

Improving Mutual Cooperation and Students' Cognitive Learning Outcomes using Problem Based Learning Assisted by Student Worksheets in Biology Learning

Meiliana Dwi Cahya¹, Aulya Nanda Prafitasari², Mohamad Abdul Somad³, Ali Usman⁴

¹Universitas Muhammadiyah Jember, Indonesia

^{2,4}Pendidikan Biologi, Universitas Muhammadiyah Jember, Indonesia

³SMA Negeri Umbulsari, Indonesia

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ABSTRACT

Mutual cooperation is an important competency of the Pancasila student profile and can impact student learning outcomes. Applying problem-based learning (PBL) assisted by student worksheets is expected to improve cooperation and students' cognitive learning outcomes (CLO). The study aimed to determine the increase in mutual cooperation and students' CLO using PBL assisted by student worksheets in biology learning. This type of research uses classroom action research. The research subjects were students at SMAN Umbulsari, Jember, class X-1, 2022/2023 academic year, with a total of 35 students. Classroom action research is implemented through the Plan, Do, and See stages. The study results show that the application of PBL assisted by student worksheets can improve students' mutual cooperation and CLO. The increase in student cooperation is evidenced by an average value of 65 (cycle 1), 71 (cycle 2), and 87 (cycle 3). In contrast, students' CLO are evidenced by an average value of 57 (cycle 1), 84 (cycle 2), and 89 (cycle 3). The findings of this study can be a solution for educators to implement student worksheets-assisted PBL as an alternative to improve cooperation and students' CLO.

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Corresponding Author:

Meiliana Dwi Cahya,

Universitas Muhammadiyah Jember, Indonesia

Jalan Karimata No. 49 Sumbersari, Jember, Indonesia

Email: <mailto:meilianacahya24@gmail.com>

1. INTRODUCTION

Biology learning must emphasize student activities (Precious & Feyisetan, 2020). Learning that is not student-centered will make it difficult for students to understand biology material. According to Weng et al. (2020), students still need help understanding biology material because biology concepts are difficult to understand, abstract in nature, and considered rote material. Student's difficulties in understanding biology material must be overcome by applying an independent curriculum in learning. The current learning process has yet to entirely implement an independent curriculum (Pratikno et al., 2022).

Applying the Independent Curriculum will strengthen students' knowledge, attitudes, and awareness of the problems they face (Purnomo et al., 2023). In the independent curriculum, there is a strengthening of the Pancasila Student Profile, which consists of six dimensions, namely: 1) faith, piety to God Almighty, and noble character, 2) independent, 3) cooperation, 4) global diversity, 5) critical thinking, and 6) creative (Chamisijatin et al., 2023). Mutual cooperation is one of the Pancasila Student Profiles that must be developed to increase students' understanding of biology material. According to Raviv et al. (2017), cooperation includes important abilities that encourage students to work together and communicate to understand problems in learning, take responsibility for contributing to group work or learning assignments, and commit to the group learning process.

The observations of learning activities in class X conducted in March at Umbulsari High School showed that students still had an attitude of cooperation that needed to be maximized. Low student cooperation is seen when they lack cooperation and lack positive interdependence to achieve common goals. Students also need more communication or expressing opinions and coordination during group discussions. Students still need to gain more sharing of roles and responsibilities in group activities. The lack of student cooperation causes the results of group assignments to be less than optimal and last a long time. The study's results by Le et al., (2018) also show that

collaboration skills, which are part of the dimensions of student cooperation, still need to be higher. It can be caused by low motivation and enthusiasm for student learning, and sometimes students are still embarrassed to express their opinions (Nahar et al., 2022). The problems found in addition to the low cooperation are the low cognitive learning outcomes.

Cognitive learning outcomes (CLO) are measurable results from students' intellectual efforts in carrying out various activities during learning (Shi et al., 2022). Based on the test of biology learning outcomes in class X of Umbulsari SMAN, as many as 71% of students still have CLO under KKM 75. According to the results of the study, the low CLO of students are caused by students' learning difficulties, students lack understanding of biology concepts, lack of teaching materials appropriate, students are also not used to being trained to solve biological problems, so students have difficulty solving the questions given (Jufrida et al., 2019; Kusumawati et al., 2021; Rahmatika et al., 2020). Thus, CLO and student cooperation still need to be improved.

Student-centered active learning can improve cooperation and students' CLO. Active learning will emphasize student involvement in collaborative work or cooperation and hone problem-solving skills (Harris & Bacon, 2019; Ullah et al., 2018). Learning that emphasizes student cooperation will positively affect students' problem-solving abilities and make time more efficient for carrying out activities (Agusta & Noorhapizah, 2018). One model of active learning that emphasizes student activity is Problem-Based Learning.

Problem-Based Learning (PBL) is a student-centered learning model. PBL has several steps, including student orientation on the problem; organizing students to study; guiding individual and group investigations; developing and presenting works; analyze and evaluating the problem-solving process (Arends, 2015). Research Aslan (2021) and Cahya et al. (2023) proves that the application of PBL affects student interaction, communication, collaboration, problem-solving abilities and student learning outcomes. Learning biology using PBL can facilitate collaborative learning and encourage students to understand the material deeply. The research results prove that PBL can train students to work in groups and solve complex problems (Hidayatullah et al., 2020). PBL emphasizes contextual learning through complex activities by presenting various authentic and meaningful problem situations to students. These activities allow students to work independently to build knowledge (Efendi & Yulastri, 2019). Therefore, applying PBL in biology learning can improve students' cooperation and CLO.

The application of PBL in improving students' cooperation and CLO can be assisted by using student worksheets. Student Worksheets is an activity sheet containing instructions and activity steps that students must carry out to complete the task. Student worksheets is useful for facilitating students to study independently, helping maximize their basic understanding to achieve learning goals (Marshel & Ratnawulan, 2020). The research results by Purnamasari et al. (2018) showed that student worksheets could increase understanding of the material, increase collaboration, and activate the student learning process during group discussion activities. Research Azizah et al. (2021) also proves that using student worksheets can help students add information about the concepts of the material being studied and can improve CLO. The potential of student worksheets-assisted PBL for cooperation and students' CLO has yet to be discovered in biology learning. Thus, this study aims to determine the increase in cooperation and CLO of students using worksheet-assisted PBL in biology learning.

2. RESEARCH METHOD

This type of research is called Classroom Action Research (CAR). The implementation of CAR is carried out in the stages of Plan, Do, and See. The research was conducted in March-April, even the semester 2022/2023 school year, at Umbulsari High School, Jember Regency, East Java, Indonesia. The research subjects were students in class X-1, which consisted of 35 students. The treatment instruments included teaching modules, teaching materials, learning media, and student worksheets. The assessment instruments used were the cooperation assessment and the post-test. Cooperation assessment is carried out through observation activities during learning, while the post-test is carried out after learning, which is used to measure students' CLO. In the student cooperation assessment category, if you get a score of ≤ 20 , it means very poor, $21 \leq x \leq 40$ is not enough, $41 \leq x \leq 60$ is enough, $61 \leq x \leq 80$ is good, and $81 \leq x \leq 100$ is very good (Sabon et al., 2022). In the category of assessment of students' cognitive learning outcomes, if the value ≤ 54 means very poor, $55 \leq x \leq 59$ is lacking, $60 \leq x \leq 75$ is sufficient, $76 \leq x \leq 85$ is good, and $86 \leq x \leq 100$ is very good (Cahyaningtyas et al., 2020).

Applying the PBL model assisted by student worksheets in learning activities uses five steps: orientation to problems, organizing students for learning, guiding individual and group investigations, developing and presenting work, and analyzing and evaluating problem-solving processes (Arends, 2015). Implementation of learning practices carried out as many as three cycles. Each cycle consists of the stages of Plan, Do, and See. The stages of CAR implementation in each cycle can be seen in Figure 1.

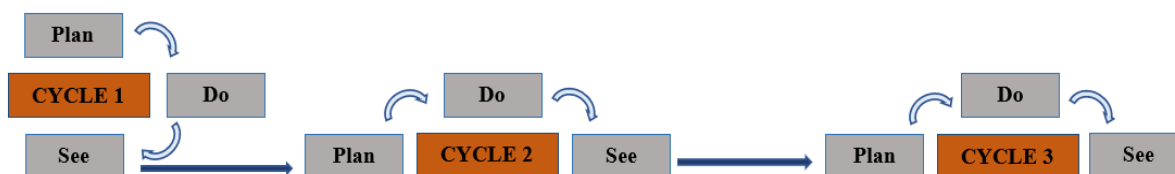


Figure 1. CAR Implementation Stages in Each Cycle

3. RESULT AND DISCUSSION

The results showed that learning biology using the PBL model assisted by student worksheets improved cooperation and students' CLO. The increase in cooperation and CLO was seen from cycles 1 and 2 to cycle 3. In each learning activity, cooperation and CLO were assessed on students. The results of the assessment are then classified based on predetermined value categories. The percentage of the number of students who scored based on the cooperation and CLO assessment categories in each cycle is shown in Table 1.

Table 1. Results Percentage of the Number of Students in Mutual Cooperation and CLO Assessments

Category	Mutual Cooperation			CLO		
	Cycle 1	Cycle 2	Cycle 3	Cycle 1	Cycle 2	Cycle 3
Very less	0,00%	0,00%	0,00%	54,29%	0,00%	0,00%
Not enough	22,86%	17,14%	0,00%	14,29%	0,00%	0,00%
Enough	11,43%	20,00%	0,00%	14,29%	34,29%	28,57%
Good	20,00%	5,71%	37,14%	2,86%	25,71%	11,43%
Very good	45,71%	57,14%	62,86%	14,29%	40,00%	60,00%

In Table 1, the cooperation assessment shows that, overall, there was a decrease in the percentage of students who scored "very less, less and sufficient." In contrast, students who scored "good and very good" experienced an increase from cycle 1 to cycle 3. Assessment of results cognitive learning based on Table 1, as a whole, it can be seen that students who scored "very less and less" decreased from cycles 1 to 3, while the scores of "enough, good and very good" increased from cycles 1 to 3. The value of cooperation and students' CLO can also be seen from the average value obtained in each cycle. The results of the average value of cooperation and students' CLO in each cycle are in Table 2.

Table 2. Results of the Average Value of Mutual Cooperation and Students' CLO in Each Cycle

The Average Value of Mutual Cooperation			The Average Value of CLO		
Cycle 1	Cycle 2	Cycle 3	Cycle 1	Cycle 2	Cycle 3
65	71	87	57	84	89

Table 2 shows that the average value of students' cooperation and CLO is increasing from cycles 1 to 3. The greatest increase is in cycle 3, as evidenced by the average value of cooperation of 87, while the average value of CLO is 89. Improvement of the average value of cooperation and students' CLO in more detail can be seen in Figure 2.

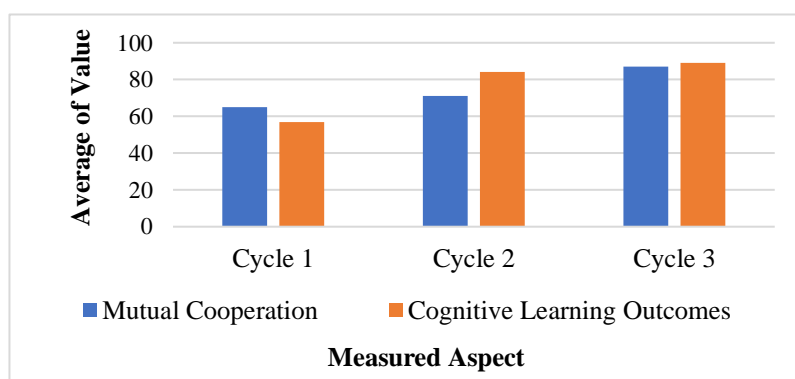


Figure 2. Increasing the Average Value of Mutual Cooperation and Students' CLO

Figure 2 shows that cooperation and students' CLO in biology learning increased from cycles 1 to 3. This increase was influenced by using the student worksheets-assisted PBL model given during biology lessons in class. Students also show different responses in each cycle of learning activities. Each learning cycle consists of Plan, Do, and See stages. The Plan stage is carried out with the team, namely the supervising lecturer, tutor teacher and Teacher Professional Education (PPG) colleagues, before learning activities in class. Plans are carried out to discuss learning tools (teaching modules, teaching materials, learning media, student worksheets, and assessment instruments) used during learning. The Do stage is carried out during classroom learning by applying learning tools prepared based on suggestions and input according to Plan. Implementation of learning in class is done by applying the PBL model.

The first step of PBL is problem orientation. In cycles 1, 2, to 3, problem orientation activities are carried out by students with their groups. It supports student cooperation to understand and find common problems through the learning process. The learning process is carried out according to the student's learning style. Students with an auditory learning style carry out the learning process by watching learning videos. Students who have a visual learning style are given a learning process by studying articles. Students with a kinesthetic learning style carry out the learning process with puzzle shopping activities. These different learning processes are called process-differentiated learning. The application of differentiated learning makes students active, motivated, and happy to participate in learning activities. It is proven that differentiated learning can provide learning independence for students and create fun learning to influence student learning outcomes. Supported by the results of research Yanzi et al., (2022) and Cahya et al., (2023), differentiated learning can facilitate students' needs, collaboration and learning outcomes for the better.

The second step of PBL is organizing students to learn. In this step, students and groups work together to define the problems found in learning. The learning problems students face in cycles 1, 2, and 3 differ. Problems in cycle one regarding biogeochemical cycles (sulfur cycle and phosphorus cycle). Cycle 2 concerns environmental change, and cycle two concerns environmental pollution. Students are also trained to ask questions about the problems to investigate and explore. This activity can train students' thinking skills and train cognitive abilities. In cycle 1, the second PBL step experienced problems; students still needed clarification in defining the problem. The students' process of defining the problem took a long time because students still needed to understand the meaning of the problem. This activity is new for students because previously, students have never been assigned to find problems on their own. Therefore, the teacher guides by explaining to each group of students the problems they face. In cycles 2 and 3 of subsequent learning, students better understand the meaning of the problems encountered than in cycle 1.

The third step of PBL is guiding individual and group investigations. This step trains students to collect various problem-solving information. Students are also trained to find alternative solutions to the problems they face. Information can be obtained through teaching materials from teachers, as well as through the learning process and from various other relevant learning sources. In cycle 1, students needed to carry out the third step of PBL optimally. Students are still guided by teaching materials in the form of worksheets provided by the school, so they need help finding information about their problems. Information from LKS could be more extensive. Therefore, in cycles 2 and 3, the model teacher emphasizes that students learn through the teaching materials provided by the teacher by the learning objectives. The model teacher also guides students to learn through a learning process that is carried out according to their learning style. This activity had a good impact on the process of cooperation of students in solving problems and increasing students' understanding of the material being studied.

The fourth step of PBL is developing and presenting the work. This step invites students and their groups to convey the results of their discussions in front of the class. In cycle 1, the fourth step of PBL still needed to be improved. Students are still shy in expressing opinions, so discussion activities do not get a response to feedback from students. In cycles 2 and 3, students were more active in expressing opinions even though they were not assigned to present them in front of the class. It is because the model teacher gives additional points to students or groups who dare to give opinions during presentation activities. This fourth PBL activity needs to be trained in students because it encourages active involvement and responsibility of students in group assignments. It also has a positive impact on student cooperation. Research (Chen & Kuo, 2019) supports that PBL steps in learning activities can encourage student activity and interaction in learning and produce collaborative study groups. Applying PBL can also develop students' communication skills, collaboration, teamwork, and problem-solving abilities (Deep et al., 2019). The fifth step of PBL is to analyze and evaluate the problem-solving process. This step invites students to reflect and evaluate the results of discussions or learning activities.

Obstacles to implementing PBL in cycle one is seen from students' need for clarification in following each step of the learning activity. It is because students are participating in biology learning activities for the first time

using the PBL model assisted by worksheets. The application of the PBL model is something new for students because students are directly invited to understand each step of PBL to solve problems in learning biology. The lack of students' understanding of the PBL steps makes it difficult to find problems and is not precise in solving them. Student involvement in group discussion activities still needs to improve. Some students still need to pay more attention when their group members discuss. Students also tend to be less active in expressing opinions in discussion activities. It causes the work of student worksheets to be hampered. Therefore, the model teacher carries out reflection activities at the See stage. This reflection is carried out to correct deficiencies and overcome obstacles encountered during learning. The reflection results are then used as material for planning a follow-up.

In cycles 2 and 3, based on the reflection results. Teachers pay more attention to some problematic students. Model teachers guide more students with problems and always try to motivate students to learn. The model teacher provides a variety of interesting activities to increase the enthusiasm for learning and cooperation of students. These activities include ice-breaking and providing learning processes according to student learning styles. The results of the reflections carried out by the model teacher also impact improving the steps of learning activities. In learning activities in cycles 2 and 3, students have begun to understand the stages of the PBL model in the worksheet assignments. The student worksheets has been equipped with learning objectives that students must achieve and instructions that students must follow at each step of PBL. Students' understanding of PBL steps in student worksheets enables students to find problems and work together with groups to solve problems and find solutions to problems they face. Students who are used to being trained to solve problems and find solutions will develop their cognitive abilities. This ability will positively impact improving students' CLO. When working on student worksheets, students can also work with groups, express opinions, share roles and responsibilities, and coordinate to achieve common learning goals. According to the statement Hendarwati et al., (2021), PBL, supported by group activities, can train students' cooperation skills.

The implementation of learning activities from cycles 1, and 2 to cycle 3, as a whole, received increased positive student responses. This response can be seen from the increase in cooperation skills and students' cognitive learning outcomes in each cycle. The highest increase was in cycle 3. It proved that applying PBL assisted by student worksheets effectively increased cooperation and students' CLO. Thus, the findings in this study can be an alternative solution for teachers to improve mutual cooperation and students' CLO.

4. CONCLUSION

The application of the student worksheets-assisted PBL model is proven to improve cooperation and students' CLO in biology learning. The increase in student cooperation is evident from the average value in cycles 1 of 65, 2 of 71, and 3 of 87. The increase in students' CLO is evident from the average value of 57 in cycle 1, 84 in cycle 2, and 89 in cycle 3. Therefore, educators can apply PBL assisted by student worksheets as an alternative learning to develop mutual cooperation and CLO. In future research, educators should be able to identify students' characteristics or learning needs and pay more attention to students with learning problems.

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