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Comparative Study of Student Chemistry Learning Results using Problem Based Learning (Pbl) Model and Think Pair and Share (Tps) On Basic Law of Chemistry Materials at Sma Negeri 1 Gandapura

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***Abstract:** This study aims to see the comparison of learning outcomes between PBL and TPS models. The type of research is quasi experimental research with non equivalent group pretest and posttest design. Sampling techniques in this study using purposive sampling. Sampel in this study is class X IPA[1] as experimental class 1 that applies PBL learning model and X IPA[2] as an experimental class 2 that applies TPS model which each class numbered 25 students. based on the results of data analysis, the average cognitive learning outcomes obtained in pretest-psttest in experimental class 1 were 24.28 and 71.72 while the average cognitive learning outcomes in Pretest-Posttest in experiment class 2 were 21.00 and 58.00. T-test is conducted by independent sample test using SPSS Software 18.0. significant value (2-tailed) is 0.00 < 0.05 which means H0 is rejected and Ha is accepted. Based on the research, it can be concluded that there is a significant difference between students taught with PBL and TPS models on basic chemical legal materials.*

***Keywords:** Learning Outcomes, Basic Law of Chemistry, PBL, TPS*

1. INTRODUCTION

Education is an important aspect in educating the nation's life. Enhancement and improvement of the quality of education can not be separated from various efforts. One of the efforts that the government doing is implementing and developing competency-based curriculum in 2004 and 2006 into curriculum 2013. The curriculum 2013 was established as part of improving the quality of Indonesian education at all levels assessed from three areas, namely: knowledge, attitudes, and skills (Tri et al., 2014:2). The quality of education in Indonesia depends on the learning process. The learning process is defined as an effort to

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make students learn, so that the situation is a learning event *(event of learning)* that is an effort to change the behavior of students (Sunhaji, 2014:4).

The learning process in high school chemistry subjects often emphasizes more on the subject matter or pure science without associating the science studied with the environment, technology, and society as a whole (integrated) and it causes students to find chemistry lessons very difficult to understand (Wardani et al., 2008:5).

Based on the results of class observations and interviews to teachers of chemistry subjects conducted in class X of SMA Negeri 1 Gandapura in the academic year 2019/2020 on the chemical learning process, it is known that the daily test results of students are carried out every two times is low because it does not reach the minimum standard that has been determined, which is 70. The low learning outcomes obtained by the X-grade students showed that the understanding of chemical concepts that students have is still very low and also shows the lack of effectiveness of the chemical learning process that has been done. Research conducted by Aisyah et al (2017) with the title "Analysis of Factors Causing Low Learning Outcomes of Students in Economics Subjects at SMA Negeri 15 Palembang". The low learning outcomes can be influenced by external and internal factors that can affect learning outcomes and show less effectiveness in the learning process that comes from outside and from within. The problems in the chemical learning process that occur in SMA Negeri 1 Gandapura include (1) Teachers still rarely apply methods that can provide interaction between students and students with teachers, such as methods of discussion, demonstration, and other methods that can cause student interaction, (2) Teachers rarely connect chemistry lessons with facts that occur in daily life so that learning activities carried out in the classroom tend to mon oton and less alive. In addition, students do not have curiosity about information related to chemistry lessons. So that the student's learning outcomes are less satisfactory, (3) Students are lazy to think more critically and less participate in solving problems given by the teacher because students are more likely to wait for all the information provided by the teacher so that later students are very difficult to understand the concepts on chemistry learning.

There are many ways that teachers can do to build students' thinking skills by providing learning experience and designing the learning process. One of the learning models that can be used in chemistry learning that is able to train students in problem solving and can provide good learning outcomes such as PBL (Problem Based Learning) and TPS (Think Pair Share) learning models. PBL is a learning approach that uses real-world problems as a context for students to learn how to think and skills in problem solving, and to acquire essential knowledge and concepts from lecture materials or subject matter (Setyorini et al. 2011:5; M. Chian, M. Bridges, &Edward, 2019; Alexander, McDaniel, Baldwin, & Money, 2002; J Oja, 2011; Papastrat &Wallace, 2003; Yew &Schmidt, 2012; Zhou, 2018). Usually, the problem posed as learning is a problem that occurs in real life, but it does not close the possibility that hypothetical problems can also be used (De Graaf &Kolmos, 2003). The PBL model provides a lot of time and opportunities in learning, and not only that the model can build students' ability to solve problems in real situations so as to provide good learning outcomes. Therefore, PBL is one of the alternative models that can be utilized so that students not only gain knowledge, but also proficient in applying it (E. Mills &F. Treagust, 2003).

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While TPS is a cooperative learning model designed in the form of discussions that can improve thinking skills, communication skills, and encourage student participation in the classroom (Arki et al., 2017:4). Making students more active in teaching and learning activities is the basis of TPS model (Sugiarto &Sumarsono, 2014). TPS model can train students' thinking skills, skills and discussions, so that students' learning outcomes are good. In the TPS model, a group of 2 people was formed so that there was an optimal interaction pattern. In the group, one student presented his idea, and another responded. This develops team spirit, motivation, and hones effective communication skills (Sumarni, 2016).
Based on those problems, researchers are interested in conducting a study titled "Comparative Study of Student Chemistry Learning Results Using Problem Based Learning Model (PBL) and Think Pair Share (TPS) Model on Basic Law of Chemical Materials at SMA Negeri 1 Gandapura."
Based on the background of the problem that has been presented, the problem formulated in this study are: (1) How are the results of learning chemistry students taught with PBL model in grade X SMA Negeri 1 Gandapura? (2) What are the results of learning chemistry students taught with TPS learning model in grade X of SMA Negeri 1 Gandapura? (3) Is there a significant difference between the chemistry learning outcomes of students taught and the PBL learning model and the TPS learning model? (4) Which is a better learning model between students taught with PBL and TPS models?
The purposes of this research are: (1) Knowing the results of learning chemistry students taught with PBL learning model in grade X SMA Negeri 1 Gandapura, (2) Knowing the results of learning chemistry students taught with TPS learning model in grade X SMA Negeri 1 Gandapura, (3) Knowing the significant difference between student learning outcomes taught with PBL learning model and TPS learning model, (4) Know the better learning model between students taught with PBL and TPS models.

2. RESEARCH METHODS

This study uses a quantitative approach, in order to prove hypotheses by comparing two classes on different treatments with quasi-experimental research designs or consisting of two research groups using Non-Equivalent Group Pretest and Posttest designs that recognize two groups, both of which were given experimental treatment. In general, this research is conducted in several steps, namely: (1) preparation of test spread (2) test spread and (3) test collection. Use the teacher's interview and observation sheet to find out the chemistry learning activities of students. The test is given twice, namely Pretest and Posttest are multiple choice questions. The test results were analyzed using hypothetical tests to draw conclusions.

3. RESULTS AND DISCUSSION

Result
Learning outcome description using PBL (*Problem Based Learning*)

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Based on the research, there is an improvement on students learning outcomes using PBL. It can be seen on table 1:

Table 1. Average of Learning Result on PBL Model

Learning Model	Number of Students	Average Results	
		Pretest	*Posttest*
PBL	25	24,28	71,72

The average *pretest* result of students is 24.28 while the average *student's posttest* result is 71.72.

Description of Learning Outcomes Using TPS Model (*Think Pair and Share*)

From the results of research that has been done by applying tps model there is an increase in learning outcomes. The average *pretest* and *posttest* results are presented in table 2.

Table 2. Average of Learning Outcomes on TPS Model

Learning Model	Number of Students	Average Results	
		Pretest	*Posttest*
TPS	25	21,00	58,00

The average *pretest* result of students is 21.00 while the average *student's posttest* result is 58.00.

Prerequisite Test Results

1. Normality Test

Normality test is used to see whether the sample is normal or not. Shapiro wilk is used on normality test because number of the sample is <50 and the overall total of both classes was only 50 samples with a significant level of 5% or 0.05. Pengujian ini dilakukan pada kelas eksperimen I dan II dari hasil *pretest* dan *posttest*. Pretest results are showed that the class studied has been normally distributed after being treated so that it can be made that the class has been distributed normally. The provision of normality test is if the significant value is >α so that the data is distributed normally whereas if the significant value <α so that the data is not normal.

Table 3 Normality Test Result of Experiment Class 1 and 2

Class	*Shapiro Wilk*		Conclusion
	Sig	*α*	Normal
Pretest experiment 1	0,060	0,05	Normal
Posttest experiment 1	0,556	0,05	Normal

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Pretest experiment 2	0,263	0,05	Normal
Posttest experiment 2	0,704	0,05	Normal

From the data above, it can be seen that normality test results between sig. > *αon Shapiro-Wilk* with normal distributed results. Pretest-posttest variable data in experiment class I obtained a sig.>α value of 0.060 > 0.05 and 0.556 > 0.05 while experiment class II obtained a sig value. >α of 0.263 > 0.05 and 0.704 > 0.05 so that it can be concluded that the research data is normally distributed.

2. Homogeneity Test

Homogeneity test using homogeneous test of variance with a significant level of 0.05. If a significant value is > α then the data is homogeneous, whereas if the value is significant < α then the data is not homogeneous

The function of homogeneous is to see if the population variants are the same or not. From the results of the pretest, it is known that both classes are already homogeneous (Table 4), therefore it can be concluded that both classes were selected for research.

Table 4. Students' Pretest-Posttest Homogeneity Test Result

Class	Sig.	*α*	Conclusion
Pretest Experiment 1 dan Experiment 2	0,759	0,05	Homogeneous
Posttest Experiment 1 dan Experiment 2	0,361	0,05	Homogeneous

3. Hypothesis Test

Hypothesis tests are conducted to make a decision on whether the research hypothesis is accepted or rejected.

The hypotheses that will be tested are:

a. Hypothesis

H_0 = There is no significant difference between students taught with PBL and TPS models.

Ha = There is significant difference between students taught with PBL and TPS models.

b. Decision Criteria

If sig. (*2-tailed*) > 0,05 then Ha is accepted

If sig. (2-*tailed*) < 0,05 then H_0 is rejected

Table 5. *Posttest* Hypothesis Test Result of Experiment Class 1 And Experiment Class 2

Class	Number of Students	*α*	Sig.(*2-tailed*)	Conclusion
Experiment 1	25	0,05	0,00	H_a Accepted
Experiment 2	25			

In table 5 is obtained sig value. (2-tailed) cognitive learning outcomes = 0.00 < 0.05, then H0 is rejected and Ha is accepted. This shows there is a significant comparison of learning

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outcomes between students using PBL and TPS learning models. Where PBL model is better than TPS model.

4. DISCUSSION

The data of the research results were measured through pretest and posttest with multiple choice question types totaling 30 questions. Pretest is done before the teaching and learning activities begin this is done to know the initial ability of students in receiving lessons that have not been learned, while posttest is done after the teaching and learning activities this test is done to know the ability of students in receiving lessons that have been learned. The average posttest score in experiment class I increased by 47.44 compared to the average pretest score. The average pretest score in experiment II grade improved learning outcomes compared to the posttest average score of 37. From the data, it can be concluded that the results of studying in experimental class I that applies PBL model are better than the experimental class II that applies TPS model. This is because in experimental class I, learners are required to be able to relate experiences in real life so that learning is more interesting and can pour all ideas and can stimulate and train the students' high-level thinking skills with detail and more time given to solve problems that have been given. This means that each group that has been shared has the same responsibility in managing each group. According to Hmelo-Silver (in Nafiah, 2014:129) PBL learning is a set of learning models that use problems as a focus to develop students' critical skills and thinking in problem solving, materials and self-regulation. The above opinion is in line with research conducted by Rahayu (2017:109), her research results showed that the PBL model improves students' learning achievement, compared to conventional models. Supiandi, et al (2016:61) also explained the PBL learning model emphasizes on improving and improving the way of learning with the aim of strengthening concepts in real situations, developing high-level thinking skills, problem solving skills, improving student learning activity, increasing confidence, responsibility and cooperation.

Normality test is calculated by using *SPSS 18.0 sofware for windows* to find out whether the data is normal distribution or not. This study used normality test with Shapiro wilk technique with a significant level of 5% or 0.05. The reason for the selection of this technique is because the number of samples is < 50 with samples from two classes only 50 students.

The basis of decision making on normality tests

1. If significant > 0,05 then data is normally distributed.
2. If significant < 0,05 then the data is not normally distributed.

Significant values in normality tests for pretest of experimental class I and experimental class II is 0.759, it can be concluded that the data above is distributed normally because a significant value of 0.759 > 0.05. The result of significant value in the posttest of experiment class I and experiment class II is 0.361 > 0.05, it can be concluded that the data is distributed normally.

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Homogeneity test results are the same as normality tests, homogeneity tests are also used to find out if the data obtained is homogeneous or not. This study using homogeny test of variance assisted SPSS 18.0 application with a significant value of 5% or 0.05. The basis of decision making on homogeneity test is if signification is more than 0.05 then data is homogeneous and if signification is less than 0.05 then data is not homogeneous

The significant value in the homogeneity of variance test for the pretest value of experimental class I and experimental class II is 0.759 so it can be concluded that the data is homogeneous because the significant value of 0.759 > 0.05. The result of significant values in the posttest value of experiment class I and experiment II of 0.361 so it can be concluded that the data is homogeneous because the significant value of 0.361 > 0.05. Previous research conducted by Nurdiyanti (2010:100) stated that the results of pretest and posttest data calculation of experimental class I and experimental class II that have homogeneous variance are eligible for t test.

The hypothesis test used in this study is an independent samples test. This test is used to determine whether the hypothesis was accepted or rejected. The hypothesis in this study is "Is there a significant difference between students taught with PBL model and students taught with TPS model on basic law of chemical material at SMA Negeri 1 Gandapura?".

The results of this study hypothesis test were conducted using parametric analysis with SPSS 18.0 for windows program with Independent Samples T-test

Based on independent samples T-test, sig value. (2-tailed) cognitive learning outcomes were 0.00 < 0.05, so H0 was rejected and Ha accepted. With the acceptance of Ha's decision, it can be concluded that there is a significant difference between the learning outcomes of students taught with the PBL model and the TPS model. The results of the hypothesis test using the t test showed that the average value of experiment class I was greater than in the experimental class II. This happens because the learning process (the steps in each model applied) are different. According to Nurisya et al (2017:247) PBL one of the models applied is in the study of biology has been shown to be able to deceive metacognitive abilities and understanding biological concepts.

The implementation of learning in experiment class I using PBL model obtained an average posttest score of 71.72 while the second experimental class that implemented the Think Pair Share (TPS) model obtained an average posttest score of 58.00. When statistical tests are conducted using softwere SPSS 18.0 for windows application on PBL models and TPS models, both have normal and homogeneous data. However, significant differences can be seen based on the test results of the posttest hypothesis that Ha was accepted and Ho rejected. Therefore, from both models it can be stated that there are significant differences in learning taught with PBL model and TPS model. Between them, the PBL model is better than the TPS model. This is because students in the first experimental class taught by the PBL model look more active in understanding problems, thinking in finding solutions to problems provided by teachers, and have a high curiosity.

As explained by Nurdiyanti (2010:100), that PBL learning is a learning model that involves learners to solve a problem through the stages of scientific methods, so that students can learn knowledge related to the problem while having the skills to solve problems. Therefore, the learning results obtained by experimental class I are better than the second experimental

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class. This is because in the experimental class I students think independently first, and it makes the learners have a greater curiosity.

5. CONCLUSION AND RECOMENDATION

Conclusion

Conclusions of the research result and discussion include: (1) In the experimental class I that applies PBL learning model (Problem Based Learning) obtained an average posttest score of 71.72. This value has reached the minimum standard criteria at 70. (2) In the second experimental class that applies TPS (Think Pair Share) model obtained an average posttest value of 58.00. This value does not reach the minimum standard criteria of 70. (3) There is a significant difference between the chemistry learning outcomes of students taught with PBL models in the first class of experiments and experimental class II that applies TPS models with basic chemical law materials. (4) A better learning model is PBL because it provides many opportunities to think about solving problems in a real-world context, as well as having a higher sense of responsibility in managing a group.

Recommendation

Based on the conclusion of the study, it can be suggested several things as follows: (1) PBL and TPS model can be used as an alternative choice of learning model for teachers, especially on the subject of basic law of chemistry. However, due to the weaknesses in this model, it is required that teachers should be able to manage the class well and the material chosen is not difficult. (2) Teachers can use PBL and TPS as reference learning models to be implemented in the classroom.

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