The Implementation of collaborative learning models using worksheet to increase student learning outcomes at senior high school the subject of light waves

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Abstract. This action research aims to increase the learning outcomes of students by implementing of collaborative learning models using worksheet on the subject of light waves in SMAN 2 Indramayu XI-1 Mathematics and Natural Sciences. The research models used in this study is action research that actions applied with the following stages: the first stage of planning; the second stage of acting; third stage of observing; fourth stage of reflecting. This study consisted of three cycles implemented in January 2019. The instruments of this study are worksheet, observation sheets of teacher and student activities and learning outcomes assessment sheets which consist of cognitive, psychomotor and affective assessments. Based on the results of research and discussion of students learning outcomes gradually in each cycle, the conclusions obtained in this study that by implementing of collaborative learning models using worksheet to increase students learning outcomes at senior high school on the subject of light waves.

1. Introduction

Science and technology is one important cornerstone in the development of the nation. Learning science is expected to deliver the students meet 21st century skills. Activities of teachers and students is at the core of activities at the school where the learning activities intended to achieve successful learning outcomes for each learner. Some activity students learning disorders in a lesson, to absorb the lessons or have differences in intellectual ability, physical ability, family background, habits, talents, factors parents, the house, the economic situation the family, school, mass media, as well as the social environment, result of poor understanding of the light waves in pure physics national standard schools exam attended by 246 students at SMAN 2 Indramayu in the academic year 2017/ 2018 to answer correctly the light waves as much as 29 or 12%. One of researchers efforts in delivering students meet 21st century skills using collaborative learning models within the team can bring its members come together and work to achieve the same goal. Working together in teams to facilitate students in completing the exercises and certain tasks faster for sharing the responsibility with others, foster self-confidence in their ideas, develop skills of communication between teachers and students and students...
in the team or other teams to increase of the learning outcomes by implementing of collaborative learning models using worksheet on the subject of light waves.

Collaborative learning [1] is an educational approach to teaching and learning that involves groups of students who work to solve the problem, complete a task or create the product. Students are responsible to learn from each other and their own knowledge, there are five basic elements that characterize the collaborative learning program, namely: positive interdependence; considerable interaction between students; individual responsibility and personal responsibility; social skills; evaluate yourself. The technique used in this study using techniques to category problem solving with the type of structure problem solving [2] is a type of collaborative learning that follows a structured format to resolve the issue is particularly useful to divide the processes of solving problems into steps that can be managed so that students do not feel overwhelmed and that they learn to identify, analyze and solve problems in an organized way.

2. Methods
This study aims to increase the learning outcomes of students at SMAN 2 Indramayu by implementing collaborative learning models using worksheet on the subject of light waves are held in January 2019 in SMAN 2 Indramayu XI-1 Mathematics and Natural Sciences as much as 29 responden selected based on consideration of data the average value of mid-term assessments smallest of seven parallel classes in the academic year 2018/2019. The research models used in this study is a models of action research proposed [3,4,5] actions applied three cycle in action research with the following stages: the first stage of planning; the second stage of acting; third stage of observing; fourth stage of reflecting.

3. Results and Discussion
This research begins with pre-cycle activities, corrective actions beginning in the first cycle, cycle II and cycle III.

3.1 Pre cycle
On Monday, January 21th, 2019 researchers conducted cognitive assessment in the form of multiple choice questions the subject of sound waves to determine the level of understanding and learning process have an impact on learning outcomes of students. Observations of students in class has been observed by researchers since the beginning of first semester of the academic year 2018/2019 the initial state in the classical passive students, lack of confidence in the work or solve the problems regarding the sound wave. Average value of cognitive assessment data subject of the sound waves is 42 with less category so a whole students have not optimally mastered the subject matter of sound waves and need to repairs be done.

3.2 Cycle I
The researcher implemented corrective actions beginning in the first cycle of treatment on the sub-subject of dispersion using a collaborative learning models of structured problem solving assisted by worksheet with the laboratory virtual learning media phet simulations bending light held on Monday, January 28th. The learning activities begins with the formation of the group in a random way, the students call the numbers 1 through 5 in sequence from the front row to back, after that students are given a number one assembled with students of the same number as well as number of others, forming 5 groups, each members of each group was given the role/ special assignment. Teachers distributes worksheet as a guide discuss and gather information to answer questions or problems by conducting dispersion experiments using phet virtual laboratory, bending light simulation. Teachers goes around to observe the students in each group. Discussions was not effective because students are nervous and working individually so that works finish and collect information about only one person while the students others just watch and teachers feel overwhelmed to be around to guide each group to solve the problem. Discussion and completion of worksheet take a long time, exceeding the specified time allocation, the teacher only asks one student from each group to present the results of their discussion.
They did not seem confident when presenting the results. Process of giving an opinion is not effective, no one expressed their opinion. Results documentation was presented in the form photographs following:

**Figure 1.** Students seem confused to solve the problem

**Figure 2.** Lack of good cooperation, only one person works

### 3.3 Cycle II

The corrective action of first cycle implemented on second cycle with the sub-subject of diffraction a collaborative learning models of structure problem solving using worksheet with laboratory optics kit learning media held on Monday, February 4th. Learning activities begin with the formation of new groups in a random manner, students say numbers 1 to 6 in sequence from the front row to backward, after that students who get number one gather with students with the same number as well as the other numbers so that 6 groups are formed with each member of each group given the role/task in the group. Teachers gives motivation to learning by trying to show the phenomenon of single gap diffraction with a simple tool and see the pattern of light formed on the diffraction of the lattice. The teacher distributes worksheet as a guide discuss and gather information to answer questions or problems by conducting experiments using instructional media kit optics laboratory, when the discussion, teachers around to observe students in each group. Students begin to work with the stringing equipment and materials together with the members of his group, there is still wandering around looking at the work of other groups and have confidence in their work. The students has already responded and asked questions things that are still not understood. Documentation is presented in the form photographs of the following:

**Figure 3.** Distribution of roles/tasks of students in groups.

**Figure 4.** Lack of confidence in working together to assemble equipment

### 3.4 Cycle III

The third cycle on the sub-subject of interference and polarization using a collaborative learning models structure problem solving using worksheet with laboratory kit optics learning media held on Monday, February 8th. Students are ready and appropriate groups has been working in accordance with the task/role. Teachers start learning by motivating the students to attention a demonstration using instructional media kit diffraction optics laboratory and worksheet as a guide work together to discuss and gather information to answer any questions or concerns by conducting experiments. The learning process was
observed and evaluated using observation sheets were prepared. Discussion group has been running well, students already showed good teamwork in assembling the tools and materials together with the members of his group and trying to gather information. Teachers observe and give direction and guide students in collecting information and answer any questions/ problems on a worksheet. Teacher asks one learner from each group at random to present the results, students confidently presented the results of discussions and other students actively respond and ask things that are still not understood. Documentation is presented in the form photographs of the following:

![Figure 5. Teamwork has been very good](image)

![Figure 6. Confidently present the results of the discussion](image)

According to the analysis, we found that the learning outcomes for the better. Application of collaborative learning model to increase the learning outcomes of students, as follows:

### Table 1. Observation Results of Teacher Activities

| No | Indicator                                                   | Average Value | Cycle I | Cycle II | Cycle III |
|----|-------------------------------------------------------------|---------------|---------|----------|-----------|
| 1  | Study preparation                                           |               | 50      | 85       | 90        |
| 2  | Guiding the group divisions and roles / tasks students      |               | 67      | 73       | 93        |
| 3  | Guiding students work together in a group discussion to resolve problems |               | 55      | 75       | 90        |
| 4  | Presentation of group discussions                           |               | 60      | 70       | 80        |
| 5  | Conclude learning                                           |               | 60      | 73       | 87        |
| 6  | Assessment of learning outcomes                            |               | 60      | 75       | 90        |
|    | Total average value                                         |               | 59      | 75       | 88        |

According to the table 1, the average value of the activity of teachers in collaborative learning using worksheet in the cycle to increase accordance with the opinion of [2] that the responsibility of an instructor in implementing collaborative learning. According to [1] the teaching and learning that involves groups of students who work to solve the problem, complete a task or create the product will increase the responsibility to learn from each other and their own knowledge.

### Table 2. Observation Results of Student Activities

| No | Indicator                                                   | Average Value | Cycle I | Cycle II | Cycle III |
|----|-------------------------------------------------------------|---------------|---------|----------|-----------|
| 1  | Study preparation                                           |               | 50      | 70       | 90        |
| 2  | Group divisions and roles / tasks students                  |               | 67      | 73       | 93        |
3 Work together in a group discussion to resolve problems  50  80  90
4 Presentation of group discussions  60  80  80
5 Conclude learning  53  73  87
6 Assessment of learning outcomes  40  65  90
Total Average Value  53  74  88

According to the table 2, shows an increase in the activity of students in collaborative learning using worksheet from the average value of cycle in accordance with the results of research [3] models of collaborative learning students mutual learning in which students who have more ability to help students who are less able, nor should be, students feel less able to help students who are able.

| Cognitive Assessment | Average Value |
|----------------------|---------------|
| Cycle I              | 70            |
| Cycle II             | 78            |
| Cycle III            | 85            |

According to the table 3, to increase in the average value of the activity of teachers in collaborative learning using worksheet shows the responsibility of a teacher to the success of students in accordance with the opinion According to [6] the teaching and learning that involves groups of students who work to solve the problem, complete a task or create the product will increase the responsibility to learn from each other and their own knowledge.

| Psychomotor Assessment | Average Value |
|------------------------|---------------|
| Cycle I                | 69            |
| Cycle II               | 81            |
| Cycle III              | 91            |

According to table 4, shows an increase in the average value of ratings psychomotor students in cycle is accordance with the results of [7,11] direct experiment helps students to encourage their creativity in problem solving, foster self-reliance, and increase the attitude of science and scientific process skills. This research [8] approach provides a balance between academic competition and cooperation. The worksheet [9] was developed based on a constructivist approach allows students to participate actively during the learning process, helping them to learn better and increase the success of student.

| Affective Assessment | Average Value |
|----------------------|---------------|
| Cycle I              | 67            |
| Cycle II             | 75            |
| Cycle III            | 83            |

According to the table 5, shows the increase in the average value of affective students. Analysis research, we found that learning outcome of students consists of the average value assessment of cognitive, psychomotor and affective increased gradually in each cycle in accordance with [10] states
that implementation of collaborative learning models can improve the learning process and learning outcomes in learning physics. In condition students can experience what they have learnt by themselves, follow the procedure, observe all objects and analyse the data.

4. Conclusion
Based on research and discussion of the results of students consists the average value assessment of cognitive, psychomotor and affective increased gradually in each cycle, the conclusions obtained in this study by implementing of collaborative learning models using worksheet to increase students learning outcomes at senior high school on the subject of light waves.

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