Application of the Active Learning Strategy Type True False Chain to Improve Student’s Achievement on Solubility and Solubility Product Constant Subject

Miftahul Jannah\textsuperscript{1*}, Elva Yasmi Amran\textsuperscript{2}, and Rasmiwetti\textsuperscript{3}

\textsuperscript{1,2,3}Department of Chemistry Education, FKIP, Universitas Riau, Pekanbaru, Indonesia

miftahuljannah101092@gmail.com, elvayasmiamran@gmail.com, rasmiwetti.19@gmail.com

*Corresponding Author
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Abstract: The research about application of the active learning strategy type True False Chain has been done to improve student’s achievement on solubility and solubility product constant subject in class XI IPA MAN 1 Pekanbaru. This research is experimental research based on pretest-posttest design. The samples of this research were the students of class XI IPA 4 as the control class and students of class XI IPA 3 as the experimental class that randomly selected after testing homogeneity. Experimental class is a class that is applied active learning strategy type of True False Chain, while the control class was not. Data analysis technique used is the t-test. Based on analysis of data we obtain \( t_{\text{count}} > t_{\text{table}} \) i.e. \( 2.80 > 1.67 \). It means that the application of active learning strategy type true false chain can improve student achievement on the subject of solubility and solubility product constant in class XI IPA MAN 1 Pekanbaru where the effect of an increase is 10.10\%.

Keywords: Active Learning Strategy Type True False Chain; Learning Achievement; Solubility and Solubility Product Constant.

1. Introduction

The learning process is a process that occurs due to the interaction between a person and the environment, among others consisting of students, teachers, principals, material or subject matter and a variety of learning resources and other facilities [2].

The learning process needs to be oriented to the needs and abilities of students. The activities implemented should provide a fun learning experience and useful to them [6]. To improve the learning process of students, teachers should be able to choose and apply the appropriate learning ways to improve student’s achievement. If the teacher managed to create an atmosphere that led to motivated students actively in learning, it allows an increase in achievement [3].

Based on interviews with one of chemistry teacher in class XI IPA MAN 1 Pekanbaru, chemistry learning achievement of students on the subject of the solubility and solubility product constant is still relatively low. This is evident from the low achievement of students caused a lot of students who daily test values obtained by the student on the subject of the solubility and solubility product constant has not reached the minimum completeness criteria (KKM) is 78. This is caused by the teacher used to use teaching methods that dominated the teacher so that the lack of student activity at the time following the learning process. Students just heed and listen to the information or knowledge provided by the teacher, so that students feel bored, indifferent to the tasks given, many students who modeled his work and did not try to resolve itself. Conditions are not conducive to make the teachers are very active, whereas the students become passive. Students are less motivated and often do not pay attention to the teacher explaining the lesson so that result in low student achievement that is visible from the average value of repeat obtained by the student.
One of the strategies that will be able to overcome these problems is by the application of active learning strategy type *True False Chain*. Stated strategy type *True False Chain* is a development of the strategy true or false. Active learning strategy type *True False Chain* is to encourage cooperation of students in the study group [7].

In general, measures of active learning strategy type *True False Chain* are as follows [7]:

1. Define the topics to be studied, and also specify the reading material.
2. Make some statements about the reading text that contains elements of true or false.
3. The statements had been grouped into several groups and each group is written on a piece of paper. Each paper marked A, B, C, D, E, and F.
4. The students are divided into 6 groups according to the amount of paper statements made.
5. Each group was given a paper that had contained statements. This will be obtained by group 1 holding the paper, group 2 holds paper B, group 3 holds paper C, group 4 holding the paper D, group 5 holding a paper E, and group 6 holding the paper F.
6. The task of each group is to write statements they have then discuss whether these statements true or false for a predetermined time (Each paper statements have the same time to do it). Note: The paper should not be written or given any sign.
7. After all the groups complete tasks rotated paper to be given to the group side. With this second group will receive paper A, group 3 received the paper B, group 4 received the paper C, group 5 receiving paper D, Group 6 receives the paper E, and group 1 received a paper F.
8. After each group received the new paper assignment as in step (f) is repeated.
9. After finished, repeat steps (g) and step (f), and so on until all groups have all the papers.
10. Teacher is clarified by reading the statements there. Each group asked their answers and compared with the other group answers.
11. Do it until completed or accordance with the time and conditions possible.

Active learning strategy type *True False Chain* is basically built through the process of thinking, cooperation in group, fast learning, and help each other then poured through writing. This strategy can improve the activity of students in each group, this can create optimal interaction so as to develop the potential of the students. This activity will certainly influence on student achievement [7]. This study aims to determine the improvement of student achievement on the subject of solubility and solubility product constant with the application of the active learning strategy type *True False Chain* in class XI IPA MAN 1 Pekanbaru. It also aims to determine the effect of the application of active learning strategy type *True False Chain* toward improving student achievement on the subject of solubility and solubility product constant in class XI IPA MAN 1 Pekanbaru.

2. Related Works

The research related to the implementation of active learning strategy type *True False Chain* has been done on the physics lesson in class X.3 SMAN 1 Kencong which concludes that the implementation of active strategy type *True False Chain* can improve student learning activity and the completeness of student learning outcomes by 5%. Active learning strategy type *True False Chain* can build the attention or interest of the students without coercion, to train students to be ready to follow the learning activities since the beginning of the lesson, to train students to be more confident in choosing an answer, and stimulate students to fast thinking [5].

Furthermore, Dona (2013) conducted research on mathematics learning in class VII SMPN 2 Linggo Sari Baganti. The result of this research concludes that the understanding of mathematical concepts of students with the application of strategy type *True False Chain* is better than the result of learning mathematics of students using conventional learning with the average of experimental class 74.53 and the mean of control class 54.14. During the implementation of active learning strategy type *True False Chain* student activities each meeting is better and students are also seen more actively cooperate in the group [4].
3. Material & Methodology

3.1. Data

Technique of collecting data in research is test technique. The data collected were: (1) The homogeneity test result (prerequisite material), (2) Pretest: performed in both classes before learning of solubility and solubility product constant, and (3) Posttest: given to both classes after learning of solubility and solubility product constant. While the data analysis technique used in the study is t-test.

3.2. Method

The research design is Pretest-Posttest Design Randomized Control Group can be seen in Table 1 [9].

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>$T_0$</td>
<td>X</td>
<td>$T_1$</td>
</tr>
<tr>
<td>Control</td>
<td>$T_0$</td>
<td>-</td>
<td>$T_1$</td>
</tr>
</tbody>
</table>

Where:
- $T_0$ : Initial data (data before treatment), taken from pre-test value
- X : Treatment of learning is strategy type True False Chain on solubility and solubility product constant subject
- $T_1$ : The final data (data after treatment), is obtained from the post-test value

T-test statistics can be performed based on the criteria of normally distributed data. Therefore, before the data processing, first tested the normality using Liliefors test. If $L_{\text{max \ count}} < L_{\text{table}}$, then the data is normally distributed. $L_{\text{table}}$ is obtained from the formula as follows [1]:

$$L = \frac{0.886}{\sqrt{n}}$$  \hspace{1cm} (1)

After the data is normally distributed, then the homogeneity test is done by testing the variance of both samples (homogeneous or not) firstly, by using the formula:

$$F = \frac{\text{Varians Terbesar}}{\text{Varians Terkecil}}$$  \hspace{1cm} (2)

Both samples are said to have the same or homogeneous variance if $F_{\text{count}} < F_{\text{table}}$, where $F_{\text{table}}$ is obtained from the distribution of F with probability $\alpha$, where ($\alpha = 0.05$) and $dk = (n_1 - 1, n_2 - 2)$. Hypothesis test is done by using the right-t test with the formula as follows:

$$t = \frac{x_1 - x_2}{S_g \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$  \hspace{1cm} (3)

The combined standard deviation can be calculated using the following formula [12]:

$$S_g^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$  \hspace{1cm} (4)

The hypothesis is accepted if $t_{\text{count}} > t_{\text{table}}$ with probability criterion 1 - $\alpha$ ($\alpha = 0.05$ and $dk = n_1 + n_2 - 2$), for the other price t, the hypothesis is rejected. To determine the large increase in student achievement on the subject of solubility and solubility product constant through implementation of active learning strategy type True False Chain, calculation coefficient of determination by formula:

$$K_p = r^2 \times 100\%$$  \hspace{1cm} (5)

Where, $r$ and $t$ can be calculated using the formula [11]:

$$r^2 = \frac{t^2}{t^2 + n - 2} \quad \text{and} \quad t = \frac{r\sqrt{n - 2}}{\sqrt{1 - r^2}}$$  \hspace{1cm} (6)
4. Results and Discussion

4.1. Result

The results of data processing analysis in this study include the results of data processing analysis of homogeneity test, the results of hypothesis test data analysis and the coefficient of influence described as follows:

a. Homogeneity Test

Data used to test homogeneity in this research is data obtained from the value test prerequisites material of solubility and solubility product constant that subjects is chemical calculation, chemical equilibrium, and acid base. Before the homogeneity test, normality test data to see normal distributed data or not. The results of normality test data analysis of test items prerequisite samples 1 and 2 can be seen in Table 2.

<table>
<thead>
<tr>
<th>Class</th>
<th>n</th>
<th>$\bar{X}$</th>
<th>Sd</th>
<th>$L_{max, count}$</th>
<th>$L_{table}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>36</td>
<td>61</td>
<td>12.9835</td>
<td>0.0721</td>
<td>0.1477</td>
</tr>
<tr>
<td>Sample 2</td>
<td>36</td>
<td>60.2222</td>
<td>12.8622</td>
<td>0.1067</td>
<td>0.1477</td>
</tr>
</tbody>
</table>

Where:
- $n = \text{total of students}$
- $\bar{X} = \text{value average of the prerequisite material test results}$
- $\text{Sd} = \text{standard deviation}$
- $L = \text{statistical symbol to test the normality (Liliefors test)}$.

After the normality test, the data homogeneity test is performed. The data were first tested for variance and then tested the similarity of two parties to know the homogeneity of the two classes. The variance test is performed as a requirement of the homogeneity test because the tested data must have the same variance. The result of data processing analysis for homogeneity test can be seen in Table 3.

<table>
<thead>
<tr>
<th>Class</th>
<th>n</th>
<th>$\Sigma X$</th>
<th>$\bar{X}$</th>
<th>$F_{table}$</th>
<th>$F_{count}$</th>
<th>$t_{table}$</th>
<th>$T_{count}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>36</td>
<td>2196</td>
<td>61</td>
<td>1.76</td>
<td>1.02</td>
<td>2.00</td>
<td>0.26</td>
</tr>
<tr>
<td>Sample 2</td>
<td>36</td>
<td>2168</td>
<td>60.2222</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where:
- $n = \text{total of students}$
- $\Sigma X = \text{total value of the prerequisite material test results}$
- $\bar{X} = \text{value average of the prerequisite material test results}$
- $F = \text{statistical symbol for the variance test}$
- $t = \text{statistical symbol for homogeneity test}$.

b. Hypothesis Test

Data used to test the hypothesis in the research is the difference between posttest and pretest value in both groups that is experimental class and control class which shows the magnitude of student achievement improvement before and after learning solubility and solubility product constant with and without using active learning strategy type True False Chain. Posttest and pretest data were first tested for data normality. The result of normality test of pretest data of experimental class and control class can be seen in Table 4.
Application of the Active Learning Strategy Type True False Chain to Improve Student’s Achievement on Solubility and Solubility Product Constant Subject

Table 4. Test Result of Normality of Pretest Data

<table>
<thead>
<tr>
<th>Class</th>
<th>n</th>
<th>X̄</th>
<th>Sd</th>
<th>L_max count</th>
<th>L_table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>36</td>
<td>36.4444</td>
<td>9.4065</td>
<td>0.1020</td>
<td>0.1477</td>
</tr>
<tr>
<td>Control</td>
<td>36</td>
<td>36.1111</td>
<td>10.3199</td>
<td>0.0734</td>
<td>0.1477</td>
</tr>
</tbody>
</table>

Where:
- n = total of students
- X̄ = value average of pretest sample
- Sd = standard deviation of pretest
- L = statistical symbol to test the normality (Liliefors test)

While the result of normality test of posttest data of experimental class and control class can be seen in Table 5.

Table 5. Test Result of Normality of Posttest Data

<table>
<thead>
<tr>
<th>Class</th>
<th>n</th>
<th>X̄</th>
<th>Sd</th>
<th>L_max count</th>
<th>L_table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>36</td>
<td>77.4444</td>
<td>7.8356</td>
<td>0.1172</td>
<td>0.1477</td>
</tr>
<tr>
<td>Control</td>
<td>36</td>
<td>71.5556</td>
<td>10.3770</td>
<td>0.1443</td>
<td>0.1477</td>
</tr>
</tbody>
</table>

Where:
- n = total of students
- X̄ = value average of posttest sample
- Sd = standard deviation of posttest
- L = statistical symbol to test the normality (Liliefors test).

Normally distributed pretest and posttest data can be used subsequently for hypothesis test. The results of hypothesis test analysis can be seen in Table 6.

Table 6. Hypothesis Test Results

<table>
<thead>
<tr>
<th>Class</th>
<th>n</th>
<th>∑X</th>
<th>X̄</th>
<th>Scombined</th>
<th>ttable</th>
<th>T_count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ekexperimental</td>
<td>36</td>
<td>1476</td>
<td>41</td>
<td>8.40</td>
<td>1.67</td>
<td>2.80</td>
</tr>
<tr>
<td>Control</td>
<td>36</td>
<td>1276</td>
<td>35.4444</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where:
- n = total of students
- ∑X = number of posttest and pretest difference values
- X̄ = the average value of posttest and pretest differences
- Sgab = the combined standard deviation.

Based the homogeneity test on the Table 2 shows that normality test value of prerequisite materials in sample 1, L_max count was smaller than L_table, 0.0721 < 0.1477 same as in sample 2, L_max count was smaller than L_table, 0.1067 < 0.1477 means that the test value data of the prerequisite materials of both sample classes is normally distributed. Than the Table 3 shows that the value of F_count = 1.02 and F_table = 1.76 at α = 0.05 with dk (35,35) from distribution list F which means F_count was smaller than F_table, 1.02 <1.76 means that both groups of samples have the same variance (homogeneous).

Based the Hypothesis test on the Table 4 shows that the value of pretest normality in experimental class, L_max was smaller than L_table, 0.1020 < 0.1477, same as in control class, L_max value was smaller than L_table is 0.0734 < 0.1477 means that the pretest data of both classes is normally distributed. Than the Table 5 shows that the value of posttest normality in the experimental class, L_max was smaller than L_table, 0.1172 < 0.1477, the same as in the control class, the value of L_max count was smaller than L_table, 0.1443 < 0.1477 means that posttest data of both classes are normally distributed.

Hypothesis test is done by using t-test one side (1-α) with α = 0.05 and known dk = n₁ + n₂ - 2 = 70 to know whether hypothesis in this research accepted or not. From the Table 6 can be seen that the
value of $t_{\text{count}}$ was greater than $t_{\text{table}}$, $2.80 > 1.67$, therefore hypothesis: "Application of the Active Learning Strategy Type True False Chain to Improve Student’s Achievement on Solubility and Solubility Product Constant Subject" is acceptable.

Based on result above, it can be seen that the percentage of increase students achievement (influence coefficient) is obtained from the coefficient of determination ($r^2$). After doing analysis of data obtained determination coefficient of 0.1010. Great influence coefficient ($K_p$) can be found by multiplying the value of the coefficient of determination by 100%, so obtained the percentage coefficient of influence ($K_p$) of 10.10% means that the application of active learning strategy type True False Chain give effect to improve students achievement on the solubility and solubility product constant subject in class XI MAN 1 Pekanbaru.

4.2. Discussion

Increased student achievement experimental class on the subject of the solubility and solubility product constant by the application of active learning strategy type True False Chain is due to the influence of active students in the learning process. Student activity seen when students collaborate and help each other in a group discussion to solve the existing problems on the paper statement questions true false chain, spurring students to active learning. This is in accordance with the views expressed by [8] that the learning activities together in a group can help stimulate active learning. As the discussion progresses, students actively interact and discuss the mind to solve problems that have to be determined in the form of a statement is true or false and give a good reason for each statement on the paper statement true false chain questions given so that students will acquire maximum learning outcomes.

After discussing the answers, the students write the results of the discussion in the form of the reason of the answers they get. The work on the paper statement true false chain questions is limited time for 4 minutes each time the rotation. Each group received a different question every time exchanged. Rotation different chain questions in each of these groups meant that students can’t cheat an answer other groups so that students will be better prepared to understand and work on a job.

Workmanship chain questions and limited time make students more quickly complete the task and disciplined with time, so that when the discussion took place no student is playing around in a group and the students are more focused in the discussion so that a given task can be done in time. In addition, students will be trained to think more quickly to solve a given problem. This is consistent with the statement by [5] that the active learning strategy type True False Chain can train and stimulate students to think more quickly so that a given task can be done right at a predetermined time.

Once the work is completed discussion, the teacher pointed to 1 students at random to present the answers of the group, so that each student has the same sense of responsibility to the group's success in understanding and completing a given task. Each student will prepare as much as possible in order to obtain a good value and boasts a group so that students become more active in the learning process. This is consistent with the statement by [8] that one way for students to learn actively and productively in the group is by random assignment.

When students make a presentation, other groups are allowed to ask, answer or respond to the results of the discussion group renderers. These activities will clarify the students' knowledge and understanding. The involvement of students in asking, answering or responding also shows the active role of students in participating in the learning process so that will affect the study results. This is consistent with the statement by [10] that actively engage learners to learn, ask, and answer, as well as interact with each other to discuss the learning materials will affect the study results.

Obstacles encountered when research is the first meeting of the implementation of active learning strategies type True False Chain, there are some groups that have not been able to resolve the matter in a paper statement in accordance with a predetermined time. It causes that the group holds the paper statement is true, one chain should have been exchanged into groups beside. To overcome this problem, each time the questions completed by the group, the teacher took the paper's reply statement true false chain questions from each group, so that during the discussion of each group will be responsible for working on each sheet a statement on time.
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5. Conclusion

Based on the results of data analysis and discussion then it can be concluded:

a. The application of active learning strategy type True False Chain can improve student achievement on solubility and solubility product constant subject in class XI IPA MAN 1 Pekanbaru.

b. Percentage of increasing student achievement through the application of active learning strategy True False Chain on solubility and solubility product constant subject in grade XI IPA MAN 1 Pekanbaru is 10.10%.

c. Active learning strategy True False Chain can be used as an alternative learning strategies to improve student achievement, especially on solubility and solubility product constant subject.

d. The next researcher is expected to apply active learning strategy type true false chain on other subject.

e. For the next researcher who want to apply active learning strategy type True False Chain is expected to equalize the level of statement questions true false chain, so that each group of students can work on the questions in accordance with a predetermined time. Thus, no time is less and the time remaining in the work on any given questions.

References