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Cooperative learning implementation to improve an achievements of students on science competition

Durrul Jauhariyah*
Madrasah Aliyah Negeri 1 Bandar Lampung
INDONESIA

Dardiri
Madrasah Aliyah Negeri 1 Bandar Lampung
INDONESIA

Andika Eko Prasetiyo
Graduate School of Humanities and Social Sciences, University of Melbourne
AUSTRALIA

Fitria Lestari
Universitas Muhammadiyah Lampung
INDONESIA

Jutamat Sutduean
Dhurakij Pundit University, Bangkok
THAILAND

Thanaporn Sriyakul
Mahanakorn University of Technology
THAILAND

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Abstract

The number of student achievements in competition is one indicator to see the quality of learning in a school. This study aims to see the extent to which the application of cooperative learning in improving students' ability to face physics olympiad and other competitions. The sample consisted of 12 students who were prepared to compete and were taken from 3 different grade levels namely 10th grade, 11th grade, and 12th grade in one of the State Madrasah Aliyah (MAN) in Bandar Lampung City. The 12 students were divided into 2: 6 students in the experimental class and 6 in the control class. The study used a type of Quasi Experiment with the design of One Group Pretest-Posttest Design. Learning is done by applying three types of cooperative learning, namely Student Team Achievement Division (STAD), Jigsaw II type, and Teams Games Tournament (TGT) type with a total of 24 meetings. The results of the learning process are obtained from the results of the pre-test given to all students. In the pre-test, it was divided into 2 types, namely: Pre-test grub and Individual Pre-Test. Pre-Test grub is a test that answers questions quickly, precisely, and carefully. In the Pre-test grub, it is done by dividing 12 students into 4 grub (3 students/grub). Pre-Test grub is a simulation of LCT (Lomba Cepat Tepat). Pre-Test grub is an application of cooperative learning method type (TGT) which aims to train speed in answering questions correctly. Individual Pre-Test is Pre-Test which is done by giving students a question sheet to answer. Both types of Pre -Test are given 120 minutes each. After doing the Pre-Test, students test results were evaluated to find out the deficiencies in understanding. Furthermore, the re-learning process is given again in the form of repetition and reinforcement of material that is poorly understood before the Post-Test (grub and individual) is carried out. The results showed that there were differences in understanding the theory and test scores based on differences based on class level, the number of participants in learning activities, and the number of students practicing answering questions. The results of this study were then correlated with their achievements from the results of physics competitions at various events. The results showed that cooperative learning methods with 3 types, namely: type (STAD), type Jigsaw II, and type (TGT) can improve achievement in physics competitions. The conclusions of these results, obtained from the results of the scores on the grub or LCT competitions conducted at different times and places, and also from the results of the comparison of physics olympiad scores (individual competition). The results of this study show that the cooperative learning model has a positive impact on student achievement.

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INTRODUCTION

Achievement is a learning measure tool in many cases. To achieve this target, teachers use a variety of teaching methods such as theoretical explanation, work on sample questions, discussions, and demonstrations of the use of experimental tools. Among all the methods that are most widely accepted and practiced are explanations of the theory and the completion of sample problems (Abrami *et al., 2004; Nguyen et al., 2006).

* **Corresponding author:**
Durrul Jauhariyah, Madrasah Aliyah Negeri 1 Bandar Lampung, INDONESIA. ✉ durrul_jauhariyah@yahoo.co.id

Although teaching methods such as explanation and work on sample questions are the most popular in the world of education, they still have criticism by many researchers who state that they have not been sufficiently helpful in an in-depth understanding of the concept of a subject (Irwansyah et al., 2018; Tompo et al., 2016). This has encouraged a lot of emphasis on teaching through various methods to improve learning and understanding (Jatmiko et al., 2018; Putra et al., 2018; Widiana et al., 2018). Some methods used to improve student achievement are cooperative learning methods, continuous learning methods (Retnowati et al., 2018), have feedback, and followed by evaluation (Abdurrahman et al., 2018; Suryandari et al., 2016).

The implementation of cooperative learning process has been used in this research. This research is expected to be able to improve student achievement, interest and enthusiasm in learning (Gull & Shehzad, 2015). Cooperative learning has advantages over other teaching methods in terms of their effectiveness in improving cognition (Gillies, 2016), social skills (Sulisworo & Suryani, 2014), and motivation (Gull & Shehzad, 2015).

Cooperative learning methods are learning methods by forming groups. In this group students who have different understandings are strived to teach each other (Gillies, 2016). This method can produce more understanding than individual learning methods (only accept teaching (Güvenç, 2010) In addition, this cooperative method has been proven in previous studies that can improve significant achievements (ul Haq & Saad, 2015) in the fields of science (Mehta & Kulshrestha, 2014) and other relevant fields such as (the arts, humanities, and social sciences (Gull & Shehzad, 2015). Cooperative learning also increases positive attitudes towards learning (Clare, 2009), improves social relations (Johnson et al., 2014), in addition to high self-esteem and cohesiveness (Sahin, 2010). Cooperative learning can also be expressed in terms of learning strategies where students work together to achieve learning goals (Abrami * et al., 2004).

There are dozens of strategies that can be used in the learning process, some of which have been the Student Teach Achievement Division (STAD), Jigsaw II, and Teams-Games-Tournaments (TGT) (Harahap & Derlina, 2017; H. K. Sari, 2016; Mehta & Kulshrestha, 2014; Zulva, 2016). The essence of all these learning activities is that in each case students are divided into heterogeneous groups based on their learning abilities, where they support each other for learning (Slavin, 2010).

STAD is the simplest form of learning, where the teacher provides material to students and they learn it as a group (Gull & Shehzad, 2015). Whereas Jigsaw II is a team activity, where one type of member is responsible for mastering their own part of the material (Güvenç, 2010), while experts are responsible for teaching their material to other members of the group (Syed et al., 2017). After that, each member's score is generated based on the test, and then the accumulative scores of all teams are calculated by reference to individual scores. Research studies conducted by Jolliffe (2005) report its effectiveness to improve academic achievement and social skills. Similar results have been reported by (Vaughan, 2002). TGT is a method in which students are divided into heterogeneous groups, where they play several games based on the given teaching material (Gull & Shehzad, 2015). Scores are given individually and collectively too, however, only team scores are considered as the basis for winning and losing (Tran et al., 2014).

Continuous learning methods and having feedback are one of the most popular methods used in education today. As explained by (Black & Wiliam, 1998; Hattie & Timperley, 2007) in research (Abdurrahman et al., 2018), feedback is one of the factors in the continuum of learning that has a very strong impact on the success of the learning process and achievement of students. This is also presented by (Syed et al., 2017) that learning methods that have feedback or feedback can be used as teaching activities, increasing motivation, class participation, and student academic achievement (Mehta & Kulshrestha, 2014). Several improvement responses to each "evaluation" in the writings of Abdurrahman et al, both those carried out by students themselves (self-assessment), teachers (ongoing and formative assessment) (Retnowati, 2017), other students (peer-assessment), and parents (Ramadhanti & Yanda, 2018). Feedback, if viewed from the attributes, the roles can be divided into five categories: correction (correction), reinforcement (reinforcement), forensic diagnostic, bench-marking, and longitudinal development (Price et al., 2010).

Several studies have been conducted (Triarini et al., 2017), in a study that examined the effect of cooperative learning on academic achievement on Senior high school students in the field of mathematics, he reported that there was a significant difference between the value of student

achievement taught by cooperative and traditional methods (Retnowati, 2018). Students taught by cooperative methods show high grades. As well as (Roseth et al., 2008) have done their research using cooperative learning to improve the performance of ESL students, the results are positive. Likewise, studies conducted by (Sari et al., 2018) for two weeks students in general science also proved that students who were taught with cooperative learning methods had improved outcomes than the control group.

METHOD

This study had been conducted used the quasi-experimental method with qualitative data correlation for 6 months on September 2017 – Februari 2018. Physics concept mastery data was obtained by pre-test scores (group and individual), post-test (group and individual), and physics competition scores (held in various competitions in Lampung Province), and achievement of rankings or awards from the results of the physics competition. A total of 12 students of MAN 1 Bandar Lampung were selected and involved in this study, with details of 1 class 10, 4 class 11, and 7 class 12 students. All students were treated equally by giving learning in the form of deepening the theory and discussing the questions continuously (ongoing assessment), evaluation of pre-test scores (group and individual), post-test (group and individual), and physics competition scores. This evaluation is emphasized to predict the types of questions that often come out in competitions or physics competitions and subsequently given repetition of theoretical and discussion of the questions in the material or sub-chapters of fields that are still poorly understood. Table 1 below presents (research and treatment).

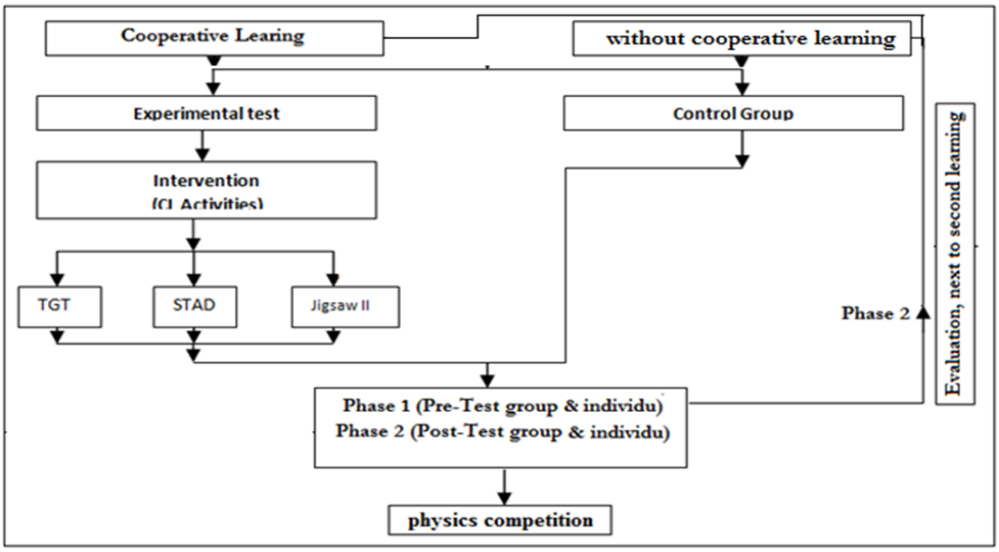

Figure 1. Pre-test-Post-test control group experimental design (TGT=Team Game Tournament; STAD= Student Team Achievement Division) (Modified from (Gull & Shehzad, 2015))

Table 1. Research and treatment (based on experimental and control classes)

Types of learning activities	Treatment	Frequency of assessment / meeting	Total of Students (N)
Experiment	Deepening theory and continuous discussion of questions (ongoing assessment), predicting the types of questions that often come out in competitions or physics competitions. With feedback using evaluation, repetition, and reinforcement (reinforcement). All are done using cooperative learning methods	phase 1 (12x meeting then pre-test) evaluation, repetition (second learning) phase 2 (12x meeting then pre-test)	6

Types of learning activities	Treatment	Frequency of assessment / meeting	Total of Students (N)
Control	The Formative assessment uses pre-test scores and physics competition with feedback in the form of corrections and discussion of questions. All are done with classical learning methods (without cooperative learning)	phase 1 (12x meeting then pre-test) evaluation, repetition (second learning) phase 2 (12x meeting then pre-test)	6

In this study, the learning process was given with 2 types of classes: experimental class (6 students) and control class (6 students) randomly selected from 12 selected students (MAN 1 Bandar Lampung physics competition team). This cooperative learning process is given only to the experimental class. While the control class is given a classical learning process or without cooperative learning. The cycle is carried out 2x repetitions (phase 1 and phase 2). The learning process in the experimental class uses a continuous cooperative method with 3 types: Student Teach Achievement Division (STAD), Jigsaw II, and Teams-Games-Tournaments (TGT). In the learning process, students are divided into heterogeneous groups that support each other to understand and achieve high scores. The pre-test was conducted in 2 types, namely pre-test grub, and individual pre-test. The pre-test aims to measure the level of accuracy and speed in working on the problem. In this group pre-test, students are given a score based on the total score of each group. Both of these pre-tests were given the correct 20 points rating, did not answer 0 points, and one -10 points

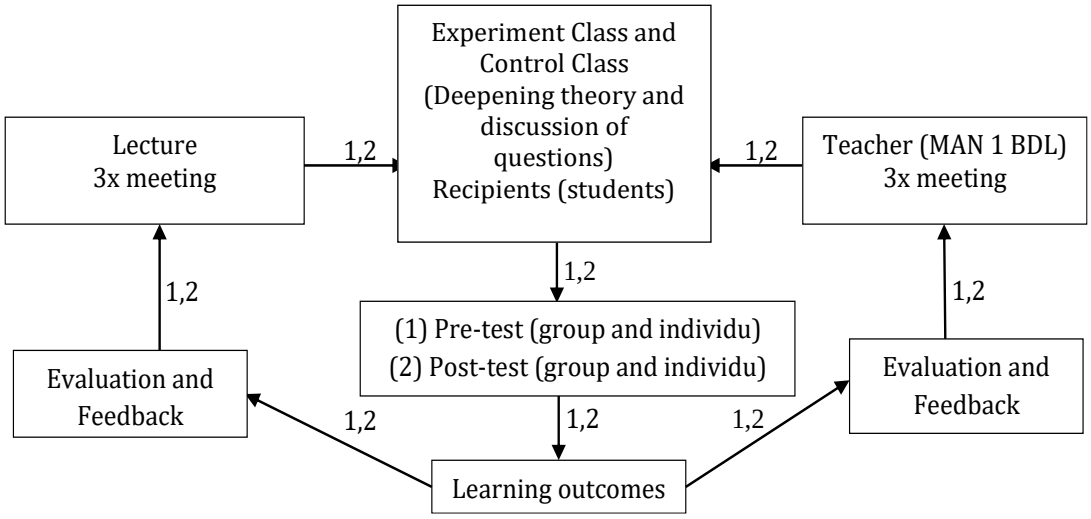

Figure 2. The cycle of experimental and control classes in phases 1 with pre-tests.

The experimental class students were given 2x phases with cooperative learning methods 3 types: Student Teach Achievement Division (STAD), Jigsaw II, and Teams-Games-Tournaments (TGT). The first phase is given 6x meetings (3x meetings by MAN 1 BDL teachers, and 3x meetings by lecturers). After the first phase is given, the next step is to do a pre-test with 2 types: pre-test grub and individual pre-test (Figure 2). The pre-test grub is a pre-test given based on the level of speed in answering questions and is formed in 4 groups (2 grub from the experimental class and 2 grub from the control class), with the number of students per group randomly. Pre-test grub is a simulation of a physics competition type LCT (Exact Fast Race). Furthermore, an individual pre-test was carried out in the form of giving a question sheet to 12 students to answer. This individual pre-test is a simulation of a physics competition type "Olympic Physics". The results of this pre-test will be evaluated to determine the level of understanding of students. After the evaluation process is complete, students are given the second motivation and learning with 6x meetings (same as in the first phase).

After the learning process, the experimental class and the second phase of the control class were completed. Furthermore, the second test is given again, namely the posttest with 2 types (group and individual). Before finally taking part in a physics competition. In this physics competition, students are expected to be ready and able to answer questions well. Even so, the results of the physics competition test will be evaluated again to re-strengthen and repeat the learning process in the sub-chapter which

is considered to still have deficiencies in understanding the physics concept in accordance with the feedback model conducted in previous studies (Figure 3)

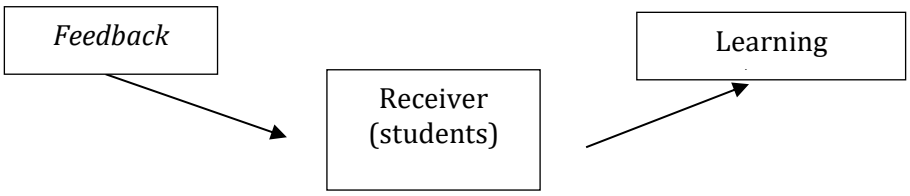

Figure 3. Feedback cognitivism model (Thurlings et al., 2013)

RESULTS and DISCUSSION

This research was conducted to see the application of cooperative learning methods to see the effectiveness of understanding and accepting the concept of physics. This method is also doped by applying the method of implementing feedback on ongoing assessment in the context of assessment for learning as research has been conducted by (Abdurrahman et al., 2018) in improving learning achievement and school achievement at Senior High School of MAN 1 Bandar Lampung, a routine learning process was conducted for students and students selected from the grants of "Physics Club MAN 1 Bandar Lampung".

This learning process is conducted in 24x meetings consisting of phase 1 (3x lecturers and 3x teachers), and phase 2 (3x lecturers and 3x teachers). Each phase consists of 6 meetings and then takes the first test or pre-test with two types: pre-test group and individual pre-test. Based on the results of the first individual pre-test, the values obtained from 30total questions indicate that the average 24 questions answered, the average score is 473, the most common score is 450, and the standard deviation is 25.70 (see Table 2).

Table 2. Results of the first individual test/pre-test scores with 30 questions (True 20 points; False -10 points; Not answering 0 points) (45 minutes).

No	The chapter taught	Teacher	Frequency of assessment	Total of Students (N)	Average of answered	Mean (point)	Modus (point)	Standard deviation
1	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Lecture	3x meeting (phase 1)	12	24	473	450	25.70
2	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Teacher	3x meeting (phase 1)					

The results of the Pre-test group were done by dividing into 4 groups (2 groups from the experimental class and 2 groups from the control class). The pre-test group was conducted with a total of 20 questions, each question was given 3 minutes. Based on the score analysis, shows that there are significant differences in learning outcomes between the four groups. These results indicate that the groups from the experimental class score higher than the control class (Table 3).

Table 3. Results of the first test group/pre-test scores with 20 questions (60 minutes)

No	The chapter taught	Teacher	Frequency of assessment	Total of Students (N)	True (20 point)	False (-10 point)	Not answering (0 point)	Total score
1	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Lecture	3x meeting (phase 1)	Group 1 (3 students) experiment class	4	0	0	80
				Group 2 (3 students) experiment class	6	0	0	120
2	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Teacher	3x meeting (phase 1)	Group 3 (3 students) control class	5	1	0	90
				Group 4 (3 students) control class	4	0	0	80

After evaluation, motivation, and second learning, based on the results of the second test or post-test (group post-test and individual post-test). Post-tests show that the average number of questions answered is 27 questions with an average value of 526.6, the most frequent score being 500, and the standard deviation is 35.24 (see Table 4). Based on the results of the second individual test (individual post-test), it appears that there is an increase in the average value and also the value of fashion. This shows that the learning process carried out using cooperative methods (Student Achievement Division (STAD), Jigsaw II and Teams-Games-Tournaments (TGT)] with evaluation, feedback, and continuous assessment can improve students' ability to improve score scores (Gull & Shehzad, 2015). Even so, this increase is also influenced by the provision of motivation (Güvenç, 2010), because the increased enthusiasm for student learning can increase interest and facilitate the learning process (Gillies, 2016).

Table 4. Results of the second individual test / post-test scores with 30 questions (True 20 points; False -10 points; Not answering 0 points) (45 minutes).

No	The chapter taught	Teacher	Frequency of assessment	Total of Students (N)	Average of answered	Mean (point)	Modus (point)	Standard deviation
1	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Lecture	3x meeting (phase 2)	12	27	526.6	500	35.24
2	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Teacher	3x meeting (phase 2)					

The second group post-test was conducted with a total of 20 questions, each question was given 3 minutes. The number of groups is 4 groups, and each group consists of 3 students randomly selected. Based on the score analysis, it shows that one group answered incorrectly because it was not accurate. Based on the results of the group test, the highest score was achieved by the experimental class group (Table 5). These results were strengthened in the group pre-test (first test) (Table 3), namely that the highest score was achieved by the experimental class group.

Table 5. Result of the second test group / post-test scores with 20 questions (60 minutes)

No	The chapter taught	Teacher	Frequency of assessment	Total of Students (N)	True (20 point)	False (-10 point)	Not answering (0 point)	Total score
1	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Lecture	3x (phase 4)	Group 1 (3 students) experiment class	6	0	1	120
				Group 2 (3 students) experiment class	4	0	1	80
2	Kinematics, Dynamics, Force, Energy, Impulse & Momentum, Temperature & Heat	Teacher	3x (phase 4)	Group 3 (3 students) control class	4	1	1	70
				Group 4 (3 students) control class	4	0	1	80

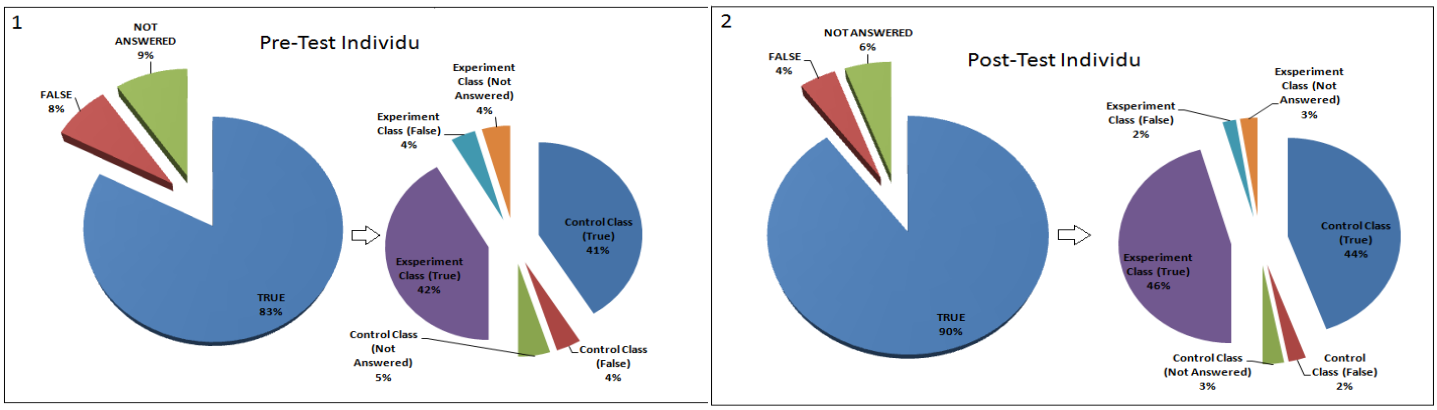

Figure 4. Percentage diagram of the individual pre-test results (1) and individual post-test (2)

Figure 4 is the percentage of individual pre-test and individual post-test results. Based on the pie chart, the results of the individual pre-test have the average percentage of students correctly answered 83%, wrong 8%, and did not answer 9%. While the results of individual post-tests on circle diagram 2 are correctly answered 90%, wrong answers 4%, and no answer 6%. This result is the whole of the experimental class and also the control class. Both have an increase compared to the results of the pre-test and the post-test results. Most likely, this increase was due to repetition of sub-bab or repetition after evaluation of individual pre-test results. This proves that cooperative learning methods or classical learning are strongly supported by evaluation and repetition.

Students of MAN 1 Bandar Lampung (BDL) who have participated in learning using cooperative methods attend the 2018 Physics Olympiad held at Institut Teknologi Sumatera (ITERA). In this competition (Post-test 1), students who take part in the race are 4 students who have been selected based on the pre-test of the individual and group who get the highest score. Based on the 2018 Physics Olympiad (OLIKA) selection, 4 students who were sent to join OLIKA got the results of "Graduation" with each score namely rank 2 (126), ranking 5 (103), ranking 9 (90), and ranking 16 (59) (Figure 5). The OLIKA results, prove that cooperative learning methods are effective enough to improve the ability of natural students to understand the concept of physics and answer physics questions.

Kementerian Riset, Teknologi, dan Pendidikan Tinggi
HIMPUNAN MAHASISWA FISIKA
INSTITUT TEKNOLOGI SUMATERA
ITERA
Jalan Terusan Ryacudu, Desa Way Hui, Kecamatan Jati Agung, Lampung Selatan 35365
Email: himafi@lk.itera.ac.id , Website : http://www.himafi.fi.itera.ac.id

PENGUMUMAN BABAK SEMIFINAL
OLIMPIADE FISIKA 4 2018

NO	NAMA PESERTA	ASAL SEKOLAH	NO. PESERTA	NILAI	KETERANGAN
1		SMA N 2 BDL	1 - 002	143	LULUS
2		MAN 1 BDL	1 - 009	126	LULUS
3		SMA N 2 BDL	1 - 019	114	LULUS
4		MAN 1 Metro	2 - 025	109	LULUS
5		MAN 1 BDL	1 - 044	103	LULUS
6		SMAN 1 Metro	2 - 029	99	LULUS
7		SMAN 1 Metro	2 - 009	94	LULUS
8		SMAN 1 Kotaagung	4 - 017	94	LULUS
9		MAN 1 BDL	1 - 015	90	LULUS
10		SMA N 2 BDL	1 - 050	82	LULUS
11		SMA N 12 BDL	1 - 041	78	LULUS
12		SMAN 1 Gadingrejo	4 - 011	75	LULUS
13		SMA N 2 BDL	1 - 033	72	LULUS
14		MAN 1 Metro	2 - 001	69	LULUS
15		SMA AL-KAUTSAR	1 - 031	64	LULUS
16		MAN 1 BDL	1 - 029	59	LULUS
17		SMAN 1 Gadingrejo	4 - 026	57	LULUS
18		MAN 1 LAMPUNG TENGAH	3 - 010	56	LULUS
19		SMAN 1 PUNGGUR	3 - 006	55	LULUS
20		SMA N 2 BDL	1 - 011	54	LULUS
21		SMA N 2 Kotabumi	5 - 009	50	LULUS
22		SMA N 2 Kotabumi	5 - 005	48	LULUS
23		MAN 1 Pesawaran	4 - 007	47	LULUS
24		SMA N 1 Abungsemuli	5 - 016	47	LULUS
		SMAN 1 Metro	2 - 014	42	LULUS

Figure 5. Announcement of the semifinal results of the "2018 Physics Olympiad" held at Institut Teknologi Sumatera (ITERA); (MAN 1 Bandar Lampung in the number two (second winner)

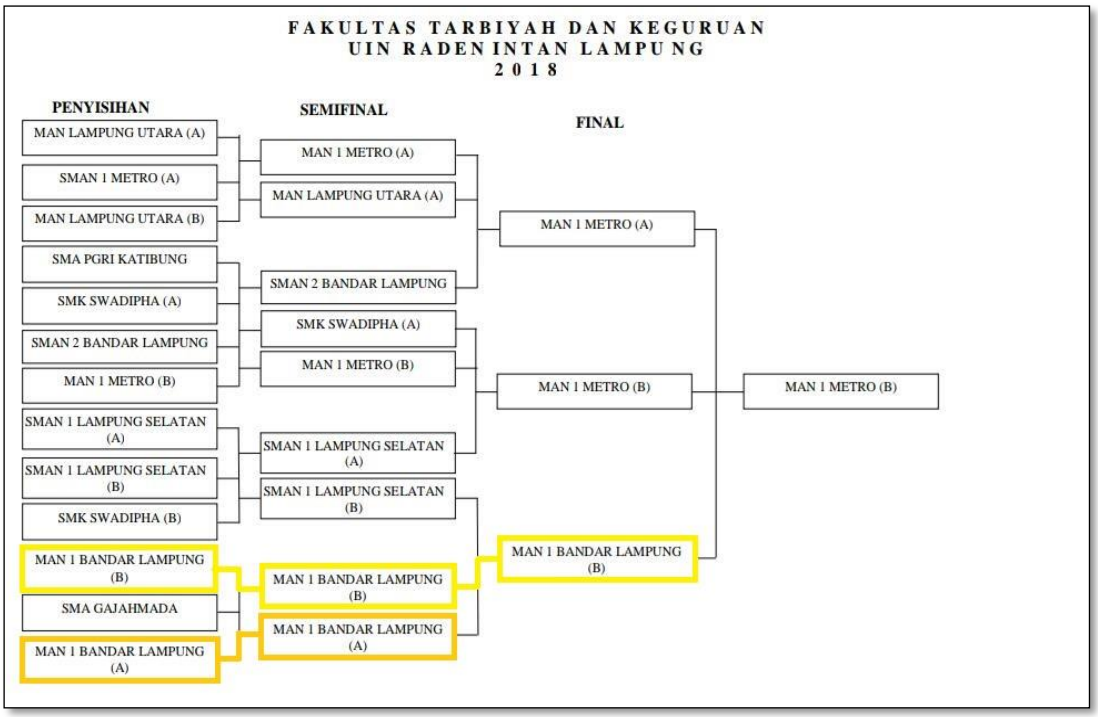

Figure 6. The 2018 Physics Quick Race (LCT) flow diagram was held at UIN Raden Intan Lampung.

Furthermore, in the Right Quick Competition (LCT) 2018 Physics was held at UIN Raden Intan Lampung (Posttest 2). Students of MAN 1 Bandar Lampung who took the LCT were divided into 2 groups. The division of this group is also based on the highest scores from individual and group pre-tests that have been conducted in cooperative learning. Figure 6 is a chart of the 2018 LCT Physics implementation at UIN Raden Intan Lampung.

LCT Physics 2018 results held at UIN Raden Intan Lampung, can be seen that 2 groups of MAN 1 Bandar Lampung (A) and MAN 1 Bandar Lampung (B) managed to proceed to the semifinal stage by defeating Senior High School of Gadjah Mada Bandar Lampung. Furthermore, in the semifinal stage, MAN 1 Bandar Lampung (B) managed to qualify for the Final stage by defeating 2 schools, namely SMA 1 Lampung Selatan and MAN 1 Bandar Lampung (A). In the semifinal stage, group (B) MAN 1 managed

to escape because students in the group were students who entered based on the three highest scores in the individual pre-test (cooperative learning program) (Figure 6).

Furthermore, based on the final final result (Figure 7), MAN 1 Bandar Lampung managed to get 2nd place with the final score of 850. This score has a difference of 150 points by MAN 1 Metro who won 1st place. Even so, the learning process with cooperative methods has managed to improve the performance of MAN 1 Bandar Lampung students.

PRODI PENDIDIKAN FISIKA
FAKULTAS TARBIYAH DAN KEGURUAN
UIN RADEN INTAN LAMPUNG
2018

N0	SEKOLAH	SKOR AKHIR
1	MAN 1 METRO (B)	1000
2	MAN 1 BANDAR LAMPUNG (B)	850
3	MAN 1 METRO(A)	600

Figure 7. Final results of the Right Quick Race (LCT) Physics 2018 at UIN Raden Intan Lampung

Lomba Cepat Tepat (LCT) Gloraska 2018 (Last posttest) held at the University of Lampung was also attended by students of MAN 1 Bandar Lampung. In this trial, MAN 1 only sent 1 group selected through selection and evaluation based on individual pre-test and group pre-test. The groups followed were 3 people who had the highest score in the pre-test of the learning process. LCT Gloraska 2018, followed by 12 Schools in Lampung Province. The schools that took part in this competition were selected schools that had quite good achievements and often participated in provincial or even national level competitions (Figure 8).

DAFTAR PESERTA LOLOS SEMI FINAL KFC (KOMPETISI FISIKA CERDAS)
TINGKAT SMA/MA/SMK SEDERAJAT
GLORASKA 2018

NO	NAMA SEKOLAH
1	MAN 1 BANDAR LAMPUNG (B)
2	SMAN 1 PRINGSEWU (A)
3	SMA AL-KAUTSAR (A)
4	SMA YP UNILA
5	MAN 1 METRO (B)
6	MAN 1 METRO (C)
7	SMAN 1 PRINGSEWU (B)
8	MAN 1 BANDAR LAMPUNG (A)
9	SMA AL-KAUTSAR (B)
10	SMAN 1 GADINGREJO (B)
11	SMAN 1 TALANGPADANG (A)
12	SMAN 5 BANDAR LAMPUNG (B)

Figure 8. Participants in the LCT 2018 Gloraska Physics held at the University of Lampung (Unila)

Based on the results of the 2018 LCT Gloria meeting, MAN 1 Bandar Lampung managed to get 2nd place with a score of 900 points. Although the difference in scores between 1st and 2nd champions is quite large, it has the same point scoring system as LCT Physics 2018 UIN Lampung. So if we compare this with the 2018 UIN Lampung LCT score, this Gloraska 2018 LCT has an increase of 50 points (Figure 8 and Figure 9).

FINAL KFC (KOMPETISI FISIKA CERDAS)
TINGKAT SMA/MA/SMK SEDERAJAT
GLORASKA 2018

N0	NAMA SEKOLAH	SKOR
1	SMA NEGERI 1 PRINGSEWU (A)	1750
2	MAN 1 BANDAR LAMPUNG (B)	900
3	SMA YP UNILA	700

Figure 9. Results of 2018 Gloraska LCT Physics competition at University of Lampung (Unila)

The results of this study indicate that the learning process using cooperative learning models namely Student Teach Achievement Division (STAD), Jigsaw II, and Teams-Games-Tournaments (TGT) is considered effective to improve the achievement (Gull & Shehzad, 2015) and understanding of physics theory. In addition, as explained by (Abdurrahman et al., 2018), in his research "feedback in ongoing assessment with a soft scaffolding content can significantly improve student learning performance. Ongoing assessment with feedback activities encourages students to be more motivated to solve physical problems systematically and improve cognitive processes, facilitate information processing (Gillies, 2016), and transform the knowledge presented in the lecture process (Güvenç, 2010). " From this statement, in this study also carried out evaluations and feedback to improve deficiencies in a theory that has not been understood by students.

CONCLUSION

The learning process using cooperative methods, namely Student Teach Achievement Division (STAD), Jigsaw II, and Teams-Games-Tournaments (TGT) is considered effective to improve the achievement and understanding of physics theory. The concept of systematic learning, theoretical explanation, discussion of questions, and evaluation also influences the increase in understanding of the concept of physics. In addition, students are also expected to play an active role in responding and arguing in the learning process, so that it will create an atmosphere of sharing in exchanging ideas.

The combination of cooperative methods with feedback and ongoing assessment can also be one of the factors that can strengthen this learning concept. Because in general, the level of difficulty in understanding and answering questions takes a long time. In this case, feedback such as evaluation, strengthening, and repetitions are very effective for analyzing and adding experience in various physical problem solving.

In addition, individual pre-test results are considered very effective in knowing the level of students' understanding and accuracy in answering questions. While the results of the group pre-test are considered very helpful in increasing the rapid response, accuracy, and emotional training of students in answering questions. Thus, these two types of pre-tests will greatly support each other in improving student achievement. But not only that motivation also has a very important role in increasing enthusiasm and liking in studying physics more deeply.

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