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## The Effectiveness of Collaborative Learning Through Techniques on Group Investigation and Think Pair Share Students' Critical Thinking Ability on Chemical Equilibrium Material

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### ABSTRACT

The purpose of this study was to determine the differences in the improvement of students' thinking skills using collaborative learning techniques Think-Pair-Share and Group Investigation. The research used was a quasi-experimental research design with non equivalent control posttest design. The data collection technique used critical thinking skills questions consisting of 5 essay test questions. Based on the research results of hypothesis testing using paired simple t-test, the results obtained were sig (2-tailed)  $<0.05$ , which means that collaborative learning of GI and TPS techniques is effective on critical thinking skills than the control class. Hypothesis testing is to see significant differences between collaborative learning. TPS and GI techniques used independent sample t-test and the results obtained were sig (2-tailed)  $<0.05$ , which means that there is a significant difference between collaborative learning of GI and TPS techniques on critical thinking skills. For the average percentage of critical thinking skills in the collaborative learning class, the Think-Pair-Share technique is 80.57% and Group Investigation is 76.73%, and in the control class it is 68.45%, which means the application of collaborative learning techniques Think-Pair-Share is more effectively used in improving students' critical thinking skills on chemical equilibrium material.

## 1. Introduction

Education has a very important role in improving human resources in a country, because with education, it can create a generation that is superior and competitive in facing challenges that will occur in the future (Permen, 2006). In the implementation of education, sometimes there are many problems in the learning

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process, for example the interaction between teachers and students where during the learning process students often do not pay attention to the learning.

One of the efforts made by the government to improve the quality of an education nation is through changes in the learning process in the curriculum. In this 2013 curriculum, educators are also required to be facilitators and motivators for students so that students must be more active in the learning process which requires students to have critical thinking skills. Critical thinking is considered important to be developed in schools at every level of education. An understanding of students' critical thinking skills can be used by teachers in designing and determining learning objectives to be achieved, so it is necessary for teachers to monitor the development of students' critical thinking skills (Fischer., 2009). This thinking skill allows humans to see multiple perspectives to solve problems in certain situations. Thinking is also caused because of a situation of doubt or problems that arise. According to the Islamic view, thinking is a function of reason that pays attention to energy so that the human brain can work and operate. This power is obtained through meditation (Rusyna, 2014).

Critical thinking skills can be done using collaborative learning. Collaborative learning makes it easier for students to learn and work together, contribute to each other's thoughts and be responsible for the achievement of learning outcomes in groups and individually (Zubaidah, 2010). Collaborative learning has many types or types, one of which is through techniques Group Investigation and Think Pair Share.

The Group Investigation (GI) technique is a collaborative learning technique that involves students from planning, both in determining the topic and the way to study it through investigation. The GI method requires students to work together to help each other in groups and choose topics to be studied, then each group presents or displays their findings in front of the class (Salamah et al., 2016). The advantages of Group Investigation (GI) are that in the learning process they can work freely, encourage initiative, be creative, and active, can increase self-confidence, can learn to solve, deal with problems, develop enthusiasm and a sense of the physical, improve learning work together, learn to communicate both with one's own friends and teachers, learn to communicate well systematically, learn to respect other people's opinions, increase participation in making decisions, and students are trained to be accountable for the answers given (Barkley., 2014).

Meanwhile Think Pair Share is collaborative learning where students think about their responses to a problem that has been given by the teacher, then discuss the solution with their partner and share the solution in front of the class. The advantage of the learning technique think pair share is that it gives students the opportunity to work alone and collaborate with others (Tint et al., 2015). Learning type think pair share has three stages, namely stage thinking(thinking),stage pairs(pairing),and phase (sharing) (Arianti., 2020). Another advantage of this technique is the optimization of student participation. This technique provides

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more opportunities for each student to be recognized and show their participation to others (Surayya et al., 2014).

Based on the results of previous research conducted by Asyari., 2016 states one of the conclusions is that group investigation and problem-based learning can improve critical thinking skills. Budiastra et al., 2015 stated that there was a significant influence on students' critical thinking skills who were taught by group investigation. Puspita et al., 2016 stated that collaborative instructional games and group investigation models were able to improve learning outcomes for high school students.

The technique group investigation and think pair share are collaborative learning techniques recommended by the curriculum in the learning process. The technique group investigation and think pair share have something in common in developing problem-solving skills. In the learning process of the techniques group investigation and think pair share, students were required to work together between students in the group and with their teachers. Collaborative learning requires students to have critical thinking skills in the learning process.

Besides that, there is also a difference between the technique group investigation and think pair share, the difference between the two lies in the concept of learning. This technique group investigation involved students from the beginning of learning starting from material selection to solving problems. Meanwhile, think pair share focuses students on learning with discovery, and students are given a stimulus to solve problems (Kaddoura., 2013).

Based on the results of the preliminary study, the learning process at MA Darul Hikmah has not implemented the collaborative learning process optimally. This is due to the large number of subjects taught at school and the many activities outside formal learning hours, causing students to be less active during the learning process. The results of observations from the chemistry teacher and when the learning took place in class XI MA Darul Hikmah, the learning process was still teacher centered, students' critical thinking skills were also lacking because teachers rarely gave HOTS questions that could train students' thinking skills. Critical thinking as a component in higher-order thinking processes uses the basis of analyzing arguments and generating insights into each meaning and interpretation, to develop cohesive and logical patterns of reasoning (Liliasari., 2003).

In the classroom, the learning process is more directed at students' ability to memorize information. Therefore, teachers are required to provide innovations in chemistry learning so that students can think critically in the learning process, one of which is by using collaborative learning. In this study, a collaborative learning process will be carried out in class. When collaborative learning takes place in class, it is hoped that students will critical thinking skills, develop so that the learning process in the classroom runs effectively, especially when studying chemistry.

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Chemistry is one of the subjects which until now has been difficult to understand both concept and application. This causes most students to find it difficult to study this knowledge more deeply, because it is difficult to understand this knowledge in general, students only understand it at the level of memorization. So that when students are faced with problems related to everyday life, they still have difficulty analyzing, because chemistry contains many abstract concepts such as symbols, structures, reactions and structured chemical processes.

In addition, chemistry contains various kinds of problems that require a high enough level of thinking because it involves all aspects so that students are required to master all the concepts being taught. One matter on chemistry learning is often considered difficult by students in grade XI MA is a Chemical Equilibrium. The subject matter of chemical equilibrium has a large number of scientific concepts that are interrelated with one another. In addition, this material has quite a complex content, from material that is knowledgeable to analysis, and cannot be separated from calculating questions. Various kinds of student difficulties in understanding this material can come from each sub-subject, both concepts and calculation skills.

Based on the description and problems above, this research will conduct collaborative learning using Group Investigation (GI) and Think Pair Share techniques and see the effectiveness of these two techniques in improving students' critical thinking skills.

## 2. Methodology

This research was conducted at MA Darul Hikmah Pekanbaru. This research was conducted in two experimental classes, using *non-equivalent posttest control design*. The experimental design in this study is in accordance with the opinion of Wiersma (2009: 169). The first experimental class is a class that applies collaborative learning with the technique *group investigation* (GI), the second experimental class is a class that applies collaborative learning using the technique *think pair share* (TPS). In this study, was used *posttest* to measure the effectiveness of collaborative learning on students' critical thinking skills by using an instrument in the form of a chemical equilibrium test.

Table 1. Research Design

Group	Dependent Variable Critical Thinking Skills (B <sub>1</sub> )
Control Class (A <sub>0</sub> )	A <sub>0</sub> B <sub>1</sub>
Experiment 1 (A <sub>1</sub> )	A <sub>1</sub> B <sub>1</sub>
Experiment 2 (A <sub>2</sub> )	A <sub>2</sub> B <sub>1</sub>

Source: Sugiyono., 2017

Description:

- A<sub>0</sub>B<sub>1</sub> : Group of students with critical thinking skills taught by conventional learning
- A<sub>1</sub>B<sub>1</sub> : Group of students with critical thinking skills taught by collaborative learning techniques GI
- A<sub>2</sub>B<sub>1</sub> : Group of students with critical thinking skills taught by collaborative learning of TPS techniques.

The population in this study were students of class XI MA Darul Hikmah. From this population, 2 representative classes were taken as the sample class. The first experimental class is a class that applies collaborative learning to the group investigation technique and the second experimental class uses collaborative learning in the think pair share technique. In this study, the posttest was used to measure the effectiveness of collaborative learning, the group investigation technique and the think pair share technique on students' critical thinking skills and self-efficacy using questionnaires and observation sheets, as well as HOTS questions for critical thinking skills. In this study, there are two variables consisting of the independent variable and the dependent variable. The independent variable is in the form of collaborative learning, the group investigation technique and the think pair share technique, while the dependent variable is the ability to think critically. The teaching material in this research is chemical equilibrium. In this study, the instrument used was in the form of 5 essay test questions for critical thinking skills in accordance with the indicators of critical thinking skills.

The data obtained were then analyzed by calculating the percentage of the post-test value, after the data was obtained, the normality and homogeneity tests were carried out using the *SPSS for Windows 20 software*. With a significant level of 5%, and the results obtained were feasible to be used as research samples. Hypothesis testing used is paired sample t-test and independent sample t-test to determine 1) are there differences in students' critical thinking skills after using collaborative learning with Group Investigation techniques, 2) are there differences in students' critical thinking skills after using collaborative learning techniques Think Pair Share, 3) is there a significant difference in students' critical thinking skills between the class that applies collaborative learning using the Think-Pair-Share technique and the class that uses the Group Investigation technique.

### 3. Results and Discussion

Figure 1 is a collaborative learning process through the technique *group investigation* and *think pair share*, where the learning process has similarities in developing problem-solving skills. In the learning process of the techniques *group investigation* and *think pair share*, students were required to work together between students in the group and with their teachers.

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Figure 1. Group Investigation with Think Pair Share Technique

Collaborative learning requires students to have critical thinking skills in the learning process. Besides that, there is also a difference between the technique *group investigation* and *think pair share*, the difference between the two lies in the concept of learning. This technique *group investigation* involved students from the beginning of learning starting from material selection to solving problems. Meanwhile, *think pair share* focuses students on learning with discovery, and students are given a stimulus to solve problems (Kaddoura., 2013).

After knowing the data on the results of normality and homogeneity on scores *posttest* in experimental classes I and II using collaborative learning techniques are *Group Investigation* (GI) and *Think Pair Share* (TPS) declared normal and homogeneous, the data can meet the requirements of hypothesis testing analysis (Sugiyono. 2009). This hypothesis testing uses a parametric statistical test, namely the t test at the significance level (2-tailed) with an alpha of 0.05 so that the analysis test is the *independent Sample Test* using the SPSS version 20.0 application. Postresult data test from the class that was treated using collaborative learning techniques *Group Investigation* (GI) and *Think Pair Share* (TPS) can be seen in table 2 below.

Table 2. Post-test Scores

Collaborative Learning	Post Test	
	Mean	Percentage (%)
GI Technique	76,73	76,73 %
TPS Technique	80,57	80,57 %
Control Class	68,45	68,45 %

Results of average post-test scores Table 2 shows that the post-test scores of collaborative learning in TPS techniques are higher than those of GI techniques, namely, 80.57 and 76.73 in the chemical equilibrium material. This happens because in the collaborative learning process of the TPS technique there are stages of guiding students to solve the problems given at the beginning of the next activity students themselves think of solving the problem, the next step students are asked to be in pairs to solve the problem, and the final step of the

activity is students and their partners present the results in front of the class and discuss with other students.

The average post test score for classes taught by collaborative learning with TPS techniques is lower because at the beginning of learning students are asked to look for problems and information from various sources. Learning sources used in the study were textbooks, student worksheet and the internet. When learning to use collaborative learning with GI techniques, students are more active in reading and seeking information to answer all questions given by the teacher, so that the strength of students' understanding of the material is not too optimal. From the results of research based on hypothesis testing, it was found that collaborative learning of TPS techniques was more effective in students' critical thinking skills. The results of hypothesis testing can be seen in table 3, table 4, and table 5.

Table 3. Paired Sample T-Test

	Mean	t	df	Sig. (2-tailed)
GI Technique - Post Test	76,73	3,952	21	0,001
Control - Post Test	68,45			

Table 3 uses the paired sample t-test to see whether collaborative learning of the technique is effective group investigation on critical thinking skills, based on the average post test result of GI techniques higher than the post test control.

Table 4. Paired Sample T-Test

	Mean	t	Df	Sig. (2-tailed)
TPS Technique - Post Test	80,57	5,015	20	0,000
Control - Post Test	68,45			

Table 4 uses the paired sample t-test to see whether collaborative learning is effective technique pair share in thinking on thinking skills, based on average results post test TPS technique is higher than post test control.

Table 5 uses the paired sample t-test to see if there is an effective collaborative learning technique *think pair share* on thinking skills, based on the average results of the TPS technique post test higher than the post-test GI technique.

Table 5. Independent Sample T-Test

		Levene's Test for Equality of Variances		Mean	T	df	Sig. (2- tailed)
		F	Sig.				
Post Test Teknik GI -	Equal variances assumed			76,73	-1.827	41	0,075
	Equal variances not assumed	1.531	0.223				
Post Test Teknik TPS	Equal variances not assumed			80,57	-1.838	39.558	0,074

In Hypothesis Testing Table 3 uses a parametric statistical test, namely the t-test at the significance level (2-tailed) with alpha 0.05, then the analysis *Paired Sample Test* in the SPSS application program version 20.0. obtained the results of sig (2 tailed) of  $0.001 < 0.05$ , it can be concluded that  $H_0$  is rejected and  $H_1$  is accepted. Based on these results, there is a significant difference between the students' thinking ability scores on the posttest data using collaborative learning with techniques *group investigation* and control classes. Then in Table 4 Hypothesis Testing also uses a parametric statistical test, namely the -t test at the significance level (2-tailed) with alpha 0.05, then the analysis *Paired Sample Test* in the SPSS application program version 20.0. obtained the results of sig (2 tailed) of  $0.000 < 0.05$ , it can be concluded that  $H_0$  is rejected and  $H_1$  is accepted. Based on these results, there is a significant difference between the students' thinking ability scores on the posttest data using collaborative learning technique *think pair share* and control class. Meanwhile, in the hypothesis in table 5, the independent samples test is used and the results show that sig (2-tailed)  $< 0.005$ , So from these results, it was found that there was a significant difference between the learning outcomes of critical thinking skills in the collaborative learning class with the technique *group investigation* and the collaborative learning class for the technique *think pair share* on chemical equilibrium material. This is in accordance with the foundation that collaborative learning can improve critical thinking. Zubaidah., 2010 stated that collaborative learning has a positive influence on students' critical thinking.

Abdul., 2014 stated that the *Think-Pair-Share* (TPS) method is an effective method for changing discussion patterns in the classroom. The method *Think-Pair-Share* (TPS) has a procedure for giving students time to think more, answer and help each other with other students (Azlina., 2010). The *Think-Pair-Share* (TPS) method has a special characteristic that can distinguish it from other cooperative learning methods, *pairing*, namely discussing in pairs. This is



supported by Surayya et al., 2014 which states that at the pair stage, students will pair up to discuss the results of their previous thinking. In this discussion, it requires thinking skills, including identifying problems, gathering information needed to analyze data and making conclusions. These skills are the foundation for critical thinking.

Meanwhile, the collaborative learning process of techniques *Group Investigation* (GI) shows a pleasant learning atmosphere for students. Learning begins with the teacher presenting the points of learning material then the students are divided into small groups of four to six students, planning learning tasks, carrying out investigations, preparing the final report, presenting the final report, and evaluating (Malmir., 2012 ). Students interact with other students in a group to discuss and investigate (looking for information, analyzing data, making conclusions) about the topics they have previously chosen. Then each group presents the results of the investigation in front of the class while the other group evaluates the presentation of the group that is presenting.

In both the experimental class I and the experimental class II, the two techniques have something in common, namely that they can improve students' critical thinking skills. However, the increase in critical thinking skills of students who use collaborative learning of the technique *Think Pair-Share* (TPS) is higher than the increase in critical thinking skills of students who use collaborative learning with the group investigation technique (GI), due to learning the technique *Think-Pair-Share* (TPS). is a learning technique that is able to make students think critically and solve problems. The same thing has also been done by Tamara., 2018, where there is a significant difference between learning using the technique *Think-Pair-Share* (TPS) and *Group investigation* (GI) in improving students' critical thinking skills.

#### 4. Conclusion

Based on the results of data analysis and discussion, it can be concluded that collaborative learning of *Think-Pair-Share* (TPS) techniques and collaborative learning of techniques *Group Investigation* (GI) can improve students' critical thinking skills. The results of the hypothesis can be concluded as follows:

1. The existence of effective learning using collaborative learning techniques *Group Investigation* (GI) to improve students' critical thinking skills on chemical equilibrium material.
  2. The existence of effective learning using collaborative learning techniques *Think Pair Share* (TPS) to improve students' critical thinking skills on chemical equilibrium material.
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3. There is a significant difference between a class that uses collaborative learning with the technique *Think-Pair-Share* (TPS) and a class that uses collaborative learning with the technique *Group Investigation* (GI) to improve students' critical thinking skills.

Based on the conclusions obtained, the researcher recommends that teachers in the field of chemistry study apply collaborative learning of the technique *think pair share* as an alternative learning that can be used to form students' critical thinking skills.

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