



Application of PBL Model Assisting the Chemo-Edutainment Based Worksheets for Increasing the Students' Activities and Critical Thinking

Ulfa Lutfianasari^{1,2✉}, Antonius Tri Widodo², Sri Susilogati Sumarti²

¹SMA N 1 Karanganyar Demak, Indonesia

²Universitas Negeri Semarang, Indonesia

Article Info

Article History:

Received November 2017

Accepted January 2018

Published August 2018

Keywords:

PBL; Worksheet; Student Activity; Critical Thinking.

Abstract

This study aim to determine the effect application model PBL-assisted worksheet chemo-edutainment to critical thinking and student's activity. Population in this study is class XI-IPA student SMA 1 Karanganyar, Demak school year 2016/2017. Determination of the sample with cluster random sampling system obtained two classes to be sampled is a class XI-IPA2 as a class of experiments that are treated using PBL-assisted worksheet chemo-edutainment and XI-IPA4 as a control group who received treatment using conventional method-assisted worksheet from the other. The research data obtained by the method of tests, questionnaires, observation. The results of the study, obtained results of the experimental group had an average of 73,19 and a control group had an average of 65,06. Based on the analysis, obtained by the experimental group is better than the control group is shown with $t_{count} (4,417) > T_{table} (1,99)$ for the critical thinking and than $t_{count} (4,687) > T_{table} (1,99)$ for student's activity in a classroom. The conclusions of this research is the application of model PBL-assisted worksheet chemo-edutainment to critical thinking and student's activity on materi solubility and solubility product, with the level of unfluence on critical thinking outcomes are 45,55% and the amount of influence on the activity of students is 60,44%.

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✉ Alamat korespondensi:

Jl. Raya Cangkring, No. 08, Cangkring, Karanganyar, Kabupaten Demak, Jawa Tengah 59582

E-mail: ulfa.lutfianasari@gmail.com

p-ISSN 2252-6412

e-ISSN 2502-4523

INTRODUCTION

Education is an attempt to cultivate the potential of human resources through learning activities. Education is not something that is static but something that is dynamic so always changes constantly adapted to the times. Learning Trends in Indonesia today have shifted from Teacher Centered Learning to Student Centered Learning, where learners both groups and individuals actively discover, explore, find concepts and principles holistically and authentically in accordance with the nature of science learning. Learning changes are expected to learners have the ability to solve problems, critical thinking, able to communicate orally and in writing and have expertise in the field of technology. But in reality, there are still many educators who have not applied the lessons that refer to KTSP. Teacher Centered Learning (TCL) learning still dominates in the classroom learning process. As a result students become less creative in solving problems, low participation, teamwork is not optimal, teaching and learning activities are inefficient and ultimately low learning outcomes (Fajri et al., 2012).

Curriculum 2013 is a curriculum where the learning process using a scientific approach or a scientific approach oriented to the attitude competence. The learning model that is in accordance with the approach of scientific approach is discovery learning, project based learning, inquiry and problem based learning (Sudrajat, 2013).

Problem Based Learning is a learning approach that uses real-world problems as a context for learners to learn about critical thinking and problem-solving skills, and to acquire essential knowledge and concepts from course or subject matter materials (Sudarman et al., 2007). Wulandari et al. (2011) argues that PBLs are designed by confronting students with contextual issues related to learning materials so that students know why they are learning then identify problems and gather information from learning resources, then discuss them with colleagues to solve problems as well as achieve

learning objectives. In line with research Astika et al. (2013), Fakhriyah (2014), and Park & Choi (2015) explain PBL to improve the scientific attitude and critical thinking skills of learners.

Activity of students in the learning process with Problem Based Learning model can be supported by incorporating Chemo-Edutainment Based Worksheet adjusted with syntax PBL learning model. Wikhdah at al. (2015) explains that teaching materials play an important role in the learning process of chemistry. Chemical learning will be more effective if supported by the availability of instructional media, instructional materials in accordance with the needs of students and methods and models of active learning (Taufiq et al., 2014). Kurniawati et al. (2016) indicates that learning using an inquiry based LKS can improve student learning outcomes in basic chemistry and stoichiometry. Besides, in his research Nuritasari (2016) and Khoiriyah (2013) also argue that with LKS can mengkonstruk knowledge simplify the learning process students. The use of Chemo-Edutainment Based Worksheets on the learning process on the concept of colligative nature of the solution is expected to foster creativity, critical thinking, improve the activity, effective, and fun for students. n line with Nurfitrasari et al. (2015), Priatmoko et al. (2008) and Mursiti et al. (2008) also stated that with the use of CET media teaching and learning process becomes more interesting, learners are more focused attention and motivated to improve his quality.

Based on the background that has been described above, then the formulation of the problem in this research are (1) Is there influence of application of problem based learning model (PBL) aided chemo-edutainment based worksheet to learners learning outcomes? (2) Is there influence of application of problem based learning model (PBL) aided chemo-edutainment based worksheet to the critical thinking ability of learners? (3) Is there any influence of application of problem based learning model (PBL) with a chemo-edutainment based work sheet on student activeness?

The objective of this research is to measure the influence of the application of problem based learning model (PBL) with the help of chemo-edutainment based worksheet to improve the learning result of critical thinking and students activeness and to measure the existence of the most significant influence on student learning outcomes between problem based learning, chemo-edutainment based worksheets, or problem based learning (PBL) model based on chemo-edutainment based worksheets.

METHODS

The population in this study is the students of grade XI IPA SMA N 1 Karanganyar DemakTahun Ajaran 2016/2017, consisting of 4 classes totaling 131 students with details of an average of 34 students per class. The sample in this research is taken by cluster random sampling so that the class XI MIPA-2 as experiment class is given treatment in the form of learning with problem based learning (PBL) model based on chemo-edutainment and XI MIPA 4 as control class given treatment in the form of learning model conventionally assisted LKS from the publisher.

The variables in this research are: (1) independent variable, covering chemistry learning with problem based learning model (PBL) aided by chemo-edutainment (2) dependent sheets, including cognitive learning outcomes, critical thinking skills and student activeness. Methods of data collection used in this research are (1) documentation method, (2) questionnaire method, (3) observation method, and (4) test method. The research design used in this study is Pretest - Post test Control Group Design, as presented in Table 1.

Table 1. Research Design

Class	Begin ning Situati on	Treatm ent	End Situati on
Experiment	T1	X	T2
Control	T1	Y	T2

The instrument to be used in advance is validity test (construct validity, content validity, and validity of item or questionnaire), questionnaire or problem reliability, problem-solving power, and difficulty level of item. The questionnaire items used for the pre-test and post-test in this study are the questionnaires / questions that meet the valid criteria. Based on the analysis of questionnaire and questionnaire data obtained 15 questionnaires, 25 multiple choice questions and 10 essay questions that meet the valid criteria.

RESULTS AND DISCUSSION

The result of normality and homogeneity test of preliminary data is pre test data presented in Tables 2, 3 and 4.

Table 2. Data Normality Test Results

Data	Experiment	Control
χ^2 count	6,67	6,20
χ^2 table	7,81	7,81
	Normal	Normal

Table 3. Data Homogeneity Test Results

F count	Ftable	Criteria
1,185	2,05	Homogen

Table 4. Results of the difference test of two averages

Tcount	ttable	Criteria
1,125	1,988	Tidak ada perbedaan

The result of normality and homogeneity test of final data is post test data presented in Table 5 and 6.

Table 5. Data Normality Test Results

Data	Experiment	Control
χ^2 count	1,098	2,064
χ^2 table	7,81	7,81
	Normal	Normal

Table 6. Data Homogeneity Test Results

Fcount	Ftable	Criteria
1,103	2,049	Homogen

The result of normality and homogeneity of end test for student activity data presented in Table 7 and 8

Table 7. Data Normality Test Results

Data	Experiment	Control
χ^2_{count}	7,345	6,298
χ^2_{table}	7,81	7,81
	Normal	Normal

Table 8. Data Homogeneity Test Results

Fcount	Ftable	Criteria
1,246	2,049	Homogen

The first hypothesis test was used to prove that the learning outcomes of the experimental class students who were given the learning using Problem Based Learning Model (PBL) Aided Chemo-Edutainment Based Worksheet was better than the control class using conventional learning method. To find out whether or not the effect is used the average test of one right side is listed in Table 9.

Table 9. Average test results of one right side of the post test data

Tcount	ttable	Criteria
4,417	1,999	Ha be accepted

Based on the calculation results obtained by the amount of coefficient correlation biserial learning results (rb) so that the amount of coefficient of determination (KD) is 45.55%.

Based on the test of the increase of learning result by using t test is obtained tcount price of experimental class 70,60 while for

control class 67,65 with price t table 2.03 so can be said that improvement of result of learning which signifikan. The amount of increase in learning results obtained by finding the price of N-gain of each class so that the results obtained for the experimental class of 0.67 while the control class is 0.57 lower than the experimental class with the same criteria of the same high.

The second hypothesis test was used to prove that the activity of the experimental class students who were given the learning by using Problem Based Learning Model (PBL) Aided Chemo-Edutainment Based Worksheet better than the control class using conventional learning method. To find out whether or not the effect is used the average test of one right-hand side is listed in Table 10.

Table 10. Average test results of one-party data observation data of student activeness

Tcount	ttable	Criteria
4,687	1,999	Ha be accepted

Based on the calculation results obtained by the coefficient correlation biserial learning results (rb) of 0.78 so that the coefficient of determination (KD) is 60.44%.

Based on the test increase student activeness by using t test obtained t price of experimental class grade 13,83 while for control class 22,14 with price t table 2.03 so can be said that significant activeness improvement. The amount of increased activity is obtained by finding the N-gain value obtained result for the experimental class of 0,55 with high criterion while the control class 0,34 with medium criterion.

There are six aspects used to assess students' psychomotor domains. Each aspect is analyzed descriptively which aims to know which aspect the student has to be scouted and developed. The result of student psychomotor observation analysis is shown in Figure 1.

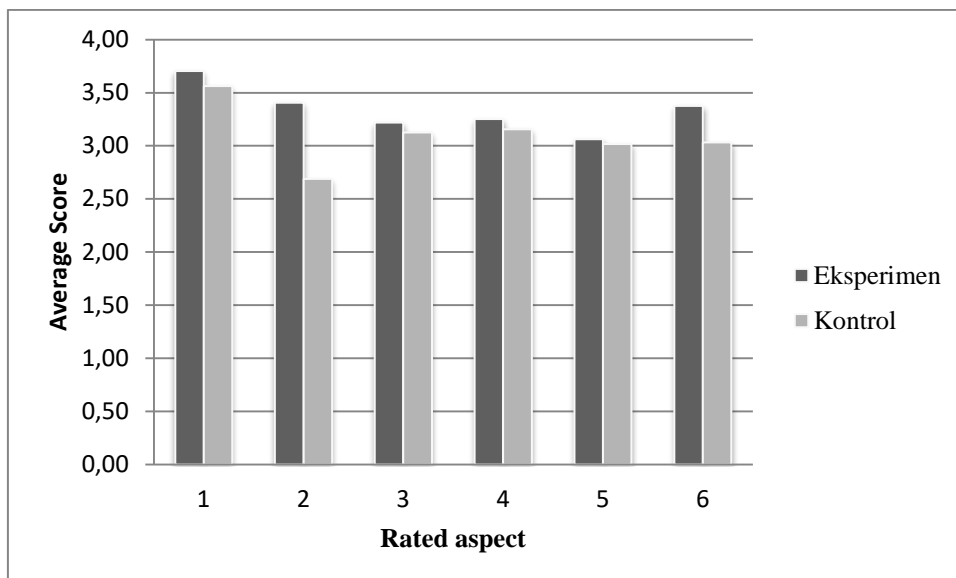


Figure 1. Graph The result of observation psychomotor domain

From the results of the analysis can be said experimental group and control group has one very high aspect that is on aspect of preparing tool and experiment material while other aspect pertained high. The mean of psychomotor aspect of students in the experimental group was 83.5% and the control group was 77.3%. The percentage of scores in either the experimental group or the control group was included in either criterion.

The questionnaire distribution in this study aims to determine the extent to which the acceptance of students to the learning process with the application of Problem Based Learning model (PBL) aided chemo-edutainment based worksheets on the solubility and solubility results. Results analysis of student responses is contained in Figure 2.

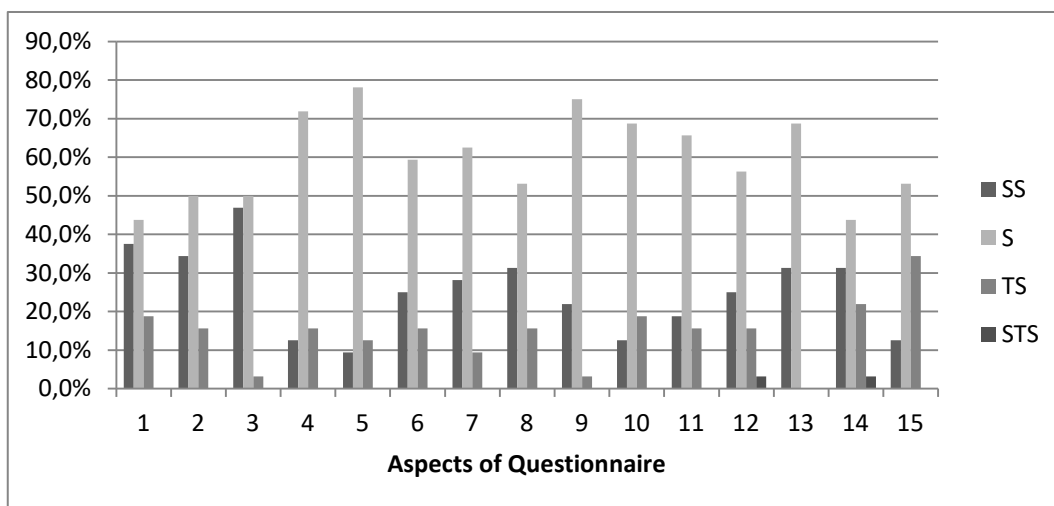


Figure 2. Graphic Results Questionnaire from students response

From the calculation results obtained the average number of students who choose SS = 25.2%, S = 60.0%, TS = 14.4%, and STS = 0.4%. This means that the student agrees to apply the application of Problem Based Learning (PBL) model based on chemo-edutainment based worksheet to assist student learning on solubility and solubility.

Before the implementation of the research, researchers first held a pre test to determine whether the class is taken depart from the same initial conditions. Looking at the initial conditions of the students, both the experimental and control classes have relatively the same initial abilities.

The preliminary analysis of the pre test between the experimental and control classes shows that the two classes start from the same condition. Then the two classes were taught by different treatment. The experimental class received learning with PBL-assisted model of chemo-edutainment based worksheet while the control class received learning by conventional method of Work Sheet-assisted from the publisher.

The study was conducted four times face to face for the implementation of learning and one meeting for the implementation of the final test (post test) on both classes of research objects to determine the cognitive learning outcomes of students. The face-to-face meetings consist of three class meetings and one meeting in the laboratory. In the experimental classroom study the students conducted a discussion group to solve the problems in the chemo-edutainment based worksheet integrated with the PBL learning model. By discussing the problems that exist in the worksheet the students will be trained so that students' critical thinking skills will increase. The results of Ikman et al. (2016), Gholami et al. (2016), Solomon (2013) indicates that the use of problem-based learning model can improve students' critical thinking skills when compared to the use of conventional learning model.

In this study encountered many obstacles, although many obstacles and shortcomings faced but researchers are trying to find a solution

for the learning process to run better. Some of the obstacles faced by researchers such as the time given is not enough to implement this method, so researchers cleverly manage the time by reducing a little time during the process of discussing the material so that in accordance with the time already planned. In addition, at the initial meeting the students are still confused with the methods used in the learning process, so that less classroom learning is conducive. The problem is also obtained due to lack of understanding of the students about the material that will be studied in the classroom so that teachers are still a little help the process of learning.

At the fifth meeting held post test on both classes of research objects. The value of this post test is used for hypothesis analysis. Before performing the hypothesis test, firstly tested the normality and equality test of two variance data of post test value in both groups. The results of the normality test can be concluded that the experimental group and control group data is normally distributed. So the next test using parametric statistics. While from the equality test two varians obtained data have the same variance.

Based on the data analysis, it is obtained that there is a positive influence of learning using PBL model aided chemo-edutainment based worksheet on students' critical thinking ability and student activeness.

To find out whether learning outcomes using PBL-aided models of chemo-edutainment based worksheets in the experimental class were better than control classes were used to test the difference between the two right-handed parties. The formula used is t test. Based on the calculation results obtained tcount of 4.417 while the price of t (0.95) (85) of 1.999 because t count is greater than ttable so Ho is rejected which means the experimental group is better than the control group.

The next test is hypothesis testing. To test the hypothesis, to know the influence and magnitude of the influence of learning with PBL model aided chemo-edutainment based worksheet on students' critical thinking ability

and student's activity of solubility and solubility result used biserial correlation coefficient (rb) and coefficient of determination (KD). From the calculation results obtained the amount of biserial correlation coefficient student learning outcomes (rb) of 0.67. If adjusted with the guidance of giving interpretation of correlation coefficient (Sugiyono 2006) then it can be said that the influence of PBL model aided chemo-edutainment based worksheet medium effect on students' critical thinking ability. Then from the price of biserial correlation coefficient (rb) is calculated the coefficient of determination (KD). The price of determination coefficient (KD) is obtained from $rb^2 \times 100\%$. Based on the calculation obtained price coefficient of determination (KD) learning outcome of 45.55%.

For the second hypothesis, the first hypothesis is to analyze the data to find out how big the influence of PBL model is assisted by chemo-edutainment based worksheet on student activity based on student activity observation data. Based on the data analysis, it was found that the application of PBL model with the help of chemo-edutainment based worksheet influenced student's activity. To find out whether the students' activity by using the PBL-aided model of chemo-edutainment based worksheets in the experimental class is better than the control class is used the difference test of the two right-handed parties. The formula used is t test. This is because the experimental and control groups have the same variance. Based on the calculation results obtained tcount of 4.687 while the price of t (0.95) (85) of 1.999 because t count is greater than t table H_0 is rejected, which means the experimental group is better than the control group.

Further test to know the magnitude of the influence of the coefficient of determination determination of student activeness. Based on these calculations obtained a large influence of 60.44% with medium criteria.

Based on the results of the above analysis which explains that the application of PBL model aided chemo-edutainment based worksheets affect the ability to think critically

and students' activeness. This is in line with his theory of Mulyasa, so that students can actively learn teachers need to create appropriate strategies to such an extent that students have high motivation to learn. Such motivation can be created if teachers can create an atmosphere of learning always looks interesting, not boring. In this case the strategy used is to apply the PBL model aided chemo-edutainment based worksheet. With this strategy, students are not only taught to think more critically but also students are invited to be more active. Lightner & Willi (2007) argue that the PBL model can build and improve the level of cooperation and communication among students in the learning process, so that will form the activity of students so that students will be more happy in following the learning.

An addition to cognitive instruments (pre test and post test), researchers also use affective aspects of the instrument, psychomotor, and student activeness in the classroom. Based on the graph, affective analysis in general shows the experimental group is better than the control group. This means that the application of PBL-aided model of chemo-edutainment based worksheets not only affects cognitive learning outcomes, but on the affective aspects as well. The mean in the experimental group was 85.31 and the control group 81.41. In the aspect of attendance both control class and experiment class have criteria that all this high because the school has a high discipline.in the aspect of responsibility, the class in the control class has the lowest value compared with other aspects .. On the aspect of cooperation in the class controls are sometimes encountered by students who only rely on other friends so the students did not participate in the teacher's questions. Based on the average affective aspects of the experimental class are high. The high affective aspect of the experimental group was due to the creation of a new environment in the classroom through a PBL-aided model of a chemo-edutainment-based work sheet. So students are more enthusiastic in following the learning process.

Psychomotor aspects show different things with affective aspects. In this study, psychomotor aspects were assessed from practicum activities. Based on the analysis in general shows the experimental group is better than the control group. It was shown that the mean of the students in the experimental group was 83.5% and the control group was 77.3%. In the experimental group showed a good learning process because a positive response is needed to facilitate the continuity of teaching and learning process. Positive response makes students more comfortable and relaxed in following the learning process so as to facilitate students to understand a material.

Based on the questionnaire analysis of the students' responses to the learning it can be concluded that the students liked learning with PBL-aided model of chemo-edutainment based worksheet compared with conventional learning through discussions and lectures. The average of students gives positive responses (happy) to each indicator contained in the questionnaire.

The advantages of using this model can be seen from several things, among others: (1) student involvement in maximal learning, (2) teamwork and team dynamics good enough, especially in answering the cases given, (3) with the question and answer made students are active in critical thinking and improve student learning activities, (4) the frequent practice of solving cases makes students have the skills and dexterity in solving problems, (5) solving cases can provide opportunities for students to apply the knowledge they have in the real world. However, although there are also some obstacles to the application of PBL-aided model of chemo-edutainment based worksheets, among others: (1) lack of teacher preparation in developing learning strategy, (2) less case discussion time, so there are some cases to be solved independently by students, (3) Students are not prepared to prepare materials that will be discussed in the learning process. Thus, researchers try to overcome the weaknesses that become obstacles by preparing carefully the concept to be performed on the learning process. Encourage students to learn the material to be

learned at the upcoming meeting so that learning will run more conducive.

CONCLUSION

Based on the results of research on the application of PBL model with the help of chemo-edutainment based worksheets, it is concluded that: (1) The application of Problem Based Learning (PBL) model based on chemo-edutainment worksheet on the ability of critical thinking and students' activity on solubilized material and product solubility. Judging from the analysis of average difference for critical thinking ability, obtained better experimental group from control group is shown by $t_{count} (4,417) > t_{tabel} (1,999)$. As for the activity of the students, the experiment group is better than the control group is shown by $t_{count} (4,687) > t_{tabel} (1,98)$; (2) The magnitude of the influence of the application of Problem Based Learning (PBL) model based on chemo-edutainment worksheet on students' critical thinking ability on soluble material and solubility product is 45,55%; and (3) The influence of the application of Problem Based Learning (PBL) model based on chemo-edutainment worksheet on student's activity on soluble material and solubility product is 60,44%.

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