



Comparison of Metacognitive and Scientific Writing Skills of Students at Ecology Topic Learned by Project-Based Learning and Guided Discovery Learning Models

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Abstract: The research with the aim to know the difference of metacognitive and scientific writing skill of students at ecology topic in biology instruction learned by project-based learning (PjBL) and guided discovery learning (GD) models in class X Madrasah Aliyah Swasta (MAS) Al-Wasliyah has been done. This research is quasi experiment designed as nonequivalent pretest-posttest control group design. Research sample was determined by cluster random sampling. Class XA was taught with a project-based learning model and XB class with guided discovery learning model. The research instrument used questionnaire for metacognitive skill and description test for scientific writing skill. Data analysis was done by using t student test. The research results showed that there was significant difference of metacognitive skills of students who taught by project-based learning and guided discovery models ($t_{count} = 2.05$; $P = 0.04$) and there was also significant difference of scientific writing skill of students who taught by the project-based learning and guided discovery models ($t_{count} = 2.21$; $P = 0.03$). The research result recommends the implementation of project-based learning model at ecology topic in biology learning process in order to improve the metacognitive and scientific writing skills of the Indonesia students.

Keywords: Metacognitive skills, scientific writing skills, project based learning, guided discovery.

1. INTRODUCTION

Quality of education is needed to support the creation of intelligent, available and democratic human beings who able to compete overtly in the era of globalization, so as to improve the welfare of all Indonesian citizens. There are so many efforts that have been done by the Indonesia government to improve the quality of education, but the results haven't been as encouraging as revealed in the academic quality report among nations through the Programme for International Student Assessment (PISA) that the performance and mastery of the subject of Indonesian students are still low. In 2012, Indonesia attained 64th rank from 65 participants and in 2015 only able to reached 66th rank from 77 participant countries (Manurung et al., 2017). The average achievement scores of Indonesia students for science, reading, and math were ranked 62, 61, and 63 of the 69 countries evaluated, respectively (PISA, 2015).

The research result of Yunus (2015) furthermore revealed that writing activities among Indonesia students is very low, from 100 students maximum only five students who are able to write with 500 words in a week. One of the causes currently considered to be most influential is the low skills of thinking including metacognitive skills among students of various academic abilities, as well as the skills to write. The skills for writing desire the mastery of the constituent of language and elements outside the language itself that will be the contents of composition.

Metacognitive skills of students is indispensable in learning process, because it determines students' cognitive abilities. If students use their metacognitive skills well then the results obtained will also learn better, because this student do the planning, development, and evaluation of the learning process implemented (Pratiwi et al, 2016). Metacognitive skills are very important for every student that is related to the independence in learning. In principle, if associated with the learning process, metacognitive skills are a person's skills to control the learning process, starting from the planning

stage, then monitoring progress in learning and in the same time correcting if there are mistakes that occur during understanding the concept, till produce learning objectives (Iskandar, 2014).

Students will more easily understand the concepts of biology learning if they have good metacognitive skills. The development of metacognitive skills in students is a valuable goal, because it can help them become self regulated learners (independent learners). According to Sholihah, et al., (2016) students who become independent learners will be able to improve cognitive learning outcomes, because students can control the learning process.

Writing is a process of the activities of the human mind who want to express something to others in the form of writing. Writing activities cannot be separated from the three other language skills, that is listening, speaking and reading. Writing is not easy to do. Dalman (2014) revealed that writing is the process of pouring ideas in the form of written, creative, logical, and critical language in order to noted, record, inform, convince, describe, comfort and influence others. Writing paragraphs of argument is an activity of creating paragraphs whose development patterns are based on arguments or reasons be delivered by the author. The argument paragraph includes facts, data, and arguments (Darmayanti, 2014).

Biology learning that uses metacognitive skills is expected to involve students activeness and find their own knowledge through interaction with their environment. Nurgiyantoro (2013) declared that compared to the other three competencies, writing competence is generally more difficult to be managed by the language speakers concerned. That's because writing skills require mastery of the various constituent of language and constituent outside the language itself that will be the contents of the composition. Project-based learning model is considered suitable for improving metacognitive skills because metacognitive has a positive direct relation with academic achievement means that the higher the metacognitive skills the better the learning outcomes (Nuryana & Sugiarto, 2013). Guided discovery allows students to be better able to develop a wider and freer creativity and willingness to move so that the teacher's role is limited to a minimum, while the role of the students is given maximum freedom. In the guided discovery the teacher functions as a facilitator.

This research has been conducted with the objective to know the difference of metacognitive skill and scientific writing skill of students who taught by project-based learning and guided discovery learning models at ecology topic in biology instruction. It is hoped that the information obtained from this study will contribute and will be useful for increasing the metacognitive skill and scientific writing skill of the Indonesia students.

2. MATERIALS & METHODS

2.1. Research Location, Population and Sample

The research was carried out at senior high school Madrasah Aliyah Swasta (MAS) Al-Wasliyah 22 Tembung and was held on the second semester in academic year 2016/2017. The study took place from February to April 2017. The population of research was all students of class X as many as three classes amounted to 121 people, meanwhile the research sample consisted of two classes. The sampling technique was cluster random sampling. Amount of sample in class X_A was 40 students and X_B counted 41 students.

2.2. Research Variables and Design

Project based learning and guided discovery models were independent variables of research, whereas its dependent variable consisted of metacognitive skill and scientific writing skill. The research design is a quasi experiment with nonequivalent pretest-posttest control group design. Class X_A learned by project-based learning and class X_B by guided discovery models.

2.3. Research Instruments and Data Analysis

In this study, data collection was done by using questionnaire and description test. Questionnaire was used to collect metacognitive skills, meanwhile description test for collecting the scientific writing skills data.

Metacognitive skill data was based on Clopter indicators that have been modified. The number of items in questionnaire are 30 items, consisting of 5 Likert scale options, starting from option A given

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a score of 5, option B is given a score of 4, option C is given a score of 3, option D is scored 2 and for option E is scored 1. For a negative statement, if the student chooses option A given score 1, option B is given a score of 2, option C is given a score of 3, option D is given a score of 4 and E is scored 5. The highest score of this questionnaire result for 30 questions is 150 and the lowest score is 30. Components of metacognitive skills of students' consisted of task analysis, planning, monitoring, checking and recapitulation.

In order to find the scientific writing skills, the students were assigned to write paragraphs of the argumentation. Previously, students had first compiled a framework of paragraphs that would be developed after implementation of both models. Assessment indicators for the description test are introduction, thesis, writing body, conclusion and correction. The highest score of this description test result is 100.

The student achievement test was conducted twice, pretest aimed at obtaining initial skills level and posttest to measure the result of metacognitive and scientific writing skills of the students. Hypothesis testing was done by using unpaired t student test (*independent sample t test*). Normality testing of data was conducted by using Kolmogorov-Smirnov test, whereas Leven's test for data homogeneity. All research data were analysed by using software SPSS version 22.

3. RESULTS & DISCUSSION

3.1. Results

The research data was mean of metacognitive skills and scientific writing skills of the students taught by project-based learning and guided discovery models. Results of data processing showed that the mean and standard deviation of metacognitive skill of student in project-based learning class ($\bar{X} \pm SD = 86.14 \pm 3.8$) was higher than in guided discovery class ($\bar{X} \pm SD = 84.61 \pm 2.71$). The scientific writing skill of the students in the project-based class ($\bar{X} \pm SD = 79.08 \pm 8.08$) was also higher than in the guided discovery class ($\bar{X} \pm SD = 74.88 \pm 8.96$). Based on this finding, it can be stated that project based learning model was better than guided discovery model regarding metacognitive skills and scientific writing skills of the students at ecology topic in biology instruction.

In order to test the hypothesis of the research, prerequisite analysis was carried out toward normality and homogeneity of metacognitive and scientific writing skill data. Based on testing that has been done, metacognitive and scientific writing skill data of the students both in project based learning class and guided discovery class were normal and homogen (Table 1, 2 and 3).

Table1. Normality test results of metacognitive skills

No	Learning Model	Kolmogorov-Smirnov	
		Sig.	Notice
1	Project-Based Learning	.065	Normal
2	Guided Discovery	.200	Normal

Table2. Normality test results of scientific writing skills

No	Learning Model	Kolmogorov-Smirnov	
		Sig.	Notice
1	Project-Based Learning	.146	Normal
2	Guided Discovery	.105	Normal

Table3. Homogeneity test results or metacognitive and scientific writing skills

Levene's Statistic		
Parameter	Sig.	Notice
Metacognitive skill	.086	Homogen
Scientific writing skill	.327	Homogen

Based on hypothesis testing that has been done by using t student test, it can be stated that there was significant difference in metacognitive skills of the students between taught by project based learning model and guided discovery model at topic ecology or ecosystem in biology learning process ($t_{count}=2.05$; $P=0.043$) (Fig. 1). There was also significant difference in scientific writing skill of the students learned by project based learning and guided discovery models ($t_{count}= 2.21$; $P= 0,003$) (Fig. 2).

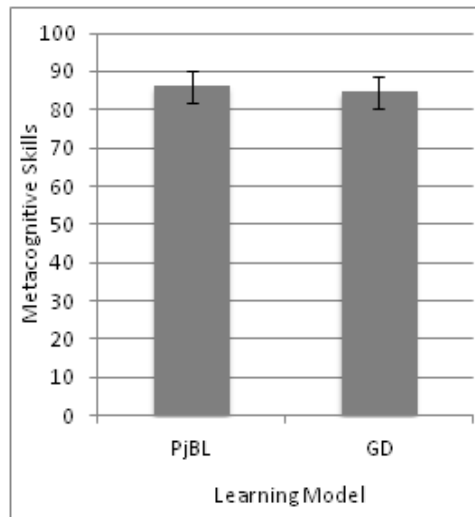


Figure1. Comparison of metacognitive skill of student learned by project based learning (PjBL) and guided discovery (GD) models ($t_{count} = 2.05$; $P = 0.043$)

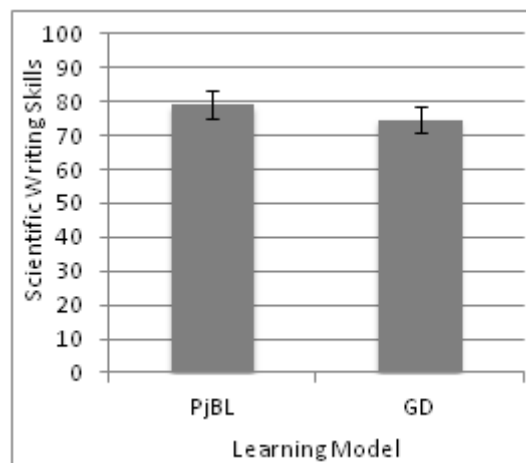
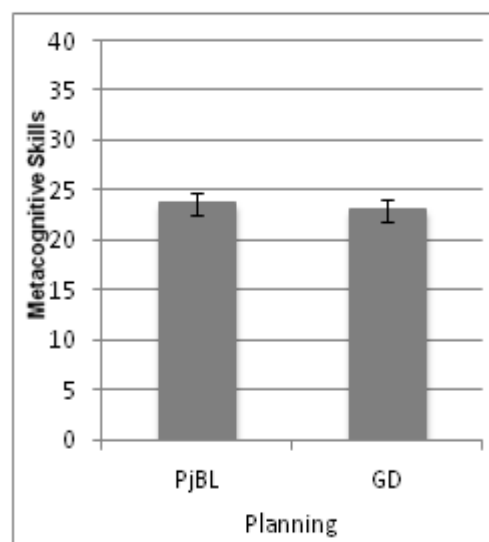
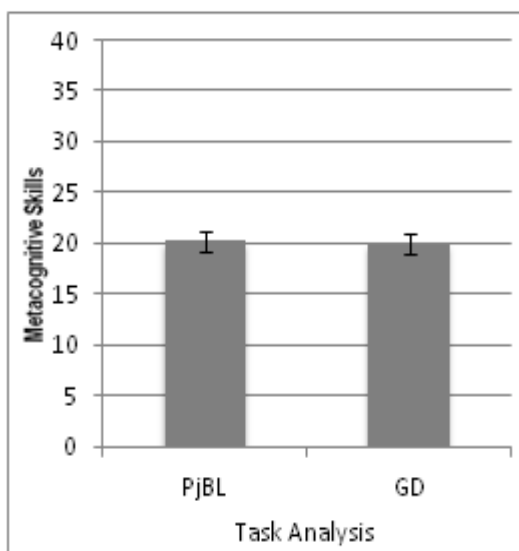


Figure2. Comparison of scientific writing skill students learned by project based learning and guided discovery models ($t_{count} = 2.21$; $P = 0.030$).

Furthermore, testing on five components of metacognitive skills showed that there was significant difference in planning and self monitoring of the students taught by project based learning and guided discovery models, whereas in task analysis, checking and recapitulation there were no significant difference (Fig. 3).



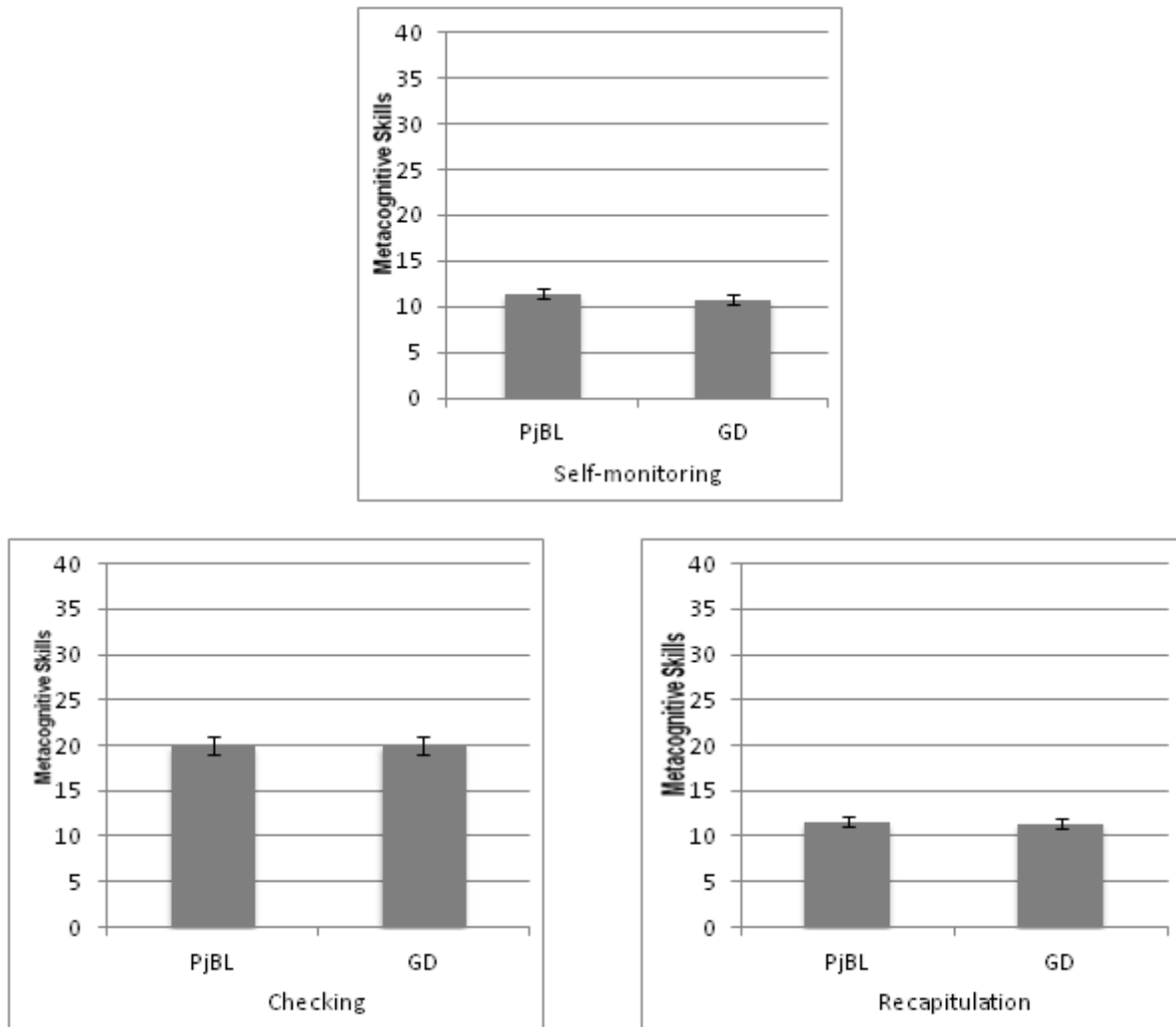
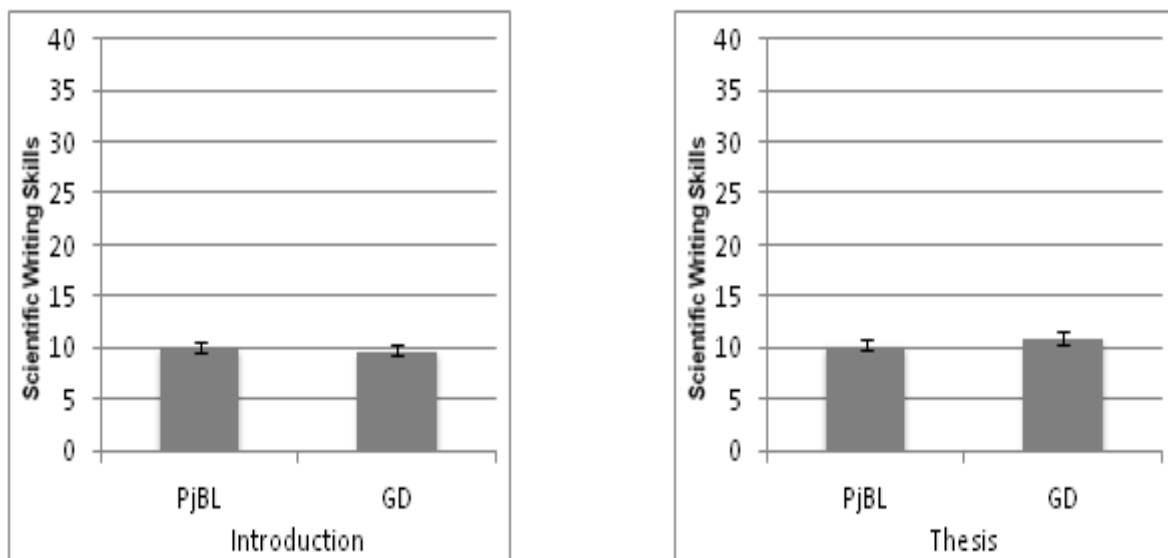


Figure3. Components of metacognitive skill of the student taught by project based learning and guided discovery models: Task analysis ($t_{count} = 0.756$; $P = 0.452$), planning ($t_{count} = 2.26$; $P = 0.026$), self-monitoring ($t_{count} = 2.59$; $P = 0.011$), checking ($t_{count} = 0.18$; $P = 0.856$) and recapitulation ($t_{count} = 1.03$; $P = 0.304$)

Testing on five indicators of scientific writing skills of students revealed that there was significant difference in conclusions formulation taught by project based learning and guided discovery models, whereas in aspect of introduction, thesis, writing body and correction there were no significant differences (Fig. 4).



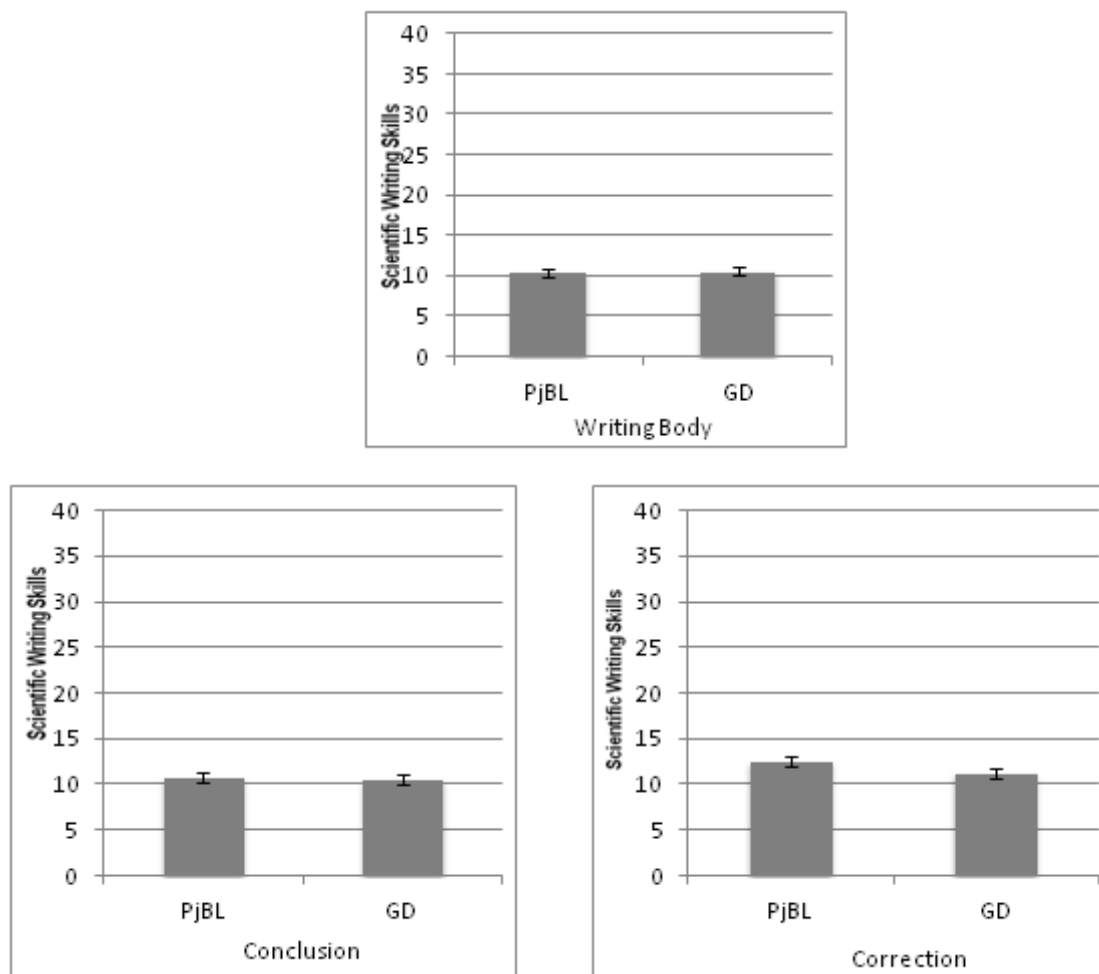


Figure 4. Aspects of scientific writing skills of students learned by project based learning and guided discovery models: Introduction ($t_{count} = 1.112$; $P = 0.270$), thesis ($t_{count} = 0.764$; $P = 0.447$), writing body ($t_{count} = 1.182$; $P = 0.241$), conclusion ($t_{count} = 2.022$; $P = 0.047$) and correction ($t_{count} = 1.320$; $P = 0.191$)

3.2. Discussion

The results of this study showed that the metacognitive skill of the students taught by project-based learning model was higher than by guided discovery model. This finding could be explained because the project-based learning model belongs to student centered learning model where the students were given activities to actively participate in learning process in order to master or to comprehend the objectives of the course. In project based learning, the students are given also the opportunity to work independently, constructing their own knowledge, to produce their own product and then to present the product (Kamaruzaman, 2010). Yuli and Sri (2015) added that in project-based learning model, the students were asked to arrange, discuss and present the project result and simultaneously obtained some inputs from various parties especially from the fellow students and teachers. All those activities of course caused the metacognitive skill of the students who taught by project based learning model better than by guided discovery model, especially in planning and monitoring components.

Metacognitive skills are very important for every student to organize and control their cognitive process both in learning and thinking, so that student learning outcomes increase. Munandar (2014) revealed that metacognitive skill emphasizes an understanding of the abilities that are possessed by person about what to do in the learning process such as checking, planning, organizing, monitoring, predicting and evaluating their own thought processes. Metacognitive consists of two basic processes that take place simultaneously during learning process that is progress monitoring and changes making (Haryani, 2012).

The finding that scientific writing skills of the student who learned by project based learning model also was higher than by guided discovery could be explained because the project-based learning model in learning process emphasizes the process of writing rather than the results of the writing

alone. This writing process gives a positive impact on the students ability in paragraphs writing. The ability to write the argumentation paragraphs is the activity to creates the paragraphs that its development pattern is based on arguments or reasons presented by the writer. The argument paragraph includes facts, data and arguments. Assessment of the writing ability of students who are monitored and followed during learning process as in project based learning class will help the students to improve their writing skills (Helmawati et al. 2015).

In comparison to the project based learning model, the scientific writing skill in guided discovery model does not emphasizes the stages of the writing process, but only on the writing results. In this case, students only serve as recipients of information about the writing of paragraph argumentation without monitoring, improvement and revision process both from teachers and other students. Nilson (2010) added that activities value of the student in writing in learning process with guided discovery model was low because the ability of the student regarding writing in guided discovery wasn't developed. Therefore, writing skills is not merely the possession of a talent for writing, but every body with serious practice. Writing skills can be owned by anyone (Akhadiyah., et al. 2012). Like other skills, the writing skill if not be honed will be lost.

4. CONCLUSION

Based on the research findings and analysis that have been undertaken, it was concluded that there was significant difference in metacognitive and scientific writing skills of the students taught by project-based learning and guided discovery models in biology instruction at ecology topic in the X-class MAS Al-Wasliyah 22 Tembung. The metacognitive and scientific writing skills of the student learned by project based learning was higher and better than guided discovery models. This study result recommends the using of project based learning in order for increasing of metacognitive and scientific writing skills of the students in biology instruction at ecology topic.

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Citation: Irda Wahidah Nasution, Binari Manurung, Tumiur Gultom "Comparison of Metacognitive and Scientific Writing Skills of Students at Ecology Topic Learned by Project-Based Learning and Guided Discovery Learning Models." *International Journal of Humanities Social Sciences and Education (IJHSSE)*, vol 4, no. 11, 2017, pp. 159-166. doi:<http://dx.doi.org/10.20431/2349-0381.0411018>.

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