Effects of Project-Based Learning Strategy on Student Metacognitive Skill to Learning Biology

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ABSTRACT

Learning of Science in Indonesia especially for Biology nowadays drives students to find out their own concept and do their own experiment so they can understand well about their own concept and learning much for the environment around them. This learning can improve student metacognitive skill that student awareness about thinking their self thinking. The learning strategy that can improve these competences is Project-Based Learning. This experiment is going to do to understand about the effect of this strategy on student metacognitive skill. The research is going on SMAN 7 and SMAN Gondanglegi Malang in second semester for 2009/2010. Students in 2 classes each school as a sample of population of this research. This is quasi experiment that use non equivalent group design and anacova nonfaktorial for analyze the results. Results of this research show that project-based learning doesn’t give different effect on students metacognitive skill even if compared by control class that learning by multistrategy. Students metacognitive skill increase to 3.2% whether students in control class increase to 5.5%. This result show us that PBL strategy must be applicate on certain condition. Project-based learning base on this research can improve not only students retention achievement, it also predict can improve students skill process, confidence, and their attitude. Based on this situation so it is important to do the next research that assay the project-based learning on improving students skill process and their attitude to the environment.
INTRODUCTION

Education in Indonesia currently held by referring to the purpose of national education, is develop learners potential to become a man who has faith and devotion to the Lord of Almighty God, healthy, creative, independent and being a democratic and responsible citizen. That national education targets is expected to be achieved through a series of learning activities based on standards in implementing determined by national education standard board (BSNP). At a senior high school level (SMA) there are some science standard competences to be protected in implementing learning activities are ability logically thinking, critical thinking, creativity, and innovative independently. Science education in senior high school is expected facilitates students to fulfill those standard of competences. Science education focus give direct experience to develop students competences within explore nature around scientifically.

The goals of science education achieved by implementing innovative strategy. Innovative learning strategy implementation hopefully help student to achieve their purpose. However implementation innovative learning strategy oriented cognitive skill although metacognitive skill is more important to enhanced. This resulted in the cognitive tend to low because they were not trained to independent learner that does not know and less able to manage and monitor their cognitive ability.

The importance of empowerment metacognitive skill in the learning process shows that implementation of the learning needs to raise student awareness to plan everything that needed in a learning process. Thus students knowing their goals and why do it. This may help students to make the right, careful, systematic, and logical decision.

Metacognitive skill is ability to think about thinking. Metacognitive skill also defined as capability of students to monitor their learning process (Peters at Corebima, 2006). Blakey (1990) add that metacognitive is about think how to think, knowing what we know and what we do not know, learn how to learn and develop sustainable thought process whereby it can be used to solve problems. Metacognitive skill in this is related to control cognitive components that enables the student understand problems faced by, then trying to get information and investigate to find answers of the problems.

Achievement metacognitive skills could be performed in class by applying learning strategy that consciously empower capacity to think independently. Learning strategy which suspected able to increase this skill is project-based learning. Project-based learning performed by student within investigation to solve problems (Hellstrom, 2009).

Project-based learning encourage students for creative and think independently to solve problems and enrich himself with relevant theories and its application. This activity focused on the group activities and tried to integrate knowledge of various sources of information and discipline concerned, including textbook, experiment, research, and tutorial. This learning strategy application change focus learning from learning centered to student centered (Ambikairajah, 2007). Students engaged in project-based learning required to plan their own study activities. Students in groups or independent asked to plan projects to be done, implementing the project and evaluate
Learning activities demanding independence students is one way to achieve student metacognitive skill. Students called to find the problems and find their own solution to deal with the problem. An active role students are very needed in the learning activities. Results was expected to be reached through the application of this learning strategy were students can develop their insights, the achievement of their ability to solve the problem, and increase communication skill in self that did not only useful for basic academic but also to the future world work. (Hellstrom, 2009).

Therefore this study is performed based on previous studies to identify the effects of project-based learning strategy on student metacognitive skill to learning Biology.

Project-based learning is learning strategy developed in various discipline, aimed to provide student learning centered, make students active, and having a problem solve approach as learning activities. Essentially project-based learning carried out students via investigation process to solve problems (Hellstrom et al, 2009). Project-based learning provide student learning centered and not only based on theoretically information but rather the project implementation laboratory. Students have to solve problems through the laboratory procedure to design and its implementation strategy to solve the problems (Ambikairajah et al, 2007). In addition, in making design to their project, students also need to understand about interdisciplinary concerned belong to project they are worked (Mc Kenzie et al, 2009). This could help students integrating their understanding between a single concept to the complex concept. Ambikairajah, et al, in 2007 show that learning activities based project focused on their group activities and tried to integrate knowledge from various sources information including a text book, activities experiment, research, and tutorials.

Project-based learning could be implemented in classroom through 3 stages as proposed by Han and Bhattacharaya, 2008 in Mahanal (2009), as follows.

1. Planning
   At this stage students choose a topic, find out source of information needed, and organizing resources to use. At this stage, students choose project, put resources necessary, and organizing work collaborative. Through these activities, students identify and show a topic, search and choose related information to make a potential solution.

2. Creating
   Second phase contains activity project. Students develop their idea project, combined some ideas from group members, and build a project. At this stage it is expected students build a product (artifact) presented by members with another class.

3. Presenting
   At a last stage project that have been done will be presented at class to get some feedback. Each group reflect and follow up their own project.

Some experts give a different opinion in defining metacognitive. The following is metacognitive definition put forward by some experts.

1. Woolfolk (2004) describe metacognitive as someone awareness of their cognitive
skill.
2. Metacognitive is knowledge about their learning, it means knowledge about how to learn and monitoring how they learn (Flavell at Slavin, 1993).
3. Arends (Corebima, 2006) define metacognitive as think about thinking and monitoring their cognitive process.
4. Blakey et al (1990) explain that metacognitive related to think about thinking, knows what we know and do not know, learn how to learn and develop thought process sustainable that can be used to solve problems.
5. Eggen and Kauchak at Corebima (2006) define metacognitive as control awareness about cognitive process.
6. Peters at Corebima (2006) explain that metacognitives is student capability to aware and monitor their learning process.

METHODOLOGY
The design of this research uses quasi experiment research type because used a control group and treatment group, formed from the beginning so that there is no randomization. The research design used is non equivalent group design.

Population in research is a whole student of X class at Senior High School in Malang academic year 2009/2010. The research sample is a X class students at SMAN 7 and SMAN Gondanglegi each in 2 study groups. One class as a control class while the second class as a experiment class. The selection of schools based on an analysis of NUN exhibiting that both schools have same level ability students. Election classes in each school done randomly.

Collecting data is done on a semester academic year 2009/2010 for 2 months from May- June 2010. Implementation of learning in each school are conducted almost simultaneously and use the same learning devices. Pre-test was given on experiment and control classes before Project-Based Learning Strategy are applied on the experiment class. Post-test given on experimental and control classes after completed Project-Based Learning Strategy are applied on the experiment class.

Data analysis was done with anacova nonfactorial with covariat from pre-test result. When the analysis result is significance (null hypothesis was rejected and research hypothesis accepted) then further trials is conducted. The data significance based on the reference as follows: If the value of probability >0.05 then the null hypothesis is accepted and the research hypothesis is rejected. If the value of the probability <0.05 then null hypothesis is rejected and research hypothesis is accepted.

RESULTS AND DISCUSSION
Student metacognitive skill means before treatment on experimental class was in 43,86. While student metacognitive skill means on control class at the beginning of the treatment is 41,99. After facilitated by project-based learning, student metacognitive skill on experiment class increased that is being 45,27 while student metacognitive skill on control class is 44,31. Student metacognitive skill served on the following chart.
Figure 1. Student Metacognitive Skills

Data analysis of student metacognitive skill based on an anacova summary show that project-based learning strategy were not influential significantly (p>0.05) of student metacognitive skill. Thus it can be said that learning strategy applied in each experiment and control class effect is no different against student metacognitive skill. This following Table 1 show data comparison of pre-test and post-test student metacognitive skill who facilitated by project-based learning and multistrategy learning.

Table 1. Data Comparison Corrected Mean Learning Strategy of Metacognitive Skill

|   | X1   | Y1       | Y2       | DIFFERENCE | CORRECTED |
|---|------|----------|----------|------------|-----------|
| 1 | 43,857305 | 45,266440 | 1.41     | 45.014     |           |
| 2 | 41,986795  | 44,306056 | 2.32     | 44.514     |           |

X 1: Project-based learning (experimental class) X 2: Multistrategy learning (control class)

Based on Table 1, it is known that the student metacognitive skill facilitated by multistrategy learning increase up to 5.5% whereas the students in the experimental class increase up to 3.2%. The results show that metacognitive skill increase between experimental and control class is no different. Corrected means of both classes are no different.

Project-Based Learning strategy is developed in the various disciplines, aimed to provide student-centered learning (Ambikairajah, et al, 2007). This strategy encourages the existence of creativity and thinking patterns independently to solve problems and enrich himself with the relevant theories and their applications of the theories (Ambikairajah et al, 2007). In principle the project-based learning strategies are able to develop the student's metacognitive skills, given through this learning students are able to develop his creativity and gives opportunities for students to think independently. This provides a great opportunity for students to develop their metacognitive skill. In general, metacognitive skill has been described as a person's ability to regulate their own process of his thinking process and monitor the lesson.

Project-based learning strategy provides activities that will increase student’s skill because it give opportunity to choose a way to solve their problems, manage time, integrating many information source and arrange teamwork among members of the
group. The management process over themselves and other people is regarded as an excellence of this strategy which is able to develop the student’s metacognitive skill.

Based on the research known that Project-based learning strategy is not capable to enhance student’s metacognitive skill. Both Project-Based Learning and Multistrategy Learning give same grade on student’s metacognitive skill. There are several factors cause of similarity influence between two strategies. Unprepared students become one causes. Project-Based Learning demanding students to be independent, creative, having ability solving problems. Independent learning is often inhibit students to require information independently, understanding with his own mind, including making links between a single concept to the whole concept by their own. Students still need help to do that things so when they have chance to carry it out independently, they are not capable to do it well. This is in line with the design of Project-Based Learning application by Romano, et al 2010 that important to give introduction for students to understand how project-based learning conducted actually.

The research conducted by Romano, et al 2010 also involved senior students that has been apply Project-Based Learning to be tutoring for new students. The introduction and implementation of tutorials is conducted during first year. After the initial year then student could realize how carrying out a project good at once and understand how a group working together to achieve the certain purpose.

While multistrategy learning by combining several cooperative strategies was familiar to students so they are easier to follow. Romano, et al, research (2010) show project-based learning able to increase motivation and student achievement.

Multistrategy learning, on the other hand, may be able to provide student opportunity to develop their metacognitive skill through some learning activities demanding students to interact with their friends. Their interaction will be media proper for a student to monitor their cognitive developments. Monitoring developments cognitive process is one way to develop metacognitive skill.

Project-based learning strategy in this study did not give impact of student’s metacognitive skill, however this strategy has a lead in fulfilling one of biology learning purpose at the senior high school, in terms of developing skill processes and confidence students. Project-based learning as Thomas said (2000) is learning strategy proper used to develop skills process of students because they were given opportunity independently to choose a strategy to be applied to solve their problem, manage their time, integrating diverse information according to their own also manage cooperation among members of the group.

Thus, student’s skill will increase, not only laboratory process skill but also socially interact skill. The development of student’s social skills expected to increase as well as student’s confidence because they are accustomed to interact with their surrounding. The attitude of tolerance, mutually cooperate, appreciate each other differences, is hoped will increase significantly in line with the frequency of interaction between students in peers and their surrounding.

CONCLUSION

Project-based learning strategy in this study did not give impact of student’s metacognitive skill, however this strategy has a lead in fulfilling one of biology learning purpose at the senior high school, in terms of developing skill processes and confidence students. Student’s skill process that can be developed by this strategy are laboratory process skill and socially interact skill.
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