

# Enhancing Student Engagement in Physics Learning Through Numbered Heads Together

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**Abstract.** Learning is the interaction of teachers, students, and teaching materials to achieve instructional goals. Thus, student engagement is very important in learning. Results of a preliminary study of the 11<sup>th</sup> grade of Ferdy Ferry Putra senior high school (SMA) in Jambi, Indonesia, indicate that the engagement of students in learning physics is very low. One effort to improve the learning conditions is to use cooperative learning with Numbered Heads Together (NHT) type. The purpose of this study is to enhance student engagement in learning physics with the use of cooperative learning with NHT type. This research is classroom action research which lasted for three cycles. The steps of every cycle include planning, action, observation, evaluation, and reflecting. The quantitative data has reached from the student engagement form checklist, discussion form checklist, and teacher observing checklist. The qualitative data has reached from formative evaluation in every end of the cycles. Results of student engagement in learning physics for each cycle I, II and III are 63.31%, 71.59%, and 77.59%, respectively. Meanwhile, the classical completeness at the end of the cycle reached 86.48%. The conclusion of this study is the NHT can increase student engagement in Ferdy Ferry School and can be an alternative solution to solve the problem of student engagement in learning physics.

## INTRODUCTION

Learning occurs when there is an interaction between teacher and students and among students as well as the interaction between teachers, students, and learning resources. Such interactions based on the learning objectives. One indicator of the achievement of learning goals can be seen from the results of learning. Major categories of learning outcomes include (a) academic outcomes, (b) personal outcomes, (c) social outcomes, and (d) citizenship outcomes [1].

The level of learning outcomes is influenced by the student engagement. Engagement refers to the intensity of a person's behavior and emotional quality in the learning process [2]. Student engagement in learning includes cognitive and psychomotor [3]. Things to indicate the active engagement can be seen from the students' motivation in preparing learning materials, complete the task, focused and attentive, reflective thinking about problems in everyday life, working in groups, active in the study group [4].

The components of engagement that can be used as indicators of engagement in learning are attendance at the classroom meeting, focused attention on the lesson, the accuracy of answering the question, do something to understand the material, learn the subject matter intensely, experiencing the learning process, find themselves how to acquire knowledge, communicating the results of thought, discovery, and appreciation of the values verbally or research, providing opinions for problem solving, motivation in learning, tolerance and accepting the opinions of others, responsibility as a member of the group, and work in groups [3, 5, 6, 7].

The result of observation in SMA Ferdy Ferry Putra showed that student engagement in the learning of physics is still low. It has impacted on students' academic learning outcomes are also very low. As seen in the Table 1.

Table 1 showed that the lowest of the average of physics learning outcome of the 11<sup>th</sup>-grade students. The results of the observations made during the physics learning, showed some problems in learning physics in class XI IPA 2 were passive students, no initiative of students to ask questions when the teacher provides the opportunity for students to ask questions, only some students who can solve problems properly and some students especially those sitting in the back chatting with their friends when the learning process. After the

interviews with some students known that the causes of some problems in physics are the lack of student interest in physics subject, lack of interaction between teachers and students, students were unhappy with the way of teacher style in explaining the lesson. Based on the identification of the problem, it can be concluded that the problem is about student engagement in learning.

**TABLE 1.** The Academic Learning Outcomes of Students in 11<sup>th</sup> grade of Ferdy Ferry Putra senior high school  
**The Academic Learning Outcomes of Students in 11<sup>th</sup> grade**

| Class |       |       |
|-------|-------|-------|
| IPA 1 | IPA 2 | IPA 3 |
| 62,86 | 54,7  | 87,9  |

The efforts were added to improve the learning condition. One way that can be done by teachers is through Classroom Action Research (CAR) [8]. Action research is a great way for teachers recognize all learning conditions, find the problem and try to solve it. It is also meant to improve the professional competence of teachers. CAR is the improvement cycle followed by defining the problem, plan the change strategy, evaluating, and planning improvements in the next cycle (Reflecting) [9]. CAR was chosen as the research methodology because it is a cyclic process of reflective practice is very suitable for educational settings [10]. Simply put action research methods focused on improving direct practice [11]. CAR can help teachers find the best solution to improve classroom conditions. The results of the CAR are expected to be the basis for a decision, broaden, documentation, evaluation, portfolio, as a means to discuss with colleagues to improve learning conditions. Based on the advantages of the CAR, it should be done by teachers to improve the quality of learning.

The learning quality also impacted by learning model. It is needed the learning model that can increase student engagement. According to discussions between colleagues of researchers and physics teachers in school and a literature review of the efforts to increase the student engagement, cooperative learning model with NHT type has chosen to be applied to the CAR.

Results of previous studies show that the use of cooperative learning can enhance students' responses in small groups and events leading to their lessons. In cooperative learning, students work in groups to complete the tasks assigned by the teacher. Assessment is done through observation during the students discuss and present the results the result of discussion [12]. Three things are important in cooperative learning are evident in base cooperative learning theory, have been valid in the research, and a clear procedure to be applied in education. In addition, cooperative learning is proven to improve student engagement in learning. It can be seen from the results of student learning, academic performance, the integration of academic and social experience, and positive perceptions of learning [13]. One model of cooperative learning is the NHT. NHT is a learning technique with head number structure. Previous research has shown that NHT is instructional techniques that efficiently and effectively to improve the responsiveness and performance of students learning [14]. NHT is another learning strategy designed to actively student engage loss during lessons and, thus, improve their academic performance [15]. In NHT class divided into groups, with each group consisting of 1-4 people. Students work in groups in response every question from the teacher, with the best answers, each member of the group certainly understands the answers. Teachers calling students by random [14]. Teachers must provide convergent and divergent questions, students are given the opportunity to respond, the response by teachers to be informative, and each question must produce answers of students [14].

## METHOD

The type of this research is Classroom Action Research with the aim to improve the situation in the class, which is done collaboratively between researchers and partners. The research carried out by identifying the problem, alternative solution., giving action, and ensuring that resolves the problem, if the problem is not corrected then the same action needs to be re-applied. The activities of each cycle consisting of planning, action, observation, evaluation and reflection. The action will involve the application of NHT. From the evaluation results of each cycle, then do reflecting to correct deficiencies in the previous cycle. This CAR conducted in several cycles until achieving the criteria of success action. The criteria of Success action followed by:

1. Engagement in the learning process for each indicator has reached > 60% or higher, including criteria.
2. Engagement of students in the discussion process for each indicator is starting to look and median overall engagement reached  $\geq$  60% or higher, including criteria.
3. The results of the test students' meet minimum completeness criteria (KKM), namely 70. The success of the teaching process is said to already be optimal if the majority (76% s.d 99%) of subjects taught can be mastered by students [16]. Based on these explanations, then action can be successful if the class already have 80% of students achieve the KKM.

This research is done in class XI IPA 2 Ferdy Ferry Putra senior high school, the number of students is 37, according to analysis results author and subject teachers have a low engagement in learning. The data in this research are quantitative data obtained from the student engagement questionnaire, the observation sheet of discussion, and achievement test.

The student engagement questionnaire is a questionnaire that contains a statement relating to indicators of student engagement that filled by students. Calculation of percentage of the results obtained from the questionnaire enclosed ordinal scale using the Equation 1.

$$SE = \frac{IS}{TS} \times 100\% \quad (1)$$

Where:

*SE* : student engagement

*IS* : item scores

*TS* : maximum total score

With criteria :

81% - 100% : very high

61% - 80% : high

41% - 60% : medium

21% - 40% : low

0% - 20% : very low

The observation sheets of discussion are a performance assessment sheet that filled by the observer. How an assessment of the results of observations together with a questionnaire assessment is calculated using the formula (1). In order of quality used test questions, questions tested first and then conducted the following analysis of validity and the level of difficulty.

## RESULTS AND DISCUSSION

Application of classroom action research through collaboration between author, teachers, and lecturer, can improve learning conditions in the classroom. It can be seen from the increased student engagement during the learning process, discussions and learning outcomes. The picture on the improvement of student engagement in the learning process of the questionnaire results at each cycle can be seen in Table 2.

**TABLE 2.** The Result of Student Engagement Questionnaire in Physics Learning

| No                          | Indicator of student engagement                | Cycle I (%) | Cycle II (%) | Cycle III (%) |
|-----------------------------|--|-------------|--------------|---------------|
| 1                           | The attendance in the classroom meeting        | 83,65       | 87,43        | 90,14         |
| 2                           | Focused attention on the lesson                | 69,73       | 76,76        | 87,57         |
| 3                           | The accuracy of answering the question         | 64,19       | 70,41        | 79,73         |
| 4                           | Do something to understand the material        | 69,73       | 79,46        | 81,49         |
| 5                           | Learn the subject matter intensely             | 50,14       | 60,95        | 65            |
| 6                           | Experiencing the learning process              | 52,84       | 63,92        | 70,27         |
| 7                           | Find how to acquire knowledge by themselves    | 49,46       | 57,84        | 70,68         |
| 8                           | Communicate the results of thought             | 59,86       | 66,76        | 71,35         |
| 9                           | Providing opinions for problem solving         | 62,97       | 75,41        | 78,24         |
| 10                          | Motivation in learning                         | 62,3        | 73,92        | 90,14         |
| 11                          | Tolerance and accepting the opinions of others | 69,86       | 77,3         | 87,57         |
| 12                          | Responsibility as a member of the group        | 61,89       | 72,43        | 79,73         |
| 13                          | Work in groups                                 | 66,35       | 72,84        | 81,49         |
| The average score per cycle |  | 63,31       | 71,96        | 77,59         |

A description of the increasing in student engagement in the discussion of the results of observations in each cycle can be seen in Table 3.

According to the Table 3, it can be concluded that the implementation of cooperative learning model type NHT to promote student engagement in learning. The increasing of student engagement, also impact on student

learning outcomes. Details of improving student learning outcomes from implementing Cooperative Learning Model NHT can be seen in Table 4.

**TABLE 3.** The Student Engagement in Discussion Based on Performance Assessment

| No                          | The indicator of student engagement in discussion  | Cycle I (%) | Cycle II (5) | Cycle III (%) |
|-----------------------------|--|-------------|--------------|---------------|
| 1.                          | Giving an opinion on problem-solving               | 38,45       | 50,08        | 70,27         |
| 2.                          | Giving feedback for the other group member opinion | 33,60       | 43,50        | 58,11         |
| 3.                          | Do the task that is given by the teacher           | 57,02       | 69,48        | 84,80         |
| 4.                          | Motivation in doing task                           | 50,11       | 61,12        | 86,82         |
| 5.                          | Tolerance with the other opinion                   | 35,70       | 48,05        | 67,23         |
| 6.                          | Responsibility in their group                      | 49,51       | 60,14        | 86,49         |
| The average score per cycle |  | 44,06       | 55,40        | 75,62         |

**TABLE 4.** The Summary of Learning Outcomes Per Cycles

| No | Indicator Assessment                   | Cycle I   | Cycle II  | Cycle III |
|----|--|-----------|-----------|-----------|
| 1  | The average of learning outcomes       | 62,74     | 74,43     | 80,78     |
|    | The number of learners                 | 11 person | 20 person | 32 person |
| 2  | completeness                           | (29,73%)  | (54,05%)  | (86,49%)  |
| 3  | The number of learner not completeness | 26 person | 17 person | 5 person  |
|    |  | (70,27%)  | (45,95%)  | (13,51%)  |

According to the Table 4, can be concluded that learning outcomes in each cycle have been increased. So the implementation of learning by applying cooperative learning model with NHT type can improve student learning outcomes on cognitive aspects.

## Cycle I

Based on the results of the cycle I known that the criteria of success action have not been achieved. It can be seen from some indicator of student engagement in learning and student engagement in discussions has not reached to  $\geq 60\%$ . Not only that the learning outcomes also show the number of learner completeness has not reached to 80%. Therefore the indicator of student engagement in learning number 5,6,7,8 must be improved. While indicator number 1,2,3,4,9,10,11 and 13 should be further improved and maintained. The student engagement in group discussions that should be improved based on the observation of student performance in the first cycle are the indicators 1,2,5 and 6. Student engagement should be maintained, namely the indicator 3 and 4.

To correct the deficiencies that exist in the first cycle and improve student learning outcomes, it is necessary to continue in the second cycle by maintaining a good activity stage in the cycle I and improving the lower indicator in engagement. Some solution to resolve the problem will be implemented in the second cycle. To improve the problem of lack of student engagement in learning the material, experienced a learning process, and find out how to acquire knowledge of the situation by themselves ( the indicator of student engagement in learning number 5,6,7, and 8) can be resolved by means of independent study [17]. Independent study for students is very profitable. One way to create an independent study for students is to assign a task or homework at a certain time, independent tasks were included in textbooks [5]. In this way is expected to understand a process of learning and to find knowledge by their own situation.

The solution for the problem of lack of responsibility as a member of the group (the indicator of student engagement in discussion 1, 2, 5, dan 6) can be accomplished with a team approach. The experience of learning in schools for students took place in the context of a social group [1,18]. In other words, classroom activities must be directed to the common interest and perhaps little individual activities. In addition, teachers can also ask students to report the results and provide feedback Teachers must be monitoring, supervising and providing guidance when learning takes place and give a direct warning to students who are noisier and guide students in discussion with the group evenly. The teacher should provoke students to ask questions and train students to respond the questions and to give opinions with baited questions and convince students not to be afraid of in an opinion even if that opinion is not necessarily true.

Last but not the less, before learning of physics using NHT is started, the teacher must allocate time for each activity so that all activities can be done well in learning. In addition, during the explanation of the learning model, the teacher should explain in detail the learning model that will be used and make sure that students understand the model used.

## Cycle II

The action in cycle II based on reflection from cycle I. The result of cycle II show that the criteria of success action have not been achieved. It can be seen from the questionnaire of student engagement show that there are some indicator have not reached  $\geq 60\%$ . That is indicator number 5 and 7. Therefore it must be improved. While other indicators need to be maintained. The result of student engagement in discussion also still have not reached  $\geq 60\%$  or not yet included in high category. Indicator number 2 need to be improved, while the other indicators must be maintained. Student learning outcomes have reached the KKM. Nevertheless, the number of students who achieved grades above KKM is only 51.35%, it can be concluded there is still a problem in the learning process. Problems in the learning process are evident from the engagement of students in the learning process, especially in studying and finding his own knowledge.

According to the result above, to correct the deficiencies that exist in the second cycle and to improve student learning outcomes, it is necessary to continue in the third cycle by maintaining phases of activities that are already well on the second cycle and improving the indicator that still low. Lack of the student's passion to learn the subject matter vigorously and discover for themselves how the situation obtaining knowledge, can be overcome by explained in concrete terms to the students what can be done at the end of instruction, provide rewards to the achievement of the students so as to stimulate to get achievements better in the future, and help the learning difficulties of the students individually or in groups [6]. Group approach is necessary because familiarity in a group is determined by the interpersonal interesting, or mutual liking each other. One of the factors that affect the familiarity determined by grouping technique by teachers. Therefore, to overcome the boredom in the group, can form a group of teachers at the proposal of students with particular considerations [16]. Lack of attention to the student in the learning process can be addressed by holding a variety of teaching styles. Teaching style variation includes variations of sound, movement of the limbs, and change the position of the teacher in the classroom [16]. Teachers should be better monitored, supervise and provide guidance when learning takes place and gives warning directly to students who are noisier and guide students in discussion with the group evenly, so that the interaction between students and students and interaction debriefing both among fellow students as well as students highly intelligent person does not dominate the course of the learning process. The speed of response of the teachers in response to the students in the discussion is also needed [19]. The teacher should provoke students to ask questions and train students to respond the questions and giving opinions or teacher can give conceptual question initially [20]. In order to respond to another student, then the student is required to listen to statements from other groups, and then look for the advantages and disadvantages of other groups.

Giving awards to students is needed to motivate students in learning. The award can be made by giving gifts. The teacher can give prizes to students who excel. Giving gifts may be made to all students, some students, as well as to the students individual [16]. Not only that, but teachers also guide students to summarize the subject matter with emphasis back to the problems just discussed.

## Cycle III

Based on the results of student learning, the questionnaire of student engagement and the observation sheet of discussion, the implementation action in the third cycle can be said that improve the learning process. The Criteria of success action have been reached. This is evident from the increase in student engagement, although the increase is not very significant. Over all indicator of student engagement is  $\geq 60\%$ . The indicator of student engagement that have not yet reached 70% was studying the subject matter diligently. To overcome this problem one way to do is through independent study. Based on the analysis of test results and observation formative data on third cycle can be seen that the actions taken in this cycle have managed to improve student learning outcomes. This is evident from the results of student learning has met the success criteria that have been set. A student is successful if it has achieved a score 70% or the value 70 and a grade is called success in the classical in the class if there are 80% of students have achieved  $\geq 70\%$  absorption. This indicates that established criteria were met well. According to reflection of cycle I, II, and III we can conclude that implementing of CAR not only give positive to learning condition, but also to teacher. Teacher can be inovatif to resolve learning process and to reflect more deeply on their own practice [21].

## CONCLUSION

The increase in the average value of the percentage of engagement and student learning outcomes in the first cycle, the average percentage of student engagement in the learning process is 63.31%, the average percentage of student engagement in the process of discussion is 44.06% and the average value of the results learns to 62.74 by the number of students who successfully many as 11 people (29.73%). In the second cycle, the average percentage of student engagement in the learning process increased to 71.96%, the students' engagement in the discussion process is 55.40% and the average value of 74.43 by the number of learning outcomes of students who were 20 people (54, 05%). In the third cycle, the average percentage of student engagement in the learning process increased to 77.59%, the students' engagement in the discussion process is 75.62% and the average value of 80.78 by the number of learning outcomes of students who succeeded in as many as 32 people (86.48%). Based on the research that has been carried out, it can be concluded that the implementation of cooperative learning model with NHT type can enhance the student engagement and student learning outcomes of the physics subject of Fluid learning material in Ferdy Ferry Putra senior high school, Jambi, Indonesia.

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