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The Use of Learning Journals with Problem Based Learning Models Against Student Metacognitive Abilities

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A B S T R A C T

This study aims to determine the effect of learning journals with Problem Based Learning (PBL) models on the metacognitive abilities of class X students of SMAN on environmental pollution material. This type of research was quasi-experimental research. The study population was all students of class X SMAN as a hypothetical population. The research sample consisted of 72 students consisting of 36 students in class X MIPA 2 as an experimental class and 36 students in class X MIPA 5 as a control class. Data collection used questionnaires and description problems. Validation used in the form of content validation and empirical validation. The analysis technique used the One Way Anova test analysis. Based on the results of data analysis and discussion show that the use of learning journals with problem based learning models has a very significant effect on students metacognitive abilities in biology learning at SMAN 2 Pekanbaru. The magnitude of the value of the analysis of the average score of the metacognitive abilities of the experimental class in the very good category is 125.53 while in the control class in the good category is 107.43. This shows the metacognitive ability of students who follow the use of learning journals with problem based learning models is better than students who follow conventional learning.

1. Introduction

Changes in primary and secondary education curriculation in Indonesia have often occurred since 1945. Currently, this 2013 curriculum change is an improvement from the previous curriculum which aims to improve the quality of the learning process in achieving the quality of 21st century graduates.

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Curriculum 2013 made changes to the four National Education Standards (SNP). The four national Education Standards (SNP) include graduate competency standards, content standards, process standards, and assessment standards. The graduate competency standards are in accordance with Permendikbud No. 54 of 2013 students are encouraged to improve and balance their soft skills and hard skills. In Permendikbud No. 54 of 2013 which discusses the competency standards of high school graduate students equivalent. In the aspect of knowledge, students are required to have factual, conceptual, procedural, and metacognitive knowledge in science, technology, arts, and culture with human, national, state, and civilization insights related to the causes and impacts of phenomena and events. In this regulation there is an additional requirement of graduates from the previous curriculum that is high school graduate students must have the knowledge of one of them is metacognitive skills.

Metacognitive is the awareness of thinking about what is known and what is not known. Whitebread et al., (2012) also states that metacognitive knowledge is general knowledge about cognition, as well as one's awareness and knowledge about one's own cognition. The role of metacognitive can also be a proof of whether learning in school can be applied in everyday life. Because when students apply the application of theory, indirectly students can sort out which parts of the concept can be applied and which parts of the concept cannot be applied (Hyerle et al., 2011). According to Sri (2014) those who have good metacognitive awareness and knowledge will have good achievements in their class. In the context of learning, students know how to learn, know their abilities and learning modalities, and know the best learning strategies for effective learning ”(Flavell, 1979; Zohar, 2012). After a person is able to recognize the ability of his knowledge of how to do the task, meaning indirectly he has been able to understand the knowledge in himself / self knowledge (Anderson et al., 2001). In humans, metacognitive abilities have developed since the age of 3-5 years in the form of planning and self correction while playing, then continue to develop 6-8 years and develop very rapidly when entering junior high school (Veenman, 2012).

Metacognitive skills are one aspect of the ability to think that is very important in the learning process. Cognitive strategies can help achieve goals, while metacognitive thinking strategies can monitor progress that has been achieved. According to Djamarah (2002) students' learning abilities such as "observation, attention, memory, thinking power and fantasy" are a measure in the development of student thinking. Therefore metacognitive abilities really need to be developed and empowered to 21st century students. Anyta et al., (2013) states that PBL combined NHT in learning has been proven to be able to improve students' metacognitive abilities, critical thinking, and cognitive abilities. Because by developing metacognitive students can be used to monitor the extent of the ability of cognition to understand a problem (Merina, 2019). However, empirical evidence about this is still lacking, especially research that combines learning journals with PBL. Lack of development of metacognitive skills and writing skills is feared to result in the low quality of education in Indonesia. Therefore, one way

to improve students' metacognitive abilities is to apply a learning journal to students.

The learning journal is a document prepared by the teacher to be filled in by students containing student reflections on the subject matter and learning process that the teacher has delivered at a face-to-face meeting in class. According to Silberman (2013) a learning journal in the form of reflective notes made by students from day to day. With learning journals students can be trained to realize what they have learned and experienced during the learning process, and can measure the progress of learning that has been achieved and identify things that are not understood. Learning journals are very useful for someone, one of which is to keep a record of one's thoughts and ideas through learning experiences and help identify strengths, weaknesses, and choices in one's learning (Kartono, 2010). It can be said learning journal is a reflection according to Dinna et al., (2016). Students can fill it in the form of reflections or observations related to classroom learning (Kurniawan et al., 2016). According to Sri (2011) providing training and a summary or reflection of the material that has been read can develop metacognitive skills and the acquisition of learning outcomes. With the learning journal, students will know what concepts they have mastered, concepts that they have not yet mastered and what problems they experience during the learning process.

Students' metacognitive abilities can be improved by writing learning journals, because with a learning journal students will train students to write about how they learn, what they have learned and experienced during the learning process, and can measure the learning progress they have achieved and identify things they have achieved. things not yet understood. Deny et al., (2015) states that the application of a learning journal with a jigsaw strategy combined with PBL based on lesson study can improve students' metacognitive abilities. PBL can train students to solve problems collaboratively so that students demand their opinions in solving problems and be independent in finding solutions to the problems presented. According to Lufri et al., (2020) said that the problem based learning model can remind students of biological competence and facilitate students in the learning process.

This problem based learning (PBL) model is expected to make students more independent and have a higher spirit of cooperation to solve problems faced by teachers, so that satisfactory learning outcomes are obtained "and train students' metacognitive abilities (Arends, 2013). Because learning models that can make active student participation in learning one of them is the Problem Based Learning (PBL) model (Nur et al., 2020). One of the advantages of the problem based learning model is that it is able to train students in using various concepts, principles and skills that they have learned to solve the problems being faced (Fakhriyah, 2014).

The results of observations made by researchers through need assessments and interviews with students and teachers in SMA Negeri 2 Pekanbaru, teachers have not implemented models or learning strategies that are able to increase students'

metacognitive knowledge. The teacher never applies a particular learning model in the learning process and reflects on the learning process.

Based on the results of student need assessment conducted by researchers, most students still experience difficulties in understanding material taught by teachers using a scientific approach. The reason is that previous learning habits were more teacher-centered, so with the demands of the 2013 curriculum which required the learning process with student-centered patterns to be suboptimal.

Based on these problems, the need for models and learning strategies that are able to meet the demands of 2013 curriculum graduates 'competency standards both soft skills and hard skills, such as students' metacognitive abilities. This study aims to determine the effect of learning journals with Problem Based Learning (PBL) models on students' metacognitive abilities

2. Methodology

This type of research used in this research is quantitative research. Quantitative research is research that uses quantitative data. Data in quantitative research is in the form of numbers or data that is leveraged and uses statistical tests to analyze the data (Paidi, 2012). This type of research used in this study was a quasi experimental research (quasi experimental research). The experimental design of this study was a control group pretest-posttest design. In this design there are two groups: the control group and the experimental group or those treated (Wiersma et al., 2009).

The study was conducted at SMA Negeri 2 Pekanbaru. Pekanbaru 2 Public High School. The population in this study were students of Class X Science. This research consists of 3 stages, namely the preparation, implementation and retrieval of data. The preparatory phase included conducting initial observations at SMA Negeri 2 Pekanbaru and conducting interviews, then selecting non-randomly determined research samples and developing learning tools, and making research instruments.

At the implementation stage of the study, it conducted pre-tests in class X MIPA 2 and class X MIPA 5 which aims to test normality and homogeneity, then carry out learning in accordance with the RPP five times a meeting and end up doing a post-test in the experimental class and the control class. The data in this study included the validity of learning devices, implementation of learning devices, observation of metacognitive abilities. Data collection techniques included observation, questionnaires, and written tests.

The analysis was carried out in a descriptive quantitative manner. The calculation was done by calculating the score of students reflective statements in a learning journal for three meetings. About 20-30 minutes before the lesson ends, students filled out a learning journal sheet containing what material has been understood, how is the experience during the learning process, what are the obstacles and obstacles during learning processes and efforts or strategies to overcome them, and the last is what are the benefits obtained from the material and the learning process, then

average it and categorize it into three tiered or ordinal categories. Metacognitive sheet scoring was done by group or metacognitive sub-aspect. Each choice scale item has a maximum score of 4 and a minimum of 1. Data obtained in the form of metacognitive awareness scores. Scores are obtained through the Metacogntive Awarness Inventory (MAI) questionnaire. The categorization of students metacognitive awareness questionnaire scores was based on a modification from Yeyendra (2017), as in Table 1.

Table 1. Categorization Score Assessment Metacognitive Awareness Inventory (MAI) questionnaire

Interval	Category
118-144	Very good
91-117	Good
64-90	Enough
36-63	Very less

Analysis of the influence of learning journals with Problem Based Learning (PBL) learning models on Student Metacognitive Abilities was done by testing One Way ANOVA (Analysis of Variance) or Anova one factor.

3. Results and Discussion

The Implementation of the Use of Learning Journals with Probem Based Learning Models

The following Table 2 presents the results of the study journal assessment for three meetings About 20-30 minutes before the lesson ends. for complete calculation results can be seen in Table 2.

Table 2. Descriptive Results of Student Learning Journal Assessments

Deskriptif	First	Second	Third
Average	88,2	90,49	94,17
The highest score	100	92,5	100
Lowest value	57,5	72,5	92,5

In table 2 above it can be seen that at the first meeting the average value of student learning journals is lower at 88.2 this is due to students who have never used a learning journal seen from students who are still difficult to write answers to questions contained in sheets learning journal. Whereas in the second meeting the average value of the learning journal increased to 90.49 and at the third meeting increased to 94.17 this was due to students who already understood using the learning journal sheet viewed from the students' answers according to the questions in the learning journal sheet how the student was themselves can know the strengths and weaknesses in learning and think about efforts to overcome their shortcomings, so they can know the meaning of the learning process. In accordance with the revelation of Rachel (2004) Journal of learning can enable

students to become more aware about their own learning, so as to increase metacognitive awareness.

Journal writing is very helpful for students to develop metacognitive awareness (Rachel, 2004). To find out how far students' interest in writing journals can be known from learning journals made by students. It is proven that after the teacher reads all student journals, most students write their own learning journal and do not imitate their friend's learning journal, meaning that students feel interested in writing a journal. This shows that students already have metacognitive awareness, because students have identified their learning processes seriously and independently. According to Marzano in Peirce (2003) the existence of metacognitive awareness in students can make students more motivated in participating in learning.

Results of Descriptive Analysis of Combined Initial and Final Data Indicators Metacognitive Awareness Questionnaire to Measure Students' Metacognitive Abilities

Metacognitive abilities of students before participating in learning with problem based learning learning models using learning journals. The learning process begins and ends with a metacognitive awareness questionnaire. Table 3 below shows the results of the initial and final descriptive statistics of the students' metacognitive awareness questionnaire.

Table 3. Results of descriptive analysis of students' metacognitive abilities

Indicators of Metacognitive Awareness Questionnaire	**Experiment Class**		**Control Class**	
	***Problem Based Learning* (X MIPA 2)**		**5M (X MIPA 5)**	
	Awal	**Akhir**	**Awal**	**Akhir**
Declarative Knowladge	98	129	107	115
Prosedural Knowladge	98	125	99	109
Conditional Knowladge	98	123	96	107
Planing	95	127	97	107
Informations Management Strategies	92	121	93	98
Monitoring	96	127	99	104
Debugging Strategies	99	130	106	109
Evaluation	94	124	101	111
Average	96,16	125,53	99,77	107,43
Category	Good	Very Good	Good	Good
Average increase	29,37 %		7,66 %	

In table 3 the results of the descriptive analysis of students' metacognitive abilities show that students from class X MIPA 2 have an average of 96.16 categories both before participating in learning with problem based learning models and experiencing an average increase to 125.53 very good categories after participating in learning with the problem based learning model. While in class X MIPA 5 the average metacognitive ability of students was 99.77 good categories and increased to 107.43 good categories after participating in the learning process.

Based on the data presented in the table it can be concluded that an increase in the average metacognitive abilities of students is greater in the experimental class that is equal to 29.37% while smaller in the control class that is 7.66%.

Descriptive data shows that there is an increase in the average metacognitive abilities of students at the end of learning activities in the class applying a learning journal with a problem based learning model. The average score of the experimental class is higher than the control class. The positive influence of the use of learning journals with problem based learning models on students' metacognitive abilities can be explained due to the influence of the use of learning journals and problem based learning models. A learning journal is a forum that contains the results of reflections in the field of learning intended for students. The teacher can read it as input for seeing students' abilities in the field they are learning. Students can fill it in the form of reflections or observations related to classroom learning. Learning journals are not summaries of learning material, but rather focus on students' reflection on what they have read or are being learned (Mursyid, 2010). Learning journals can enable students to become more aware about their own learning, so as to increase metacognitive awareness (Rachel, 2004).

Jonassen (in Fadllia, 2012) states metacognitive is a person's awareness of how he learns, the ability to assess the difficulty of a problem, the ability to observe the level of understanding himself, the ability to use various information to achieve goals, and the ability to assess the progress of learning themselves. Thus the use of learning journals in the learning process can improve students' metacognitive abilities. The application of learning journals has a significant influence on students' metacognitive abilities on environmental pollution material, being able to stimulate students to reflect and evaluate learning activities through writing learning journals. Besides giving the opportunity for students to construct their own knowledge through reflection activities so that students' learning experiences do not pass away and are more meaningful with a learning journal sheet.

An experimental class that applies the use of student learning journals has identified its learning process through the making of the learning journal. with a learning journal, students can find out their strengths and weaknesses in learning and think about efforts to overcome their weaknesses, so students can find out the meaning of the learning process. Thus journal writing is very helpful for students to develop metacognitive awareness (Rachel 2004). To find out how far students' interest in writing journals can be known from learning journals made by students. It is proven that after the teacher reads all student journals, most students write their own learning journal and do not imitate their friend's learning journal, meaning that students feel interested in writing a journal. This shows that students already have metacognitive awareness, because students have identified their learning processes seriously and independently. According to Marzano in Peirce (2003) the existence of metacognitive awareness in students can make students more motivated in participating in learning.

Prerequisite Test Results Hypothesis Test Effects of the Use of Learning Journals with Problem Based Learning Models on Student Metacognitive Abilities

Data analysis performed at this stage was the analysis of the results of the initial conditions and the final conditions of the treatment. Data obtained before and after treatment included test results and questionnaire data, namely data on metacognitive abilities for both the experimental class and the control class. The following presents the results of the normality test with Kolmogrov-Smirnov on the pretest scores of students' metacognitive abilities Table 4.

Table 4. Normality of Initial Results of Metacogitive Capabilities

Variabel	Model	Statistic	Sig.	Ket.
Metacognitive Ability	*PBL*	0,112	0,200	N
	5M	0,123	0,185	N

Based on table 4 the results of the normality test with Kolmogrov-Smirnov on the initial results of students' metacognitive abilities, show that the initial results are normally distributed, which shows significance values above 0.05. In the next stage the researcher presents the final normality data of students' metaognitive abilities in Table 5.

Table 5. Normality of Outcome of Metacognitive Ability

Variabel	Model	Statistic	Sig.	Information
Metacognitive Ability	*PBL*	0,057	0,200	N
	5M	0,98	0,200	N

Based on Table 5 the results of the normality test with Kolmogrov-Smirnov on the final results of students' metacognitive abilities, show that the final result data is normally distributed, which shows a significance value above 0.05. Table 6 below presents the results of the homogeneity test of variance with the Levene test on students' pretest and posttest metacognitive abilities.

Table 6. Results of Variance Homogeneity Test with Levene Test

	Levene Statistic	Sig.	Information
Early Metacognitive	1,087	0,301	Homogen
End Metacognitive	2,120	0,150	Homogen

In Table 5 the table of the variance homogeneity test with the Levene test shows that the initial significance value of metacognitive abilities is 0.301 which indicates values above 0.05 which means that the variance is homogeneous. The final homogeneity test of metacognitive ability is 0.150, indicating the value is greater than 0.05, which means the final data is also homogeneous.

4. Hypothesis Testing Effect of the Use of Learning Journals with Problem Based Learning Models on Student Metacognitive Abilities

From the prerequisite test above, the measurement data of students' metacognitive abilities have met parametric requirements, namely the data is normally distributed and the data group variables are homogeneous, so that the data can be continued with the parametric hypothesis test using Analysis of Variance (ANOVA) one factor (Oneway). In the following table are the results of parametric tests using Analysis of Variance (ANOVA) Table 7.

Table 7. Analysis of Variance (ANOVA) Test Results.

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	3945.681	1	3945.681	32.101	**.000**
Within Groups	8603.972	70	122.914		
Total	12549.653	71			

Based on table 7, the Analysis of Variance (ANOVA) statistical test results show that the significance value is 0,000. Sig. (0,000) <α so that H0 is rejected, so it can be concluded that the use of learning journals with problem based learning models significantly influences students' metacognitive abilities.

The influence of the use of learning journals with problem based learning models can be seen in the results of descriptive data and the results of hypothesis testing. Descriptive data shows that there is an increase in the average metacognitive abilities of students at the end of learning activities in the class applying a learning journal with a problem based learning model. The average score of the experimental class is higher than the control class. Likewise with the Anova test results it was concluded that the use of learning journals with problem based learning models had a significant influence on students' metacognitive abilities with a significance value of 0,000 <0.005.

The positive influence of the use of learning journals with problem based learning models on students' metacognitive abilities can be explained due to the influence of the use of learning journals and problem based learning models. A learning journal is a forum that contains the results of reflections in the field of learning intended for students. The teacher can read it as input for seeing students' abilities in the field they are learning. Students can fill it in the form of reflections or observations related to classroom learning. Learning journals are not summaries of learning material, but rather focus on students' reflection on what they have read or are being learned (Mursyid, 2010). Learning journals can enable students to become more aware about their own learning, so as to increase metacognitive awareness (Rachel, 2004).

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and think about efforts to overcome their weaknesses, so students can find out the meaning of the learning process. Thus journal writing is very helpful for students to develop metacognitive awareness (Rachel 2004). To find out how far students' interest in writing journals can be known from learning journals made by students. It is proven that after the teacher reads all student journals, most students write their own learning journal and do not imitate their friend's learning journal, meaning that students feel interested in writing a journal. This shows that students already have metacognitive awareness, because students have identified their learning processes seriously and independently. According to Marzano in Peirce (2003) the existence of metacognitive awareness in students can make students more motivated in participating in learning.

4. Conclusion

The results of data analysis and discussion show that the use of learning journals with problem based learning models has an effect on students metacognitive abilities in learning Biology of environmental pollution material at SMAN. The value of metacognitive abilities in the excellent category compared to the control class in the good category. This shows the metacognitive ability of students who follow the use of learning journals with problem based learning models is better than students who follow conventional learning. The advice that can be given is that metacognitive abilities at this time really need to be developed and improved for students, and that requires a long time. For future researchers, I suggest that the time for the research to be carried out can be carried out over a longer period of time and with a wider population and sample than the current researcher. To support the implementation of the 2013 curriculum and meet the standards of graduates listed therein, teachers are expected to be able to apply the use of learning journals with this problem based learning learning model in learning, especially in Biology learning in high schools so that students' metacognitive abilities can be well developed.

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