

# THE EFFECT OF PHET-ASSISTED JIGSAW TYPE COOPERATIVE LEARNING MODEL ON STUDENTS' LEARNING OUTCOMES IN PRIVATE HIGH SCHOOL GRADE XI WAVE MATERIAL GAJAH MADA MEDAN 2022/2023 Academic Year

By :

Budi

Universitas Pembangunan

## Abstract

The purpose of this study is to determine the broad impact of the use of the Jigsaw cooperative mastery model assisted by PhET on the results of students' attention recognition on the greatness of XI SMA Gajah Mada Medan Academic Year 2022/2023. The form of this research is a quasi-experimental research. The population of this study was all students of class XI MIPA at SMA Swasta Gajah Mada Medan Academic Year 2022/2023. The sample in this study was taken using cluster random sampling, namely the experimental class of 30 students implemented to the Jigsaw cooperative mastery model assisted by PhET and the control class of 28 students implemented to the DI version. This observation tool uses an essay test with ten proven questions used in this study. The average pre-test score of the experimental class is 32.89 with a normal deviation of 2.99 and the average post-test score is 84.33 with a normal deviation of 2.72. These figures are based entirely on research findings. The suggested pretest ratings and desired deviations for the manipulation style were 35.44 and 3.82, respectively, and the intended posttest ratings were 71.33 and 5.93.  $t_{count}$   $t_{table}$  was accepted for each instruction with a daily distribution, even as  $F_{count}$  obtained  $F_{table}$  for homogeneous elegance. The results of the statistical test ( $t$ -party test) and  $dk$  56 found that the initial abilities of the 2 lessons were the same because  $t_{count} < t_{table}$ , or  $-0.84 < 1.94$ , is true. Furthermore, exclusive treatment has been applied to 2 lessons and towards the end of the lesson a publication test was given. From the results of the statistical test of the fact (one-  
celebration  $t$  check) it was obtained  $t_{count} > t_{table}$ , namely  $2.41 > 1.94$ , this indicates that there is a possibility of a Jigsaw type cooperative learning model that has a large influence with the help of PhET on student learning outcomes. resulting in excessive magnificence of Gajah Mada's personal XI questions, faculty of 2022/2023 academic year. **Keywords:** *Jigsaw Type Cooperative Learning, PhET, Learning Outcomes*

## INTRODUCTION

Education is vital for the entire network and is a conscious effort and a platform to create intelligent human beings or students and inspire every community to follow trends in the world of education, especially in the disciplines of generation and statistics, which are intensively related to physics.

In accordance with Law Number 20 of 2003 concerning the Objectives of the "National Education System is to maximize the competence of students to grow into human beings who are noble, pious, and pious to God Almighty, noble, knowledgeable, successful, revolutionary, independent, and ultimately become citizens of a democratic and accountable

country". If there is no new breakthrough in the world of international training and coaching, it is certain that this country will be increasingly marginalized amidst the strengthening expansion of foreign powers and information globalism. economic and information Various efforts have been made by the government and academic institutions to improve student learning outcomes that are striking from the government's efforts to innovate along with changing the school curriculum, increasing school enjoyment and improving academic centers and infrastructure, arranging teachers and principals .

Physics lessons are a Natural Science (IPA) that is very important for students as a means to train students so that by applying these concepts, students can deepen their understanding and develop practical abilities that have been learned and can have critical and creative thinking skills. Based on the results of interviews that have been conducted with teachers at Gajah Mada Private School Medan, it shows that physics learning carried out or delivered by teachers is more monotonous and not varied or is still dominated by teachers so that teachers become the center of learning information, learning models are still less varied, and it turns out that most students do not like physics lessons due to the many formulas that must be memorized and do not like lessons that involve calculations. Based on the above problems, efforts are needed to make this better, one of which is using the right mastery version which is basically one effort to optimize student mastery results.

In physics lessons, memorization should not be necessary, but it is necessary to choose teaching strategies that will motivate students to apply what they discover through experience. Physics also studies the natural environment systematically so that acquiring physics knowledge is not just memorizing material but also knowing and applying the principles contained therein, and students are given the opportunity to find out and do what is appropriate. so that scholars gain a deeper understanding of the herbal environment. related to physics. From the explanation above, it can be concluded that to increase motivation and get good results is to use the correct version of knowing. of course one of them is the Jigsaw type cooperative learning model.

The Jigsaw Learning Model is expected to increase students' responsibility for the tasks given. The reason researchers used the jigsaw cooperative model is because this learning model is very appropriate or suitable for wave material. In this learning model, there is group formation in the class so that students have an attraction to learn and have the opportunity to develop their potential and skills.

The use of this version of the Jigsaw Cooperative will be more optimal if it is combined with the use of media mastery, both simple and technology-based media. This mastery media is the Physics Training Generation (PhET). PhET is a study-based interactive simulation of physical phenomena provided free of charge. PhET was advanced through the College of Colorado Boulder. The simulations in phEt are developed through studies so that each simulation is in accordance with real life and the ideas that are intended to be developed (Sulisworo et al., 2018: 34). PhET has developed a series of interactive simulations that utilize the integration of the laptop era into learning. Due to the availability of inadequate laboratory systems, PhET is an excellent alternative to conducting actual experiments.

## **LITERATURE REVIEW**

### **1. Jigsaw Type Cooperative Learning Model**

Jigsaw type mastery is a cooperative learning method in which many groups are formed from one class of 4-6 people in one group heterogeneously and are responsible for assigning parts of the learning material and are able to teach that part to other members in their group. Jigsaw has been developed and tested by Elliot Aronson and friends at the University of Texas and then adopted by Slavin and friends at John Hopkins University. Jigsaw is designed to increase the sense of responsibility of students now not only learning the content material offered, but they must also be ready to provide and educate cloth to other group contributors. Therefore, students rely on each other and paint collectively cooperatively to learn the assigned material (Lie, 2008).

According to Rusman (in Irwan Susanto's journal, 2020: 2) said that "the jigsaw cooperative learning version is a version of cooperative learning that emphasizes the sport of scientific institutions in the form of small organizations. The introduction of Jigsaw type cooperatives does sports where students learn together in small businesses to learn material and work on assignments, and group contributors are responsible for the success of their group. The basic consideration of the jigsaw type is to provide students with the possibility to be proportional to others, teaching and being taught through fellow students is an important part of the coaching system and continuous mastery and socialization.

#### Stages of the Jigsaw Type Cooperative Learning Model

No	Step	Treatment
1	Stage 1	The instructor divides a category into groups, for example, four to six students with special talents. This group is known as a residential group. The number of contributors in one group is adjusted to the number of problem components, considering that the aim is to learn through students with the aim of familiarizing themselves with what will be implemented. In the Jigsaw approach, each student is given a project to master one part of the mastery material. All students with the same study material study collectively in a group called a business professional (Counterpart Group/CG). In a professional group, students discuss the same components in acquiring knowledge of the material and develop a plan to convey it to their friends when they return to their home place.
2	Stage 2	After students have spoken at expert companies or start-up companies, they create displays for each institution or draw a crowd for one of the companies to offer the results of the group discussions that have been conducted so that teachers can align perceptions of the learning materials that have been discussed.

No	Step	Treatment
3	Stage 3	The teacher gave a quiz to the students for my part.
4	Stage 4	The trainer rewards the organization through a reward score based on direct growth purchases that study the consequences from the base rank to the next quiz rank.
5	Stage 5	Learning materials should be clearly divided into sections.
6	Stage 6	It is worth mentioning that when using puzzles to research new material, instructors need to construct coherent and sufficient instructions and content so that the goal of knowledge acquisition can be achieved.

### 3. PhET

#### a. Understanding PhET

PhET is an interactive simulation that invites students to conduct research and explore without delay. This PhET software contains a summary of physics animations or cannot be seen with the naked eye, such as: gears and materials used in elastic materials. For quantitative exploration, this PhET software program has measuring tools installed in addition to rulers, stopwatches, voltmeters, and thermometers (Sugiarti, in the journal Hamida Lidia 2018: 33). Technological progress goes hand in hand with the use of media as a source of knowledge and information. Technological progress has a significant impact on media used for alternative statistical and knowledge activities. The use of media and the era as a source of knowledge has brought several benefits to its consumers. PhET is one example of the creation of technology-based teaching materials for physics education .

"Based on research, PhET is an interactive simulation of physical events. To provide open access, PhET was created by the University of Colorado Boulder with funding support from several donors (Sulisworo et al., 2018: 34). Simulations in PhET are created using real-world scenarios and future building blocks. The interactive simulations created by PhET are very useful for integrating computer technology into education .

The benefits of PhET simulation are as follows:

- a) can be used as an approach that requires involvement and interaction with students.
- b) provide dynamic comments.
- c) educate students to have a constructivist attitude, where students can combine previous knowledge with virtual findings from the simulations being carried out.
- d) Makes the introduction more exciting because students can learn and play in the simulation at the same time.
- e). Visualize physics ideas in the form of models.

## RESEARCH METHODS

### A. Time and Place of Research

This research was conducted at Gajah Mada Private High School in Medan, located at Jl. Bunga Kenanga No. 2, Padang Bulan, Medan Selayang District, Medan City, North Sumatra, from May to June 2023.

## B. Population and Sample

### 1. Population

The population in this study was all grade XI MIPA students at Gajah Mada Private High School, Medan, academic year 2022/2023, consisting of 2 instruction classes with a total of 56 students.

### 2. Sample

The pattern in this test consists of instructions namely class XI MIPA1 with a total of 30 students as an experimental class with a Jigsaw type cooperative learning model assisted by PhET assistance, and class MIPA2 with a total number of students of 28 students. as elegance management with instant acquisition of engineering knowledge. through the use of the Cluster Random Sampling method, population training has been selected as a research sample.

## C. Types of Research and Research Design

This type of research is a quasi-experimental study. In conducting this type of experimental research, researchers obtain certain student learning outcomes based solely on their own cognitive abilities without identifying any external causal factors. By providing special treatment to select the experimental group and providing a comparable control group, quasi-experimental research seeks to determine whether a causal relationship exists and how significant that relationship is.

## RESULTS AND DISCUSSION

### 1. Data Description of Experimental Class and Control Class

The effects of the tabulation of experimental value grouping and manipulation of pretest mastery effect can be seen in table 1.

Table 1. Pretest data for the experimental class and pretest scores for the control class

No	experimental class	fi	control class	fi
1	27.33	3	30.00	6
2	30.00	5	32.67	7
3	32.67	4	33.33	2
4	34.00	9	36.00	6
5	36.00	6	39.33	4
6	37.33	3	41.33	3
Amount		996.67	Amount	972.67
Average		32.89	Average	35.44
Elementary School		2.99	Elementary School	3.82

As shown in the table above, the average value obtained was 32.89 with a standard deviation of 2.99 for the experimental class, while for the control class the median value was 35.44 with a deviation of 3.82. The average value of the control class was found to be greater than the experimental class . **Description of Posttest Data for Experimental and Control Classes**

The tabulation results of the experimental cost grouping and the elegance manipulation of the pretest mastering can be seen in table 2.

**Table 2.** Posttest Value Data of Experimental Class and Control Class As seen in the table

No	experimental class	fi	control class	fi
1	80.67	5	57.33	4
2	82.00	7	67.33	4
3	83.33	5	70.67	4
4	85.33	3	74.00	6
5	86.67	4	78.67	4
6	88.00	6	80.00	6
Amount		2524.67	Amount	2020.00
Average		84.33	Average	71.33
Elementary School		2.72	Elementary School	5.93

above, the experimental class has an average value of 84.33 and a standard deviation of 2.72, while the suggested average for the control group changed to 71.33 with a general deviation of 5.93. It was determined that the average value of the experiment was greater than that of the control class.

## 2. Normality Test

**Table 3.** Calculation of Normality Test for Pretest and Posttest Data

No	Data	Group	$L_0$	Lt. Abel	Note
1	pretest	Experiment	0.070	0.161	Normal
		Control	0.013	0.167	Normal
2	posts	Experiment	0.004	0.161	Normal
		Control	0.049	0.167	Normal

It can be seen from the table above that  $L_{hitung} < L_{tabel}$ . This indicates that the evaluation of the normality of the pre-test and trial facts has been carried out in general. The usual conditions that must be met if  $L_{hitung} > L_{tabel}$  at 0.05 .

### 1. Normality Test of Pretest Data for Experimental and Control Classes

The Liliefors test was used to determine whether the data was normal. The pretest data for the experiment was obtained with a calculated L value of 0.070. Since  $L_{hitung} < L_{tabel}$  was achieved at a significant level with  $N = 30$  and  $L_{hitung} < L_{tabel}$  , it can be said that the data were regularly distributed. It can be concluded that the statistics are normally diluted because the

pretest value of the control class produced  $L_{\text{count}} = 0.013$  at the goodsized stage and  $N = 28$  accepted  $L_{\text{table}} = 0.167$

Normality Test of Post-test Data for Experimental and Control Classes The post-test result value with the Jigsaw Cooperative learning model produced  $L_{\text{count}} = 0.004$  at a significant level and  $L_{\text{table}} = 0.161$  with a sample size of 30, this indicates that the data is normally distributed with  $L_{\text{count}} > L_{\text{table}}$ . It can be concluded that the data is normally distributed because the post-test data using the direct recognition model obtained  $L_{\text{count}} = 0.098$  at a fairly large stage and  $N = 28$  obtained  $L_{\text{table}} = 0.167$

### 3. Homogeneity Test

**Table 4** Summary of Results of Pretest Data Homogeneity Test

No	Class	Variance	F <sub>count</sub>	F <sub>table</sub>	Conclusion
1	Experimental Class	8.95	0.61	1.89	Homogeneous
2	Control Class	14.56			

Based on Table 4, the calculated F value for the pattern used in this study is homogeneous or can represent the entire current population. For the statistical homogeneity publication test, see the results obtained, which can be seen in Table 4.6.

**Table 5.** Post - test results of homogeneity test

No	Class	Variance	F <sub>count</sub>	F <sub>table</sub>	Conclusion
1	Experimental Class	8.95	0.21	1.89	Homogeneous
2	Control Class	14.56			

Based on table 4.6, the calculated F value  $< F_{\text{table}}$ , which means that the sample used in this study is stated to be homogeneous or can represent the entire existing population.

### 4. Hypothesis Testing

#### a. Initial Ability Test / Pretest (Two-Part t-Test )

standard is to accept  $H_0$  if  $-t_{1-1/2\alpha} < t < t_{1/2\alpha}$

**Table 6.** Summary of Two-Tailed t-Test Calculations

No	Class	Average	t <sub>count</sub>	t <sub>table</sub>	Conclusion
1	Experimental Class	32.89	-0.84	1.94	The initial abilities of students in both classes are the same

2	Control Class	35.44			
---	---------------	-------	--	--	--

then  $t_{count} < t_{table}$ , namely  $-0.841 < 1.94$ , so it can be concluded that the initial abilities of the two classes were the same before being given treatment.

b. Post-test Mean Equality Test (One-tailed t-test)

This average similarity check aims to compare the final abilities of students in the experimental field of elegance and beauty control. check  $H_a$  accepted.  $H_0$  If  $t(1-a)$  is generated from a t distribution with  $dk = n_1+n_2-2$  and, then  $-t_{table}(1-a) < t_{count} < t_{table}(1-a)$ .  $H_0$  is rejected for other t values while  $H_a$  is accepted.

**Table 7.** Summary of One t-Test Calculations Party

No	Class	Average	$t_{count}$	$t_{table}$	Conclusion
1	Experimental Class	84.33	2.41	1.94	model assisted by PhET has an extraordinary influence on students' knowledge acquisition regarding the results on the topic of Waves.
2	Control Class	71.33			

Students gain knowledge about the results substantially motivated with the help of physics to recognize the effects of using the jigsaw type cooperative learning paradigm. This is proven by how the content of the material of class XI students in the 2022/2023 academic year at Gajah Mada Private High School is influenced by student learning outcomes. Based on the research findings, the average pretest score of the experimental class (X1) was 32.89 with a regular deviation of 2.99, while the average pretest score of the control class (X2) was 35.44 with a regular deviation of 3.82. The average posttest score in the experimental class ( X1 ) was 84.33 with a standard deviation of 2.72 and for the direct learning model was 84.33 with a standard deviation of 2.72 after the teaching and learning process was completed. with a standard deviation of 7.55 for the control class (x2) of 71.33. Based on the results of the post-test with a homogeneous population, this shows that the use of the jigsaw cooperative learning paradigm has a very large impact on the knowledge acquisition of undergraduates.

Based on the findings of statistical hypothesis testing (two-tailed t-test), it can be concluded that the initial abilities of students in the experimental class of beauty and manipulation before receiving equivalent improvements ( $t_{count} < t_{table} (-0.84 1.94)$ ). The hypothesis "there is a large influence of the Phet-Assisted Jigsaw Cooperative Introduction model on the results of the Main Material of Class XI Wave of Gajah Mada Private High School Medan Academic Year 2022/2023" is accepted in the statistical hypothesis test ( one-tailed t-test/ equality of post-test means) after being given treatment and post-test t.

## CONCLUSION AND SUGGESTIONS

### A. Conclusion

1. Students analyze the consequences of wave problems depending on the quantity taught with the jigsaw cooperative learning version based on the general public test score of 84.33, PhET-assisted
2. Based on the average submission test score of seventy-one.33 , the consequences of student learning lie in the wave material taught using the direct introduction approach.
3. The Phet-assisted Jigsaw Cooperative Learning Model has a strong influence on the learning outcomes of students of XI SMA Gajah Mada Swasta Medan for the 2022/2023 academic year. The results of the one-sided t-test show that  $t_{\text{count}} > t_{\text{table}}$  ( $2.41 > 1.94$ ).

### B. Suggestion

1. There are still many weaknesses in developing questions based on Bloom's taxonomy. For researchers, it would be better to develop questions better.
2. For future researchers , the company department should be maximized by determining students based on pre-test ranking or instructions from teachers who have problems with existing companies.

## BIBLIOGRAPHY

- Adi W. 2018. *Learning Strategy*. Yogyakarta. Faculty of Social and Political Sciences, University of Yogyakarta .
- Afandi Chamalah 2013. *Learning Model*. Semarang Sultan Agung Press. Afandi, M and Jupriyanto.
- Arikunto, 2013. *Research Procedures: A Practical Approach Jakarta: Rineka Cipta*.
- Arikunto, 2011. *Research Procedures: An Approach* .
- Arikunto, 2017. *Development of Research Instruments and Program Assessment Yogyakarta: Learning Library*
- Amin, A., Charli, L., & Fita, WN (2018). The Influence of *Jigsaw and Conventional Cooperative Learning Models on Physics Learning Outcomes*. *SPEJ (Science and Physic Education Journal)* , 2 (1), 11-17.
- Lie Anita, 2008. *Cooperative Learning: Practicing Cooperative Learning in Classrooms*
- Noor J, 2017. *Research Methods*
- Priansa, 2017. *Development of Innovative, Creative, and Achievement Learning Strategies and Models in Understanding Students* .
- Sagala, 2009. *Professional Competence of Teachers and Education Personnel: Empowerment of Teachers, Education Personnel and the Community in School Management* .

Sugiyono, 2016. *Quantitative, Qualitative and R&D Research Methods*. Bandung: PT Alfabet  
Sulisworo, ddk 2018. *Mobile Cooperative Learning Training Guide*. Sleman Budi Utama.

Sanjaya, 2010. *Learning Strategy Oriented to Educational Process Standards*. Jakarta:  
Pernada Media Group.

Gajah Mada Padang Bulan Medan. *Journal of Physicist Research* , 3 (1), 1-7.

Trisianawati, E., Djudin, T., & Setiawan, R. (2016). *The effect of the jigsaw cooperative learning model on student learning outcomes in vector material in class X of SMA Negeri 1 Sanggau Ledo*. *Journal of Physics Research and Its Applications (JPFA)* , 6 (2), 51-60 .

Urwati, K., Ernita, N., & Yahdi, Y. (2019). *The Effect of the Jigsaw Type Cooperative Learning Model on Students' Cognitive Learning Outcomes in Newton's Laws of Class X at MA Darul Muhajirin Praya*. *Journal of Natural Science and Integration* , 2 (2), 203-21