USEJ 9 (1) (2020)

Unnes Science Education Journal

http://journal.unnes.ac.id/sju/index.php/usej

COOPERATIVE LEARNING MODEL OF GROUP INVESTIGATION TYPE ON STUDENTS' CRITICAL THINKING SKILL AND SCIENTIFIC COMMUNICATION SKILLS

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Article Info

Article History:
Received April 2019
Accepted July 2019
Published Februari 2020

Keywords:
Group Investigation, Critical Thinking Skill, Sciencetific Communication Skil.

Abstract

This research aims to find out the influence of the application of the group investigation cooperative learning model on critical thinking skills and the scientific communication skills of students. True Experimental Design in the form of Posttest-Only Control Design is a research design applied to this research. Analysis of the data obtained showed that the correlation coefficient value of the critical thinking skills test data was r = 0.672. The results of the t-test analysis showed that t-count = 5.671 and t-table = 2.042, which means that there is an influence on the application of the cooperative learning type group investigation model in the experimental class as seen from the coefficient of determination (KD) of 33%. The value of the correlation coefficient in the analysis of students' scientific communication skills data is r = 0.9. The value obtained from the calculation of the t-test is t = 3,576 and t table = 3,182 which means that there is an influence on students' scientific communication skills after the implementation of the cooperative learning model group investigation type. The coefficient of determination of students' scientific communication skills is 81%. The conclusion that can be drawn from the research that has been carried out is that there is an influence on the ability to think critically and the scientific communication skills of students after the implementation of the cooperative learning model group investigation type in the learning process.

p-ISSN 2252-6617
e-ISSN 2252-6232

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INTRODUCTION

Educating all of the people in the nations is the goal of Indonesian National Education. Through education, people can create the sophisticated life and develop their potential so that it can improve the nation's civilization. Therefore, in order to achieved the educational objectives as expected, more attention is needed from all elements of society.

Studying the natural phenomena is the meaning of Science (*Ilmu Pengetahuan Alam*). Explanation of these symptoms can be obtained from data collected from conducted experiments, observation of natural phenomena in surroundings, and deduction so that the data is reliable (Widiyatmoko, 2012). Students can master a material through a process and the conclusion of an invention from facts, concepts or principles of things that have been learned (Alfiana et al., 2015). Science in junior high school with 2013 curriculum is presented in an integrated manner in accordance with the opinion of Hewitt cited by Parmin et al., (2016) that science subjects are carried out in an integrated manner. The use of time becomes more effective and efficient with exposure and several interdependent fields of science such as physics, chemistry, and biology (Taufiq et al., 2014). Continuous thought processes that follow certain patterns are needed for Integrated Science learning.

Permendikbud No. 65 About Standards Process, explains that the learning process in the 2013 curriculum for all levels is carried out by using a scientific approach that consists of observing, asking, reasoning, trying and communicating. Research-based learning or inquiry / discovery learning is highly recommended for developing students' scientific attitudes. The application of high-level thinking processes is highly recommended in the 2013 curriculum. The implementation of science in the 2013 curriculum can sharpen the critical thinking skills and not only be oriented to the learning materials mastery that is teacher-centered (transfer of knowledge) (Saheri et al., 2017). The ability to think critically can be improved if the science learning process run effectively and efficiently.

One of high-level thinking stages needed by humans to solve a problem is critical thinking. Solving an existing problem requires careful and clear thinking or can also be called critical thinking (Ennis, 1989). There are several aspects of critical thinking skills proposed by Ennis (1989) including giving simple explanations, building skills, concluding, making further explanations, and also using strategies and tactics. Thinking deeply in solving a problem, wise in taking action, sorting out an assumption, conducting scientific research are mental activities that can be done through critical thinking process (Kartimi & Liliasari, 2012).

Before carrying out the research, researchers conducted an initial observations at SMP Negeri 22 Semarang. The data obtained shows that the ability of students to solve problems with critical thinking processes was still relatively low. This is proven by the results of the daily test scores of students in science subjects, where 66% of 36 students in one class have not reached the standard of minimum score completeness (KKM) where the KKM in SMP Negeri 22 Semarang on science subject is 71. There is information obtained from science teachers in SMP Negeri 22 Semarang that classical methods (lectures) are more often used in science learning activities in the classroom.

Thinking together through discovery process to find a concept is an activity that is rarely applied by the teacher during learning process. Besides, the learning evaluation does not use high-level thinking questions so that students' critical thinking skills have not increased. Discovery learning that is applied in learning process will be able to sharpen critical thinking skills (Ningsih et al., 2012). Applying the process of thinking critically in learning process will train the students in observing their surroundings so that questions and hypotheses can be answered through data collection and then conclusions are obtained, so students can think logically and do not easily believe of something (Wahyuni, 2015).

Scientific communication that is well established during the learning process will train students to think critically. Scientific communication skills can play a role in conveying thoughts, ideas, opinions, activity process, results, and conclusions (Sarwanto, 2016). Students should be competent in communicating scientifically during the learning process, both spoken and written in order to have a good mutual relationship between the teacher and students when delivering the knowledge in the classroom. The scientific communication skills of SMP Negeri 22 Semarang students are still relatively low because the students are less enthusiastic to explain and present the findings obtained.

Permendiknas number 23 of 2006 explains that one of the competency standards for junior high school educators in science subjects is being able to communicate and interact effectively and politely. The interviews results of the students showed that they feel afraid of wrong answers, lack of confidence with their own answers, and lack of willingness to convey ideas so that the students' scientific communication skills are low. Students also still have difficulty in describing the findings that have been obtained in the form of written. Those happened because students rarely make discussion reports or practical work reports, so they become less accustomed to write down their findings.

Learning alternative that can provide stimulation and develop critical thinking skills and scientific communication skills of students is through cooperative learning models. Students' skills in establishing relationships and communicating with others can be trained by applying cooperative learning models (Jareno et al., 2014). The group investigation learning model can support it.

Group investigation is a model that encourages students to contribute actively during learning peocess where students engage directly in scientific inquiry (Doymus & Simsek, 2009). Group investigation is able to foster the students' critical thinking skills. Slavin (2009) stated that the ability to cooperate, think critically, and communicate can be grown through cooperative learning. Group investigation forms the students to be able to work together in a group and have tasks and responsibilities that are fairly charged to each of their members so that they grow curious, critical, and creative in finding a material concept. This learning model is based on interaction between individuals which involves the process of exchanging thoughts and ideas also exchanging experiences through active discussion.

The objectives to be achieved in this research are (1) to find out whether there is an influence from the application of the cooperative learning model of group investigation type on critical thinking skills and scientific communication skills of students, (2) to find out how much the implementation of the cooperative learning model of group investigation type affects the ability to think critically and scientific communication skills of students.

METHODS

The study was conducted using a modified Posttest-Only Control Design. The research sample was taken using a cluster random sampling technique. Class VIII students of SMP Negeri 22 Semarang in the 2018/2019 academic year are the study population of a control class sample of VIII C and experimental class VIII B. Cooperative learning model group investigation type is an independent variable and the dependent variable is critical thinking skills and skills communicate scientific students.

Tests, observations, and documentation are the data collection methods used in this study. The data of students' critical thinking skills were obtained through tests of the form of reasonable multiple-choice questions. The data of students' scientific communication skills were obtained using non-test techniques in the form of observation sheets which were conducted at each meeting.

RESULTS AND DISCUSSION

There is an influence of the ability to think critically and scientific communication skills are the aim of the cooperative learning model group investigation type in this study. The sample homogeneity test was carried out as a first analysis. Homogeneity test results obtained Fcount = 0.26

The results of this study found several types of data namely student test score data, documentation and observation data of scientific communication skills of students. Data on test scores analyzed were tested for normality. The results of the normality test show the test data of the experimental class and the control class are normally distributed because χ ^ 2calculate <χ ^ 2table so that the next step uses the parametric statistical test, the t-test.

Critical Thinking Skill

Test scores obtained from multiple-choice questions are reasoned to be used to determine the students' critical thinking skills. The scores then being analyzed using normality test, biserial correlation, percentage, difference test, and the coefficient of determination. The results of the correlation analysis from the application of the cooperative learning model of group investigation type on students' critical thinking skills based on test data are presented in Table 1.

Table 1. Results of Critical Thinking Skills Tests

Class	N	r	T_{counts}	t_{table}	KD
Experiment	34	0.572	5.671	2.042	33%
Control	34				

Table 1 presents data that the correlation coefficient (r) is 0.572. It shows that $t_{count} > t_{table}$ so H_0 is rejected. It can be interpreted that the critical thinking skills of students is influenced by the cooperative learning model of the investigation group type. The calculation results of the correlation coefficient are then used to determine the coefficient of determination. The coefficient of determination is used to determine the effect of cooperative learning model of the investigation group type on students' critical thinking skills. Table 1 shows the coefficient of determination is 33%. This explains that 33% of students' critical thinking skills are influenced by the use of cooperative learning models of the group investigation type, while 77% are influenced by other factors.

Learning using the group investigation model trains the students to find solutions of the problems faced both in groups and individually through scientific investigations based on the phenomena that happen in the surrounding. Thus, it can lure the students to think critically

and creatively in understanding the material being studied. This statement is supported by Slavin (2009) where the ability to work together, think critically, and communicate can be grown through cooperative learning. The stages of learning with cooperative learning model of group investigation type are as follows: (1) identifying topics and dividing students into groups, (2) planning assignments, (3) making investigations, (4) preparing assignments, (5) presenting assignments, and (6) evaluation. Learning activities in the experimental class begins with the introduction of the material given by the teacher then students are divided into groups consist of 5-6 people. Each group was given the opportunity to choose their own sub topics that arepresented. Students are directed to maximize their involvement freely and controlled by the teacher in choosing sub topics that are mastered / desirable so that when investigating students think deeply or think critically about issues related to the material.

The second step is planning the assignments. In this stage, the students design a strategy of activities that will be carried out together with the group. Students plan activities with their groups so that the students are easier to carry out the investigations. In planning the problem solving, students will be active in groups that can be observed from the communication and interaction of the students in solving problems. Stages 1 and 2 have advantages in improving critical thinking skills, collaboration with others and good communication. The third step, is investigation. Stages of investigation train students in identifying, providing options in solving problems faced by gathering information about learning resources. Building students' knowledge and understanding can be done by familiarizing the students to find a solution of a problem by thinking and develop their ideas (Nurhadi & Sunduk in Mushoddik et al., 2016).

The fourth step is preparing the final project. The data results of group discussions related to the problems selected by the students are then written in the form of a discussion report which will be presented to the class later. The fifth step, which is presenting the final project. The report that has been made is explained by each group in front of other students. Students as the audience pay attention to groups that are presenting to obtain material information because another groups discuss different topics. This stage can train the students' communication skills because students are required to be able to present and explain the results of their group discussions to other groups. The teacher gives flexibility to ask questions about the results of student presentations which then reflect on learning activities with questions and answers. Understanding can be improved by exchanging ideas and reciprocity in the form of responses from others.

The final step namely evaluation. Evaluation activities are carried out to measure how much the students understand the material that has been taught. The test method is used to measure the students' success in learning the material of the human respiratory system based on the ability to think critically. The overall stages of student learning indirectly make the students think critically to find answers of a problem. Miraningsih & Azizah's research (2015) supports this statement in which to foster students' critical thinking process can be applied with cooperative learning model of group investigation type.

The effect on cooperative learning model of group investigation type toward critical thinking skills was analyzed from the results of the test scores. The questions are tested in the form of reasoned multiple choice questions that are arranged based on aspects of critical thinking skills according to Ennis which will be explained as follows.

The first indicator is focusing questions. The results' percentage score of the ability in focusing questions on the experimental class is to 57.72% and the control class is 56.25%. The data proves that the percentage of the ability in focusing questions on the experimental class is better than the control class. In the topic selection stage of the group investigation learning model, the students determine for themselves what sub-materials they want to learn which are then made plans about predictions of the phenomena so that the students can attract other students to learn the material. Desmita (2012: 160) revealed that fostering student curiosity is able to make the students to think critically. The second indicator is analyzing the argument. The percentage of ability to analyze arguments in the experimental class is 88.24% and 79.41% in the control class. This shows the difference percentages of the both classes in analyzing argument indicator. Dwijananti & Yulianti (2010) explained that being careful in analyzing thoughts or ideas, distinguishing sharply, as well as identifying and developing to be better are included in critical thinking activities. This second indicator can be achieved at the stage of investigating from group investigation learning model. In line with the opinion of Saptono et al. (2016), developing the ability to argue requires investigation and exploration activities related to the concept of a material.

The third indicator is asking and answering challenging questions. The indicator is expected for the students to be able to ask questions to the teacher or other students and provide answers to the questions given. Students are also able to convey these questions and answers clearly. The percentage of this indicator in the experimental

class is 51.10% and the control class is 45.59%. Students at the time of presentation can convey the results of the discussion, ask questions related to material that is not yet understood to the group that presents their findings and the group responds to the questions given. If the answers given by the presentation group are not appropriate or incomplete, then the other groups can express their opinions, provide rebuttal and help answer questions to the group having the presentation. The activity indirectly makes the students are able to think critically and understand the issues being discussed. In addition, the students are also more communicative and confident when expressing their thoughts and ideas. Wahyuni (2015) mentions one of the characteristics of students who have the ability to think critically that can raise questions and formulate it clearly.

The fourth indicator is to consider the credibility of a source. The percentage obtained for this indicator in the experimental and control class is 66.91% and 32.35%. These data provide evidence that in this indicator, the results obtained in the experimental class were higher. In the stage of investigating, the teacher acts as a facilitator and asks students to solve problems encountered from therelevant learning resources. This accustoms students to be independent in obtaining learning resources, so it affects the ability of students to understand a concept. Understanding the concepts obtained by being directly involved in finding them will be stored in memory for a long time (Latifa et al., 2017). The fifth indicator is observing and considering the results of observations. The average

ability of the students to compare conclusions that fit with the statements that have been given. The ability to make deductions and consider the results of the deduction from experimental and control class students is applied by observing and understanding the contents of the reading / material on the learning resources used. After understanding the material, students find answers to the questions that come up. The answers obtained by students are then used as a basis for drawing conclusions in accordance with the contents of the reading. Students in the class who apply the group investigation learning model are more able to train students to think deeply and critically, so they are able to compare conclusions that suitable with the material. Wahyuningsih et.al., (2012) suggested that by the advance of student activity during group investigation learning model made students be able to solve problems and make conclusions. The seventh indicator is making induction and considering the results of induction. The assessment is seen from the conclusions made in the report. The results average percentage of the ability to make induction and consider the results of deduction from the control class is not as good as in the experimental class. The thingking process begins with understanding the meaning followed by the percentage in the experimental class is 72.55% and the control class is 70.59%. The implementation of the group investigation learning model in the experimental class gives students the opportunity to determine their own topic material, then they make a task draft and how to solve the problems. Students then carry out investigations related to the issues that have been discussed together with the group members by seeking answers of the problems from many learning sources. The experimental class and the control class were given LDS which contained problems related to the material. The students ability to draw conclusions from discussions that have been carried out in the experimental class is better. The difference in the application of the learning model in which the experimental class is used the investigation group learning model gives a big influence. The stages of planning and investigating towards the steps of group investigation can train students' critical thinking skills in solving problems. Students' critical thinking skills can develop along with the thingking process and exercise that is applied to the completion of the LDS. This is in line with Redhana's (2012) research in which critical thinking patterns can be formed if it is given continuous training.

The sixth indicator is to make a deduction and consider the results of the deduction. The calculation results show the percentage of experimental class data have better grades. This indicator contains the

formation of an opinion so that a conclusion can be drawn. In the LDS given to students, students make predictions, observe, carry out discussions and look for information at the investigation stage. After making predictions and gathering information, students find answers to the questions. The answers obtained by students are then used as a basis for drawing conclusions. The giving of structured material and easy-to-understand direction for students make them trained in making conclusions from a problem that occurs.

The eighth indicator is to make and determine the results of consideration. The results of the percentage score from the analysis showed different results in the two classes. Students can make and determine the results of consideration based on observations of existing phenomena. Through the stages of inquiry in the steps of learning, students are given the freedom thingking to convey ideas and ideas. Hughes (2014) explains that students who think critically have alternative thoughts and rational mindsets by always seeking and describing problems. The ninth indicator, namely identifying terms and considering definitions. The analysis showed that

students which use the group investigation learning model in the class had a higher percentage. Latifa et al. (2017) argues that new experiences and knowledge make the students are able to provide an explanation of a term or concept. The tenth indicator is identifying assumptions. The percentage results obtained by the control class are less satisfactory. The teacher provides exercises through questions that can be found in everyday life for students to discuss. New experiences and knowledge obtained by the students make them determine their own assumptions based on the definition or understanding of a concept.

The eleventh indicator is determining an action. The teacher asks the students to analyze questions about problems concerning respiratory system problems that occur in the surrounding environment and explain the prevention. Students who categorize having high critical thinking skills can explain the prevention related to the respiratory system appropriately based on the analysis of the problem given. Arifin (2012) explains that students who have the ability to make decisions to solve problems have good critical thinking power. The ability to think can make us wiser in deciding an action (Gunawan & Liliasari, 2013). The twelfth indicator is interacting with others. The success indicator is seen from the good cooperation with group members and an active role in the discussion as being obtained in the experimental class which has a better percentage than the control class. Students who contribute actively in group discussions by giving opinions, thoughts, or ideas are considered to have met the indicators of good cooperation. Discussion activities can help the students to develop the ability to cooperate and interact with others. Students can easily build their knowledge and relate to the concepts learned if students participate directly in reasoning and interacting during learning (Mushoddik et al., 2016).

The group investigation learning model can train the students' critical thinking skills. Students develop and practice their critical thinking skills through the stages of investigation namely observation and direct search of information that can trains the students to analyze and solve contextual problems. Miraningsih & Azizah (2015), Sahfriana et.al., (2015), and Maxnuari (2017) who support that critical thinking skills can be improved through group investigation learning models.

Students' critical thinking skills will increase if in the learning process there is good scientific communication between the teacher and students. Rifa'I & Anni (2012: 159) explained that the transfer of knowledge from teacher to student and student to student can run well through communication. Scientific communication skills can play a role in conveying thoughts, ideas, opinions, activity processes, results, and conclusions (Sarwanto, 2016). The results of the observation sheet show that there is an influence of the cooperative learning model of group investigation type on students' scientific communication skills.

Correlation analysis of the application of the cooperative learning type group investigation model to scientific communication skills is presented in Table 2.

Table2. Correlation Analysis Results of Cooperative Learning Model of Group Investigation on Students' Scientific Communication Skills

Class	N	r	KD (%)	Dk	t_{table}	T_{counts}
Experiment Control	34 34	0.9	81	3	3,182	3,576

Table 2 shows the value of the correlation coefficient (r) obtained is 0.9. The t_{count} in Table 2 is greater than t_{table} so H_0 is rejected. This shows that there is a very strong relationship thus it can be interpreted that there is an influence of the use of cooperative learning model of the group investigation type on scientific communication skills of students.

Observation of students' scientific communication skills for each indicator was carried out three times. Next Figure 1 shows the results of observations of students' scientific communication skills

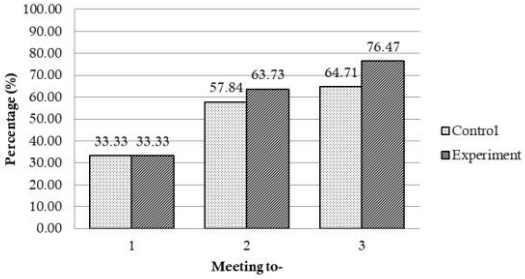

Figure 1. Scientific Communication Skills on Indicators Describing Empirical Data Results of Discussions with Tables

Figure 1 shows the students' skills in describing experimental or observational data with tables. This scientific communication skill is measured from the writing of an observation table containing criteria, title, description of the table, writing the table according to the command and the suitability of the title with the contents. This scientific communication skill is measured from the writing of the observation table which contains the criteria contained the title of the table, the description of the table, and the suitability of the title with the contents of the table. The results of the observational analysis showed that the skills of describing empirical data from the discussion table with the experimental class were higher than the control class. The

percentage of achievement during the three observations increased significantly.

The first observation in the experimental class and the control class took place during the activity of performing on LDS. The difference percentage of scientific communication skills on this indicator from the first observation is due to the different mastery of student material. The experimental class that was given a group investigation model paid more attention to the material delivered by the teacher. Students are enthusiastic about asking questions about things that are still unclear. The students' activeness in learning from the experimental class is better and indicates the student aware about the importance of learning. Umah et al., (2014) stated that student activeness indicates the existence of student motivation to follow the lessons and influence the expected learning outcomes.

It can be found some students in each group who are less active in in the control class. They talk to themselves or play with other students when discussing and not doing their duties. This cause learning materials cannot be fully accepted by students. Hutomo et al., (2016) support that low learning activities can influence the student learning outcomes. How inaccurate the students in drawing diagrams cause students who have not met the indicators of scientific communication assessment.

The results of observations of students' scientific communication skills with the second indicator are shown in Figure 2 as follows:

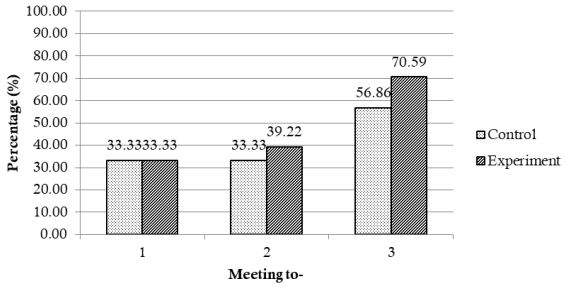

Figure 2. Scientific Communication Skills on Indicators Reading the Results of Discussion Tables

This communication skill is measured from the students' skills in reading the contents of the table, the description of the table, and inferring the data of the table in communicative language. Students' skills in reading tables in three observations have increased. The reading skills of the tables in the class being tested appear when students are working on LDS to answer the problems and the questions in the table that have been provided by the teacher. The teacher gives problems and questions in the table related to the material to test the students' skills in reading the table then the answers are written in the discussion report. Good material mastery in the experimental class makes the students to read the table easily.

The quite different conditions occur in the control class because of the different learning models being applied. The class carries out a conventional learning so the students are less able to explore their knowledge. Students do not pay attention when the teacher explains so that students' understanding of material is reduced. This has an impact on students' expertise in reading Tables. Some students are not good at explaining the contents of the table, the description of the table, and summarizing the data in the table.

Figure 3 shows the results of observing students' skills in preparing reports

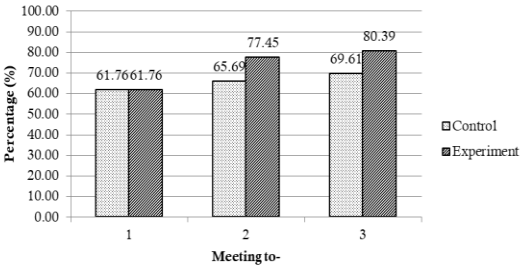

Figure 3. Scientific Communication Skills on Indicators for Reporting Systematically

The skills in preparing systematic reports are included in written communication skills. Students' skills in preparing reports on work or activities that have been carried out sequentially and systematically are written communication skills. Students' skills in preparing reports on the results of discussions will be assessed on this indicator. Students' written communication skills are measured from the use of communicative language (easy to understand), writing reports systematically and writing reports according to the correct Indonesian language.

Students of the experimental class conduct investigative and discussion activities enthusiastically. They collect answers from learning resources to find solutions to the questions presented in LDS and write the answers in discussion report. Some students in the class research were still not participating in exchanging ideas and depending the answers to others. This can affect their skills in writing reports. This is supported by the statement Rustaman (2005) where the activity of preparing and delivering experimental reports systematically and clearly will cause students' written communication skills to increase.

The observation results of student reports from three observations showed an enhancement where students become more trained in compiling the results of discussion systematically. Through observation and analysis the data is obtained which are then arranged in the form of a discussion report then drawn a conclusion by

students. Research conducted by Wiryarta et al., (2014) supports this statement where students are able to arrange work projects such as reports after the implementation of the group investigation learning model. The report compiling occurs at the stage of preparing the assignment in the steps contained in the group investigation model where students together with their groups compile the reports that will be presented in class. Most of the students have been able to compile reports systematically although there are still some students who have not written reports systematically such as the order in which the reports are written upside down, details of the objectives have not been written down, or have not written a complete report. This will certainly affect the assessment score so that it becomes not maximal.

Figure 4 shows the results of observing students' skills in discussing a problem or event

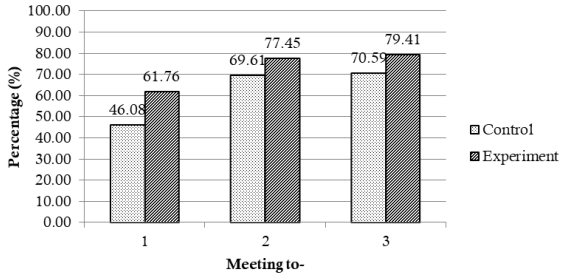

Figure 4. Students' Scientific Communication Skills on Indicators Discussing a Problem or Event

The assessment of this indicator is measured when students and their groups discuss together. The students' activeness in contributing thoughts or ideas in completing or finding answers to problems that exist during the discussion will be assessed by the observer. The percentage of the students' discussion skills achievement during the three observations shows a difference. The use of group investigation in learning gives quite different results in the class being tested. The model trains the students to be able to work in a group and establish good relationships with the group members in solving problems so that effective communication is created in discussion. The investigation stage in the group investigation model gives students the freedom to exchange ideas and information, submit their opinions with students in the group.

Different conditions occur in the control class. Students in the class are less enthusiastic when discussing. Many students don't participate in discussions or wait for answers from other members so they don't contribute ideas to the group. Students are less active in discussions because they feel not understand it, thus they are more dependent on their classmates who understand more. This shows that the students are less able to collaborate and less skilled in discussions which causes the student assessment scores to be less than optimal.

Figure 5 shows the results of observing students' skills in explaining the results of the discussion.

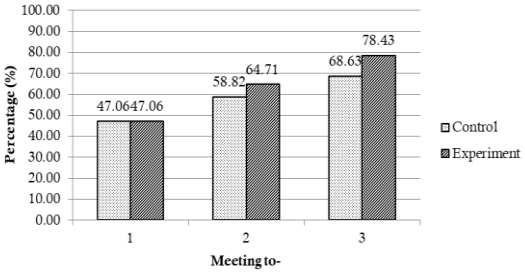

Figure 5. Students Scientific Communication Skills on Indicators Explaining the Results of Discussion

The ability to explain the results of an experiment or the results of a discussion includes the ability to communicate orally or verbally. The ability to convey the results of an experiment or discussion is measured by the ability of students to express opinions, convey answers, speak in a good and polite communicative language, and the voice is heard clearly. The results of observation show that the percentage achievement of this indicator in the experimental class has better results because the use of the group investigation model.

The student skill to convey the results of discussions is measured during the presentation activity. The activeness of the students in presenting the results of their discussions has a considerable influence. Students are required to actively discuss and interact to develop their mindset in the class applying the group investigation model. The stages of presenting the final project sharpening the students' skills in presenting their findings. Anita et al., (2013) states that the activity of presenting the results of discussions in a group investigation can foster the student self-confidence that he is able to give his opinion in front of many people. Kencana (2013) supports the statement where the students' ability to convey a thing to others can develop through presentation activities.

Different things happen in the control class where students are less enthusiastic when presenting the results of the discussion. Students are less active in discussions and only rely on friends in their groups so that not all group members understand the results of the discussion. Students become less confident and lazy to present the results of the discussion. This has an impact on the assessment score being not optimal.

The correlation relationship value (r) of the investigation group learning model application on scientific communication skills is 0.9. The coefficient value according to Sudjana (2005:

390) belongs to a very strong influence. The factor during the study that caused a very strong influence was the difference in the use of the learning model during the learning process. These conditions resulted in the learning activities of students of the two different classes. Experimental class students are accustomed to use learning steps that stimulate the students to actively discuss and convey ideas. Aditya (2016) explains that increasing student activity influences learning outcomes after applying the group investigation model. The development analysis of the students' scientific communication skills was taken from observational data at the last meeting. The determination coefficient is used to analyze the effect exerted from the application of the group investigation model on scientific communication skills. The analysis that has been done shows that the coefficient of determination is 81.00%.

The group investigation learning model has an influence on students' scientific communication skills as seen from the difference average obtained. This model makes the students to cooperate with each other in finding solutions and developing communication skills with interaction between group members and with other students so that scientific communication skills both in verbal and written communication can be further developed. Students' scientific communication skills aim to make students skilled in the preparation of a scientific work (Levy et al., 2008).

CONCLUSION

The research that has been done produces a conclusion that critical thinking skills and scientific communication skills of students are influenced by the cooperative learning model of group investigation.

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