

# Effect Cooperative Learning Model Type of Group Investigation Using PhET to Cognitive Learning, Interpersonal Communication and Communication Ability Capability

Derlina\* Naimah Hasanah

Faculty of Mathematics and Science, State University of Medan, North Sumatra, Indonesia

## Abstract

This study aims to: (1) Know the influence of cooperative learning model type of group investigation (GI) using PhET to cognitive learning outcomes, (2) Analyze improvement of psychomotor learning outcomes. Research is a quasi-experiment with two group pretest-posttest design. The research population is all Students of SMA Negeri 11 class XI Medan, Indonesia. The sample of research was taken two classes from population with class random sampling technique. An experimental class is taught by a Cooperative learning model type of group investigation using PhET and a control class is taught by conventional learning. The research instrument consisted of a learning result test and an observation sheet. Learning result test is used to measure cognitive learning result, observation sheet is used to obtain data of psychomotor learning result and student interpersonal communication. The result of cognitive learning was analyzed by t test, to know the effect of learning model to the learning result, psychomotor learning result and the development of interpersonal communication was analyzed by score gain test. The research results show: (1) There is influence of Cooperative learning model type of group investigation using PhET to cognitive learning outcomes, (2) Cooperative learning model type of group investigation using PhET effectively improve psychomotor learning outcomes. Through the Cooperative learning model type of group investigation using PhET, learning atmosphere becomes more effective, group cooperation in learning encourages Students to have courage in communicating opinions, communicating and sharing information with other friends in solving learning problems. As an information material the influence of Cooperative learning model type of group investigation using PhET to cognitive learning outcomes, improving psychomotor learning outcomes and the development of interpersonal communication of Students as well as alternative information materials for the selection of learning models.

**Keywords:** GI type cooperative learning using PhET, learning outcomes, interpersonal communication.

## 1. Introduction

The main support for the achievement of quality human development goals is quality education. Quality education is not enough to be done only through the transformation of science and technology, but among others supported by the development of Students' ability to help themselves in choosing and making decisions for the achievement of his ideals. The ability of Students is not only about academic aspects, but also concerns aspects of personal development, social, intellectual maturity, and value systems.

Factors that cause less successful Students in the academic field not only lies in the intelligence of the brain, but on the issue of character, namely self-confidence, ability to work together, ability to get along, ability to concentrate, empathy and ability to communicate. A person's ability to interact is called interpersonal communication skills.

Teachers should provide examples in the process of learning how to grow interpersonal communication in Students. Interpersonal communication will grow in Students, if the environment provides facilities in recognizing and managing their emotions. Through interpersonal communication, human beings can interact with each other openly and mutually respectfully as the fulfillment of human needs internally (Olayiwola, A. R, 1993: 103; Erozkhan, A, 2013: 739).

Teachers should be able to ask questions that trigger Students to think and ask questions with a scientific-oriented, open-ended question that allows them to conduct an investigation to find a question-oriented scientific answer (Li, W. S. S., & Arshad, M. Y, 2015: 154). This can be done to improve student learning outcomes and interpersonal communication. With interaction and listening will affect one's interpersonal communication (Ames, D., Maissen, L. B., & Brockner, J, 2012: 348).

The ability to communicate is very important owned by Students because in the learning process Students are required to be able to issue ideas or ideas in the social, Students are often faced with things that make it must be able to express personal opinions without emotion, anger or rude attitude, even Students should be able Trying to neutralize the situation in case of a conflict. One way Teachers often use is to ask Students to speak in front of the classroom to train Students' courage.

The ability to engage effectively in complex interpersonal relationships is an interaction capable of understanding others effectively. People in interpersonal relationships tend to influence each other, share their thoughts and feelings and engage in joint activities that contribute largely to building a relationship of trust

(Erozkan, A, 2013: 739; Adigwe, P., & Okoro, E., 2016: 1). Morreale, S. P., Osborn, M. M., & Pearson, J. C(2000: 2) state the ability to communicate verbally in favor of psychological sound development. In psychological terms, achieving self-actualization involves communication activities such as making contributions in groups, exerting influence over others, and using acceptable behaviors Socially.

Physics is a science that includes the clump of science, therefore physics has characteristics similar to IPA, these characteristics are physical objects, how to obtain and use. Physics learning in SMA / MA there are two things related to inseparable physics, namely physics as a product (in the form of facts, concepts, principles, laws, and theories) and physics as a process (scientific work). Therefore, the subject of physics is a lesson that teaches various knowledge that can develop reasoning power, analysis so that almost all issues related to nature can be understood.

From the observation, there are still many Students who find difficulties in studying physics because they have not been able to understand the physics material taught by the Teacher thoroughly, resulting in low student learning outcomes. Physics learning is still using conventional learning model with average value less satisfactory. The low learning result of Students is caused by the learning process that occurs only centered on the Teacher (Teacher centered) so that the Students only listen to Teacher explanation.

Teachers also rarely provide opportunities for Students to interact with classmates or with Teachers, most Students memorize the subject matter without linking the lessons with daily life and the less used learning model that causes Students to become bored and less active while learning, Lab or experiment in understanding the lessons of physics so that learning physics becomes less meaningful for Students.

One of the main reasons for low academic achievement among Students is due to the effectiveness of teaching and learning strategies in the classroom. The process of physics learning in Teacher centered schools causes Students not to be actively involved and Teachers directly transfer information to Students in one interaction only (Astra, I. M., Wahyuni, C., & Nasbey, H, 2015: 75; Akçay, N. O., & Doymuş, K, 2012; 110; Aksoy, G., & Gurbuz, F, 2013: 99; Amiruddin, M. H., Samad. N. A., & Othman, N, 2015: 184).

One effort that can improve student learning outcomes through the application of work together to develop Students' interpersonal communication is by applying cooperative learning model. Cooperative learning model is an appropriate learning approach to improve student activity and communication during the learning process takes place. This learning comes from the concept that Students will find it easier to understand and understand difficult concepts when discussing with their friends. The main idea in cooperative learning is that Students work together to learn and be responsible for the learning progress of their peers.

A cooperative learning model that keeps Students active happens because Students are assigned to work together in small groups, helping each other to solve learning problems. Students are free to reintroduce their friends to ideas and opinions, thereby increasing individual confidence, developing communication skills and actively participating in learning (Akçay, N. O., & Doymuş, K, 2014: 18; Changeiywo, J. M.,Wambuğu, P. W. & Wachanga, S. W, 2010: 1334).

According to Pitoyo, A., Waluyo, H.J., Suwandi, S., & Andayani(2014: 21) the learning model is a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve specific learning goals, and serves as a guide for instructional and Teacher designers in the planning and implementation of learning activities. So that teaching and learning activities are activities that really arranged systematically.

In a study conducted by Sangadji, S (2016: 92) states that the cooperative model of group investigation type requires Students to have good ability to communicate and process group skills. Hosseini, S. M. H (2014: 178) stated that Students form themselves and cooperate with groups to achieve common goals.

Interpersonal communication has a very important role because it improves relationship quality. When talking to many people in different places and for different purposes. The pattern of communication changes according to who we relate to such as family, school, work, community, friends, and others. Each has a different format of communication in everyday (Sethi, D., & Seth, M, 2009: 40). Interpersonal communication is able to express or understand others properly and has great importance in all areas of life (Matin, H. Z., Jandaghi, G., Karimi, F. H., & Hamidizadeh, A, 2010: 388). The importance of interpersonal communication in providing professional development is paramount and is the only way for a human being to know himself and the world outside himself (Popescu, M, 2013: 370). The most effective way to interact and resolve the conflict is by communicating (Drussell, J, 2012: i).

In addition to the use of varied models and learning methods, the selection of instructional media is also very important to note. Selection of one particular teaching method will influence the appropriate type of instructional media, although there are other aspects to be considered in selecting the media, including learning objectives, task types and responses that Students are expected to master after the learning takes place, and the learning context including the characteristics of the Students. One of them media that can be used is PhET.

Physics Education Technology (PhET) is a simulation created by the University of Colorado that contains simulations of science learning for the benefit of individual and group learning. PhET simulations emphasize the

relationship between real-life phenomena with underlying science, supporting interactive and constructivist approaches, providing feedback, and providing creative workplaces (Finkelstein, N, 2006: 110-112). Physical Laboratory PhET (Physics Education Technology), which provides free, fun, interactive, and research-based physical phenomenon simulations to get Students to learn by exploring ways directly. With this program, Students can more real observe the existing phenomenon (Perkins, K., Adams, W., Dubson, M., Finkelstein, N., Reid, S., & Wieman, C, 2006: 19; Ajredini, F., Izairi, N., & Zajkov, O, 2013: 60).

This study aims to determine whether there is influence due to cooperative learning model type group investigation by using PhET to cognitive learning outcomes and see the development of psychomotor learning outcomes and student interpersonal communication.

## Theoretical review

### *Cooperative Learning Model Type Group Investigation*

Cooperative learning is not a new idea in the world of education, but prior to this time, this method is only used by some Teachers for certain purposes, such as certain group tasks or reports. However, research over the last twenty years has identified cooperative learning methods that can be used effectively at every grade level and to teach a wide variety of subjects. There are many reasons that make cooperative learning enter the mainstream of educational practice, one of which is to increase student achievement, as well as other positive consequences that can develop intergroup relationships, acceptance of weak academic classmates, and increased price feeling Self (Slavin, R.E, 2005: 4). The role of the Teacher in the classroom conducting the group investigation project acts as resource person and facilitator, the Teacher goes around among the existing groups, and to see that they can manage their tasks and help with any difficulties they encounter in group interactions, including performance issues Special tasks related to learning projects.

Students should be conscious in conducting investigations and knowing methods, so they can collect data, collect and classify past experiences, test hypotheses, study causality and plan. Students are instructed to select and develop awareness and attention to experiences to clearly make learning conclusions and combine them with brilliant ideas (Joyce, B., Weil, M & Calhoun, E, 2011: 315-318). The six steps of the Cooperative learning model type of group investigation are as follows:

**Table 1. Steps of GI Type Co-operative Learning Model**

I. Selection of topics	Students choose a specific subtopic within the field of masala h. Then the Students are organized into groups of two to six members. The group composition is heterogeneously formed academically and ethnically.
II. Cooperative planning	Students and Teachers plan specific learning procedures, tasks and goals consistent with the subtopics of the problems that have been out of step 1
III. Implementation	Students carry out the plans that have been formulated from step 2. Learning directed to various types of activities are extensive and skills that lead Students in search of different types of sources from within and outside the school. Teachers participate in the development of each group and offer help when needed.
IV. Analysis and synthesis	Students analyze and evaluate the information obtained during step 3 and plan how it can be summarized in some interesting styles to be displayed or presented to classmates.
V. Presentation of the final product	Some or all of the groups in the class give a presentation of the highlights of the topics being studied to make classmates engage in any other group work and to achieve a broad perspective on the topics. Coordination of Presentation by Teacher.
VI. Evaluation	In cases where groups work on different aspects of the same topic, Students and Teachers evaluate the contribution of each group to the overall classroom work. Evaluations may include individual or group assessments, or both.

The cooperative learning model does not evolve from an individual theory or from a single approach to learning. It has its roots in early Greek times, but its contemporary development can be traced to the work of educational psychologists and information processing theories associated with learning and cognitive and developmental theories, such as Piaget and Vygotsky (Arends, 2008: 7)

The theory underlying cooperative learning is the theory of constructivism. Basically, the constructivism theory approach in learning is an approach where Students must individually find and transform complex information, receive information with existing rules and revise them if necessary. This learning model was developed from constructivism learning theory that was born from the idea of Piaget and Vigotsky (Rusman, 2013: 201).

According to Piaget and Vigotsky's view of the social nature of a learning process and also about the use of learning groups with the varying ability of its members, there is a conceptual change. The group learns an active opportunity for Students and the opportunity to express something that Students think of a friend will help them

see things more clearly even to convey things and ideas that are not in line with their opinions.

### ***Interpersonal Communication***

Communication is a process of delivering information (messages, ideas, ideas) from one party to another to happen to affect each other between them. In general, communication occurs orally or verbally that can be understood by both parties. If there is no verbal language that can be understood by both, communication can still be done using gestures, showing certain attitudes, such as smiling, shaking his head, shrugging. This way is called communication with non-verbal (Surip, M, 2013: 2).

The difference of perception is one of the causes of communication. Inequality of view, thought or giving meaning to something object resulted in others having to seek the similarity through communication. Ongoing communication will cause a connection between the message provider and the recipient of the message. In order for good communication, the communicator as the message giver must convey well, which then can be accepted, understood and then responded by the communicant (Hidayat, D, 2012: 2).

Interpersonal communication is an interaction that occurs and can be responded directly either verbally or nonverbally (Suranto Aw, 2011: 3). Interpersonal communication is an action oriented, is a goal-oriented action specific. Interpersonal communication has 6 goals, among others (Muhammad, A, 2004: 165-168).

#### 1. Finding Yourself

One of the goals of interpersonal communication is finding personal or personal. When an individual engages in an interpersonal encounter with another individual then the individual learns a great deal about himself or others.

#### 2. Discovering the Outer World

Interpersonal communication allows individuals to understand more about themselves and others who communicate with them. Much information that a person knows comes from interpersonal communication, although the vast amount of information coming from the mass media is often discussed and ultimately studied or explored through interpersonal interaction.

#### 3. Establish and Maintain a Meaningful Relationship

One of the greatest wants of the people is to form and maintain relationships with others. Much of the time spent in interpersonal communication is enshrined to shape and maintain social relationships.

#### 4. Changed Attitude and Behavior

A lot of time is used to change attitudes and behavior of others with interpersonal sessions. Every individual may choose a particular way, such as trying a new diet, buying certain things, seeing a movie, writing a book, entering a certain field and believing that something is right or wrong.

#### 5. For Play and Fun

Play includes all activities that have the main goal is to seek pleasure. Talking to friends about activities over the weekend, discussing sports, telling funny stories and stories in general it is a time-consuming conversation.

To help Psychologists, clinical psychologists and therapists use interpersonal communication in professional activities to direct clients.

According to Devito (Suranto Aw, 2011: 82-84), there are five positive attitudes to consider when one is planning interpersonal communication, the five attitudes include:

#### 1. Openness

Openness is the attitude to receive input from others, and is willing to convey important information to others. In other words, openness is the willingness to open up to reveal information that is normally hidden, provided that the disclosure of this information does not conflict with the principle of communication compliance.

#### 2. Empathy (empathy)

Empathy is the ability of a person to sense that if someone else, can understand something that is experienced by others, can feel what others are feeling, and can understand something from someone else's point of view.

#### 3. Supportive attitude

An effective interpersonal relationship is a relationship where there is a supportive attitude. This means that each party that communicates has a commitment to support the implementation of interaction openly.

#### 4. Positive attitude (positiveness)

Positive attitudes can be demonstrated by a variety of behaviors and attitudes, such as respect for others, positive thinking toward others, over-suspicion, belief in others, praise and appreciation, commitment to cooperate

#### 5. Equality

Equality is the recognition that both parties have an interest, both parties are equally valuable and valuable, and need each other.

### PhET Simulation Media

Physics Education Technology or PhET is an interactive simulation of research-based phenomena, which can be used for free. The PhET team from the University of Colorado at Boulder America states a research-based approach, which combines the results of previous research with self-conducted activities, enabling Students to link real life phenomena and underlying science. This will ultimately deepen their understanding and increase their interest in physics.

Media that can help in this research is PhET. PhET is available interactive website PhET ( <http://PhET.coloradu.edu> ) PhET simulation animation using quantities heavily in graphic form and can be controlled as a click (click) and drag (drag) in the form of a button. PhET simulations are moving images or interactive animations that are created like games where Students can learn by exploring. To help Students understand visual concepts, PhET simulations animate the physical quantities using intuitive images and controls such as clicks and drag on the mouse, ruler and buttons. Simulations also provide measurement instruments such as rulers, stopwatches, voltmeter and thermometers to encourage quantitative exploration. So the PhET is very effective to help Students in building understanding and intuition for abstract phenomena. This simulation can be used in dynamic fluid material. Through simulations in the PhET Students can see clearly the abstract physical phenomena

### 2. Method

The type of research is quasi experimental research. The study population is all Students of class XI SMA Negeri 11 Medan in Lesson Year 2016/2017. The sample in this study consists of two classes, namely experimental class and control class taken with class random sampling technique. The variables in this study consist of independent variables (cooperative learning model type of GI using PhET) and dependent variable (learning result and interpersonal communication).

The study involved two different treatment classes. One class is used as an experimental class and the other class becomes control class. To know the result of student learning done by giving multiple choice test at both class before and after given treatment and in analysis using t test (Sudjana, 2005). Psychomotor learning outcomes and interpersonal communication are measured using observation sheets. The development of learning outcomes and interpersonal analysis using the gain test (Hake, R, 2007). The design of this research can be seen in the following Figure 1:

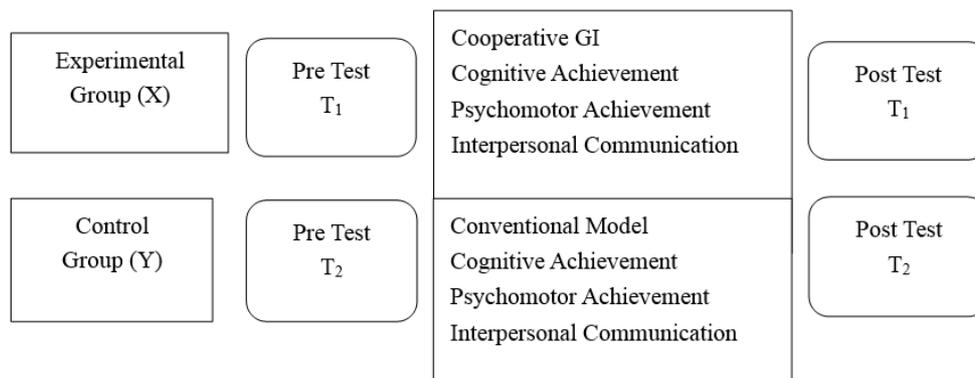


Figure 1. Two Group Pre Test - Post Test Design

### 3. Result & Discussion

#### 1. GI Cooperative Effect Using PhET on Cognitive Learning Outcomes

This research is a quasi-experimental research involving two classes which are given different learning model. Before the learning of both classes is done pre-test to get the Students' initial ability data in each class. After the pre-test both classes were given different treatments the experimental class was taught by cooperative type GI model using PhET and control class was taught by conventional learning model. Furthermore, post-test is done to get the data of Students' cognitive learning after completion of learning. Research data on pre-test and post-test cognitive learning outcomes for the second class of classes is presented in Table 2.

Table 2. Data Description of Student Cognitive Learning Outcomes

Variable	Group	Mean	Standard Deviation	N	t count	t table	Conclusion
Pre-Test	Experimental	43.46	13.96	35	1.79	1.99	Initial Cooperation Capability
	Control	37.17	15,39	35			
Post-Test	Experimental	77.89	9.94	35	1.93	1.67	There is a significant influence
	Control	72.60	12.82	35			

Table 2 above shows that the pre-test values in the two classes are not much different. For  $\alpha = 0.05$ ,  $-t_{table} < t_{count} < t_{table}$  ( $-1.99 < 1.79 < 1.99$ ), so it can be concluded that between the experimental class and the control class have the same initial ability. Furthermore Table 2 shows that the post-test values in the control class differ significantly for  $\alpha = 0.05$  obtained  $t_{count} = 1.93 > 1.67$ . It can be concluded that there is influence of Cooperative learning model type of group investigation using PhET to Students' cognitive outcomes. This result is in line with the research results (Adora, N. M., 2014: 146; Jongsermtrakoon, S., & Nasongkhla, J, 2015: 785).

The results of student learning in the classroom using cooperative model of type GI using PhET is better because Students are actively involved in learning. Students in groups participate in the selection of learning topics, conducting investigations, analyzing data and presenting it to their friends. Similar results stated Bello, T. O (2011) that studying with group investigation in groups is better than individual learning. Through collaboration in the inquiry process, Students are able to interact with one another and Teachers, making connections between scientific knowledge found in various sources and their own scientific knowledge, improving their learning about themselves capable of applying science content to new problems, Are actively involved in problem-solving, planning, decision-making, and discussion groups and experience consistent assessments of the active approach to learning (Damini, M., & Surian, A, 2013: 24; Escalada, L. T., and Zollman, D. A, 1997: 468; Tsoi, M. F, Goh, N, K., & Chia, L. S, 2004)

The objective of cooperative learning is to enhance individual self-confidence and communication skills, strengthen problem-solving and critical thinking skills and Students interact, participate, and communicate actively in the educational process (Şimşek, U, 2013: 5; Damini, M., & Surian, A, 2013: 25). All group members in cooperative learning type GI are tasked. This causes each member of the group to be active, there is an interaction between Students, and Students with Teachers, Students are trained to develop social communication skills, encourage Students to value the opinions of others, and improve Students' academic abilities, and train Students to speak in front of the class. Therefore, Cooperative learning model type of group investigation not only affects cognitive learning outcomes, but also on the development of interpersonal communication and psychomotor learning outcomes. According to Akçay, N. O., & Doymuş, K (2012: 116) the main purpose of implementing cooperative techniques is to provide responsibility to Students and interaction with each other.

## 2. *Interpersonal Communication and Student Psychomotor Learning Outcomes in the Cooperative Model Type GI*

The interaction between Students leads to interpersonal communication with each other. During the process of inquiry, Students are required to have a good ability in communicating. The development of Students' interpersonal communication is due to Students becoming more active. Students take the role of studying in the classroom, actively studying learning materials, actively expressing opinions, questioning, developing knowledge, solving problems, discussing, and drawing conclusions.

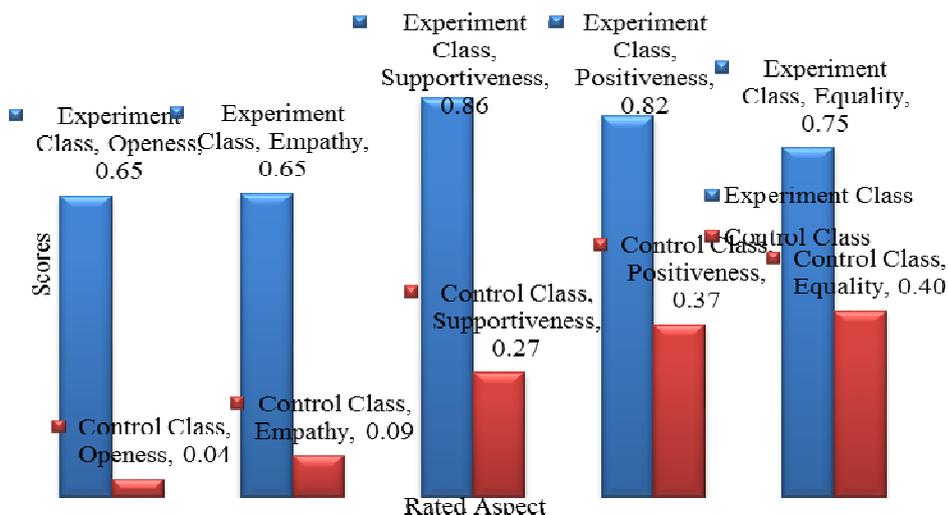
The skills of interpersonal communication are very important and are the behavioral skills necessary for the achievement of personal goals can develop collaboration and cooperation (Popescu, M, 2013: 373; Kokkonen, L., & Almonkari, M, 2015: 33).

In this study, the development of Students' interpersonal communication is seen based on observations made during the learning process. Through the average value of interpersonal communication, the result of gain test in the experimental class and control class is calculated. The value of Students' interpersonal communication development in each aspect of each session is presented in the following Table 3:

**Table 3. The mean value of interpersonal communication of each aspect**

ASPECT	Session in the Experiment class				Session in the Control class			
	1	2	3	4	1	2	3	4
Openness	49	67	77	82	48	50	50	50
Empathy	51	60	64	83	44	47	48	49
Supportiveness	51	66	84	96	44	49	56	59
Positiveness	56	69	87	92	54	54	67	71
Equality	56	66	77	89	40	57	59	64
Total Score	51.1	62.48	74.1	84.19	45,71	48.95	53.33	55.81

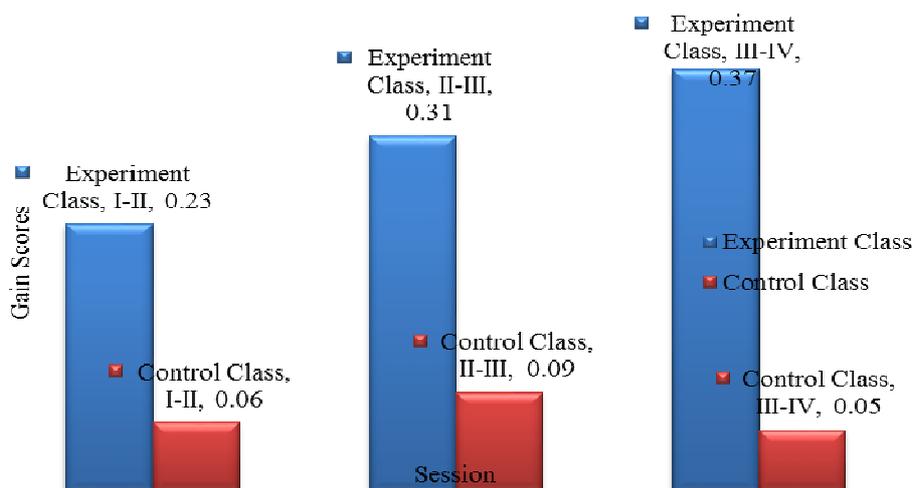
Based on the above table shows that the experimental class experienced a significant increase in the average value of each aspect of interpersonal communication when compared with the control class. Therefore, it can be said that the cooperative model GI type using PhET influence on improving interpersonal communication. Based on the average value of the above, the increase in interpersonal communication Students were then analyzed using the gain test. The result of the gain for each aspect of interpersonal communication that are presented in Figure 2 below:



**Figure 2. Results of the gain test every aspect of the development of interpersonal communication**

In the experimental group, the gain test results show that openness aspect and the aspect of empathy with the gain of 0.65 in middle category, while the aspect of being supportive with the gain of 0.86; positive attitude with a gain of 0.82 and equal value with the gain of 0.75 at the high category. Furthermore, the control class, the gain test results showed that aspect openness, empathy, and being supportive is below the value of 0.3 in less category, while aspects of a positive attitude with a gain of 0.37 and an equal value with the gain of 0.40 in middle category. Based on the diagram above shows that the experimental class that learned with Cooperative learning model type of group investigation has a high interpersonal more communication skills effectively in every aspect compared to the control class that learned to conventional models. This suggests that cooperative learning type GI using PhET has trained Students to be able to develop interpersonal communication.

Group investigation conditioning the Students learn in groups, groups that Students interact to plan what they are going investigation, investigative measures, up to present the results of the investigation. Learning atmosphere like this, making the Students practice to express their opinions, ask and answer questions. GI train communicative attitude, Students begin to dare to argue and answer questions in the discussion. Students become more willing to cooperate not only in groups, but also within the scope of the class. The following test results gain interpersonal communication development of Students in the experimental class and control class at each session:



**Figure 3. Test results for each student gain develop interpersonal communication in session**

Learning in the classroom experiment at a session of the I-II, interpersonal communication skills of Students still in the low category with the gain of 0.23, so that when a student is learning still confuse when carrying out the investigation and only some Students are actively discussing. Upon entering session of II-III with category with the gain of 0.31, Students enthusiastically followed the learning procedure. Communication and exchange opinions already visible. Improvement continued until the session III-IV which are in the medium category with a 0.37 gain value. Unlike the control group, where at each session an increase in student interpersonal communication is still in the low category. It can be concluded that the development of

interpersonal communication Students in the experimental class tends to increase during the receiving of learning by cooperative learning model Type of GI using PhET, although still in the moderate category with an average gain value of 0.30.

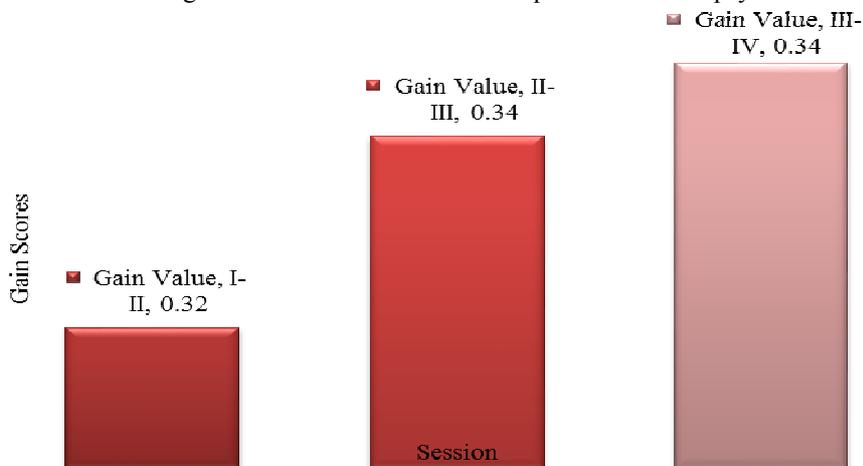
Possible lack of communication skills a person someone is a lack of interest on the topic and the lack of confidence to communicate their opinions. Based on the diagram above shows that the experimental class interpersonal communication progressing very significant compared to the control class. This suggests that GI cooperative learning model is applied to the experimental class gives more influence for Students to improve interpersonal communication skills compared with conventional learning model is applied to the control class.

Through the GI in model of a learning atmosphere would be more effective, cooperative relationships in the learning group will excite Students to have the courage to explain Their opinions and share information with other friends in discussing the learning material. The investigation process requires Students to be able to communicate well, interact, learn to be responsible for the group and doing practical result of psychomotor learning outcomes of Students also honed. The results of this psychomotor include aspects of observing, classifying, designing experiments, collecting data, collate, and present the results.

According to Siddiqui, M. H (2013: 79), the application of the model is to make an inquiry, to increase the level of participation, to make an inquiry about the problem, to increase the level of interaction, to develop logical thinking, to improve the level of critical thinking, to improve the communicative skills of Students and Teachers. Increase the speed of communication, interaction and networks can create innovation, but also force the continuous improvement of competence and adaptation to rapidly changing socio-economic environment (Bernatowicz, Anna., & Iwanski, Rafal, 2012: 3).

Investigative approach to science teaching will improve student performance for it is based on theoretical principles that emphasize the importance of intrinsic motivation raise student engagement by structuring the learning situation maximizing the initiative and responsibility for learning, both individual and collaborative (Adora, N. M. , 2014: 146).

Through interaction or activity of designing, researching, studying and doing practical work, Students will gain work experience that is valuable and likely to apply theory which is been learned through tasks that are accounted for (Chiu, L. K., Mahat, N. I., Hassan, S., Chik, A. R., & Yahya, M. A, 2010: 134). The observation of psychomotor learning outcomes can be seen from the results of observations made during the learning process. The development of the learning outcomes of Students in the experimental class psychomotor shown in Figure 4.

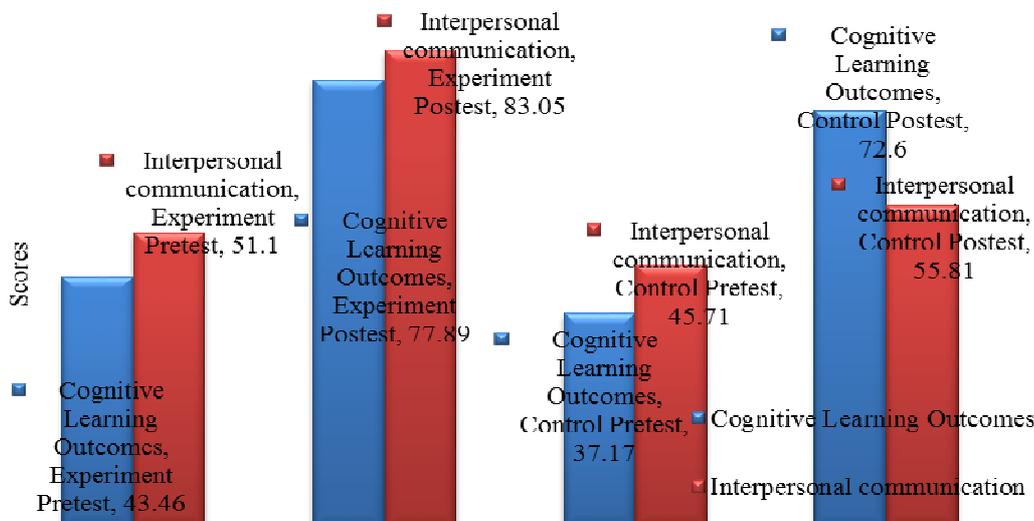


**Figure 4. Test Results Grade Students Gain Psychomotor Experiment**

The result of the gain on classroom experiments showed that psychomotor learning outcomes of Students from the first session until the fourth session is likely to increase. III Session of the gain 0,32dan at the session of II-III and III-IV increased to 0.34. So that the average value of psychomotor student learning outcomes gain of 0.33 and a middle category. Therefore, the application investigation group can improve psychomotor learning outcomes of Students. Clearly that learning must be designed so that Students can play an active role and perform physical activity or psychomotor to find their own concepts learned. From the bar chart above shows each session, psychomotor Students has increased. This is due to the more frequently GI cooperative learning model using PhET applied, Students are getting used to the learning model so as to improve psychomotor Students.

After analyzing the cognitive learning, development of interpersonal communication and psychomotor learning outcomes of Students, the obtained relationship between the cognitive learning to the development of Students' interpersonal communication and relationship between interpersonal communication with psychomotor learning outcomes of Students based on the average value of each aspect. The relationship between learning

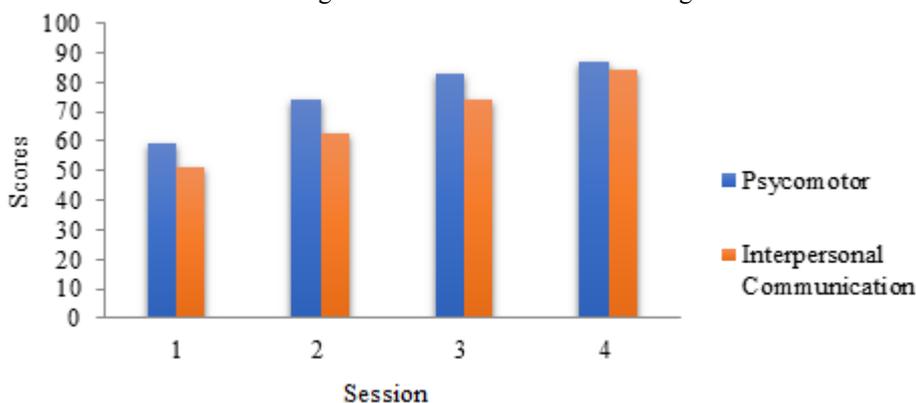
outcomes and student interpersonal communication development visualized in the following charts:



**Figure 5. Relationship of Learning Outcomes Cognitive and Interpersonal Communication**

Based on the diagram above shows that the increase in cognitive achievement and interpersonal communication in the experimental class is higher than the control class, it can be concluded that the learning outcome is accompanied by the development of interpersonal communication. The development of interpersonal communication tends to rise seen in the experimental class that learned with cooperative learning model type GI using PhET. In this case, the interpersonal communication has a positive effect on learning outcomes through cooperative learning model.

Furthermore, the relationship between psychomotor learning outcomes and development of interpersonal communication Students based on the average value of both can be seen in Figure 6.



**Figure 6. Diagram of psychomotor learning outcomes relationship and interpersonal communication**

Based on Figure 6, it appears that at each session psychomotor learning outcomes increase with interpersonal communication. It can be concluded that increasing the psychomotor learning outcomes interpersonal communication will also increase. Based on the diagram of the relationship of learning outcomes, development of interpersonal communication and psychomotor learning outcomes can be concluded that the learning outcome is accompanied by the development of interpersonal communication and psychomotor learning outcomes. Significant developments seen in the experimental class that learned through the cooperative learning model type of GI using PhET. The result of the gain on classroom experiments showed that psychomotor learning outcomes of Students from the first session until session IV in middle category with an average of 0.33. Therefore, the application investigation group can improve psychomotor learning outcomes of Students. Clearly that learning must be designed so that Students can play an active role and perform physical activity or psychomotor to find and establish its own concepts learned.

Based on the data and the results of observations that have been observed, it can be said that interpersonal communication and psychomotor learning outcomes affect cognitive achievement of Students through cooperative learning model using PhET. The higher the interpersonal communication skills and psychomotor learning outcomes of Students, the results of cognitive learning is also increasing. Although the results obtained have increased at every session, but the development of interpersonal communication and psychomotor skills of

Students in the experimental class cannot be said to be optimal because it has not reached the high category, so that Students still need guidance in order to interpersonal communication skills and learning outcomes psychomotor develop optimally to meet its aspects respectively.

Students who have the interpersonal communication skills in the category means that Students are able to make interpersonal relationships as shown openness but only limited to people nearby, showing empathy to a friend but is still limited to empathize with a friend who knows. Students already show support to others but still not deep only limited to providing the same support other people in general, Students have shown a positive attitude but still limited to those nearby, and the student has shown an attitude of equality but still need to develop ways of communicating equality to be accepted by others.

The importance of interpersonal communication in human life cannot be denied, as well as in educational institutions. One of the factors, that may cause harmonious interpersonal relationships is communication, because communication is one component in interpersonal relationships. Interpersonal communication is not just about what is really adjectives used but what is said and non-verbal messages sent through tone of voice, facial expressions, gestures and body language and the quality of interpersonal relationships between psychologists and clients is a significant increase in the price self-esteem, emotional stability, and the possibility of interactional (Kibe, N. P., & Kamunyu, C. K, 2014: 1; Adigwe, P., & Okoro, E, 2016: 1).

According to Gaur, V (2013: 143), the greater our ability to adapt and communicate in their language, the greater our chances of success. Good interpersonal relationships created if there is good communication. To foster good interpersonal relationships, we need to be open and replace dogmatic attitudes. We also need to have a confident attitude, the attitude of support, and open that encourage mutual understanding, mutual respect and develop quality (Tirmidzi, A., Nursalim, M., Pratiwi, T.I., & Setiawati, D, 2013: 128)

The success of the GI cooperative learning model using PhET is based a lot of things this is a model group investigation emphasizes the involvement of Students in full process. Investigation or inquiry carried out a learning activity that gives Students the possibility to develop Students' understanding through various activities and learning outcomes in accordance with the development of the Students passed. Learning activities traversed by solving problems or issues assigned by the Teacher, while the next learning activities tend to be open, that is not strictly structured by the Teacher, which in practice refers to various theories of the investigation.

Cooperative learning resulted in a higher-level reasoning, more frequent generation of new ideas and solutions. Interaction with the study group also brings high esteem, better communication and a better understanding. Through interaction can broaden their horizons and knowledge of the background, experience, attitudes and behavior of others and can provide a good influence (Orebiyi, A. O., & Orebiyi, T. P, 2011: 110; Bello, T. O, 2011: 73).

Although the cooperative learning model type of GI using the media PhET has made results better learning and the development of interpersonal communication tends to increase as compared to conventional learning, but there are some obstacles in conducting research, the researchers not optimally manage your time so that all the syntax less effective as the implementation of the learning process. In terms of control, directing the Students, to curb an activity, the researchers themselves are still not proficient overcome, the results of time which may be used in the investigation is still less than the maximum progress and most of the time wasted. In order to reduce the constraints described above, should Researchers must be mastered all the syntax and set the time to implement in a timely manner and the Students had no difficulty in following it.

#### 4. Conclusion

Based on an analysis of data from studies conducted, it can be concluded that the learning outcomes of Students subjected to cooperative learning model GI using the PhET better than the learning outcomes of Students who are subject to the conventional learning model, it can be seen from the average posttest Students after treated. In cooperative learning model type of GI using PhET, interpersonal communication Students also increased at each session. This is because the model is capable of increasing the activity and student interaction. The existence of interactions between Students causing interpersonal communication with one another, so that during the investigation process, Students are required to have good skills in communication. Students who have good interpersonal communication skills have good learning outcomes as well. Therefore, interpersonal communication has a positive effect on learning outcomes through cooperative learning model. It is also an effect on psychomotor learning outcomes of Students. Their learning activities during the investigation process can improve psychomotor learning outcomes. Thus, the learning outcome is accompanied by the development of interpersonal communication and psychomotor learning outcomes. Their learning activities during the investigation process can improve psychomotor learning outcomes.

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