UJME 9 (1) 2020: 1-10
UNNES JOURNAL OF MATHEMATICS EDUCATION
https://journal.unnes.ac.id/sju/index.php/ujme/
ISSN: 2252-6927 (print); 2460-5840 (online)

The practicality of Problem Based Learning tools with a scientific approach to improve students' critical thinking ability

Adi Candra Kusuma*

Politeknik Harapan Bersama, Jl Mataram No 9 Pesurungan Lor Tegal, Indonesia

** E-mail address: candraraden45@gmail.com*

ARTICLE INFO

Article history:
Received 28 January 2020
Received in revised form 21 February 2020
Accepted 4 March 2020

Keywords:
Practicality; Problem Based Learning; Scientific; Critical Thinking Ability.

Abstract

The aim of this study was to obtain the practicality of Problem Based Learning (PBL) tools with a scientific approach to improve students' critical thinking ability (KKBKM). This study was a quantitative type with research subjects of 2D class as the control class and 2F as the experimental class. Both classed consisted of 32 students in the even semester of the academic year 2018/2019. The control class was treated by using an expository learning model, while the experimental class was treated by PBL with a scientific approach. This study carried out the interview, observation, and questionnaires to collect data. Then the practicality test analysis was obtained by observation of the implementation of learning according to RPP, questionnaire for lecturers and students' response, and observation of KKBKM activities. Afterward, the average score of learning implementation observation according to RPP was 74.2%, questionnaire of lecturers' response was 4.17, students' response was 86.10%, and KKBKM observation was 4.14 with an excellent predicate. Thus, the learning tool prepared positively could be used in learning.

1. Introduction

Mathematics is one of the science branches that becomes the basis of other branches. The development of science requires mathematics, especially science. Thus, students in all education levels are expected to learn and master mathematics well.

Thinking ability combines behavior, knowledge, and other abilities, which probably lead someone to shape his environment to be better. Thinking ability is divided into critical and creative thinking. Due to many abstract concepts in learning mathematics, students assume that mathematics is difficult. Students are only able to learn and memorize facts, concepts, principles, law, theories, and innovative ideas in the level of memory. They are not able to effectively use and apply mathematics in contextual problem-solving in daily life.

In fact, the expository model is still often used in the learning process. This is one of the conventional learning models that focuses on a one-way learning model by lecturer or teacher. The observation result conducted in the Diploma of Computer Technique study program of Politeknik Harapan Bersama shows that the learning currently still uses this learning model. As a result, students are not trained to think to solve the problems in their own way critically. They are only able to solve similar problems as lecturers exemplify. It goes without saying that they will get difficulties with the developed questions given.

Under those circumstances, mentioned, students' ability can be developed through a learning model that provides problem and requires students to solve it by all their knowledge and abilities. Indeed, a learning model is not only transferring knowledge, yet consciously developing students' potential through their applicable and dynamical abilities (Lidinillah, 2013). Whereas, a learning model should make students

To cite this article:
Kusuma, A.C. (2020). The practicality of Problem Based Learning tools with a scientific approach to improve students' critical thinking ability. *Unnes Journal of Mathematics Education*, *9*(1), 1-10. doi: 10.15294/ujme.v9i1.37081

become a center of learning, so they are able to actively shape their knowledge. Bruner (in Trianto, 2009) says that learning is an active process in which students shape their knowledge based on their own experience. Therefore, it is necessary to apply a learning model that focuses on students and gives them experiences in solving mathematical problems. One of them is the Problem Based Learning (PBL) model.

Again, according to Hamalik (2001), learning is a modification or strengthening of behavior through experiences. Hence, learning is a process of a series of activities and not only a result or goal. It is not only recalling activity but broader than it namely experiencing. For more, learning results do not only focus on how to lead students are able to master the exercise result but also to change their attitude. Kline (in Rohendi and Dulpaja, 2013) conveys that mathematics is not independent science and not able to complete or improve itself, yet it helps the community to understand and have the social, economic, and natural problem at the finger ends. This kind of thinking can be developed through mathematics learning since it has strong and clear structures and relevancies between each concept, so it enables students to think rationally.

Above all, a change that probably happens due to learning is in psychological aspects and affects someone's attitude. A behavior change that relatively occurs in a long time goes along with someone's efforts to do something which impossible to do before. Specifically, House and James (Kusuma, 2017) explain that mathematics learning results cover comprehensive mathematical thinking on knowledge and solve the problem systematically with good attitude and motivation. Thus, it is also necessary to use an appropriate learning approach.

A learning approach should be presented in the form of a contextual problem, so students get stimulation to learn. An approach with teaching and learning concepts links the materials with student's real conditions and encourages them to make a relation between the knowledge they have with its implementation in real life. Problem Based Learning (PBL) model is an approach that applies contextual problems. It gives students a chance to conduct research based on real and authentic problems. Problem Based Learning should meet several criteria, namely, complex, unclear structure, open, and authentic (Pratiwi, 2010). The characteristics of PBL are more challenging for students to learn how to learn well and work in a group to find a solution to problems in real life (Maryati, 2018). The problems are used to improve students' curiosity toward the learning given. The principles of PBL that must be attended are basic concepts, defining the problem, self-learning, and exchanging knowledge. Therefore, lecturers can design the learning by giving a problem that involves students' thinking ability and analysis process based on the real problem (Nafiah and Suyanto, 2014).

Then, the assessment system of PBL is carried out by combining three aspects namely knowledge, ability, and attitude which are in accordance with Indonesian National Qualification Framework (KKNI) curriculum that is directed to develop students' knowledge, comprehension, ability, attitude, and interest to lead them to do something in the form of skill, accuracy, and success with full of responsibility. The assessment on knowledge comprehension covers all of the learning activities in the last semester through the final test (UAS), midterm test (UTS), quiz, homework, document, and report, which are then recapitulated. The assessment of skill or ability can be measured through tool mastery, including software, hardware, and the ability to design and test. Meanwhile, the assessment of attitude focuses on the mastery of a soft skill, namely the active participation in discussion, the ability to work in a group or team, and the attendance in learning. The weight for the assessment of three aspects is determined by the lecturer during the learning contract.

According to Budiyanto et al. (2016), scientific learning covers the activity of observing, asking, collecting information, associating, and communicating. In orientation learning, lecturers or teachers are demanded to conduct a student center learning in which lecturers/ teachers are only as of the facilitator of the problem. At the beginning of PBL, a problem is given to students to solve. They can solve it through observing, asking, collecting information, associating, and communicating.

Regarding the previous explanation, this study used a Problem Based Learning model that is well designed and developed, so students can actively find and develop the concept learned. This learning model must be in line with the cognitive development theory by Piaget; that is, students must be actively involved in the process of collecting information and developing their own knowledge (Dahar, 2011). The learning is begun by giving questions or interesting problems that are related to students' daily life (Syaribuddin et al., 2016).

The next issue carried out by this study is critical thinking, which happens in the cognitive system by comparing knowledge in mind and aims to solve a problem by deciding which appropriate knowledge to use to solve the problem. Based on this explanation, the indicators of critical thinking used in this study are 1) being able to analyze an argument, 2) being able to evaluate information, 3) being able to synthesize evidence, and (4) being able to draw a conclusion.

For more, a leaning that is developed and validated by Plomp and Nieveen (2007) is practical if it has already met several criteria, namely 1) lecturer's ability in managing the learning into good category, 2) students' positive response, and 3) the positive activities to improve students' critical thinking ability.

2. Methods

This study was a quantitative study that was supported by qualitative proofs. The subject of this study was 32 students of 2D class as the control class and 32 students of 2F class as the experimental class of the Diploma III Computer Technique study program in Politeknik Harapan Bersama in the academic year 2018/2019. This study used random sampling, while to collect the data, this study conducted an interview, questionnaires, and observation. Plomp, as Rochmad says (Rochmad, 2012), conveys that the general model of problem-solving in the education field consists of the preliminary investigation, design, realization/ construction, test, evaluation, and revision phases.

First, a preliminary investigation was done by identifying of information, articles, books, and journals related to the study as the basis of theoretical studies, conducting a preliminary study on research subjects and analyzing the results, defining the problems limit, planning further activities to determine the competencies to be achieved, and analyzing curriculum, theories of learning, students' characteristics, and competencies to be achieved.

Second, the design phase aimed to obtain initial design from learning tools that will be developed. This phase gave an overview for lecturers how and what must-do during the learning, designing a support system that will be used during the study, and designing the learning impact.

Third, realization/ construction phase was conducted through the further activity of design phase such as preparing instruments including semester lesson plan (RPS), daily lesson plan (RPP), textbooks, students' worksheet (LKM), students' critical thinking ability test, RPP implementation, students' response, and tools validation sheets on statistics material in PBL with scientific approach then called as draft 1, compiling reaction from learning that has already conducted, and determining system of PBL with a scientific approach.

Fourth is the last phase, namely, test, evaluation, and revision. Based on the data collected, then it could be determined which solution was appropriate and satisfactory and which solution needed to develop. In other words, it was necessary to conduct another supplement activity in previous phases, which was called a feedback circle. The cycle was repeatedly conducted until the expected solution is reached. In this phase, the researcher also carried out tools validation and limited trials to get practical tools and effective learning. In addition, in this phase, learning tools validation and evaluation were performed by experts and peers who were called as a validator. These activities aimed to find out whether draft 1 of the learning tools designed was already valid or not by conducting several steps, namely draft one validation, analysis of validation result, and revision. If there was no revision or only a few revisions of draft one from validator, it was then continued by limited trials of draft 1. However, if the analysis result of validator consideration toward draft 1 needed a revision, a revision would be conducted to obtain draft two and so on in order to get the result of validator analysis on the draft without revision or only a few.

Further, a limited trial was conducted on the validated learning tools to obtain the analysis of Students' Critical Thinking Ability (TKKBKM) problems. Before the test instrument of students' critical thinking ability was tested to experimental class, the test instrument trial was done in advance to improve validity, reliability, difficulty level, and the capacity of distinguishing questions. The recapitulation of the TKKBKM question trial result is presented in Table 1.

The plot of the PBL learning tool development with a scientific approach can be seen in Figure 1.

Table 1. The Recapitulation of TKKBKM Questions Trial Result

Question Number	Validity	Reliability	Difficulty Level	Distinguishing Power	Notes
1	Invalid		Easy	Excellent	Not Used
2	Valid		Difficult	Good	Used
3	Invalid		Medium	Good	Not Used
4	Valid		Medium	Good	Not Used
5	Valid		Medium	Good	Used
6	Valid		Medium	Fair	Not Used
7	Valid		Medium	Good	Used
8	Valid	Very High	Medium	Good	Used
9	Valid		Medium	Good	Used
10	Valid		Medium	Good	Used
11	Valid		Medium	Good	Used
12	Valid		Medium	Good	Used
13	Valid		Medium	Good	Not Used
14	Valid		Medium	Good	Used
15	Valid		Medium	Good	Used

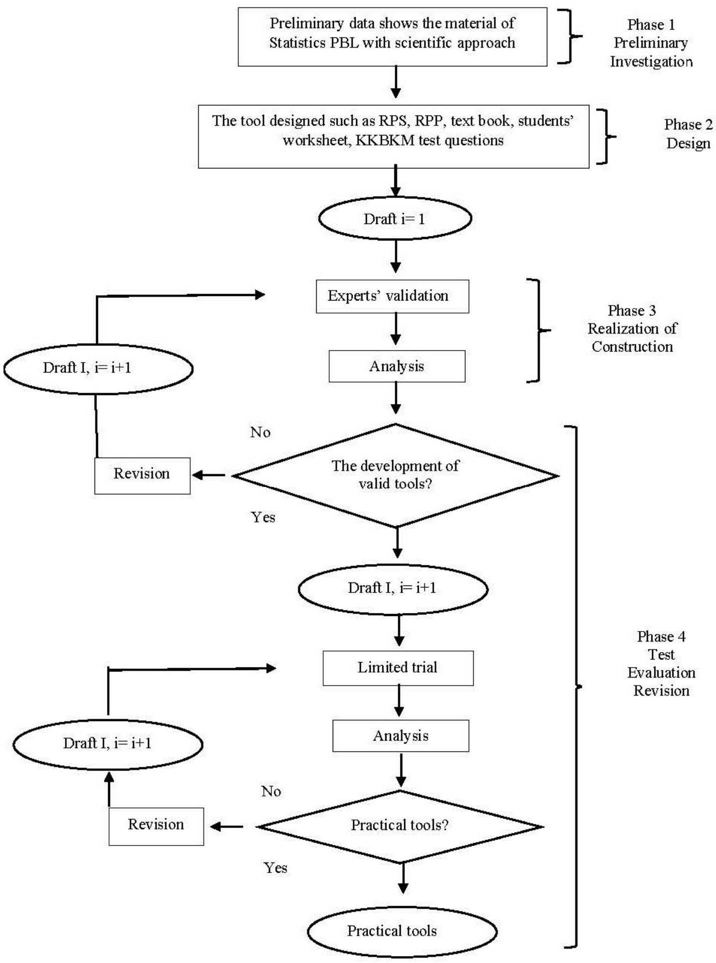

Figure 1. The Plot of PBL Learning Tools Development with Scientific Approach of Plomp Model

3. Results & Discussions

The implementation of tools development used was based on the Plomp model that had been modified by adjusting Problem Based Learning with a scientific approach. Five phases were simplified into four phases by eliminating the fifth phase namely implementation phase. The result of tools development modification included a) preliminary investigation phase, b) design phase, c) realization/ construction phase, d) test, evaluation, and revision phase. Based on previous research (before 2006) that also carried out four phases, the result of learning tools validation was valid with good predicate. The learning tools tested included RPS, RPP, textbooks, LKM, and TKKBKM questions. The description of the scoring average from each learning tool used a Likert scale, as presented in Table 2.

Table 2. The Learning Tools Criteria

Interval	Criteria
$1{,}00 \leq R_g \leq 1{,}80$	Poor
$1{,}80 < R_g \leq 2{,}60$	Poor
$2{,}60 < R_g \leq 3{,}40$	Fair
$3{,}40 < R_g \leq 4{,}20$	Good
$4{,}20 < R_g \leq 5{,}00$	Excellent

The recapitulation of experts' validation results toward learning tools can be seen in Table 3.

Table 3. The Recapitulation of Learning Validation Result

Tools	Validator					Average	Notes	Criteria
	I	II	III	IV	V			
RPS	3.88	4.12	3.9	4.1	4	4.00	Valid	Good
RPP	4.19	3.9	3.7	4.48	4.3	4.10	Valid	Good
Textbooks	3.92	3.85	3.85	4.62	4.54	4.03	Valid	Good
LKM	4.14	3.21	3.79	4.50	4.30	4.01	Valid	Good
TKKBKM	4.1	4	4.1	3.9	4.4	4.00	Valid	Good

In this study, the validation of learning tools had passed several phases, as previously mentioned. Yet somehow, on the fourth phase (test, evaluation, and revision phase), the researchers carried out a limited trial on all valid learning tools. This was done in 2C with 30 students, which can be seen in Table 1. The indicators of students' mathematical critical thinking ability were 1) being able to analyze the arguments, 2) being able to evaluate the information, 3) being able to synthesize the proofs, and 4) being able to conclude.

Furthermore, a learning tool that had been developed and validated from experts was valid (Plomp and Nieveen 2007) if it met criteria 1) lecturer's ability to manage the learning in good category/ the learning implementation was already in accordance with RPP, 2) peer lecturer's positive response, 3) positive students' response, and 4) the positive activity of students' critical thinking ability.

The next phase of practical research was the test, evaluation, and revision phase. In this phase, the researcher carried out an expert's validation and trial of TKKBKM questions on the implementation of the PBL model with a scientific approach. Firstly, the result of experts' validation was used to revise and improve draft one into draft 2. Secondly, the trial of TKKBKM questions was used to find out validity, difficulty level, item discrimination, reliability (as seen in Table 1), and the test of learning tools practicality, which was conducted five times in mathematics learning. The respondents of this test were 2F class of 32 students and two lecturers of the educational field.

The result of learning practicality was the first indicator of lecturer learning implementation, which was already in line with RPP. It was analyzed by calculating the total of an average value of the lecturer's ability to organize the learning multiplied by the maximum score (5) with criteria, as explained by Kusworo & Hardianto (2009). The formula used in calculating the data of RPP implementation is as follows, while Table 4 shows the criteria nd Table 5 shows the results.

$$\text{Lesson plan implementation } (K) = \frac{\text{the total of average score of each activity}}{\text{number of activity aspects}} \times 100\%$$

Notes: the activity of RPP implementation consisted of 3 activities including opening, core, and closing activity.

Table 5 shows that the final average was 0.742 or 74.2% with good criteria. It means that the lecturer's ability to organize the class by using PBL with the scientific approach was in good criteria.

Table 4. Criteria of RPP Implementation

Interval	Criteria
$0\% \leq K \leq 25\%$	Bad Ability
$25\% < K \leq 50\%$	Poor Ability
$50\% < K \leq 75\%$	Good Ability
$75\% < K \leq 100\%$	Excellent Ability

Table 5. The Recapitulation of RPP Implementation

	Activity		
	Opening	**Core**	**Closing**
Average	0.780	0.710	0.735
Total Average	**0.742**		

The second indicator was the peer lecturer's response. It was analyzed by using the criteria of the peer assessment response questionnaire, which was adjusted to the rubric. The formula is presented as follows:

$$\textit{Lecturer Response } (R_g) = \frac{\textit{average total of score}}{\textit{number of aspects}}$$

Notes: The average score was obtained from each indicator from total meetings conducted during the research. The lecturer who observed the response toward the learning was two lecturers (see Table 6).

Table 6. The Criteria of Peer Response

Interval	Criteria
$1{,}00 \leq R_g \leq 1{,}80$	Bad
$1{,}80 < R_g \leq 2{,}60$	Poor
$2{,}60 < R_g \leq 3{,}40$	Fair
$3{,}40 < R_g \leq 4{,}20$	Good
$4{,}20 < R_g \leq 5{,}00$	Excellent

The criteria of peer's response at least could be used to meet good criteria. The result of the lecturer's response questionnaire completion on a practical test of learning tools by using PBL with the scientific approach is presented in Table 7.

Table 7. The Recapitulation of Lecturer's Response on Learning

Respondent	Indicator										Average of All Indicators
	1	2	3	4	5	6	7	8	9	10	
Total of Lecturer's Response Per Indicator	45	41	40	43	43	42	43	42	36	42	4.17
Average of Each Indicator	4.5	4.1	4	4.3	4.3	4.2	4.3	4.2	3.6	4.2	

The indicators of lecturer's response on learning consisted of 2 aspects, namely a) the assessment of learning tools (point 1 – 7) covered RPS, RPP, observation sheets of critical thinking and implementation of RPP, table of specification of critical thinking ability test, textbooks, and student's worksheet, b) the feasibility of learning tools (point 8 – 10), included tool development on other competencies, the development of PBL with a scientific approach, and the willingness to complete the assignments.

Table 5 shows that the average of the lecturer's responses was 4.17 with a good category. Shortly, lecturers were generally able to receive learning activities by using PBL with a scientific approach.

Further, the third indicator was the result of the students' responses. It was analyzed by using score percentage analysis calculated by using the formula as conveyed by Kusworo & Hardianto (2009) as follows.

$$The\ percentage\ of\ student's\ response\ score\ (R_s) = \frac{\sum X_i}{n \sum Y} x\ 100\ \%$$

Notes:

$\sum X_i$ = the number of positive response on each aspect

n = the number of respondents

$\sum Y$ = the number of the assessment aspect

Students' response was positive if the percentage average of student's response was more than 75%. There were two criteria of response assessment, namely, positive and negative responses (see Table 8). The positive response for PBL with the scientific approach emerged from a comfortable feeling of having a large number of students in one class. On the contrary, the negative response emerged from the uncomfortable feeling of most students. This assessment was based on the attendance of 32 students (present/ absent). Furthermore, the result was found by combining the result of comparative test and N-Gain test on further research as well as the average result of students' critical thinking ability and students' response to the learning process.

Table 8. The Criteria of Students' Response

Interval	Criteria
$0\% \leq R_s \leq 25\%$	Bad
$25\% < R_s \leq 50\%$	Poor
$50\% < R_s \leq 75\%$	Good
$75\% < R_s \leq 100\%$	Excellent

The result of the questionnaire completion of students' responses toward learning using PBL with a scientific approach can be seen in Table 9.

There were three aspects of students' response indicators, namely a) students' attention (point 1 – 4) consisted of the preparation immediately before class and test, the attendance in class, and enthusiasm during the learning process, b) students' attitude (point 5 – 7) covered response on mathematics learning using PBL with the scientific approach, response on students' mathematical critical thinking ability observation, and the willingness to complete the assignment, c) students' participation/ involvement during the learning process including participation in carrying out the assignment, discussion, and training with Yes (Y) and No (N) options.

Table 9. The Recapitulation of Students' Response (RM) toward Learning.

Respondent	Indicator Number									
	1		2		3		4		5	
	Y	T	Y	T	Y	T	Y	T	Y	T
% RM	83	17	77	23	89	11	87	13	88	12
Respondent	**Indicator Number**									
	6		7		8		9		10	
	Y	T	Y	T	Y	T	Y	T	Y	T
% RM	93	7	77	23	86	14	89	11	92	8
Average % Yes			86,10%		Average % No				13,9%	

Moreover, as seen in table 9, the average of students' responses (RM) was 86.10% with an excellent category in every positive meeting. Students felt happy and comfortable with the new learning situation that was more interesting. In this learning, students felt respected to give a piece of mind; consequently, they liked the PBL with a scientific approach. Also as seen on table 7, the questionnaire of students' response was categorized into three, namely 1) students' attention covered 1, 2, 3, and 4 indicators, 2) students' attitude included 5, 6, and 7 indicators, 3) students' participation/ involvement during the learning process covered 8, 9, and 10 indicators which were completed as follows 1) students' attention was obtained from the result of questionnaire calculation consisted of preparation immediately before the class was 83%, preparation before test or assignment was 77%, students' attendance was 89%, and students' enthusiasm was 87% with an average of 85% from all indicators. Hence, students' attention toward PBL with scientific approach was positive. 2) Students' attitude was obtained from the calculation result of students' questionnaire on PBL with the scientific approach of 88%, response on students' critical thinking ability observation of 93%, and the willingness to do the assignment of 77% and the average was 86%. In brief, students' attitude during the learning was positive. 3) The average of students' participation/ involvement in the learning was 89%. It was obtained from the calculation of students' questionnaires from 3 indicators. It means that students' participation was positive.

The fourth indicator was the activity of students' critical thinking ability. It was analyzed by using the criteria of students' critical thinking ability questionnaire assessment, which had been adjusted with the prepared rubric. The formula can be seen as follows.

$$The\ activity\ of\ mathematical\ critical\ thinking\ ability(A) = \frac{the\ total\ of\ score\ average}{the\ numbe\ rof\ aspects}$$

Table 10. The Criteria of Critical Thinking Ability Activity (Emayanti, 2017)

Interval	Criteria
$1{,}00 \leq A \leq 1{,}80$	Bad
$1{,}80 < A \leq 2{,}60$	Poor
$2{,}60 < A \leq 3{,}40$	Fair
$3{,}40 < A \leq 4{,}20$	Good
$4{,}20 < A \leq 5{,}00$	Excellent

For more, the validity of critical thinking ability activity could be used at least to meet good criteria. The calculation result of critical thinking ability activity with its indicator can be seen in Table 11.

Table 11. The Recapitulation of Critical Thinking Ability Activity Observation

	The Indicator of Critical Thinking Ability Activity			
	Be able to analyze the argument	Be able to evaluate the information	Be able to synthesize the proofs	Be able to conclude
Average	4,15	4,16	4,12	4,13
Category	Good	Good	Good	Good
Total average	4,14 (Good)			

As seen in Table 11, the final average was 4.14 with a good category. The average of all indicators was mostly in the good category. It means that students were able to do the activity well.

Subsequently, the practicality test was gained from the questionnaire of the lecturer's and students' responses on the developed learning tools. The calculation result of RPP implementation was 74.2% with a good category. In other words, the teacher's ability to managing PBL with the scientific approach was good. Meanwhile, the average of the calculation result of the lecturer's and students' responses on PBL with the scientific approach was 4.17 and 86.10%. It means that the lecturer's response was good, and the students' response was very good, in which both were positive.

During the learning process with PBL and scientific approach, the average of students' critical thinking ability activity was 4.14% with a good category. Students' positive response was aimed to train on how to complete TKKBKM problems.

4. Conclusion

Regarding preliminary results and discussion, the conclusion that can be drawn are; first, the practicality of PBL tools with a scientific approach was conducted after the learning tools were considered valid; both it is content and constructs. Second, the result of learning training by using PBL with a scientific approach to Statistics material showed that the learning tools were practical. It could be seen through data, the implementation of RPP, lecturers' and students' responses, and the activity of mathematical reasoning, which was practical or good. Meanwhile, 3) the result of an average score of the learning implementation, which was already in line with RPP was 74.2%; the lecturer's response questionnaire was 4.17, students' response was 86.10%, and the average of KKBKM observation was 4.14 in the good category.

References

Budiyanto, M. A. K., Waluyo, L., & Mokhtar, A. (2016). Implementasi pendekatan saintifik dalam pembelajaran di pendidikan dasar di Malang. In *Proceeding Biology Education Conference: Biology, Science, Enviromental, and Learning* (Vol. 13, No. 1, pp. 46-51).

Dahar, R. W. (2011). *Teori-teori belajar dan pembelajaran*. Jakarta: Erlangga

Hamalik, O. (2001). *Proses Belajar dan Mengajar*. Jakarta: PT Bumi Aksara.

Kusuma, A. C. (2017). Efektifitas Pembelajaran Tutor Sebaya Berbantuan Modul Untuk Meningkatkan Komunikasi Matematik Mahasiswa. *Cakrawala: Jurnal Pendidikan*, 11(1), 1-8.

Lidinillah, D. A. M. (2013). Pembelajaran berbasis masalah (problem based learning). *Jurnal Pendidikan Inovatif*, *5*(1), 17.

Maryati, I. (2018). Penerapan model pembelajaran berbasis masalah pada materi pola bilangan di kelas VII Sekolah Menengah Pertama. *Mosharafa: Jurnal Pendidikan Matematika*, *7*(1), 63-74.

Nafiah, Y. N., & Suyanto, W. (2014). Penerapan model problem-based learning untuk meningkatkan keterampilan berpikir kritis dan hasil belajar siswa. *Jurnal Pendidikan Vokasi*, *4*(1).

Pratiwi, D. A. (2010). Pembelajaran berbasis masalah (problem based learning) dengan metode proyek dan resitasi ditinjau dari kreativitas dan konsep diri (self concept) siswa (studi kasus materi biologi" plantae" di kelas X semester dua (*Doctoral dissertation*, UNS (Sebelas Maret University)).

Plomp, T. (2007). Educational Design Research: an Introduction in *An Introduction to Educational Design Research*. Netherland: SLO

Rochmad, R. (2012). Desain Model Pengembangan Perangkat Pembelajaran Matematika. Kreano, *Jurnal Matematika Kreatif-Inovatif*, 3(1), 59-72.

Rohendi, D., & Dulpaja, J. (2013). Connected Mathematics Project (CMP) model based on presentation media to the mathematical connection ability of junior high school student. *Journal of education and practice*, 4(4).

Syaribuddin, S., Khaldun, I., & Musri, M. (2016). Penerapan Model Pembelajaran Problem Based Learning (Pbl) Dengan Media Audio Visual Pada Materi Ikatan Kimia Terhadap Penguasaan Konsep Dan Berpikir Kritis Peserta Didik SMA Negeri 1 Panga. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education), 4(*2), 96-105.

Trianto, M. P. (2009). *Mendesain model pembelajaran inovatif-progresif*. Jakarta: Kencana.