DOI: https://doi.org/10.24036/bioedu.v4i2.274

p-ISSN 2354-8363 e-ISSN 2615-5451//Vol. 4 No.2 Season Year 2020

BIOEDUCATION JOURNAL

http://bioeducation.ppj.unp.ac.id/index.php/bioedu

The Effect of Metacognitive based Learning Process on Environmental Pollution Subject towards Students' Cognitive Competence

Pengaruh Pembelajaran Berbasis Metakognitif pada Materi Pencemaran Lingkungan terhadap Kemampuan Kognitif di SMA

Aditya Rahman[1)*], Dwi Ratnasari[2)], Silvy Destianingsih[1)], Nurul Rahmah Kusumaputri[2)]

[1)]*Departemen of Biology, Faculty of Teacher Training and Education Science,University Sultan Ageng Tirtayasa Jln. Raya Jkt KM 4 Jl. Pakupatan, Kec. Cipocok Jaya, Kota Serang, Banten, Indonesia*

[2)]*Dinas Lingkungan Hidup dan Kehutnan, Provinsi Banten*

*)Email: adityauntirta@gmail.com

INFO ARTIKEL

Sejarah Artikel

Dikirim 21-09-2020
Direvisi 10-12-2020
Diterima 11-12-2020
Dipublikasi 31-12-2020

Kata Kunci
Cognitive, Environmental Pollution, Metacognitive Basis, Metacognitive

ABSTRACT

This research aims to determine the effect of metacognitive-based biology learning process towardsstudents' cognitive competenceon environmental Pollution subject of class X SMA Plus Putra Bangsa Tangerang District. The method used in this research was quasi-experimental method. The population was all class X MIA with X MIA 1 of 17 people as the control sample and X MIA 2 of 18 people as the experimental sample. The instrument in this research were a test of students' cognitive competence, a metacognitive competence questionnaire, and a compliance sheet. Based on the results of the research it can be concluded that there were differences in cognitive competence of students between the experimental class that was treated using a metacognitive basis and the control class that was treated using a conventional basis on environmental Pollution subject. The average score of cognitive competence in the control class was 53.09 which was included in the "sufficient cognitive" category. The result showedthe score of 68.61, which was included in the "goodcognitive" category. In the hypothesis test, it can be concluded that there was an impact of the use of Metacognitive-based learning process on students' cognitive competence on environmental Pollution subject.

***How to cite* artikel?** **Rahman, A., Ratnasari, D., Destianingsih, S., dan Kusumaputri, N.R. (2020). The Effect of Metacognitive based Learning Process On Environmental Pollution Subject towards Students' Cognitive Competence. *Bioeducation Journal. Vol 4* (2), 84-94**

INTRODUCTION

Education is a learning process conducted by carrying out several activities, such as guiding, teaching, and exercises that take place in all environments (school or outside school). The learning process has two important components, students and teachers, students will be assisted to achieve educational goals by the teacher (Rusman, 2011). According to Purwanto (2012), changes in behavior and skills in students will can be achieved by learning process. The achievement of a change depends on several factors, some of which are intrinsic factors, for example: maturity in thinking, motivation, intelligence, and other personal factors, others are extrinsic factors, including ways of learning, family factors, learning media, environment, and available opportunities.

Based on the results of interviews with Biology teachers at SMA Putra Bangsa Tangerang District, learning in the classroom still emphasizes the method of memorizing concepts. In the learning process, the role of students is still lacking and the teacher still dominates in providing information. Students are less active in expressing their opinions and asking only when offered by the teacher. As for the learning process

on the concept of environmental pollution the teacher applies a conventional model, where the teacher is more dominant in the delivery of information using the lecture method. The concept of environmental pollution cannot just by remembering the concept, but students must be able to analyze existing problems in the surrounding environment so that they are able to present relevant solutions. Similarly, Rahman & Ersanti (2017) stated that the concept of environmental pollution is material that requires several aspects such as understanding, analysis, and being able to link the concept of environmental pollution in daily life so that it is able to solve environmental pollution problems. If students can understand, analyze, and be able to relate the material to the surrounding environment, students will achieve learning outcomes in the maximum cognitive domain.

According to Bloom, that the cognitive domain is anything related to brain activity. The cognitive domain is the thinking competency of students, including the competency to remember, understand, apply, analyze, evaluate, and create (Anderson & Krathwohl, 2010). Another factor that is capable of influencing cognitive learning outcomes is metacognitive competence. Metacognitive knowledge is knowledge that is able to control awareness of knowledge about its own cognition (Anderson &Krathwohl, 2010). In addition, according to Tan et al. (2004) states that metacognitive self-regulation is a strategy for learning such as planning, monitoring and regulating. So, metacognitive basis is a strategy in the learning process that makes students able to manage the conditions that exist in him by using several aspects such as planning, monitoring and regulating.

Researchers Purnamawati & Saliruddin (2017) stated that the use of metacognitive-based learning tools in the field of industrial electronics expertise was effective in improving students' learning outcomes. However, it has not beentested for pollution subject. Therefore, it was a necessity to conduct an experiment using metacognitive-based on pollution subject. At the beginning of the study the researchers conducted interviews to Biology teachers at SMA Putra Bangsa Tangerang District, which stated that the learning outcomes of students on environmental Pollution subjecthad not yet reached the KKM score. Therefore, in learning biology, environmental Pollution subjectrequires a metacognitive-based learning process in order to increase the comprehension of environmental Pollution subject. Referring to the explanation above, it is important to conduct a study entitled "The Effect of Metacognitive-based Learning Process On Environmental Pollution Subject towards Students' Cognitive Competence".

RESEARCH METHODS

This research method used quasi-experimental method. The research design used was the posttest only control group design, which is a design that used two subject classes (control and experiment). In this study the population samples were all grade X students in SMA Plus Putra Bangsa, Tangerang District who were enrolled in the even semester of the 2018/2019 school year consisting of 2 classes. The sampling technique uses random sampling.

The technique used in data collection was in the form of tests and non-tests. Data collection in the form of essay survey sheetswas to measure the cognitive competence of students. Theseessay survey sheets were carried out at the end of learning and no different treatments between the control class and the experimental class. Data collection in the form of non-test was a questionnaire and observation sheet of the implementation of learning process. The questionnaire in this study was intended to determine students' metacognitive competence. This instrument was measured using a Likert scale. The instrument was created by asking positive and negative questions with four alternative answers, A (always), O (Often), S (Sometimes), and N (Never). Observation sheet in this study to see the implementation of learning process delivered by researchers. This observation sheets were made as data to find out the compatibilitybetween thelearning process and the lesson plan using metacognitive-based conducted by researchers. Observation sheets are made on the Guttman scale.

Before being used for data retrieval, the cognitive competence description test instrument was first tested and calculated using Software Anates Version 4. The analysis of the test instruments included validity, relicompetence, distinguishing features, and degree of difficulty.Data processing techniques were in the form

of cognitive data analysis, metacognitive competence questionnaires, and observation sheets.Data analysis technique was using hypothesis testing. This hypothesis test aimed to find out the provisional estimates formulated in the research hypothesis using the two-party test. Hypothesis testing in this study used SPSS software version 22. To test the proposed hypothesis, non-parametric statistical assistance used was Mann-Whitney U Test with the following criteria: if the score of t <0.05 then H0 was rejected and H1 was accepted, otherwise if t> 0.05 then H0 was accepted and H1 was rejected.

The research hypothesis will be tested by testing criteria:

1. If the score of t < 0.05 then $H_o$is rejected and H_1 is accepted, it means that there is an influence of the use of metacognitive bases on the cognitive competence of class X students at SMA Plus Putra Bangsa Tangerang District on environmental Pollution subject.
2. If t > 0.05 then H_o is accepted and H_1 is rejected, it means that there is no influence of the use of a metacognitive basis on the cognitive competence of class X students in SMA Plus Putra Bangsa Tangerang District on environmental Pollution subject.

RESULTS AND DISCUSSION

In this study data collection was carried out in two meetings. Each meeting addresses a different topic, the first meeting discussed about the kinds of environmental pollution and their causes, meanwhilethe second meeting discussed about the impact and efforts to overcomeenvironmental pollution. This research was conducted in the control and experimental class. In the control and experimental class data obtained in the form of students'cognitive competence, but in the experimental class used metacognitive-based learning process. In this study hypothesis testing was conducted to determine the effect of the metacognitive basis on the cognitive competence of students conducted in the experimental class and the control class using a conventional basis of the Mann-Whitney test. The Mann-Whitney test was used in this study because the data obtained were not normal so the hypothesis testing used non-parametric tests. The thing that causes abnormal data is the lack of discriminant data resultingvarious the limited score. Likewise, Supranto (2004) stated that the lack of discriminant data makes the data becomes truly continuous data and normally distributed data look district and not normal. When testing the Mann-Whitney hypothesis using SPSS Version 22 software. Hypothesis test results obtained are the significance score of 0.035 <0.05 (H0 is rejected) means that there is an influence of the use of metacognitive bases on the cognitive competence of class X students in SMA Plus Putra Bangsa Tangerang District on the concept of environmental pollution. Cognitive competence in students whose learning process uses a metacognitive basis have higher cognitive competence compared to the control class that uses conventional bases, which can be seen in Figure 1.

The cognitive competence of SMA Plus Putra Bangsa Tangerang District students were assessed using a description test. The average percentage of students cognitive competence is shown in Figure 1.

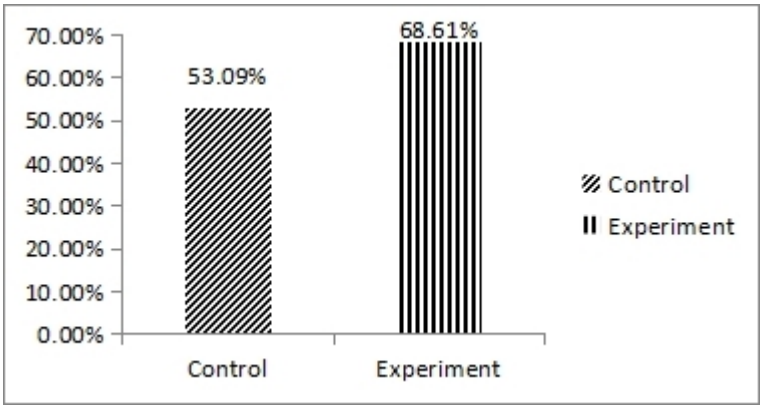

Figure 1. Cognitive Competence of Students in the Control Class and Experimental Class

After different treatments in the two classes, where the control class used a conventional basis and in the experimental class used a metacognitive basis, the results obtained in Figure 1 is the average score of cognitive competence of students in the control class of 53.09 included in the “sufficient cognitive”category because when the learning process took place there were some students who did not pay attention to learning material, students were less active, and learning was ‘teacher centered’, this can be seen on the observation sheet. In addition, when the teacher gave the opportunity for students to ask questions and gave their opinions, only a few students responded, and also, there were some students who give questions that were not in accordance with the subject matter. This means not all students already have a good understanding, because there are several possibilities such as students do not understand the material presented by the teacher but feel shy for asking questions and giving opinions. This is in line with the opinion expressed by Winasih (2009) which stated that students lack of courage to express ideas in learning activities and care less in class because of the teaching methods and media used by teachers are considered to be very monotonous and boring.

In the control class, the concentration of students tends to be less because students only sat listening to the teacher’s explanation, resulting in students became bored. In the learning process there were some students who were chatting, daydreaming, and sleepy, resulting in a lack of absorption of students during the learning process. Teachers must be diligent in reprimanding students who carry out activities outside the learning context, so that other students are not affected and disturbed during the learning process. A very different result achieved from the experimental class whereat each stage of the learning process, the students participated, as in the planning stages of the learning process, the students planned the activities that will be carried out by the students during group discussions. In the experimental class,not only teachers that were active but students were also forced to be active in the learning process. In the control class, when the teacher gave time for group work there were some students who were chatting and not actively helping out, this can be seen on the observation sheet. According to Nopiani et al. (2013), learning activities carried out by conveying a number of materials to students interspersed with a few questions and answers then followed by assignments make students feel bored and bored, making it difficult to understand learning material.

Based on Figure 1, the average score of cognitive competence of students in the experimental class of 68.61 included in the “good cognitive”category, because in the learning process, students carried out learning steps using metacognitive bases well and students are trained to be aware of the competence they have and improved their independence, and students could find out how and when to use cognitive strategies that were best in various situations, for example during group discussions, this also can be seen on the observation sheet. When students were in group discussions using metacognitive basis stages, they built better knowledge. Similarly, the opinion expressed by Kramarski & Mevarech (2003) stating that the learning process using a metacognitive basis carried out in groups can build better knowledge, so students are able to answer a series of metacognitive questionsin group activities.

The score of cognitive competence of students who have been obtained, then interpreted in 5 categories of cognitive competence; very good cognitive, good cognitive, sufficient cognitive, less cognitive, and very less cognitive categories. The percentage calculation in full grouping of 5 categories of students 'cognitive competence. The acquisition of the percentage of students cognitive competence in each category of cognitive competence is shown in Figure 2.

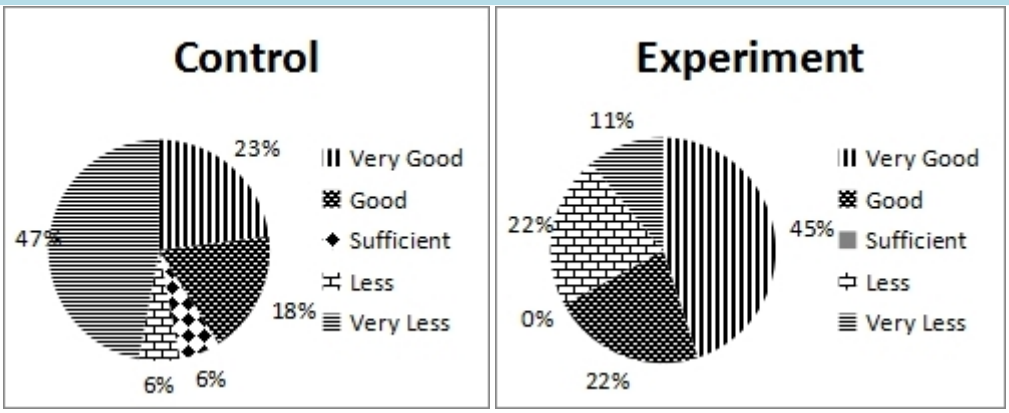

Figure 2. Percentage Scores of Cognitive Competence Based on the Cognitive Competence Category

Based on Figure 2, the very good and good cognitive category the percentage in the experimental class is higher than in the control class. This shows that in the experimental class that used the metacognitive-based learning process, more students got good grades. In the category of very less cognitive control class has higher percentage score than in the experimental class. This can also prove that by using a metacognitive basis, students tend to have good grades, although there were still some students who had grades in the less and very "lesscognitive" category. This is in line with the Sastrawati (2011) opinion which stated that learning with a metacognitive basis is very important to develop students' competence in learning cognitive strategies, so that students get good learning outcomes. Students in the experimental class who had a score in the category of "less cognitive"and "very lesscognitive" could be the result of not understanding the material delivered and were to shy to ask when the teacher offered, it also can be seen on the observation sheet.

The cognitivecompetence of students were measured using post test questions based on 5 learning indicators. A complete calculation of the acquisition of students cognitive competence. The acquisition of the average cognitive competence of students of each indicator is shown in Figure 3.

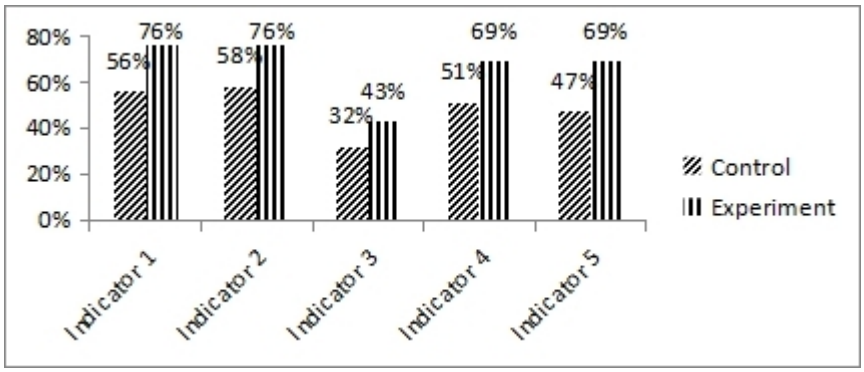

Figure 3. The Average Scores of Each Indicator of Students' Cognitive Competence

Based on Figure 3, the acquisition of cognitive competence of students in each indicator of the experimental class has a higher score than the control class. In indicator 1, students were only asked to explain the meaning of environmental pollution and its type, and the results obtained were the average score in the control class is 56 (sufficient cognitive category), while in the experimental class the average score is 76 which is included in the good cognitive category. Judging from these results in both classes the average student can still easily answer questions about the C1 level, because the C1 level is still included in the low-level cognitive group (Anderson & Krathwohl, 2001). Students can answer easily to this indicator because students often encounter a pollution surround theirenvironments. Similar to the opinion of Wartono (2004), states that with direct experience can develop students' competencies, thus helping students to gain a deeper understanding of the natural surroundings.

In indicator 2, students were asked to describe the causes of soil, water, and air pollution. The results obtained on average the score in the control class was 58 which was included in the sufficient cognitive category, while in the experimental class the average score was 76 which was included in the good cognitive category. According to the results in the two classes, the average student can still answer the questions Cognitive level 2 which is higher than Cognitive level 1, although it is still included in the cognitive level at a low level. In this indicator, students can also still easily answer their questions because this indicator has a close relationship with indicator 1, where with the experience,learners can also understand what causes environmental pollution around it, such as water pollution caused by factory waste .

In indicator 3, students were asked to analyze the problem of environmental pollution. The results obtained on score average in the control class was 34 which was included in the category of very less cognitive, while in the experimental class the average score is 43 which was included in the category of less cognitive. Judging from these results, in both classes students were less able to answer the C4 level questions that were included in the high-level cognitive group. In this indicator, the experimental class students also cannot answer the questions well, because students have not been good at solving global warming problems that can be caused by air pollution. Maiyena (2013) stated that the material global warming is material that is difficult to observe directly with the five senses because it occurs in a very broad atmosphere and involves greenhouse gases that are abstract. So, it can be concluded that the material on global warming is abstract material (cannot be seen by the naked eye), so students have difficulty being able to relate it to environmental Pollution subject.

The students have used thinking skills in the learning process, but in the learning process, students have not learned the relationship between air pollution and global warming so that students have difficulty in answering questions about it in the post test. Similarly, as stated by Syah (2009), the cause of the bad score obtained by students from a subject can occur due to a mismatch of material taught by the teacher with a matter of measuring students' understanding of the material. A good solution so that students do not experience difficulties in working on the problem is that before making a score related to a material, in the learning process students have learned about the material, so students can understand the material learned by using their thinking skills and get good grades.

In indicator 4, students were asked to determine solutions on how to deal with environmental pollution. The results the average scoreobtained in the control class was 51 which was included in the less cognitive category, while in the experimental class the average score was 69 which was included in the sufficient cognitive category. In this indicator, there are several cognitive levels; cognitive level 3 and cognitive level 5. Students in the experimental class can solve questions on this indicator that use the metacognitive domain well, this happens because the implementation of the metacognitive-based learning process, where students carry out all stages of metacognitive-based learning process well, this can be seen on the observation sheet. Learners make learning plans such as analyzing the time that will be spent working on the Student Worksheet, students at the planning stage use their thinking skills as well as working on the questions available on the Student Worksheet, and at the student sat evaluation stage asked to keep a journal, so students can know the extent of knowledge gained during the learning process and review the knowledge that has not been understood.

The last indicator is the indicator 5 where students were asked to analyze the impact of environmental pollution on life. The score average in the control class was 47 which was included in the less cognitive category, while in the experimental class the average score is 69 which was included in good cognitive category. Judging from these results, in the experimental class the students can answer C4 level questions that were included in the high-level cognitive group. Students of the experimental class can complete this indicator well, because the learning process using a metacognitive basis requires students to get used to using their thinking skills. Similarly, the Nasution (1989) stated his opinion that students in solving a problem require thinking skills, including observing, classifying, drawing conclusions, and making generalizations based on information collected.

Figure 3 shows that the acquisition of students' cognitive competence in each indicator at the experimental class has a higher score than the control class. In indicator 1, students were only asked to explain the meaning of environmental pollution and its type and the average score obtained was 56 in the control class which was included in the sufficient cognitive category, while in the experimental class the average score was 76 which was included in the good cognitive category. Judging from these results in both classes the average student can still easily answer questions about the C1 level, because the C1 level was still included in the low-level cognitive group (Anderson & Krathwohl, 2001). Students can answer easily to this indicator because students often encounter an environmental pollution for example water in blackened times caused by water pollution, so students can easily understand the meaning of environmental pollution. Similar to the opinion of Wartono (2004) that stated direct experience can develop students' competencies, thus helping students to gain a deeper understanding of the natural surroundings.

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The students have used thinking skills in the learning process, but in the learning process students have not learned the relationship between air pollution and global warming so that students have difficulty in answering questions about the post test. Similarly, as stated by Shah (2009), the cause of the bad score obtained by students from a subject can occur because of the mismatch of material taught by the teacher with a matter of measuring students' understanding of the material. A good solution so that students do not experience difficulties in working on the problem is before making a score related to a material, in the learning process students have learned about the material, so students can understand the material learned by using their thinking skills and get good grades.

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The last indicator (indicator 5), students were asked to analyze the impact of environmental pollution on life. The the score average obtaines in the control class was 47 which was included in the less cognitive category, while in the experimental class the average score is 69 which is included in sufficient category. Judging from these results in the experimental class the average student can answer C4 level questions that are included in the high-level cognitive group. Students of the experimental class can complete this indicator well, because the learning process using a metacognitive basis requires students to get used to using their thinking skills. Similarly, Nasution (1989) stated that students in solving a problem require thinking skills, including observing, classifying, drawing conclusions, and making generalizations based on information collected.

Figure 3 shows that the acquisition of cognitive competence of students in the experimental class who were treated using a metacognitive basis had an average score that was higher than the control class. This is in line with the opinion of Maulana (2008) showing that learners who carry out the learning process on a metacognitive basis have better performance, compared to students who do not undertake a metacognitive-based learning process, because the metacognitive basis requires students to plan, follow developments , and evaluate the learning process. Another opinion, Imel (2002) emphasizes that every day people will think metacognitive, that is conscious and then monitor the progress of learning. Although metacognitive interrelated different from cognitive. Cognitive is the knowledge needed to carry out a task, while metacognitive is a skill needed to know how the task is carried out.

The metacognitive competence of students in the experimental class were measured using a questionnaire sheet of 30 metacognitive competence. The percentage of students metacognitive competence is shown in Figure 4.

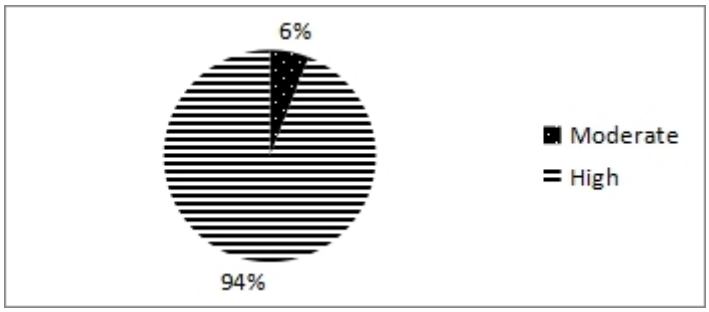

Figure 4. Metacognitive Competence of Students Using a Metacognitive Basis

Metacognitive competence highly corresponds to cognitive competence. Based on Figure 4, 94% of students have metacognitive competence in the “high” category. The high metacognitive competence of students wasdue to the use of learning bases that are able to develop higher-order thinking skills of students, one of which was the metacognitive learning base. According to Wilson & Conyers (2016), metacognitive will improve students' understanding of how, why, when, and evaluation techniques in cognitive use within themselves. In addition, metacognitive will foster students' awareness about what they will do to improve their learning.

The potential for learning to use metacognitive bases in empowering metacognitive competence is inseparable from the stages of the metacognitive-based learning process. The stages of planning, where students are asked to plan themselves to work on problems and find appropriate cognitive strategies to find the solution to the next stage of the problem is monitoring, where the teacher only directs it and students conduct discussion activities and conduct studies. When students conduct discussion activities and conduct studies with group friends, students will try to think to answer a series of questions in the Student Worksheet either independently or in groups. Thinking activities to answer questions can practice self-monitoring which is part of metacognitive. According to Syarifah (2016) discussing to predict answers functions as a metacognitive strategy helping students to pay more attention to the problem solving process, monitor progress, and encourage success in solving problems, students will be more aware of the learning outcomes they get by making questions and answers independently. The learning process using this metacognitive

basis has previously been carried out by researchers Mursali (2015) showing that by doing a metacognitive-based learning process can improve students' cognitive abilities. The last stage is evaluation, where students were asked by the teacher towrite a daily journal to monitor their knowledge and help students realize what they are learning to help develop metacognitive competence.

Metacognitive competence of students in the experimental class were measured based on 3 indicators; self-planning, self-monitoring, and self-evaluation which were measured using a metacognitive competence questionnaire sheet containing positive and negative statements. In the questionnaire students were asked to choose 1 rating scale that is never, often, sometimes, and always. A complete calculation of the students' metacognitive competence scores. The average scores of each student's metacognitive competence are shown in Figure 5.

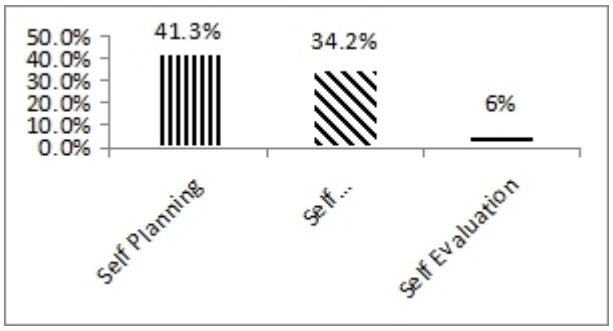

Figure 5. Metacognitive Competence of Students in the Experimental Class on Each Indicator

Figure 5 shows that the acquisition of the metacognitive competence of students in the experimental class after conducting the learning process using a metacognitive basis shows that all indicators are in the high category. This shows that students in the experimental class can develop metacognitive competence well. The high category (80 – 100%) indicators of all metacognitive competence in the experimental class can be caused by the new learning process using a metacognitive basis, so that they get situations and learning habits that are different from usual. This makes students more enthusiastic and they follow the rules or stages of the learning process using a metacognitive basis.

Metacognitive competence need to be developed in learning biology because students who use metacognitive competence in learning can have better achievements because metacognitive competence enable students to plan, follow developments, and monitor the learning process, so that it can also have an impact on increasing cognitive learning outcomes. This was also stated by Mursali (2015) showing that by doing a metacognitive-based learning process can improve students' cognitive competence. Metacognitive competence are very necessary for success in learning, because using a metacognitive basis allows students to be able to manage cognitive skills and be able to find weaknesses that will be corrected with subsequent cognitive skills (Brasilita, 2015). Further explanation of the indicator of metacognitive competence is as follows:

1. Self-Planning

In this indicator students must be aware to make plans and prepare for participating in learning activities, set the time to complete learning tasks, use strategies in learning, and find out relevant knowledge to solve problems. The highest score on this indicator is 60 found in statement number 11 with a negative statement "when I work on the Student Pollution Worksheet environmental pollution, I do not know the knowledge that supports in working on the problem". 6 students chose the option never (N) and 12 students chose the option sometimes (S), so most students get grades of 3 to 4. This shows that most students know the relevant knowledge to solve the problem.

2. Self-Monitoring

In this indicator students must be aware of monitoring the achievement of objectives, monitoring initial knowledge with learning material, and monitoring the time spent. The highest score on this indicator is 55 found in statement number 21 with a negative statement "I forgot to check the answers at the time of the test or test before being submitted to the teacher". 7 students chose the option never (N), so most students get

a score of 4. This shows that most students realize that the importance of monitoring the time spent in learning so that the learning process runs well.

3. Self-Evaluation

In this indicator students must realize the importance of evaluating learning strategies. The highest score obtained on this indicator was 56 found in statement number 30 with the negative statement "I keep quiet when I make mistakes in studying biology". This shows that most students always correct errors in learning biology.Metacognitive bases affect the cognitive competence of students because the use of metacognitive bases has several advantages. The advantages of the metacognitive-based learning process are sequential processes used to control cognitive activity and ensure the achievement of cognitive goals. The process includes planning things needed in the learning process, comprehension monitoring, and evaluating the learning process. And also to ensure the achievement of these goals and understanding, self-questioning can be used and students are required to voice their thoughts (think aloud) (Wilson & Conyers, 2016).

CONCLUSION

Based on the results of the study, it can be concluded that there are differences in cognitive competence of students between the experimental class that is treated using a metacognitive basis and the control class that is treated using a conventional basis on environmental Pollution subject. The average score of cognitive competence in the control class was 53.09 and included in the sufficient cognitive category, meanwhile in the experimental class the average score was 68.61 and included in good cognitive category. Hypothesis testing results show that there is an influence of the use of metacognitive bases on the cognitive competence of students on environmental pollution subject.

REFERENCES

Anderson, L. W. & Krathwohl, D. R. (2010). *A Taxonomi for Learning, Teaching, and Assassing*. New York: Addison Wesley Lonman Inc.

Brasilitas, Y. (2015). Pengaruh Model Pembelajran Simas Eric Pada Jenis Kelamin Berbeda Terhadap Keterampilan Metakognitif dan Hasil Belajar Kognitif Siswa Biologi di SMAN 6 Malang. Diakses dari http://jurnal-online.um.ac.id/data/artikel/938DF5FF9EA90F6D046CCB816B7E0CD.pdf. 07 Juli 2019, pk. 19.50.

Imel, S. (2002). Metacognition Beckground Brief from the QLRC News Summer 2004. Diakses dari http://www.cete.org/acve/does/tia.0017.pdf, 11 Juli 2019, pk 17.14.

Kramarski, B. & Mevarech, Z. R. (2003). Enchancing Mathematical Reasoning in the Classroom: The Effects of Cooperative Learning and Metacognitive Training. *American Educational Research Journal*, 40(1), 281-310.

Maulana. (2008). Pendekatan Metakognitif Sebagai Alternatif Pembelajaran Matematika Untuk Meningkatkan Kemampuan Berpikir Kritis Mahasiswa PGSD. *Jurnal Pendidikan Dasar,* 1(10):1-8.

Nasution, S. (1989). *Kurikulum dan Pengajaran*. Jakarta: BumiAksara.

Nopian, E., I. G. Meter, & I. W. Wiarta. (2013). Model pembelajaran TGT berbantuan media permainan ular tangga berpengaruh terhadap hasil belajar matematika siswa kelas IV SD gugus VIII Sukawati. *Mimbar PGSD,* 1(1):37-45.

Purwanto,N. (2012). *Ilmu Teoritis dan Praktis*. Bandung: PT. Remaja Rosdakarya.

Rahman, A. & Ersinta, K. (2017). Implementation of fishbowl learning model on Students of communication students on concept of Environment pollution in class x sman 18 tangerang District. *Biodidaktika,* 12(2):91-101.

Rusman. (2011). *Model-model Pembelajaran (Mengembangkan Profesionalisme Guru)*. Jakarta: Raja Grafindo Persada.

Sastrawati, E. (2011). Problem Based Learning, Strategi Metakognisi, dan Keterampilan Berpikir Tingkat Tinggi Siswa. *Jurnal Tekno-Pedagogi,* 1(2):1-14.

Syah, M. (2009). *Psikologi Belajar*. Jakarta: Rajawali.

Syarifah, H. (2016). Pengaruh strategi pembelajaran reading questioning and answering (RQA) dipadu think pair share (TPS) terhadap keterampilan metakognitif siswa laki-laki dan perempuan SMAN di Kota Malang. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan,* 1(5):801-805.

Tan, O. S., Richard, D. P., Hinson, S. L., & Sardo-Brown, D. (2004). *Enchancing Thinking Through Problem-Based Learning Approach: International Perspectives*. Singapore: Change Learning.

Tiro, M. A. (2008). *Dasar-Dasar Statistik*,*Cet. II*. Makassar: State University of Makassar Press.

Wartono. (2004). *Materi Pelatihan Terintegrasi Sains*. Jakarta: Depdiknas.

Wilson, D., & Conyers, M. (2016). *Teaching Students to Drive Their Brains*. Virginia USA: ASCD.

Winasih, Y. (2009). Peningkatan respon siswa pada pembelajaran IPS melalui Pendekatan Keterampilan Proses. Program Sarjana Pendidikan IPS. *Skripsi*. Surakarta: FPMIPA Muhammadiyah 2 Surakarta.