The Differences of Chemistry Learning Outcome Through the Implementation of Think-Talk-Write (TTW) Type of Cooperative Learning Model and Scramble Type in Teaching Atomic Structure

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Received 14 December 2020, Revised 15 January 2021, Accepted 15 February 2021

doi: 10.22487/j24775185.2021.v10.i1.pp36-41

Abstract

This research aimed to determine the differences of chemistry learning outcome through the implementation of scramble type of cooperative learning model and think-talk-write (TTW) type in teaching atomic structure at class XI of SMA Negeri 1 Pamona Selatan. This research was a quasi-experiment with a non-randomized pretest-posttest control group design. It was conducted by arranging two groups in which class XI Natural Science 1 as experimental group 1 ($n = 21$) and class XI Natural Science 2 as experimental group 2 ($n = 20$). The data of the research were analyzed using a one-party t-test statistic with the prerequisite test, normality test, and homogeneity. The result of data analysis obtained, $\bar{X}_1$ value of chemistry learning on the students of experimental class 1 was 79.86 ($SD = 7.15$), whereas in the experimental class 2 students $\bar{X}_2$ value was 73.95 ($SD = 8.26$). The result of hypothesis testing was obtained $t > t_{1-\alpha}$ was $2.55 > 1.68$ with significant level ($\alpha = 0.05$) and degrees of freedom = 42. This showed that H_0 was rejected and H_a was accepted so that it can be concluded that there were differences in chemistry learning outcome through the implementation of scramble type of cooperative learning model and think-talk-write (TTW) type in teaching atomic structure at class XI of SMA Negeri 1 Pamona Selatan.

Keywords: Think-talk-write, scramble, atomic structure, chemistry learning outcome

Introduction

Education is greatly influenced by the quality of the learning process in schools, therefore to improve the quality of education, the learning process continues to be developed. One of them is through cooperative learning innovation.

Chemistry lessons are subjects that tend to be difficult for students to accept and understand because they require a fairly high understanding of concepts. In fact, there are still some difficulties faced by students in understanding and exploring chemistry material. Students often experience difficulties in the understanding process so that which has an impact on the acquisition of learning outcomes that are not optimal (Aisha & Nurhayati, 2013; Iyer, 2013).

Chemistry subject is a subject that requires a broad understanding of concepts in understanding each material because it deals with something abstract from simple concepts to complex concepts. So it requires understanding the correct concept in studying chemistry subjects (Sinaga, 2010). Chemistry is one of the most important branches of science and has been considered a complex subject

for both students and chemistry teachers, researchers, and educators. "Of course, chemistry is one of the most important branches of science and has been regarded as a difficult subject for young students by chemistry teachers, researchers, and educators" (Ozmen, 2004).

One form of learning that can be done is by applying an active and innovative learning model. The cooperative model is a model that is effectively used in the academic field (Gambari, 2013). In the application of the cooperative learning model, the teacher organizes students into small groups and works together to help them understand the learning material (Tran, 2014). Cooperative learning is a learning model used to realize student-centered teaching and learning activities (Isjoni, 2009).

Cooperative learning has been proven to be helpful in encouraging students to take an active role in learning and to recognize fellow students as valuable contributors to the learning process (Solihatina & Öztürk, 2014).

Cooperative learning refers to constructivism, where students are required to learn independently and in groups, construct knowledge;

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students are required to identify existing problems, seek solutions, and adjust the results obtained with the correct results. Science process skills can be improved by making changes or variations in learning models (Glason & Lalik, 1993). The constructivist-based learning model can be applied to the learning process (Rustam & Adli, 2016). Researchers and education experts support the view that student learning can be maximized so that academic performance is enhanced, by developing a sense of "We are all in the same boat together," the basic principle of cooperative learning (CL) (Kupczynski et al., 2012).

The think-talk-write (TTW) type of cooperative learning model is a learning model that can train the ability to think, speak, and write down their opinions. In addition, the think-talk-write (TTW) cooperative learning model can develop the ability to analyze, be responsible, and write, and be able to develop ideas and complete assignments on time, so as to develop the character of curiosity and responsibility in students (Ambari et al., 2013; Yanuarta et al., 2014).

Scramble is a cooperative learning model that can increase student concentration and thinking speed. Scramble learning allows students to interact more with each other in the group to solve questions with available random answers so that learning is more fun and students become enthusiastic about learning (Elisa, 2014).

The two types of cooperative learning have something in common; namely, the teacher asks a problem or question, then students are asked to work together and discuss answers to the problem

or question. (Murti et al., 2014; Maheady, 2016). In addition to the similarities between the TTW and Scramble models, there are also differences between the two cooperative models. The difference between the TTW and Scramble models is that in the TTW type of cooperative learning, students are given the opportunity to think individually, then discuss with the group that has been determined by the teacher, and at the end of the discussion, a presentation is made, then writes the results of the discussion. In the presentation section, each group member is required to share the knowledge and understanding they got during the discussion, but other members may not help the designated members (Amalia & Surya, 2017).

The purpose of writing this article is to obtain information about differences in chemistry learning outcomes of class XI students through the application of the think-talk-write (TTW) type of cooperative learning model with the Scramble type in the atomic structure material in SMA Negeri 1 Pamona Selatan.

Methods

This research is a quasi-experiment. This design uses control group pre-test post-test design Table 1. where: X1 is the TTW type of cooperative learning model; X2 is Scramble type cooperative learning model; Y1 is the pretest value for the experimental class 1 and experiment 2; Y2 is the Posttest Value for the experimental class 1 and experiment 2.

Table 1. Design the static group pratest-posttest design

Class	Pretest	Treatment (Independent Variable)	Posttest
Treatment 1	Y1	X1	Y2
Treatment 2	Y1	X2	Y2

This research was conducted at SMA Negeri 1 Pamona Selatan, Pamona Selatan District, Poso Regency in the odd semester of the 2017/2018 school year. The population in this study were all students of class XI IPA at SMA Negeri 1 Pamona Selatan who were registered in the 2017-2018 school year as many as 41 people consisting of 2 classes. The sample of this study consisted of 2 classes, namely class XI IPA 1, amounting to 21 students, and class XI IPA 2, amounting to 20 students. The sampling technique used was saturated sampling.

The data collection techniques in this study were obtained from the teaching and learning process through the initial test, worksheets, and the final test of learning outcomes on the atomic structure material given to students.

This research was carried out in three stages, namely the preparation stage, the implementation stage, and the final stage which are shown below:

1) Preparation phase

The preparation stage includes a preliminary study. Designing a learning implementation plan (RPP) with the TTW cooperative learning model, including learning and student worksheets for experimental class 1 and learning implementation plans (RPP) with the Scramble type cooperative learning model for the experimental class 2. Learning for atomic structure material was carried out 3 times meeting. RPP is a guide for teachers to prepare, organize, and evaluate the results of learning and learning activities.

2) Implementation Stage

The implementation stage includes: validate the test questions used so that the test questions are obtained after validation. Give a pre-test to experimental class 1 and experiment class 2. Carry out the teaching and learning process by applying the TTW type cooperative learning model in experiment class 1 and the scramble type cooperative learning model in experimental class 2. Give a final test to the experimental class 1 and experimental class 2 to obtain data on students' chemistry learning outcomes (posttest).

3) Final Stage

At this stage, the researcher processes and analyzes the data obtained during the implementation stage and produces a report on the research results. Hypothesis testing in this study uses the right side t-test. The statistical hypothesis is if it has preconditions:

H_0 : There is no difference in student learning outcomes between those using the TTW cooperative learning model and the Scramble type

H_1 : There are differences in student learning outcomes between those using the TTW type of cooperative learning model and the Scramble type

The mathematical hypothesis is:

$H_0 : \mu_1 \leq \mu_2$ and $H_1: \mu_1 > \mu_2$

where

μ_1 = student learning outcomes using the TTW cooperative learning model;

μ_2 = student learning outcomes using the Scramble type cooperative learning model.

The test criterion is that H_0 is accepted if $t \leq t_{1-\alpha}$ and rejects H_0 if it has other prices. Degrees of freedom for the t-test distribution list ($n_1 + n_2 - 2$) with odds $(1 - \alpha)$ with $\alpha = 0.05$ (Sudjana, 2013).

Results and Discussion

During the process of teaching and learning activities in class XI IPA 1 using the Think-Talk-Write (TTW) type of cooperative learning model and XI IPA 2 using the Scramble type cooperative learning model in SMA Negeri 1 Pamona Selatan, which includes students chemistry learning outcomes.

Instrument Analysis

The research instrument used in this study was a validated multiple-choice test. This validation is carried out as an evaluation tool in education which has an important role in measuring student achievement because a good test needs to pay attention to its validity and reliability as a measuring tool if it meets the test requirements.

The instrument test results were analyzed using the AnatesV4 application to determine the validity, reliability, difficulty level, and distinguishing power of each item of the instrument (To & Wibisono, 2009). The results of the instrument analysis obtained from the 40 questions tested were obtained 20 questions including the valid category and 25 questions including the invalid category. Furthermore, 20 questions are used to measure student learning outcomes in class XI IPA SMAN 1 Pamona Selatan.

Student learning outcomes are one aspect of the achievement of research conducted in addition to looking at the teaching and learning process. Student learning outcomes were obtained from multiple-choice tests given after the overall teaching and learning activities for the Atomic Structure material ended (posttest). The learning outcome data came from 21 students of Class XI IPA 1 and 20 students of Class XI IPA 2.

The data on the value and frequency of the final test of chemistry learning outcomes of experimental class 1 and experimental class 2 students are shown in Table 2.

Table 2. The range and frequency of the final test score of chemistry learning results in experiment class 1 and experiment class 2 students

Experiment Class 1		Experiment Class 2	
Class intervals	Fi	Class Interval	Fi
60-64	8	55-63	7
65-69	3	64-72	2
70-74	2	73-81	1
75-79	4	82-90	4
80-84	3	89-99	4
85-89	1	100-108	2
Total	21	total	20

Based on the data on student learning outcomes in Table 2, it can be seen that the average value of experimental class 1 using the Think-Talk-Write (TTW) type of cooperative learning model is lower than the average value of experimental class 2

using the Scramble-type cooperative learning model.

Comparative analysis data of the final test of chemistry learning outcomes in experimental class 1 and experimental class students are summarized in Table 3.

Table 3. Comparison of chemistry learning outcomes in experiment class students 1 and experiment class 2

Description	Final Test (PostTest) Students	
	Experiment Class 1	Experiment Class 2
Sample	21.00	20.
Lowest score	60.00	55.
The highest score	85.00	100.
Average score	70.57	77.
Standard deviation	8.53	17.

Analysis of Learning Outcomes Data

Data analysis in this study consisted of normality testing, homogeneity testing, and hypothesis testing.

Normality Testing

The normality test aims to determine whether the data is normally distributed or not by using the chi-square formula. The normality test is said to be normal if $\chi^2_{\text{count}} \leq \chi^2_{\text{table}}$.

a). Experiment Class 1

The calculation results obtained data $\chi^2_{\text{count}} = 11.4$ and $\chi^2_{\text{table}} = 5.99$. Score $\chi^2_{\text{count}} \geq \chi^2_{\text{table}}$, that is $11.4 > 5.99$ which indicates the data obtained is not normally distributed.

b) Experiment Class 2

The calculation results obtained data $\chi^2_{\text{count}} = 12.61$ and $\chi^2_{\text{table}} = 5.99$. Score $\chi^2_{\text{count}} \geq \chi^2_{\text{table}}$, that is $12.61 > 5.99$, which indicates the data obtained is not normally distributed.

Homogeneity Testing

One of the conditions in the homogeneity test states that the difference between the two classes taken as a sample must be homogeneous, namely that the two samples have the same variance, by performing the F test. Based on the results obtained, the largest variance is 17, and the smallest variance is 8.53, so that the F value = 1.99 and F table = 2.18 with a significant level (α) = 0.05 and db = (20; 19).

Because the value obtained meets the criteria $F_{\text{count}} < F_{\text{table}}$ ($1.99 < 2.18$), it can be concluded that there is no difference in variance between the two classes so that the data is homogeneous.

Hypothesis Test

The purpose of this test is to differentiate the learning outcomes of chemistry using the think-talk-write (TTW) type of cooperative learning model with the same or different Scramble type.

The testing criterion is if $t_{\text{count}} \leq t_{\text{table}}$ then H_0 is accepted and H_a is rejected. So that the t_{count} is 6.72 and the price of t_{table} equal to 1.70 with a significant level $\bar{I} = 0.05$ and $dk = 41$. Based on the data obtained $t_{\text{count}} \geq t_{\text{table}}$ ($6.72 \geq 1.70$). So H_0 is rejected, and H_a is accepted, so it can be concluded that there are differences in student learning outcomes using the think-talk-write (TTW)

cooperative learning model with the Scramble type in the Atomic Structure material.

This research is an experimental study that aims to determine differences in the learning outcomes of class XI students through the application of the scramble type cooperative learning model with the think-talk-write (TTW) type on the atomic structure material in SMA Negeri 1 Pamona Selatan.

The difference was made in the experimental class 1 and the experimental class 2, namely in the experimental class 1 using the think-talk-write (TTW) learning model, while in the experimental class 2 using the scramble learning model. The purpose of this study was to determine the differences in learning outcomes of class XI students through the application of the Scramble-type Cooperative Learning model with the think-talk-write type (TTW) on the atomic structure material at SMA Negeri 1 Pamona Selatan.

At the first meeting, both in experimental class 1 and the experimental class 2, a preliminary test was carried out which aims to test the extent to which students' understanding of the material to be taught to them, the value obtained is used as the pretest value. Then at the second, third, and fourth meeting, the learning process is carried out in accordance with the Learning Implementation Plan (RPP). At the last meeting, a final test was carried out which aims to determine the differences in student learning outcomes achieved in both the experimental class 1 and the experimental class 2, the final score obtained is used as the posttest score. The instrument used in the pre-test and in the final test is a written instrument that has been validated in the form of multiple choices with a total of 20 questions that have been previously validated.

Cooperative learning model type Scramble is a game that can be played by 2 or 4 people in a group; in this game, the players have to reconstruct words from letters, sentences from words, and discourse from scrambled sentences. (Harjasurjana & Mulyati, 2007) Scramble type learning has similarities with other learning models. Students are randomly grouped based on high, medium, and low abilities. If possible, group members come from different cultures, races, ethnicities, and genders.

Based on the results of research and data analysis, it was found that the chemistry learning outcomes of students in the class treated by using

the think-talk-write (TTW) type of cooperative learning model were lower than in the class using the Scramble-type cooperative learning model on atomic structure material. This can be seen from the mean value obtained by the experimental class students 1 = 70.57 with a standard deviation = 8.53 and the mean value of experimental class 2 students = 77.90 with a standard deviation = 17.00.

Whereas for data analysis using the t-test of one party right, both the experimental class 1 and the experimental class 2 which have data that are not normally distributed where for the experimental class 1 value $\chi^2_{\text{count}} \geq \chi^2_{\text{table}}$ ($11.4 > 5.99$) while for the experimental class 2 the value of $\chi^2_{\text{count}} \geq \chi^2_{\text{table}}$ ($12.61 > 5.99$) and the data is homogeneous because it has a homogeneous variance where $F_{\text{count}} < F_{\text{table}}$ ($1.99 < 2.18$) and t-test analysis obtained $t_{\text{count}} \geq t_{\text{table}}$ ($6.72 > 1.70$). Based on these data, it is clear that t_{count} is in the area of Ho's rejection, so Ho is rejected, and Ha is accepted, so it can be concluded that there are differences in chemistry learning outcomes of class XI students through the application of cooperative learning model Think-Talk-Write (TTW) with Scramble type on the atomic structure at SMA Negeri 1 Pamona Selatan.

Data analysis of student learning outcomes (posttest) shows that student learning outcomes in experimental class 1 are lower than those in experimental class 2. The difference in student learning outcomes in experimental class 1 and experimental class 2 is due to the influence of the learning model applied in that class. In experimental class 1, the think-talk-write (TTW) learning model is applied where students are required to think, speak and write down their respective opinions then discuss it again with group friends, and in practice, the students are still confused and are still discussing or asking their friends when writing down possible answers at the thinking stage and students' courage to present the results of the discussion in front of the class is still lacking. So that the researcher gave more assertive directions to students when writing answer ideas at the thinking stage, students were not allowed to discuss or ask their friends so that the understanding of the concepts possessed by each student could last a long time. Whereas in experimental class 2, the Scramble learning model was applied where students could study the material casually and without pressure because the scramble learning model allowed students to learn while playing. In this learning model, there are no students or group members who are passive or silent. This is because each member of the group has the responsibility for the success of his group, whereas in experimental class 1 there tends to be a selection of group representatives to express their opinions representing the group and only for students who have above average abilities or are only dominated by a student who is very active in his group. This made the rest of the homegroup less active in the discussion.

Conclusions

There is a significant difference in students' chemistry learning outcomes using the TTW cooperative learning model with the chemistry learning outcomes of students using the Scramble type cooperative learning model on atomic structure material. This can be seen from the posttest average score of each class, namely the experimental class 1 = 70.57 and the experimental 2 = 77.00.

Acknowledgments

The authors gratitude goes to I Made Suata, as a chemistry teacher at SMA Negeri 1 Pamona Selatan, and all those who have helped the author in completing this research.

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