



Improving Colloidal Learning Outcomes through Problem Based Learning in 11th Vocational School Students

Helen Soraya Sirait^{1,*}, Hartono¹, & Eddy Dharmansyah²

¹Department of Chemical Education, Universitas Sriwijaya, Indonesia

²SMK Negeri 4 Palembang, Indonesia

Abstract: This Classroom Action research aims to know whether Problem Based Learning can improve students' chemistry learning outcomes in class XI SMK Negeri 4 Palembang. This Research use Subject at students of class XI TITL 3 SMK Negeri 4 Palembang, amount to 38 students. This research which is implemented in two cycles. Data obtained from each cycle were analyzed to determine the development of learning and as a reflection thing in the next cycle. Data collection is done through an evaluation test at the end of each learning cycle. The collected data was analyzed statistically using student learning outcomes average and percent student's classical. In the first cycle the average score of students is 61 and the percentage of students' classical is 44,74%. While in the second cycle there is an increase in student learning that can be seen from the average score of students by 83 and percent classical student to 86.84%. Therefore, the application of Problem Based Learning model in colloid chemistry subject can improve student learning outcomes.

Keywords: problem based learning, chemistry learning outcomes, classroom action research.

▪ INTRODUCTION

The success of a process of teaching and learning activities can be measured by how much the level of understanding, mastery of subject matter and student achievement. There is a very close relationship between understanding, mastery of the material, and learning outcomes. If the level of understanding of students is high and mastery of the material is also high, then it can be ascertained that the learning outcomes of students will also be high so that the success rate of learning will also be higher. One of the subjects that is considered difficult to learn by students at the SMA/SMK equivalent level is chemistry, especially if the teacher who teaches does not master learning models that make students take an active role and are interested in learning an abstract subject. and many involve symbols or chemical reactions and calculations (Rudi & Ibrahim, 2013).

In this study, the researchers focused on the problems that existed at SMK N 4 Palembang, especially the Electrical Power Installation Engineering Department, class XI. SMK N 4 Palembang has implemented the 2013 curriculum and made a minimum completion criteria 75 for all subject areas. Based on the results of initial observations, namely interviews conducted by researchers with chemistry teachers at SMK N 4 Palembang, several realities in the field were obtained as follows: a) class conditions were not conducive and students were less active during the learning process. It was seen that almost no students asked the teacher, b) students are less interested in studying chemistry because it is not related to the major they choose, c) students are more focused on practice so they don't like lessons related to calculations or concepts. These things caused the chemistry learning outcomes of class XI students to still reach 40% who passed the minimum completion criteria, while another 60% were still below minimum completion criteria. When viewed from the results of the presentation, the learning process still cannot

be categorized as successful because learning is said to be successful if the total number of students has a minimum MINIMUM COMPLETION CRITERIA score of 85%.

Other facts were obtained through interviews conducted with class XI TITL 3 students, namely: a) teachers who teach are still conventional which forces students to only memorize learning, b) there are no books or adequate learning resources so that in each learning process students have to take more notes. In connection with this, it is necessary to have classroom action research for improvement in the implementation of learning. Improvements are directed at the way the material is presented and the patterns of interaction in the class so that it can lead to an increase in the ability of students in learning.

One way to realize the success of this learning is by selecting appropriate models, methods, and learning media so that students are interested and interested, and have a curiosity to find out more about the material to be taught (Sudarman & Silaban, 2015). Using models and media will greatly assist students in understanding the material and can also help teachers to convey learning more easily so that learning indicators can be achieved. One strategy or learning model that can be applied is the Problem Based Learning (PBL) learning model. Problem Based Learning learning model is a teaching method that focuses on students being able to carry out investigations of the problems given by the teacher. The investigation was carried out based on literature studies from various sources. With the application of this learning model it is hoped that students will not only have good cognitive values but are also expected to be able to think critically and logically and be able to relate the knowledge they already have with facts and concepts related to the problems given by the teacher (Suprijono, 2011). This model has been researched by Dina, Setiabudi, & Nahadi (2015) with results showing an increase in students' argumentation skills on the subject of salt hydrolysis. In the research of Assriyanto, Sukardjo, & Saputro (2014) also showed positive results that student achievement was higher when taught using a problem-based learning model through the inquiry method compared to the experimental method in terms of students' knowledge and attitudes. From the results of these studies it can be concluded that the problem-based learning model has many advantages or advantages compared to other models. This model can be used as an alternative learning model in chemistry subjects so that students' perceptions of chemistry as difficult and boring will be reduced. In this study, the issues to be discussed were limited to cognitive student learning outcomes obtained through evaluation tests, the Problem Based Learning model, and the materials to be discussed were colloids and polymers.

The formulation of the problem in this study is how to improve chemistry learning outcomes through the application of the Problem Based Learning learning model in class XI TITL 3 SMKN 4 Palembang?. The goal to be achieved in this study is to improve chemistry learning outcomes in colloid and polymer materials in class XI TITL 3 SMKN 4 Palembang through the application of the Problem Based Learning learning model. The benefits of this research are: 1) for chemistry teachers to enrich knowledge and insight about learning methods or models that can be used in teaching colloid and polymer material, 2) for students to improve students' skills in working together and expressing opinions in class to solve the problems faced, 3) it is hoped that schools will make a positive contribution in improving the quality of learning, especially chemistry subjects.

▪ **METHOD**

Subject, Time and Place of Research

The subjects in the study were 38 class XI students majoring in TITL SMKN 4 Palembang in the academic year 2017/2018. The research was conducted from November 1 2017 – May 2018. Data was collected in class XI TITL SMKN 4 Palembang in the odd semester of the 2017/2018 school year.

Types of Research

The type of research carried out was classroom action research conducted in collaboration between researchers and chemistry teachers in class XI SMKN 4 Palembang. The research will be carried out in two cycles and each cycle will consist of planning, action, observation, and reflection stages.

Planning Stage

At the activity planning stage to be carried out is to determine the learning material for cycle 1, namely dispersion systems and types of colloids. Then make a learning implementation plan according to the syntax of the Problem Based Learning learning model, design Student Worksheets (students' worksheets) for learning activities in cycle 1, compile observation sheets of student activities, compile end-of-cycle 1 evaluation test instruments, and prepare tools and materials needed required for the experiment if there are experimental activities.

Action Stage

In this action stage three activities will be carried out, namely preliminary activities, core activities, and closing activities. In this preliminary activity, the teacher conditions students so that they are ready to learn physically and mentally. Then the teacher provides apperception, motivation, and learning objectives to be achieved in the learning process. Then in the core activities, the teacher carries out all the steps contained in the lesson plan that has been made, starting from using the media, giving students' worksheets to students, giving instructions to students in solving problems to developing the results of discussions and collecting students' worksheets again. In closing activities, students with teacher guidance conclude learning and carry out evaluation tests and give homework to students.

Observation Stage

The observation stage is carried out when the learning process takes place in the classroom through practicing the PBL learning model. Observations were made using the observation sheet that had been made at the planning stage. This observation is assisted by teacher observers and colleagues who can be trusted to observe students during the learning process activities take place. In the process of observation can be supplemented with photos and videos during learning activities as research evidence.

Reflection Stage

Reflection is carried out to evaluate the results of actions that have been taken during the implementation of learning so that it can be determined what actions need to be corrected for the next cycle. Observations during the two meetings will be reviewed and analyzed against all data obtained.

Research Instruments

Data collection techniques in this study were carried out using tests. Tests in research were used to measure chemistry learning outcomes after participating in the learning process with the Problem Based Learning model. The form of the test used in this study was multiple choice of 15 items at the end of each cycle. The test results will be used as quantitative data to measure the cognitive domain.

Data Collection Technique

The data analysis technique used to obtain learning outcomes is to compare learning outcomes before being given treatment with after being given action. The first step is to find the average value of students using the following formula (Arikunto, 2006):

$$X = \frac{\sum x_i}{n}$$

Keterangan:

x_i = nilai rerata hasil belajar

$\sum x$ = jumlah nilai seluruh peserta didik

N = banyaknya peserta didik

Then calculate the classical learning completeness of students using the formula:

$$P = \frac{\sum n_1}{\sum n} \times 100\%$$

Keterangan:

P : The value of classical learning mastery

$\sum n_1$: Number of students completing individual learning (score ≥ 75)

$\sum n$: Total number of students

Cognitive learning outcomes of students can be calculated using the following formula:

$$Nilai = \frac{\sum \text{jawaban benar}}{\sum \text{seluruh soal}} \times 100$$

After analyzing the data, it can be concluded that the success of the research that has been done. This research is categorized as successful if the learning outcomes of students increase classically, namely 85% of students achieve a minimum score of 75.

▪ RESULT AND DISCUSSION

This Classroom Action Research has been carried out at SMK N 4 Palembang by applying the Problem Based Learning (PBL) learning model. This research was conducted in two cycles and each cycle consisted of two meetings. Data on student learning outcomes before being given action was taken from the daily test results on chemical equilibrium material with very low learning completeness and a low average learning outcome as well.

Data on student learning outcomes after being given action by applying the Problem Based Learning (PBL) learning model were obtained from the results of tests carried out

at the end of each cycle. After doing the calculations, the average student learning outcomes and classical completeness criteria for class XI TITL 3 SMK Negeri 4 Palembang are obtained by applying the Problem Based Learning learning model as shown in table 1 below:

Table 1. Recapitulation of student learning outcomes

Siklus	Nilai Rata-rata	Kriteria Ketuntasan Klasikal
1	61	44.74 %
2	83	86.84 %

From the table it can be seen that there was an increase in student learning outcomes from cycle 1 to cycle 2. The average score obtained in cycle 1 and cycle 2 increased from 61 to 83. Likewise with students' classical completeness criteria there was an increase from cycle 1 to cycle 2 of 44.47% to 86.84%. These results indicate that the work indicator in this classroom action research has been achieved, which is greater than 85%.

Cognitive learning outcomes of students in cycle 1 seen from the end of the cycle test. The average cognitive learning outcomes in cycle 1 were 61 and classical completeness was 44.74%, with details of 17 students who had completed and 21 students who had not completed. In cycle 1, there is an increase in the cognitive learning outcomes of students when compared to the cognitive learning outcomes obtained in the learning before using the Problem Based Learning learning model seen from the daily test scores with only 3 students completing.

In the implementation of cycle 1, planning, implementation of actions, observation, and reflection have been carried out. In this planning activity, the thing to do is determine the learning material, namely colloids, prepare lesson plans about the material to be studied at meeting 1 (dispersion systems, differences in solutions, colloids and suspensions, and types of colloids) and meeting 2 (properties of colloids) and the role of colloids in everyday life) in accordance with the learning model used, namely Problem Based Learning, making students' worksheets, compiling research instruments in the form of observation sheets of learning activities, making a grid of final evaluation test questions and key answers to final cycle 1 test questions.

The next stage is the implementation of the action which consists of two meetings with a time allocation of 2 x 45 minutes. Learning activities are carried out in accordance with the lesson plan that has been prepared at the planning stage. at meeting 1 the material studied was dispersion systems, dissolving solutions, colloids, and suspensions, as well as types of colloids, while at meeting 2 the material studied was the properties of colloids and the role of colloids in everyday life.

In the initial activity, the teacher conditions students to learn starting from greeting, praying, checking class tidiness, and checking student attendance. Then the teacher gives apperception, motivation and conveys learning objectives to students according to what is written in the lesson plan. After the initial activity, the teacher forms a discussion group consisting of 4-5 people. Then start learning according to the syntax of Problem Based Learning. Phase 1, namely conducting problem orientation to students by giving student worksheets containing case studies that must be completed by students. Phase 2 is organizing students to study, looking for literature or learning resources related to the case problem given. Then enter phase 3, namely guiding students in carrying out investigations through the literature that has been obtained and making temporary conclusions. Then phase 4, presenting and communicating the results of the discussion

through presentations in front of the class. Other groups are given the opportunity to respond or provide suggestions, comments to the group presenting. Then phase 5, namely analyzing and evaluating results by guiding students to conclude problem solving in students' worksheets. Then do the closing activity by giving assignments, and saying hello. Then make observations according to the format of the observation sheet that was made before. Then reflect on the implementation of cycle 1 after conducting data analysis.

Judging from the results of observations and reflections during the implementation of cycle 1, it was found that there were still many weaknesses. These weaknesses include: 1) the lack of learning resources for students so that the discussion results are not optimal, 2) the students were less active as seen from the lack of student response when the teacher asked questions and the teacher had to appoint the group that was presenting, 3) during the discussion there were groups who were busy and excited about telling stories outside of the topic of learning because they did not understand what had to be done, 4) there were still many the group that did not write down the conclusions in the students' worksheets resulting in difficulties when presenting, 5) the lack of good use of time so that not all groups presented. These weaknesses become material for improvement for cycle 2, namely: 1) the teacher asks students to borrow books from the library and reproduces teaching materials for each group, 2) the teacher gives awards to each student who participates in answering and is active in the process learning, 3) the teacher asks students to read the work instructions contained in the students' worksheets, 4) reminds each group to complete and check the students' worksheets at a glance before they are collected, 5) use the time according to the plan in the lesson plan.

Cycle 2 was carried out with consideration of the results of observations and reflections in cycle 1. In carrying out cycle 2, the things that were carried out were the same as the stages in cycle 1, namely starting from the planning stage by making lesson plans for materials for making colloids and polymers, making teaching materials, worksheets, assessment instruments, evaluation questions, and answer keys. Next is the action implementation stage, namely carrying out learning according to the learning model that has been prepared at the planning stage. At the time of carrying out the action, observations were also made by the observer in accordance with the format that had been made. The last stage in cycle 2 is to reflect and analyze the data. As is the case with cycle 1, that cognitive learning results are obtained through tests at the end of the cycle. The average cognitive learning result of students in cycle 2 was 83, and the classical completeness criteria was 86.84% with details of the number of students who completed as many as 33 people and 5 people who had not yet completed. From the results of data analysis of cognitive learning outcomes in cycle 2, it was concluded that the research target had been achieved in this cycle so that the research was stopped only up to cycle 2. Observations from cycle 1 and cycle 2 showed an increase in the average student learning outcomes from 61 to 83 and the classical completeness criteria also increased from 44.47% to 86.84% as shown in Figure 1.

Based on the results of research and data analysis that has been carried out at SMK N 4 Palembang, it can be concluded that the application of the Problem Based Learning learning model can improve chemistry learning outcomes for class XK TITL SMK N 4 Palembang. The increase in cognitive learning outcomes is seen from the increase in the average value of students and the classical completeness criteria in cycle 1 to cycle 2. This occurs due to improvements in the learning process in cycle 2 from the results of observations and reflections carried out in cycle 1. If you look at the results cognitive learning for each individual student there are 5 students who are still incomplete at the

end of cycle 2. As seen from the video, this is because these students are not serious during discussions and are often absent.

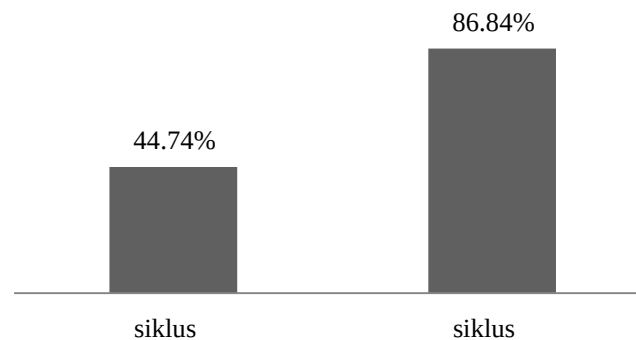


Figure 1. Graph of classical mastery of cognitive learning outcomes

With the application of the Problem Based Learning learning model, this creates a new experience for students because during the learning process students are given the opportunity to conduct investigations of problems provided through literature studies from various sources. This causes students to think more critically and logically in solving problems. In addition, students are getting more compact because the learning process trains them to work together and be active in discussions. This is consistent with research conducted by (Rudi, 2013) showing that using problem-based learning models which are then integrated with multimedia-based media gives positive results, namely student learning outcomes that increase in the subject matter of buffer solutions.

▪ CONCLUSION

Based on the research data, it can be concluded that the Problem Based Learning learning model can improve chemistry learning outcomes for class XI TITL students of SMK Negeri 4 Palembang. The increase occurred in the average learning outcomes from 61 to 83 and the classical completeness criteria from 44.74% to 86.84%.

▪ REFERENCES

- Arikunto, S. (2006). *Dasar-dasar evaluasi pendidikan*. Jakarta: Bumi Aksara
- Assriyanto, K, E., Sukardjo, J., & Saputro, S. (2014). *pengaruh model pembelajaran berbasis masalah melalui metode eksperimen dan inkuiri terbimbing ditinjau dari kreatifitas siswa pada materi larutan penyangga di SMA N 2 Sukoharjo Tahun Ajaran 2013/2014*. *Jurnal Pendidikan Kimia*. 3(3): 89-97.
- Dina., Setiabudi., A., & Nahadi (2015). *Pembelajaran berbasis masalah untuk meningkatkan keterampilan berargumentasi siswa SMA pada konsep hidrolisis garam*. *Jurnal Pendidikan Matematika dan Sains*. 3(2): 133-143.
- Rudi., L., & Ibrahim., L. (2013). *penerapan model pembelajaran berbasis multimedia melalui model pembelajaran berbasis masalah untuk meningkatkan hasil belajar kimia siswa kelas XI IA1 SMA Negeri 9 Kendari*. *Jurnal Pendidikan Kimia*. 12(2):127-136.
- Sudarman, S., & Silaban., R. (2015). *Penerapan model pembelajaran berbasis masalah terintegrasi media internet pada pembelajaran kimia larutan untuk meningkatkan hasil belajar dan karakter siswa SMA*. *Jurnal Pendidikan Kimia*. 7(3): 87-92.

Suprijono, A. (2009). *Cooperative learning*. Yogyakarta : Pustaka Pelajar.

Trianto. (2009). *Mendesain model pembelajaran inovatif- progresif*. Jakarta: Kencana Prenada Media Group.