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IMPROVING PHYSICS LEARNING OUTCOMES THROUGH THE JIGSAW COOPERATIVE LEARNING MODEL IN CLASS X IPA-1 STUDENTS OF SMA NEGERI 6 BATANG HARI

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ABSTRACT:
This study uses classroom action research (*classroom action research*) for two cycles. The purpose of this action research is the purpose of this research is to find out the increase in physics learning outcomes of class X IPA-1 SMA Negeri 6 Batang Hari by using the cooperative learning model *jigsaw* . The target of this research was students of class X IPA-1 SMA Negeri 6 Batang Hari with a total of 32 students. The data obtained were in the form of formative test results, observation sheets of teaching and learning activities. From the results of the data analysis carried out, it was obtained that student learning outcomes data experienced an increase starting from the pre-cycle, cycle I to cycle II, namely, cycle I (68.18%) and increased in cycle II (90.91%). From these results it can be concluded that the type cooperative learning model *jigsaw* .can have a positive effect on student physics learning outcomes at SMA Negeri 6 Batang Hari so that this learning model can be used as an alternative improvement in learning Physics.

Keywords: *jigsaw,* Physics

INTRODUCTION

In formal institutions the process of reproduction of value systems and culture is carried out primarily through the teaching and learning process of a number of subjects in the classroom (Canagarajah, 1993). In accordance with Law no. 20 of 2003 concerning the national education system(Simamora &

Songgirin, 2023) (Jay, 2003) (Mahfud, 2019), article 3 states that;

"National education functions to develop capabilities and form dignified national character and civilization in the context of educating the life of the nation, aiming at developing the potential of students to become human beings who fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent and become citizens democratic and responsible" (Ismail et al., 2022).

The researcher argues that the task of a teacher is tough, because the progress of a nation is determined by the educational success of the nation itself (Finnemore, 1993). If a teacher or educator does not succeed in developing the potential of students then the country will not progress, conversely if the teacher or educator succeeds in developing the potential of students, intelligent, skilled and qualified human beings are created (Kunter et al., 2013).

Developing countries are always trying to catch up, namely by actively carrying out development in all areas of life. In the field of education, the government is always trying to improve the quality of education in various ways such as changing the curriculum, improving the quality of teachers through upgrading or continuing school to a higher level, providing School Operational Assistance (BOS) funds and so on (Rogan & Grayson, 2003).

Learning activities in schools will take place well if there is reciprocal communication between teachers and students (Chickering & Gamson, 1987). Students are required to be active, creative and innovative in responding to each lesson being taught so that the messages conveyed in the form of subject matter can be well received by students (Skinner & Belmont, 1993). One of the subjects that plays an important role in educating natural sciences, in everyday life to grow students from an early age is the subject of Physics.

But in reality, Physics is often considered a subject that is considered difficult for most students. The concept of learning Physics conveyed by the teacher cannot be understood by students. The lack of personal resilience in studying Physics can be expected to have a major effect on the enthusiasm for learning Physics. If this is allowed to happen, students will increasingly dislike Physics and even to a certain extent will be anti-Physics. As a result of all this, of course the achievement or results of Physics learning obtained by students will be lower, coupled with the teacher's delivery method in the learning process which is only monotonous. This is evidenced by the low student learning outcomes in Physics in class X IPA-1 SMA Negeri 6

Batanghari. The results of the data obtained by the researcher through the pretest showed that of the 31 students in class X IPA-1, only 10 students were able to achieve learning outcomes above the KKM, namely ≥70. While as many as 21 other students still got low learning outcomes, namely below the KKM ≤70.

Conditions in the classroom were also exacerbated by the management of teachers (researchers) who often used the lecture learning model. This learning model can not generate student activity in learning. This can be seen from the behavior of students who tend to only listen and record the lessons given by the teacher. Students do not want to ask questions or express opinions about the material provided. Even though they have held discussions, it turns out that from the discussions that have been carried out, it turns out that students are still unable to express opinions, because students' basic abilities are low. In group work, only one or two people are active, while the others talk about other things that are not related to group assignments.

In carrying out group discussions, researchers also noticed that among group members there were those who liked to disturb friends because they thought that in group study (discussion) it was not necessary for everyone to work. Because not all group members are active, there is less responsibility in the group, even in group work (discussion). Looking at the facts that the researcher found on students' attitudes in the learning process mentioned above, the researcher believes that the learning outcomes of students at SMA Negeri 6 Batanghari, especially in class X IPA-1 in learning Physics, are very poor.

Based on the experiences that researchers face in the inactive Physics learning process, the actions of researchers as teachers in an effort to increase student activity and learning outcomes are manifested by choosing other learning models or active learning models so that learning is more meaningful and of higher quality. One of the appropriate cooperative learning models in learning Physics is a model *jigsaw*. Model *jigsaw* This learning model is designed to increase students' sense of responsibility towards their own learning as well as the learning of others. Students not only learn the material provided, but they must also be prepared to provide and teach the material to their group. So that both cognitive and social abilities of students are needed (Zebua, 2022).

Based on this fact, to improve student learning activities and improve their learning outcomes, the researcher wishes to conduct classroom action research with the title "Improvement of Physics Learning Outcomes through the Cooperative Learning Model *jigsaw* in class X IPA-1 SMA Negeri 6 Batanghari".

RESEARCH METHODS

In accordance with the type of research chosen, namely action research, this research uses the action research model from (Kemmis & McTaggart, 1988), which is in the form of a spiral from one cycle to the next. Each cycle includes *planning* (plan), *action* (action), *observation* (observation), and*re flection* (reflection) (Sartori et al., 2011). The steps in the next cycle are revised plans, actions, observations, and reflections. Before entering cycle 1, a preliminary action is carried out in the form of problem identification (Kyrö, 2004). The spiral cycle of the stages of classroom action research can be seen in the following figure:

Figure 1.PTK flow

Cycle I

1. Planning

a. Identification of problems and determination of alternative solutions to problems.
b. Planning learning that will be applied in the teaching and learning process.
c. Establish competency standards and basic competencies.
d. Choose the appropriate study material
e. Prepare resources, materials, and other tools needed
f. Develop student worksheets
g. Develop an evaluation format
h. Develop a learning observation format.

2. Action

a. Implement actions that refer to learning scenarios.
b. Students read the material contained in the source book.
c. Students listen to the teacher's explanation of the material contained in the resource book.
d. Students listen to the teacher's explanation of the material being studied.
e. Students discuss problems (cases) that have been prepared by the teacher.
f. Each group reports the results of the discussion.
g. Students work on student worksheets.

3. Observation

a. Make observations using the observation format that has been prepared, namely with a tape

recorder, anecdotal notes to collect data.

b. Assess the results of actions using the student worksheet format (LKS)
c. Reflection
d. Evaluate the actions that have been taken including evaluating the quality, amount and timing of each type of action.
e. Conduct meetings to discuss evaluation results regarding learning scenarios and student worksheets.
f. Improve the implementation of actions according to the results of the evaluation, to be used in the next cycle.

Cycle II

1. Planning

a. Identification of problems that arise in cycle I that have not been resolved and determination of alternative solutions to problems.
b. Determine indicators of achievement of learning outcomes.
c. Action program development II.

2. Action

Implementation of action program II which refers to the identification of problems that arise in cycle I, in accordance with alternative solutions to problems that have been determined, including through:

a. Distribution of material or different problems in each group.
b. Students discuss in groups to analyze the learning material that has been given.
c. After the discussion, students were asked to present the results of their discussion in front of the class.
d. Teachers and students ask each other questions
e. Students with teacher guidance make conclusions or summaries

3. Observation

a. Make observations according to the format that has been prepared and record all the necessary things that occur during the implementation of the action.
b. Assess the results of the action according to the format that has been developed.

4. Reflection

a. Evaluate the actions in cycle II based on the data collected.
b. Discuss the results of the evaluation of learning scenarios in cycle II
c. Improving the implementation of actions in accordance with the results of the evaluation to be used in the next cycle.

RESULT AND DISCUSSION

The research data was obtained from observational data in the form of observations on the management of type cooperative learning models *jigsaw* and observation of teacher and student activities in each cycle (Hakim & Sakti,

2019). Observation sheet data were taken from two observations, namely observational data on the management of type cooperative learning models *jigsaw* which is used to determine the effect of applying the type of cooperative learning model *jigsaw* in improving student learning outcomes and observation data of teacher and student activities. Furthermore, the formative test data is used to determine the increase in student learning outcomes after the implementation of the type cooperative learning model *jigsaw*.

Research result

Cycle I

A. Student Test Results

The following are the results of student tests in cycle I, which are stated in the following table.

Table 1
Formative Test Values in Cycle I

No. Mass age	Mark	Information	No. Mass age	Mark	Information
1	66	Not Completed	17	60	Not Completed
2	65	Not Completed	18	85	complete
3	85	complete	19	75	complete
4	65	Not Completed	20	65	Not Completed
5	65	Not Completed	21	55	Not Completed
6	70	complete	22	55	Not Completed
7	65	Not Completed	23	64	Not Completed
8	70	complete	24	77	complete
9	70	complete	25	75	complete
10	45	Not Completed	26	78	complete
11	55	Not Completed	27	55	Not Completed
12	35	Not Completed	28	70	complete

13	66	Not Completed	29	79	complete
14	59	Not Completed	30	66	Not Completed
15	68	Not Completed	31	70	complete
16	66	Not Completed			
			Total Value =	2044	
			Total Score l Ideal =	3100	
			Average Value Achieved =	65.94	
			Information:		
			Number of students who have not completed=		19
			Number of students who completed=		12
			Classical=		Not Completed

Table 2
Recapitulation of Formative Test Results in Cycle I

No.	Description	Cycle I Results
1.	Formative test average score	65.94
2.	Number of students who complete the study	12
3.	Percentage of learning completeness	38.71

From the tables and pictures of cycle I above, it can be explained that by applying the type cooperative learning model *jigsaw* there is a significant increase in learning completeness. The value of student learning outcomes reached an average of 65.94 with mastery learning reaching 38.71% or there were as many as 12 students out of 31 students who had achieved complete learning. This shows that the learning outcomes in the first cycle are still not thoroughly studied classically, because only 65.94% of students who score ≥70 have not been able to achieve the desired percentage of learning completeness, which is 85%.

B. Learning Management

The observation data for meeting 1 and meeting 2 in cycle I are as follows:

Table 3
Management of Learning in Cycle I

No.	Observed Aspects	Assessment (Observer)	Percentage (%)
I.	KBM observation A. Introduction		
	1. Motivate students	1	25
	2. Delivering learning objectives	3	75
	3. Connect with the previous lesson	2	50
	4. Organize students in study groups	2	50
	B. Core Activities		
	1. Presenting the steps of the cooperative learning method	2	50
	2. Guiding students to carry out activities	1	25
	3. Train cooperative skills	1	25
	4. Supervise each group in turn	1	25
	5. Provide assistance to groups experiencing difficulties	3	75
	C. Closing		
	1. Guide students to make a summary	3	75
	2. Provide evaluation	2	50
II.	Time Management	2	50
III.	Class Enthusiasm		
	1. Students are enthusiastic	1	25
	2. Enthusiastic teacher	2	50
	Amount	24	
	Information :	Mark Criteria	

	1	Not good
	2	Not good
	3	Pretty good
	4	Good

Based on the table of observations of teaching and learning activities above, information is obtained that the aspects that get the criteria of being unfavorable and not good are motivating students, organizing students in study groups, providing evaluation and time management with percentages of 25%, 50%, 50% and 50%, while teacher activities such as conveying learning objectives, guiding students to carry out activities, practicing cooperative skills, providing assistance to groups experiencing difficulties, and teacher enthusiasm reach percentages of 75%, 25%, 25%, 75%, and 50%. The aspects that received poor and not good ratings above, were a weakness that occurred in cycle I, which will be a study material for reflection and revision that will be carried out in cycle II.

The results of this study are in line with the opinion of (Christiansson & Rentzhog, 2020) who argued that learning management is an activity of projecting what actions will be carried out in a lesson (PBM), namely by coordinating (arranging and responding) the components of learning, so that the direction of the activity (objectives), the content of the activity (material), how to deliver activities (methods and techniques, and how to measure it (evaluation) becomes clear and systematic.

C. Teacher and Student Activities

The results of the next observation are teacher and student activities as shown in the following table

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Table 4
Teacher and Student Activities in Cycle I

No.	Teacher activity observed	Percentage (%)
1	Delivering goals	50
2	Motivating Students	25
3	Relate to previous lessons	50

4	Deliver material / steps / strategies	50
5	Explain difficult material	50
6	Guiding and observing students in discovering concepts	50
7	Ask students to present and discuss the results of the activity	25
8	Provide feedback	25
9	Guide students to summarize the lesson	50

No.	Observed student activity	Percentage(%)
1	Listening/paying attention to the teacher's explanation	42,7
2	Read a book	41,9
3	Work with fellow group members	41,9
4	Discussions between students / between students and teachers	38,7
5	Presenting learning outcomes	42,7
6	Presenting/responding to questions/ideas	44,4
7	Writing that is relevant to KBM	42,7
8	Summarize learning	43,5
9	Doing evaluation tests	43,5

Based on the table above it appears that on average the most dominant teacher activity in cycle I was relating to the previous lesson, conveying material/steps/learning strategies, Asking Students to present and discuss the results of activities, providing feedback and guiding students to summarize the lesson by percentage of 50%, 50%, 25%, 25% and 50%. Furthermore, aspects of motivating students, conveying goals, explaining difficult material, as well as guiding and observing students in finding only achieving percentages of 25%, 50%, 50%, 50% and 50%.

While the most dominant student activity is presenting/responding to questions/ideas and writing relevant to teaching and learning, achieving a percentage with an average score of 43.55%, working with fellow group members with a percentage of 41.9%, presenting learning outcomes with a percentage of 42 .7%, summarizing the lesson with a percentage of 43.5%. Meanwhile other aspects still achieved minimal scores, namely listening/paying attention to teacher explanations with a percentage of 42.7%, reading

books, discussions between students/between students and teachers, taking evaluation tests only achieving an average percentage of 41.37%.

The results of the observations in the above research are in line with the opinion(Nanang Hanafiah, 2010: 23), which suggests that the process of learning activities must involve all aspects of students, both physically and spiritually so that changes in behavior can change quickly, precisely, easily and correctly, both related to cognitive affective and psychomotor aspects

Cycle II

Cycle II is an advanced stage of a PTK, which will be held in 2 meetings, with each meeting covering the cycle stages of planning, implementing, observing, and reflecting.

A. Student Test Results

The following are the results of student tests in cycle II, which are stated in the following table.

Table 5
Formative Test Values in Cycle II

No. Mas sage	Mar k	Information	No. Mass age	Mark	Information
1	80	complete	17	60	Not Completed
2	90	complete	18	85	complete
3	85	complete	19	75	complete
4	75	complete	20	65	complete
5	75	complete	21	80	complete
6	76	complete	22	90	complete
7	65	complete	23	64	Not Completed
8	70	complete	24	77	complete
9	70	complete	25	75	complete
10	45	Not Completed	26	78	complete
11	80	complete	27	88	complete
12	77	complete	28	70	complete
13	66	complete	29	79	complete
14	59	Not Completed	30	66	complete
15	68	complete	31	70	complete
16	66	complete			

Total Value =	2269
Total Score Ideal =	3100
Average Value Achieved =	73.19
Information:	
Number of students who have not completed=	4
Number of students who completed=	27
Classical=	complete

Table 6
Recapitulation of Formative Test Results in Cycle II

No.	Description	Cycle II results
1.	Formative test average score	73.19
2.	Number of students who complete the study	27
3.	Percentage of learning completeness	87.10

From the tables and figures of cycle II, it can be seen that student learning outcomes experienced a better improvement than cycle I. The average student learning outcomes reached 73.19 with the number of students who completed their studies reaching 27 students out of 31 students with learning completeness reaching 87.10%. , meaning that the students' Physics learning process in cycle II classically has achieved complete learning, because students who score ≥70 have increased by 87.10% greater than the desired percentage of completeness, which is equal to 85%.

From these data it can be concluded that an increase in learning outcomes in cycle II is influenced by an increase in the teacher's ability to apply the type of cooperative learning model *jigsaw* so as to make students more enthusiastic and motivated in participating in learning, learning concepts increasingly attract students' interest and attention so that understanding of the learning material delivered increases and will have a good effect on improving learning outcomes.

1. Learning Management

The observation data for meeting 1 and meeting 2 that occurred in cycle II are as follows:

Table 7
Management of Learning in Cycle II

No.	Observed Aspects	Assessment (Observer)	Percentage (%)
I.	KBM observation A. Introduction		
	1. Motivate students	3	75
	2. Delivering learning objectives	3	75
	3. Connect with the previous lesson	4	100
	4. Organize students in study groups	4	100
	B. Core Activities		
	1. Presenting the steps of the cooperative learning method	4	100
	2. Guiding students to do activities	3	75
	3. Train cooperative skills	3	75
	4. Supervise each group in turn	3	75
	5. Provide assistance to groups experiencing difficulties	3	75
	C. Closing		
	1. Guide students to make summaries	3	75
	2. Provide evaluation	3	75
II.	Time Management	4	
III.	Class Enthusiasm		
	1. Enthusiastic students	3	75
	2. Enthusiastic teacher	4	100
	Amount	47	
		Rate-rate	83,93%

Information :	Mark	Criteria
	1	Not good
	2	Not good
	3	Pretty good
	4	Good

From the table above, it can be seen the aspects observed in the teaching and learning activities (cycle II) carried out by the teacher using the cooperative learning model *jigsaw* experienced an increase in very good ratings from observers starting from motivating students, organizing students in study groups, presenting the steps of the cooperative learning method, guiding students to make summaries, increasing the enthusiasm of teachers and students, organizing students in working groups, guiding students formulating conclusions finding concept, providing evaluation, time management which achieves a percentage with an average of 83.93%.

2. Teacher and Student Activities

The results of the next observation are teacher and student activities as shown in the following table.

Table 8
Teacher and Student Activities in Cycle II

No.	Teacher activity observed	Percentage(%)
1	Delivering goals	100
2	Motivate students	75
3	Relate to previous lessons	75
4	Deliver material / steps / strategies	100
5	Explain difficult material	75
6	Guiding and observing students in discovering concepts	100
7	Ask students to present and discuss the results of the activity	75
8	Provide feedback	75
9	Guide students to summarize the lesson	100
	Rate-rate	86,11
No.	**Observed student activity**	
1	Listening/paying attention to the teacher's explanation	76,6
2	Read a book	90,3
3	Work with fellow group members	78,2
4	Discussions between students / between students and teachers	80,6
5	Presenting learning outcomes	77,4

6	Presenting/responding to questions/ideas	76,6
7	Writing that is relevant to KBM	80,6
8	Summarize learning	76,6
9	Doing evaluation tests	75,8

Based on the table above it appears that the average activity of teachers and students in cycle II experienced a better increase than the previous cycle. The most dominant teacher activity that experienced an increase was motivating, conveying materials/learning strategy steps with percentages of 75%, 100%, 75% and 100%, students presenting and summarizing learning with percentages of 75% and 100%..

While student activities that experienced the most dominant increase from the previous cycle I were writing relevant to teaching and learning 80.6%, presenting/responding to questions/ideas 76.6%, doing evaluation tests 75.8%, reading books 90.3% , working with group members, listening/paying attention to teacher explanations with percentages, summarizing 76.6% and presenting learning outcomes reaching 76.6% and discussions between students/between students and teachers achieving a percentage of 80.6%.

Discussion

1. **Completeness Student learning outcomes**

Through the results of this study, it shows that learning with the cooperative learning model is type *jigsaw* has a positive impact in improving student learning outcomes. This can be seen from the increasingly solid understanding and mastery of students towards the material that has been delivered by the teacher during the cycle.

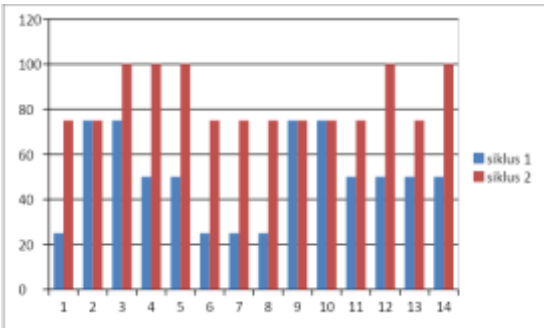
So that it has an impact on increasing students who have completed learning cycle I as many as 12 people, and cycle II to 27 students from a total of 31 students. Learning completeness increased starting from the first cycle, and the second cycle, namely 38.37% and 87.10%, respectively. In cycle II the classical mastery of student learning has been achieved and experienced a very significant increase.

2. **Teacher's ability to manage learning**

Based on the results of data analysis originating from observer observations in each cycle, it can be seen that the teacher's ability to manage learning with a cooperative learning model *jigsaw* increased rapidly in each cycle. Teachers have been able to motivate students

well, convey learning objectives optimally, convey learning material well followed by the ability to review and summarize well.

In addition, teachers have been able to apply cooperative learning model steps *jigsaw* properly, from forming study groups to managing learning time properly so that the target of learning material can be achieved. In this case the teacher has succeeded in making the learning environment a pleasant class.



3. Teacher and Student Activities in Learning

Based on the analysis of observer observation data from cycle I and cycle II, it can be concluded that the activities of teachers teach with the subject matter of the basis of the state and the constitution with the type cooperative model *jigsaw* has increased. Previous weaknesses, such as conveying goals, and others have been fixed. In addition, the most dominant teacher activities, namely motivating students, relating to previous lessons, explaining difficult material, guiding and observing students in discovering concepts, asking students to present and discuss the results of activities and guiding students to summarize lessons, seen in large or good scores which is obtained.

Table 10
Recapitulation of Cycle I and II Teacher Activities

Teacher activity observed	Percentage	
	Cycle	Cycle II
Delivering goals	50	100
Motivate students	25	75
Relate to previous lessons	50	75
Deliver material / steps / strategies	50	100
Explain difficult material	50	75
Guiding and observing students in discovering concepts	50	100
Ask students to present and discuss the results of the activity	25	75
Provide feedback	25	75
Guide students to summarize the lesson	50	100

As for student activities during learning, based on observations by observers, after the application of the type cooperative learning model *jigsaw*

also increased significantly. This can be seen from the pictures of student activity between cycle I to cycle II. Various weaknesses that occurred in cycle I have been resolved in cycle II. It can be seen that the most dominant activities are listening/paying attention to teacher explanations, reading books, discussions between students/between students and teachers, writing relevant to teaching and learning activities, presenting ideas and presenting learning, summarizing learning and doing evaluation tests marked with an assessment score of 24.00-27.50. So, it can be said that student activity can be categorized as active.

Table 11
Recapitulation of Student Activities Cycles I and II

No.	Observed student activity	Percentage (%)	
		Cycle I	Cycle II
1	Listening/paying attention to the teacher's explanation	42,7	76,6
2	Read a book	41,9	90,3
3	Work with fellow group members	41,9	78,2
4	Discussions between students / between students and teachers	38,7	80,6
5	Presenting learning outcomes	42,7	77,4
6	Presenting/responding to questions/ideas	44,4	76,6
7	Writing that is relevant to KBM	42,7	80,6
8	Summarize learning	43,5	76,6
9	Doing evaluation tests	43,5	75,8

CONCLUSION

Based on the results of the research data analysis that has been presented for two cycles as well as the results of all discussions, it can be concluded that the type of cooperative learning model *jigsaw* can improve the quality of learning Physics and cooperative learning model types *jigsaw* has a positive impact on improving student learning outcomes which is marked by an increase in student learning completeness in each cycle, namely cycle I (38.37%), and cycle II (87.10%)

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