THE IMPLEMENTATION OF COOPERATIVE LEARNING MODEL TYPE GROUP INVESTIGATION USING BRAINSTORMING METHOD TO IMPROVE STUDENT LEARNING OUTCOMES ON WAVES MATERIAL

Novyta Sitanggang and Wawan Bunawan
Faculty of Mathematics and Natural Science, State University of Medan
Novytasitanggang50@gmail.com

Abstract

This research objective are to know the effectiveness of the implementation of cooperative learning model type *group investigation* using brainstorming methods to improve student learning outcomes in sound waves material. This research method is quasi-experiment with the design of *two group* pretest and posttest. The Population of this study were all class XI SMA N 1 Tebing Tinggi A.Y 2018/2019. The study sample was taken by *class random sampling* technique consisting of two classes, namely the experimental class applied cooperative learning model type *group investigation* using brainstorming method, and the control class applied conventional learning models, each class as many as 36 students. This research data was obtained by using instruments in the form of 10 questions essay tests and activity observations. The results of the data analysis obtained the average value of the experimental class pretest was 30.18 with a standard deviation of 7.76 and the average value of the control class pretest was 33.70 with a standard deviation of 7.91. In the normality and homogeneity tests both classes were normally distributed and homogeneous. The pretest t test results obtained $t_{count} < t_{table} = 1.92 < 1.99$, then H_0 is accepted, meaning that both classes have the same initial ability. After being given different treatments, the posttest results were obtained with the results of the experimental class averages 68.61 with a standard deviation of 10.64 and a control class 61.75 with a standard deviation of 8.26. The results of the posttest t test were obtained $t_{count} > t_{table} = 2.94 > 1.99$ so that Ha is accepted, then the implementation of cooperative learning model type *group investigation* using brainstorming method can significantly improve student learning outcomes on sound waves topic in Class XI SMA N 1 Tebing Tinggi Academic Year 2018/2019.

Keywords: *Cooperative Type Group Investigation, Brainstorming, Learning Outcomes, Sound Waves*

Education is an educational process, namely a process in order to influence students to be able to adjust themselves to their environment, so that it will cause changes in themselves. A good education system also plays an important role in improving education efficiency. Various efforts have been made by the government in improving the quality of education, including raising or improving the curriculum, completing educational facilities and infrastructure, improving the quality of teachers through certification, development of learning outcomes assessment systems etc. (Trianto, 2011)

As stated in Law Number 20 of 2003 concerning the National Education System states that: "The curriculum is a set of plans and arrangements regarding the purpose, content and material of learning and the methods used as guidelines for implementing learning activities to achieve certain educational goals. Based on this understanding , there are two dimensions of the curriculum, the first is plans and arrangements regarding the objectives, content and learning material, while the second is the method used for learning activities. The curriculum that was implemented starting in the 2013/2014 school year fulfilled both dimensions." (Permendikbud Number 69 of 2013 concerning the basic framework and structure of the SMA / MA curriculum).

The development of the 2013 curriculum is proof that the government is very concerned about the quality of education, as expected by educators and students. However, it is very unfortunate if this changing education system confuses teachers and students in its implementation at school. The quality of education is often seen as dependent on the teacher's

role in managing the teaching components used in the teaching and learning process which is the responsibility of the school. The quality of education can be reflected in the results of student learning achievements.

Learning is the main activity in the school environment which determines the quality of human resources. The main problem in learning in formal education or schools today is the low absorption of students. This is evident from the average student learning outcomes are always still apprehensive. Therefore, efforts to improve the quality of learning are an important requirement. The overall reflection of learning is shown by the learning outcomes achieved by students. (Isjoni, 2009)

In this case, learning physics is a part of science which is essentially a collection of knowledge, ways of thinking, and investigation. Science is a collection of knowledge arranged systematically, and in its use it is generally limited to natural phenomena. Its development is not only characterized by a collection of facts, but by the existence of scientific methods and scientific attitudes. This scientific attitude is developed in students in student centered learning. Through this model, students can learn concepts well and can also look for new things.

Physics is one branch of natural science that is very important because physics studies the symptoms and phenomena that occur in nature and cannot be separated from the progress of science and technology. One character of physics is to have objects that are real. real is one of the supporting factors that can help students learn physics. But in reality, physics is considered as one of the subjects that is difficult for students to understand. As the researchers experienced while undergoing shootout PPLT at SMAN 1 Tebing Tinggi show that physics including hard lessons in school. So, most students don't like it. Especially seeing the number of educators in applying physics concepts. Because learning physics taught by teachers in this school is still teacher-centered, which means that the teacher only presents the physics as a lesson that memorizes formulas without understanding where the formula came from. As a result students feel bored and not interested in learning.

Most students have difficulty in applying physics to everyday life. Students are not given the opportunity to express ideas related to physics, so that children forget quickly and cannot apply it in daily life. Students are not accustomed to developing their thinking potential. This results in many students tend to be lazy to think independently. Students can think if the teacher explains it. For example, when students are asked about a question, only a few students are active in answering it, while the other students are just silent (Rusman, 2014)

Based on the results of interviews with one of the teachers who taught at the school, Mr. Adil Shadli, he stated that:
"Many students don't like physics because it is considered a difficult lesson compared to other science lessons such as mathematics, biology, and chemistry. So that it arises boredom and laziness when learning physics, because in general physics is difficult to understand and understand."

Then, from the observations carried out on January 26, 2019 at SMA N 1 Tebing Tinggi. Based researcher interviews with mom Nelfiza one of the teachers of physics, says that:
"The average score of the semester of physics is still far from what is expected when compared to other subjects and students get tired of learning physics. So that causes the value of students is still a lot below the KKM, namely the value of KKM 75."

Based on observation, the learning method that he did was a simple method by memorizing formulas without explaining the concept and only activating smart students that made students less cooperative, lacked courage when expressing opinions , feeling like sharing, and the level of cooperation that was still low , so that student learning outcomes are still low and

students are less interested in learning physics.Efforts must be made to improve learning that activates students.

Student collaboration is one part of the learning process as revealed by Warsono and Hariyanto (2012: 163) that "Collaboration is not only a way to learn, but collaboration is also part of the content of learning." This opinion convinced researchers that student collaboration is the most important part of learning. Because in addition to students developing their intelligence also invites students to exchange ideas and participate in learning". Collaboration of students is the most important part of the learning process, because students can improve their understanding when meeting other students and evaluating each other about learning that they feel lack of understanding and even solve and find solutions together. In addition, it can increase mutual respect and improve the communication fabric of students in achieving the same goals. So that it can be defined that student cooperation is a work relationship that is built between two or more students who are intertwined because of a bond and the need to achieve the same goal, the interlocking indicators can be seen through mutual support in completing academic tasks, interacting between students, interdependence and mutual respect for one another. (Suprijono, 2013: 39-40)

RESEARCH METHODS

The population in this study were class XI semester II of SMAN 1 Tebing Tinggi which consisted of 7 classes with 252 students. The sample is a portion of the population that is represented *representively*, meaning that population characteristics are reflected in the sample taken (Sudjana, 2009). The sample in this study consisted of two classes selected in *class random sampling*, that is, all classes had the chance to be sampled.. The samples taken were two classes consisting of one control class namely XI IPA 4 and one experimental class namely class XI IPA 5.

Type this study include the type of quasi-experimental, which is the research that is intended to determine the result of something that is imposed on the sample of students. In other words, quasi-experimental research tries to examine whether there is a causal relationship. You do this by comparing one or more experimental groups treated with one or more comparison groups that were not treated. This study involved two classes that were treated differently. One class is used as the experimental class and the other class is used as the control class. To find out the learning outcomes of students are given different treatments in the class. The design of this study can be seen in the following table:

Table 1 *Two Group Pretes* and *Posttes Design*

Group	Pretest	Treatment	Postes
Experiment Class	T1	X	T2
Control Class	T1	Y	T2

Information :

T1 : Pretest are given before being treatment

T2 : Postest are given after treatment

X :Teaching by applying a GI type cooperative   learning model with brainstorming methods

Y   : Learning by applying conventional learning

The pretest results obtained were carried out by the Normality test, the Homogeneity test and the average similarity test (t-test) to find out whether the data were normally distributed, homogeneous and there were no significant differences between the initial abilities of the two classes. Then the two classes were given different treatments and posttest at the end of the lesson.

The results of the posttest obtained were conducted by one-party t-test to see whether there was an effect of implementation the cooperative model type group investigation using the brainstorming method.

RESULT AND DISCUSSION
Research Result

Before the research was conducted, the pretest was given to aim to see the students' initial abilities in the experimental class and the control class. The pretest results of the experimental class students were averaged 30.18 with a standard deviation of 7.76 while the pretest of the control class was 33.70 with a standard deviation of 7.91. This research is shown in table 2.

Table 2. Data Value Pretest Experiment Class and Control Class

Class Value Interval	Frequency (Experiment Class)	Frequency (Control Class)
20-24	10	5
25-29	6	6
30-34	11	7
35-39	3	8
40-44	5	7
45-50	1	3

In detail, the frequency distribution of the pretest results can be visualized in a bar chart pretest results of experimental class and control class pretest bar chart (Figure 1)
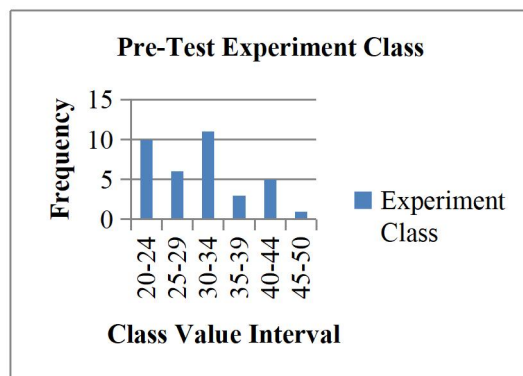

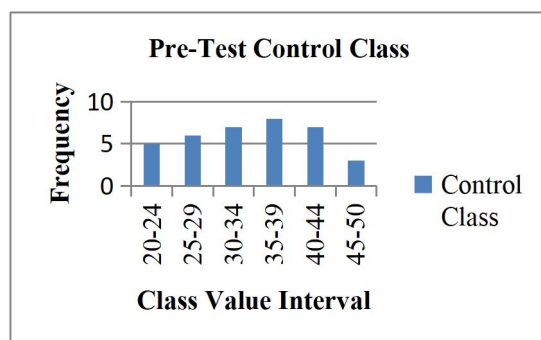Figure 1. Bar Chart Of Data Pre-Test Class Experiment

Figure 2. Bar Chart Of Data Pre-Test Class Control

The experimental class was treated with cooperative learning type group investigation with brainstorming methods and the control class was given conventional learning. Learning has been completed each in the sound wave material, the two classes were given posttest questions

that are identical to the pretest questions which aim to see an increase in learning outcomes. this research is shown in table 3.

Table 3. Data Value Postest Experiment Class and Control Class

Experiment Class		
Value Class Interval	Frequency	
46-52	4	Average = 68.61
53-59	2	
60-66	7	
67-73	13	SD = 10.64
74-80	6	
81-87	4	

Control Class		
Value Class Interval	Frequency	
43-48	3	Average = 61.75
49-54	3	
55-60	10	
61-66	8	SD = 8.26
67-72	8	
73-78	4	

In detail the frequency distribution posttest results can be visualized in a bar chart posttest results of the experimental class and control classs student
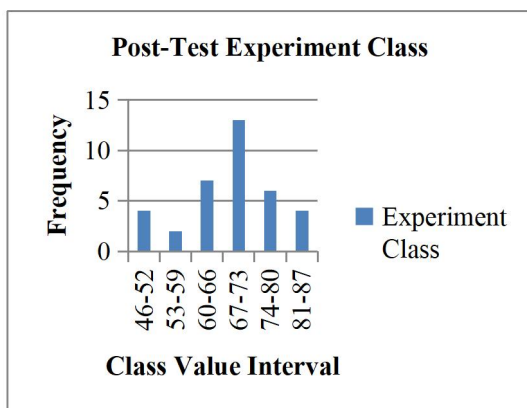

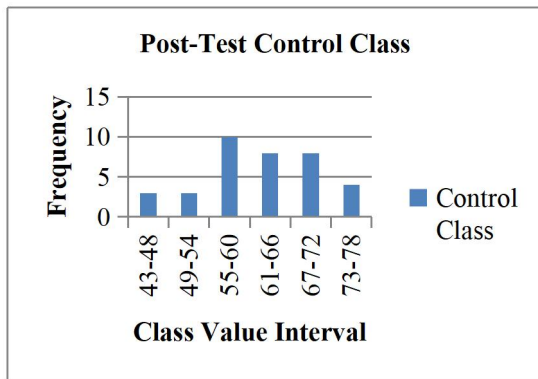Figure 4.3 Bar Chart Of Data Post-Test Class Experiment

Figure 4.4 Bar Chart Of Data Post-Test Class Control

The normality test of the pretest and posttest data of the experimental class and the control class was used to determine whether the pretest and posttest data were normally distributed. The normality test is carried out using the Lilliefors test. The results of the normality test for the pretest and posttest data of the two classes are stated in table 4.

Table 4. Test for Normality of Pretest and Post-test Data

Data Pretest		Data Postest		Conclusion
L_{count}	L_{table} $\alpha = 0.05$	L_{count}	L_{table} $\alpha = 0.05$	
0.109	0.147	0.096	0.147	Normal
0.107		0.107		

Based on the result of normality test by using Liliefors test $L_{count} < L_{table}$, then the data of the two sample groups of pre-test data distribution is normal.

Testing the homogeneity of the pretest data of the experimental class and the control class was carried out by testing the similarity of the two variances, indicating that the data from the two classes were homogeneous which meant that the data obtained could represent the entire population. The homogeneity test results using the F test the value of pretest and posttest are shown in table 5.

Table 5. Test of Homogeneity of Pretest and Post-test Data

Data	Fcount	Ftable	Conclusion
Pretest	1.04	1.74	Homogeneous
Postes	1.65		

Based the table it can be seen that $F_{count} < F_{table}$. It can be concluded that the samples come from a homogeneous population or may represent the entire population.

Table 6. t test data for pretest data

Data Pretes	Average	t_{count}	t_{table} $\alpha = 0.0$	Conclu- Sion

			1	
Experi-ment	30.18	-1.992	1.99	Initial ability of students in both groups the same sample
Control	33.70			

Based on Table 4.5 above, the calculation of hypothesis testing using t test pretest experimental class and control class, obtained t_{count} = -199 and t_{table} = 1.99. Because $-t_{table} < t_{count} < t_{table}$ (-199 < -1.92 < 1.99), it can be concluded that H_0 is accepted or Ha is rejected, which means the beginning of students' abilities before and were subjected to the same experimental class with initial capabilities of students in the control class.

Table 7. t test data for postes data

Data Pretes	Avera-ges	t_{count}	t_{table} $\alpha = 0.01$	Conclusion
Experi-ment	68.61	2.94	1.98	There significant difference
Control	61.75			

Based on these calculationsshowed that $t_{count} > t_{table}$ (2.94 > 1.998), then H_0 is rejected and Ha is accepted. This suggests that the learning outcomes of students in the experimental class that implement cooperative learning model type group investigation with the method of brainstorming is better than student learning outcomes in the control class by applying conventional learning so that it can be concluded that the average student learning outcomes higher using cooperative learning model type *group investigation* with the method of brainstorming.

During the learning process is carried out in SMA N 1 Tebing Tinggi AY 2018/2019, the observation group investigation type activity during three meetings after the pretest. Observation activity is only done on the experimental class. Observation activities carried out by two observers who have been equipped with observation sheet. The activity experimental class students at the first meeting, the second meeting, and the meeting can be seen in table 4.8

Table 8. Student Activity Class Experiments In the first Meeting I, Meeting II, Meeting III

Assessment Criteria	Meet I	Meet II	Meet III
Answering a question to get the hypothesis	22.79	32.25	59.56

Make a hypothesis	23.53	30.88	65.15
Experiment for information	24.26	37.18	54.14
Collect data and analyze data	22.79	50.00	77.65
Processing data	23.90	48.24	70.65
Make a conclusion	24.26	51.18	79.56
Average (%)	27.51	41.62	67.78
Criteria	Less Active	Enough Active	Active

Based on Table 4.8 the increasing of student learning activity in the experiment class at the beginning of meeting until the end of meeting amount to 67.78 % with activity category.

Discussion

Research conducted in SMA N 1 Tebing Tinggi using samples of two classes of XI IPA 4 with conventional learning (control group) and XI IPA 5 using cooperative learning model group brainstorming invsestigation method (experimental group) In the initial analysis, the results showed that the experimental group and the control group had homogeneous variances. this means the experimental class and the control class come from the same initial conditions, so research can be carried out. this research was conducted in class XI in two classes given different treatments, where the control class was given learning with conventional learning models and in the experimental class was given learning by applying group investigation learning models using brainstorming methods on sound wave material in class XI SMA N 1 Tebing Tinggi. Pretest and posttest testing was carried out with the same number of instruments. the instruments used were 10 essay questions.

The results showed that there was a significant effect after implementation of learning model cooperative type group investigation methods cuurah opinion on improving student learning outcomes in the subject matter of sound waves in class XI SMA N 1 Tebing Tinggi AY 2018/2019. It can be shown from the average value of 68.61 posttest experimental class and the average posttest control class is 61.75. Hypothesis test results postes the experimental class of data that is postes $t_{count} > t_{table}$ namely (2.94 > 1,998) H_0 is rejected and Ha is accepted, meaning it can be concluded there is implementation of cooperative learning model type group investigation on learning outcomes sisw in the experimental class.Improving student learning outcomes in class experiment better than the control class is due to the type of cooperative learning model group investigation by the method of brainstorming is one model of learning that is more emphasis on students' choice and control than applying teaching techniques in the classroom. It also combines the principles of democratic learning where students are actively involved in the activities pembelajara, either from the beginning to the end of the study includes students have the

freedom to choose the material to be studied according to the topic being discussed (Shoimin, 2014).

This learning model has also been applied by previous research, including Derlina (2017), where the results of his research state that the average student learning outcomes using the Cooperative Learning Model Type Group Investigation with know-want-learns methods are higher than students using the conceptual learning model. Tumanggor (2015) Cooperative type Group Investigation model influences student learning outcomes, where student learning outcomes using the Cooperative Group type of Investigation model is better than Direct Instruction learning model. This research is also in line with the research of Sinaga (2017), saying that the cooperative learning model of the type of investigation group (GI) has an effect on student learning outcomes with an average pretest value of 35.56 for the experimental class and 34.56 for the control class and mean the students' posttest experimental class students were 76.81 and the control class was 69.94 and there was also Hutagaol research (2018), saying that there was a significant influence of the group investigation (GI) learning model on student learning outcomes with average posttest scores the experimental class students amounted to 75.56 and the control class was 65.53. From some of the advantages above it can be concluded that the cooperative learning model group investigation with brainstorming methods in the experimental class was higher than the control class taught by conventional learning.

Students are initially difficult to understand the material will be aided by the discussion and exchange of opinion with the group's friends and friends who are not of his group, the students were initially shy slowly becoming bold expression so that learning becomes active and fun. Compared with conventional learning in the control class, students learn more listened to the teacher in front of class and carry out the task if given practice questions to students, so that students felt bored, passive and tend to easily forget the lessons that have been submitted. Improving student learning outcomes also disebababkan the involvement of students from early learning to the end of the lesson by following each phase of cooperative learning model type group investigation by the method of brainstorming. Students are guided active in working together, because students are divided into heterogeneous groups of 6 students each chosen at random, so that students are required to socialize well with other students. Teamwork is a set of skills that individuals use to drive the success of the group (Hughes, 2011). Thus good social skills including working in groups (teamwork skills) will make the students have a better outcomes students poor social skills (Tavakoli, 2014)

Cooperative learning type group investigation by brainstorming method does not require students to memorize facts, but a model that lead the students to menemukaan own knowledge through a given problem. A further advantage is that it can increase the level of student participation in group discussions to solve the problems encountered when conducting an investigation. It is also supported by the Arends (2008) that the cooperative learning model type group investigation to lead the students to identify topics, planned investigation in the group, carrying out investigations, reporting and presenting the results.

In this brainstorming method, students are trained to look for, find, process these resources into an idea or ideas that will be used in an opinion. Besides, students are also required to be able to work independently, so the ability of individual students can be observed clearly. This is similar to the views expressed by Nasution (2010: 7) states "learning is the process of taking and developing behavioral subject of study in order to establish his own". Process of exchanging opinions, respond to an opinion of others and adding an opinion is a good activity for the intellectual development.

The use of cooperative learning model group investigation by the method of brainstorming in an effort to improve student learning outcomes in a physics lesson indeed encounter some problems. Problems faced by researchers when applying the method of brainstorming can be described as follows students should always be motivated when they want to express their opinions, students are too dependent on the teacher, the student is still fixated on the paradigm of the teacher as a learning center or teacher should be dominant (teacher center), researchers have not yet matured in create learning scenarios, when discussing the students were still fixated on the problems experienced mostly due to the limited time to explore the question and the subject matter more deeply, besides the interesting questions to stimulate students in finding ideas and find ideas that match the learning material and to stimulate students to ask his opinion. But these problems can be solved through the efforts of improvement is a way to motivate students to students competed in his opinion, students should be familiarized with active learning (student center), need a lesson plan ripe for the learning process goes well, it should be interesting in making questions to make students more enthusiastic, always giving guidance to students so they are enthusiastic in learning of reading material, and providing relevant resources to support the learning process.

In this model, students have two responsibilities, that they study for himself and help his fellow group members to learn. According to Slavin (2016), promotes cooperative learning students interact actively and positively in a group, cooperative learning embodies how students can work in teams, the purpose of the group is a common goal. Shoimin (2014), among the models of learning that is created, group investigation is one that is democrartic learning model for students to active learning and practice independence in learning. While brainstorming is designed so that the discussion be meyenangkan and relaxed, but must abide by the rules established in order to succeed. The use of cooperative learning model type group investigation with brainstorming method will produce a more active learning process with ideas that emerge from the students. it is evident from each meeting conducted there is an increase by applying the brainstorming method. In addition, through this brainstorming method, students are trained to find, find, process sources of information into ideas or ideas that will be used in expressing opinions. Besides that students are also required to be able to work individually, so that the ability of students individually can be clearly observed.

The use of brainstorming methods during the learning process, shows the activeness of students when expressing opinions, and student responses seen from students' self-assessment, which generally shows interest or enthusiasm in the learning process. The application of brainstorming methods in physics learning does not only improve the ability to express student opinions that are the focus of research, it turns out the application of this brainstoming method can have another impact, in terms of student activity and interest in learning physics, students become more interested and focus physics learning. the quality of opinion expressed after the implementation of the brainstorming method in the process of learning physics, has increased the ability to express opinions gradually at each meeting after the application of the brainstorming method. at the first meeting the ability to express student opinions was still in less active category with a percentage of 27.51%, but in the second meeting the percentage of enough active categories was 41.62 %, in third meeting the percentage of categories was active category at 67.78%. This is evident from the results of the observation sheet of student activities during the learning process, the activeness of students when expressing opinions, and student responses seen from the assessment of student activity, which generally shows interest or enthusiasm in the learning process using the brainstorming method.

The use of cooperative learning model type group investigation by brainstorming methods also have an impact on student activity. Activities of students has increased at each meeting, the

average value of student activity at the meeting I 23.58, at the meeting II 38.95, at the meetting III 38.95, Increased activity is consistent with the results Sonny (2015) that Investigation Cooperative Group type models with brainstorming method to enhance the activity of the students who impact on student learning outcomes. at the first meeting of student activity value is still low, it is because at the first meeting of students still looks confused and less active response given researchers learning, much remains silent, other than that when students do experiments commotion fellow students for the division of the group that is not usually done in the learning process so that researchers difficult to regulate, students confused for bberkomentar with the given problem the researchers, because they never got worksheets (LKPD) during the learning process previously, sehinngga researchers explained repeatedly times regarding the implementation phase. But on the second and third meetings have started to respond and the response by answering questions for each phase, ie in the selection of topics, cooperative planning, implementation, analysis and synthesis, presentation and evaluation. Furthermore, it also stated by Hartoto (2016: 141) which states that the cooperative learning GI has positive damapak in improving student achievement marked by an increase in students' mastery learning daklam each cycle, the first cycle (72.5%), Cycle II (80.0%), the third cycle (92.5%). Similarly, research Sari, E (2017: 31) states that there are differences in learning outcomes physics taught by cooperative learning type group investigation and conventional learning.

Student activity for each meeting increased due to the phase distribution of groups of students was more secure and have started to understand the cooperative planning. Students begin to implement the third phase, the students became active since beginning to understand collected data. The fourth phase, students begin to understand that they can process data, the fifth phase they devote their opinion with the sixth phase methods of brainstorming and draw conclusions. At the first meeting of the students have not been able to devote their opinions and connect and draw conclusions on the concept of the invention obtained in the lab with the theory that the book of reference and does not correspond to a given problem. Model kooperetaif type group investigation method with brainstorming is a learning model for developing active student learning by developing its own, then the results will be long-lasting in memory and are not easily forgotten. Learn by discovery of a concept through experiments, when they discover and experience alone will be much longer and better remember reinforced by the presence of student activity.

The observation of research for carrying out research, it appear that the spirit and understanding of the students taught by using cooperative learning model type group investigation by brainstorming a better method when compared with students who are taught using conventional learning model. Therefore this study concluded that there was increase in the implementation of cooperative learning model type group investigation by the method of brainstorming on student learning outcomes in material sound waves in the second semester of class XI SMA N 1 Tebing Tinggi A.Y 2018/209

CONCLUSION

The results of students in the experimental class treated cooperative learning model of Group Investigation (GI) by the method of brainstorming is 68.61 and student learning outcomes using conventional learning model is 61.7. Brainstorming patterns that develop in this method of brainstorming, students are trained to search, find, process these resources into ideas or ideas that will be used in an opinion. In addition, students are also required to be able to work independently, so that the abilities of each student can be clearly observed without criticism, students are free and relaxed, focus on quantity not quality of opinion.The mechanism of the brainstorming method in improving the ability to express opinions is carried out in each meeting

action. Implementation of actions in the application of brainstorming methods, namely there are three things that must be done in conducting brainstorming methods, namely preparation, implementation and review activities. Activity Student learning activities with model of Cooperative Learning Group Investigation using brainstorming method on sound waves material in the second semester of the class XI SMAN 1 Tebing Tinggi increased in the meeting I is 27.51 (Less Active), at the meeting II is 41.62(Enough Active), at the meeting III is 67.78 (Active).

REFERENCES

Al-Khatib, & Adel, Bilal., (2012), The Effect of Using *Brainstorming* Strategy in Developing Creative Problem Solving Skills among Female Students in Princess Alia University College, American International Journal of Contemporary Research.

Arends, R.I.,(2012), *Learning to Teach*, Pustaka Pelajar, Jakarta.

Arikunto, S., (2010), *Prosedur Penelitian suatu Pendekatan Praktek*, Rineka Cipta, Jakarta.

Departemen Pendidikan dan Kebudayaan., (1992), *Penyusunan, penskoran, dan Penggunaan Tes Prestasi Belajar Bentuk Uraian,* Departemen Pendidikan dan Kebudayan, Jakarta.

Fraenkel, J.R, Wallen, N.E., and Hyun, H.H., (2012), How To Design and Evaluate Research in Education, New York, McGraw-Hill Companies.

Gambari and Mudasiru, Olalere., (2014), Effects Of Three *Cooperative Leraning* Strategies On The Perfomance Of Secondary School Student In Physics, *Bulgarian Journal of Science Education.*

Gillies, Robyn., (2016), Cooperative Learning: Review of Research and Practice, *Australian Journal Of Teacher Education,* Vol. 41.

Hosam, Al-Samarraie., and Shuhaila, Hurmuzan., (2018), A Review of Brainstorming Techniques in Higher Education, *Thinking Skills and Creativity Journal.*

Isjoni, (2009), *Pembelajaran Kooperatif Meningkatkan Kecerdasan Komunikasi Antar Pesrta Didik*, Yogyakarta, Multi Pressindo.

Istarani, (2012), *Kumpulan 39 Metode Pembelajaran*, Medan, Penerbit CV Iscom.

Iswardati., (1998), The Implementation of Group Investigation to Improve the Student Speaking's Skills, *Journal of Science Education,* 16(2):245-259.

Jihad and Haris, (2012), *Evaluasi Pembelajaran*, Multi Pressindo, Jakarta.

Joyce, B., Weil, M., and Cathoun, E., (2008) , *Models Of Teaching*, 8th ed, Englewood Cliffs, Prentice Hall, USA.

Kanginan, M., (2015), *Fisika untuk SMA/MA Kelas XI,* Erlangga, Jakarta.

Nur, Diah., Penerapan Model Pmebelajaran Brainstorming Untuk Meningkatkan Kemampuan Mengemukakan Pendapat Siswa, *Jurnal Pendidikan*, 15 (2):7-17.

Rawlinson, J.G., (1971), *Berfikir kreatif dan Brainstorming, Terjemahan Marbun B.N & Wachid D*, 1986, Jakarta, Erlangga.

Romadoni, S., (2014), Efektivitas Penerapan Metode *Brainstorming* Terhadap Peningkatan Minat dan Prestasi Belajar Ekonomi Siswa Kelas X SMK YPKK 3 Sleman, *Jurnal Skripsi*, FE UNY, Yogyakarta.

Sangadji, Sopiah., (2016), Implementation of Cooperative Learning with Group Investigation Model to Improve Learning Achievement of Vocational School Students in Indonesia, *International Journal of Learning & Development,* 6, (1).

Sulisworo, Dwi., & Suryani, Fadilah., (2014), The Effect of *Cooperative Learning*, Motivation and Information Technology Literacy to Achievement, International Journal of Learning & Development, (4), (2).

Suprijono, A., (2010), *Cooperative Learning Teori dan Aplikasi PAIKEM*, Yogyakarta, Pustaka Belajar.

Trianto, (2011), *Mendesain Model Pembelajaran Inovatif-Progresif*, Jakarta, Prenada Media Group.

Yuandini, Feggi., & Sahyar., (2017), The Effect of *Cooperative Learning* Model Type *Group Investigation* Assisted Flash Media, Scientific Attitude on Students' Conceptual Knowledge, Journal Of Education ans Practice, Vol. 8, No.17.

Wittmann, M.C., (2003), Understanding and Affecting Student Reasoning About Sound Waves, *International Journal of Science Education,* 24, (1), 97-118.