, and then the students with the same group's number gather to mutually discuss the problems. Times used to locate and gather with friends in the group were still quite long. From observation during focus group sessions, it was seen that some students still inactive. Perhaps it was because the group was too big, consisting of 7-8 students. After discussion, the students elected to present the results of their group work in class. Students who were not active during focus group sessions, would seem difficult when having to explain to the class, although the results of their work already in writing.

The last session was the preparation of summary by each student, with no specific concept. Although the information which students collected from various previous session has been very diverse, but from the summary made by each student showed a lot of differences. Some students composed fairly

complete and well organized. While the others were seem disordered. When linked with the observations and test results, those who prepare well summary could solve problems more quickly and correctly, particularly for problems related to the theory of knowledge.

3.2. Affective Learning Outcomes

Affective learning outcomes in terms of liveliness, cooperation, concern, and responsibility, is shown in the figure 2.
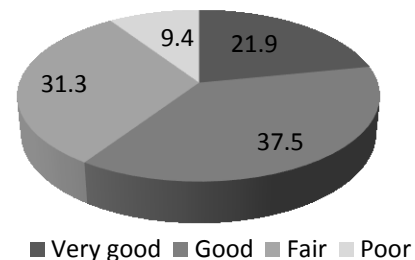

Figure 2. Students achievement in affective aspect (%)

3.3. Psychomotor Learning Outcomes

Psychomotor learning outcomes in terms of the ability to prepare presentation materials, the ability to explain, and the ability to collate summary texts, shown in the figure 3.
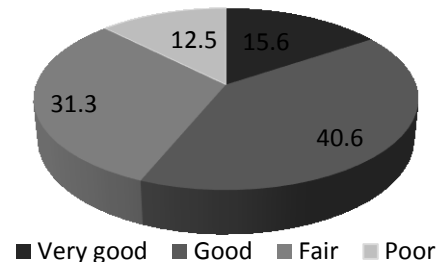

Figure 3. Students achievement in Psychomotor aspect (%)

3.4. Cognitive Learning Outcomes

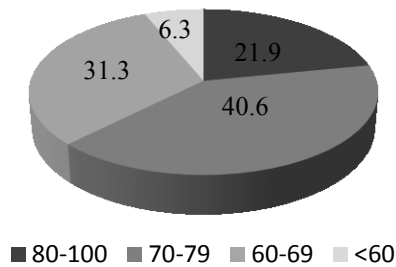Cognitive learning outcomes obtained from the final test, shown in the figure 4..

Figure 4. Students achievement in Cognitive aspect (%)

Based on observations during the implementation of lesson study, the team then discussed the analysis of the lesson study related to in what ways did students accomplish the lesson goals, How could the lesson be improved, And What did the team learn from this experience (Cerbin & Kpp, 2011).

Based on the results of the analysis, team then formulate some changes in the design of learning that can then be applied to the next cycle. The changes were as follows:

In the self-directed models session, after students were collected information in a paper, they should made literature review which contain the summary from the article's content, point out strengths and weaknesses of the study, and how to apply this information in the subject being studied. Through this technique, the students were forced to try to understand the information they have gathered from the literature.

Before starting with the discovery learning in the classroom, students were asked to make a few questions about things that they have not been able to understand related materials based on the literature they had learned previously. Then students exchange questions and answers between them in a quiz game. Students who can answer this question would get a reward. Instructors act as judges as well as to provide clarification of the answers given student. With this technique, the questions discussed in class discussions were expected to lead the problems that were not yet understood by the students.

To further streamline the course of the group discussions, number of group members in the session Collaborative Problem Based

Learning reduced to 3-4 students. Setting the class for discussion would be easier for a small group. Instructor needs to be more actively instruct all students to more quickly in forming groups based on the distribution of make a match cards.

Instructor provides direction on the outline should summarize the contents of the student flats were arranged in order to summarize the last session more planned and orderly.

3.5. Improving Learning Outcomes Using Mix And Match Models

Improved learning outcomes in the cognitive, affective, and psychomotor aspects resulted from the application of mix and match learning models in this lesson study was illustrated in the graphs at figure 5 - 7. Base line scores were obtained from the study on the same matter at the previous class.
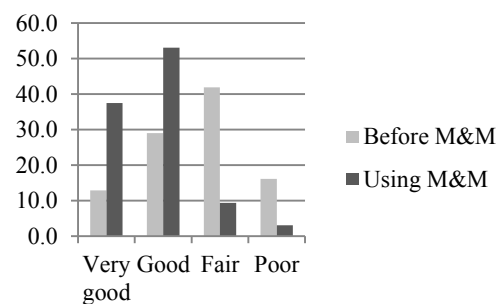

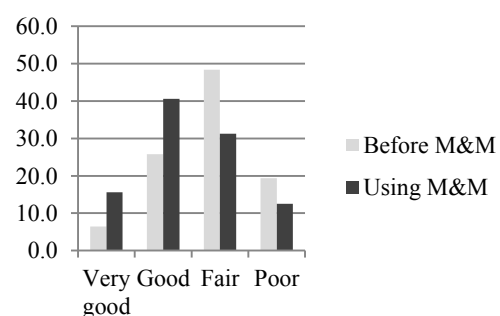Figure 5. Improved learning outcomes in the affective aspect (%)

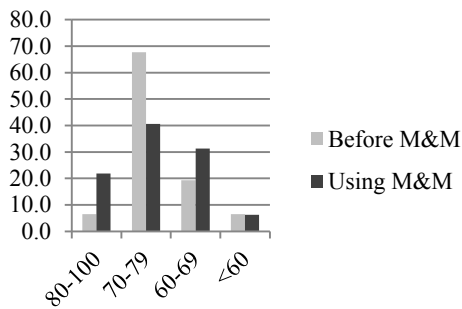Figure 6. Improved learning outcomes in the Psychomotor aspect (%)

Figure 7. Improved learning outcomes in the Cognitive aspect (%)

From the graph it appears that mix and match learning models used in this lesson study was effective in improving learning achievement in cognitive, affective, and psychomotor aspect. With mix and match multiple models, instructor has a large enough space to develop learning models, take the positives from a model to cover the shortfall from other models. Self-directed useful models to prepare the student for material that will be discussed before the class begins. With the provision of literature they have learned before entering the classroom, the learning process becomes more effective in the classroom and the class atmosphere being more alive. But this model gave minimal touch in development of affective aspects.

Discovery learning is an excellent model for shaping students' knowledge through their own search in finding a variety of questions about the material (Balim, 2009). In discovery learning, participants learn to recognize problem, characterize what a solution would look like, search for relevant information, develop a solution strategy, and execute the chosen strategy (Borthick,2000). Through its own discovery efforts that would be embedded deeper knowledge on students. Here students were also trained to develop their affective ability in terms of activeness, cooperation, concern and responsibility. Psychomotor capability was also developed through the activity of students in explaining and using various sources of information. The weakness of this model in this lesson study was that the open nature of the discussion, so that students who tend to be passive or shy is not encouraged being active.

Collaborative learning can refer to any instructional method in which students work together in small groups toward a common goal ("online", n.d.). Collaborative learning fosters the development of critical thinking through discussion, clarification of ideas, and evaluation of others' ideas. Collaborative learning is beneficial to enhance critical- thinking and problem- solving skills (Anuradha, 1995), and also to promote interpersonal skills ("online", n.d.). Johnson, Johnson and Smith through a review of 90 years of research found that collaboration improved learning outcomes relative to individual work across the board (Johnson, 1998).

Studies suggest that PBL develops more positive student attitudes, fosters a deeper approach to learning and helps students retain knowledge longer than traditional instruction; PBL provides a natural environment for developing problem-solving and life-long learning skills. While PBL and cooperative learning were distinct approaches, there was a natural synergy that instructors should consider exploiting. That was, real problems of the sort used in PBL require teams to solve effectively. At the same time, the challenge provided by realistic problems could provide some of the mutual interdependence that was one of the five tenets of cooperative learning (Michael, 2004). Collaborative Problem Based Learning Model that was applied in this lesson study was able to improve student learning achievements in the affective, psychomotor and cognitive aspect. While the weakness was the length of time it takes to resolve the problems in a group discussion, because the problem of each group's member was different and all group members must master all the problems. After resolving each corresponding cards were accepted, each student must share to friends in group a way of solving the problem. This causes the group meeting widened long duration.

Summarization is not one strategy but a family of strategies (Pressley, 1998). Nevertheless, several studies have shown benefits of summarization (Anderson&Thiede, 2008; Wong, 1986; Rinehart, 1986; Thiede&Anderson, 2003; King, 1992). Through this study it appears that the students greatly

assisted by summarization primarily in resolving the question which required the application or analysis of knowledge, it was in line with the result of previous study (Annis, 1985).

3.6. The Contribution of Each Learning Model in Improving Learning Achievement

Each learning models had different roles for each domain of learning achievement. It shown from assesment which performed in end of each sessions. Self-directed learning model and summarization were provided the lowest role of the other models in improving learning outcomes of cognitive and affective aspects, but good in improving psychomotor aspect. Students' cognitions did not increase significantly because in preparing the literature review and summarization there were many students not serious, because this session was done outside the direct supervision of an instructor. Students lack a sense of responsibility in this session. On the other hand, self-directed learning and summarization increasing student's ability in writing academic paper and collate summary texts in terms of psychomotor aspect.

Discovery learning provides a substantial contribution in improving learning outcomes in all domains.The affective and psychomotor aspect trained well during the process of discussion. The questions were provocative and interesting curiosity of students and the instructor controlling the class discussion plays a role in reviving the classroom atmosphere, enable many students, and multiply and expand students' understanding of the information related to the material covered.

The collaborative problem-based learning model was the biggest role in improving the cognitive, affective and psychomotor learning echievement. All the activities of students in this learning model supporting the achievement of better learning outcomes. In a collaborative learning setting, learners have the opportunity to converse with peers, present and defend ideas, exchange diverse beliefs, the question of conceptual frameworks, and be actively engaged ("What is", n.d). Instructor has very large role, especially in making the classroom atmosphere conducive for the implementation of discussion groups, such as the setting of the room, the

student mobilization, and ensure that all students were actively involved in the discussions. In collaborative classrooms, the lecturing / listening / note-taking process may not disappear entirely, but it lives alongside other processes that are based in students' discussion and active work with the course material (Smith&Mc Gregor, 1992).

4. CONCLUSION

Based on the above discussion, mix and match method was inclined having a higher potency in improving the learning achievement of cognitive, affective, and psychomotor aspects. It was believed that by applying mix and match learning method in accordance with students' characteristics and conditions of the learning environment provides many benefits in improving learning achievement. This study provides a contribution for science teachers and lecturers to implement mix and match models on their learning class in order to reach learning goals.

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