

Blended collaboration problem-based learning to improve critical thinking ability and complete learning of students on human heredity materials

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Article information	ABSTRAK
Article history	Berdasarkan hasil analisis di SMAN 36 pada pembelajaran Biologi sebagian peserta didik belum optimal kemampuan berpikir kritisnya dan belum mencapai ketuntasan minimal. Hal ini nampak pada kemauan untuk bertanya masih kurang, keterlibatan dalam berpendapat serta merumuskan masalah belum mencerminkan pertanyaan yang menggunakan pemikiran tingkat tinggi. Tujuan Penelitian ini untuk mengetahui peningkatan ketrampilan berpikir kritis dan ketuntasan belajar peserta didik kelas XII MIPA 4 SMAN 36 Jakarta pada hereditas manusia. Metode yang digunakan adalah penelitian Tindakan kelas yang terdiri dari dua siklus melalui BCPBL. Pembelajaran dilakukan dengan diskusi presentasi untuk memaparkan kasus tiap kelompok yang dipersiapkan secara asynchronous. Pengumpulan data dengan tes essay, observasi kegiatan pembelajaran dan angket respon peserta didik. Data hasil penelitian dianalisis menggunakan deskriptif komparatif yang dilanjutkan refleksi. Deskriptif komparatif dilakukan dengan membandingkan data kondisi awal, siklus I dan II, baik untuk aktivitas belajar maupun hasil belajar. Hasil penelitian ini menunjukkan bahwa penggunaan BCPBL dapat meningkatkan ketrampilan berpikir kritis dan ketuntasan belajar dari siklus I ke siklus II. Hasil penilaian Harian pada siklus I menunjukkan bahwa 28 peserta didik (77.78 %) tuntas sedangkan siklus II 31 peserta didik (86.11%) tuntas. Melalui kegiatan pembelajaran BCPBL peserta didik memiliki pengalaman belajar yang aktif, memiliki minat dan respon sesuai yang diharapkan.
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Kata kunci: <i>Blended Learning</i> Pembelajaran aktif <i>Problem Based Learning</i>	
Keywords: Blended Learning Active learning Problem Based Learning	ABSTRACT Based on the analysis at SMAN 36 in Biology learning, some students do have not optimal critical thinking skills and have not achieved minimum completeness. This can be seen in the lack of willingness to ask questions, involvement in opinion, and formulating problems does not reflect questions that use higher-order thinking. The study aims to determine the improvement of critical thinking skills and learning completeness of students in class XII MIPA 4 SMAN 36 Jakarta in human heredity. The method used is classroom action research which consists of two cycles through BCPBL. Learning is carried out with presentation discussions to explain the cases of

each group which are prepared asynchronously. Data collecting by tests, observation of learning activities, and student response questionnaires. The research data were analyzed using a comparative description followed by reflection. The comparative description is done by comparing the initial condition data, cycles I and II, both for learning activities and learning outcomes. The results of this study indicate that BCPBL can improve critical thinking skills and complete learning from cycle I to cycle II. The results of the daily assessment in the first cycle showed that 28 students (77.78%) completed. The second cycle showed that 31 students (86.11%) completed it. Through BCPBL learning activities, students have an active learning experience, have interest, and respond as expected.

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INTRODUCTION

In the era of the 21st century, the development of communication and information has massively affected people's lives and the world of education. In the global era, educators in addition to mastering pedagogics need to also improve the application of information technology in the learning process (Montoro et al., 2015). 21st-century skills are the main key to preparing human resources to face the global era. Critical thinking is one of the important skills to be able to face the challenges of the 21st century so it needs to be developed in the learning process (Stupple et al., 2017). Based on the results of daily observations and assessments at SMAN 36, especially in learning human heredity, some students do have not optimal critical thinking skills and have not achieved minimum completeness. This can be seen in the lack of willingness to ask questions, involvement in opinion, and formulating problems does not reflect questions that use high-level thinking. Less than optimal minimum mastery of students can be caused by low critical thinking skills. Developing students' critical thinking can be pursued through the selection of appropriate learning strategies (Zubaidah and Corebima 2011; Mahanal et al. 2019). Students' critical thinking needs to be improved to gather information and make conclusions and make a decision (Keane et al., 2016). Critical thinking skills in biology learning have a very large role in increasing the achievement of learning objectives through changes in mindset, logic, and cognitive skills (Karakoç, 2016) and the application of ICT (Kanematsu & Barry, 2016). Critical thinking is useful for making rational decisions about what is believed to be the right thing to do (Ennis, 1993). Furthermore, critical thinking is the ability to self-regulate in deciding (judging) something based on evidence, concepts, methodologies, criteria, or contextual considerations (Facione, 2013). Critical thinking is useful for students to improve their competence and as a means to deal with the problems of everyday life. The characteristics of human heredity material are related to real-life problems so that they can be used to practice critical thinking skills. Problem-based learning emphasizes students actively arguing, and collaborating to solve problems so that they can develop critical thinking skills. (Sugiharto et al., 2019). To learn human heredity for optimal results, learning sources should not only be from books and educators, it can also be from online media so that students get innovative and fun learning. Conventional learning when combined with the use of Information and Communication Technology (ICT) will increase the achievement of learning objectives (Plessis, 2015).

Blended Learning can make it easier for students to access subject matter outside the classroom, and interaction between students and educators to share information and opinions on various matters concerning the subject matter (Diep et al., 2017). Furthermore, mixed learning is a combination of traditional classrooms with technology designed with modern media and modes of communication, the educator only acts as a facilitator (Anders et al., 2011). Many

students are competent but have difficulty solving problems because of their ignorance of how to structure the problem so that it can be solved.

Problem-solving is an ability that can be learned and trained by students (Zubaidah, 2017). Problem Based Learning (PBL) also develops students' complex skills and independent learning through problem identification (Krupnik-gottlieb, 2015). Other positive effects of PBL include: increasing learning achievement, fostering positive beliefs, and developing student competencies (Tarhan & Acar-sesen, 2013) as well as developing student creativity, through collaborative work in a group environment, understanding open problems, and thinking about various problems. solutions (Siew, Chong, and Lee 2015; Hidayati et al. 2019). Furthermore, effective learning depends on creating a classroom atmosphere that encourages the acceptance of different points of view and discussion (Epstein, 2008). The critical thinking ability of students can be improved through subject matter designed by utilizing logical thinking such as discussion so that questions or problems will arise that need to be addressed.

Knowledge of human heredity is related to real-life problems so that it can be used to practice critical thinking skills. Students who understand the material will be able to apply it to real situations that are different from the original context so that it is implemented in improving critical thinking skills and achieving KKM well. The success of education cannot be separated from the aspect of literacy. Critical thinking can also be trained by reading saints so that participants can understand and identify concepts (Tabačková, 2015). Active learning can also be carried out through discussion (Yudasmini et al., 2015) making it easier for students to understand and interpret a concept that will improve critical thinking (Eggen & Kauchak, 2012). The learning process for saints can be carried out virtually or directly in the classroom (Keeley, 2015).

To increase student learning outcomes, it is necessary to do treatment with blended collaboration problem-based learning. Blended learning facilitates students to access learning materials not only in the classroom but can be done outside of face-to-face hours that have been designed by educators to search for material independently based on their critical thinking skills so that students can determine which information is right and wrong. The principle in this study is to combine blended learning media so that students continue to solve problems which are the principles of the Problem Based Learning learning model. Students can solve and present group problems well because the search source is not only from books but also from online media asynchronously (Norberg, Dziuban, and & Moskal 2011; Gurubatham 2013; Ark, Hudson, and Baugh 2014).

METHOD

The method used in this research is the McTaggart class action research method between action and observation into a single unit, consisting of two cycles through Blended Collaboration Problem-Based Learning (BCPBL). In cycle I and cycle II, learning is carried out with presentation discussions to explain the cases of each group that have been prepared asynchronously. Each cycle consists of four stages of research, namely planning, implementing actions, observing, and reflecting. As per picture 1.

This research was conducted at SMA Negeri 36 Jakarta, Perhubungan Raya Street, Rawamangun, East Jakarta. The subjects in this study were class XII MIPA 4 SMA Negeri 36 Jakarta in the academic year 2021/2022, the number of students was 36. The research was carried out for 6 months, from July to December 2021. In July 2021 an activity plan was prepared, then the preparation of research instruments was conducted in August and September. In November 2021 action will be taken. The data on the results of the classroom action research is then analyzed in November the fourth week. The discussion of the results of the analysis and the preparation of the research report is planned to be completed in December 2021.

Data collected from the results of daily assessments as primary data and secondary data from observations made by researchers and collaborators as well as student questionnaires. Data obtained from the score list document for learning outcomes data for pre-action initial conditions, observation sheets to find data on student learning activities in cycle I and cycle II, results of syntax implementation, results of student response questionnaires to Blended

Collaboration Problem-Based Learning learning, and results from the daily assessment of KD 3.7 human heredity.

Data analysis used comparative description followed by reflection. Comparative description is done by comparing the initial condition data, cycle I and cycle II, both for learning activities and learning outcomes.

The performance indicators in this study are: 1. The results of the daily assessment of class XII MIPA 4 students on the human heredity material at least 80% have scored 75; 2. The average percentage of all aspects of individual activity observation is 80% or has individual activeness with high criteria; 3. The average percentage of all aspects of observing group activity is at least 80% or having group activity with high criteria; 4. Learners can work on questions on daily assessments that are integrated with Ennis's (1985; 2011) critical thinking indicators which include providing simple explanations, building basic skills, concluding, providing further explanations, and setting strategies and techniques.

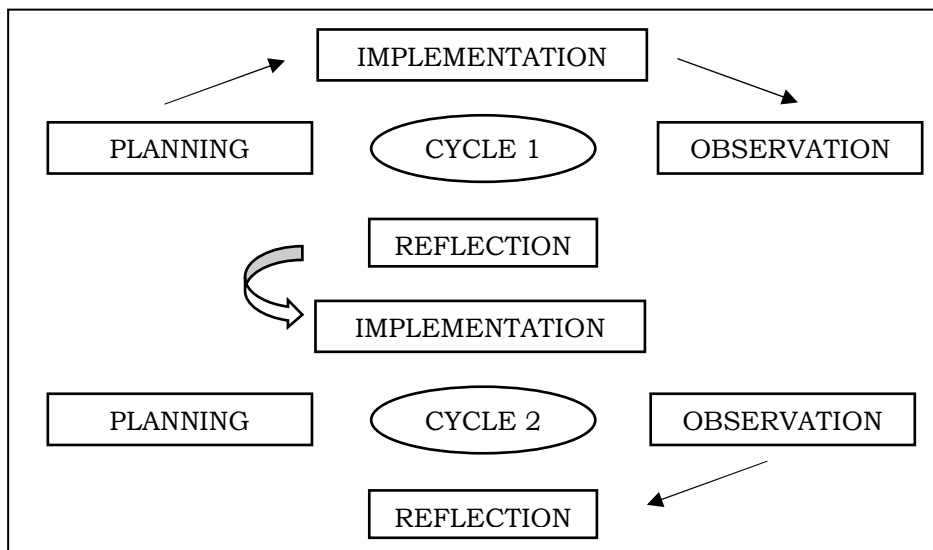


Figure 1. Research scheme

The research design can be described in terms of the following framework:

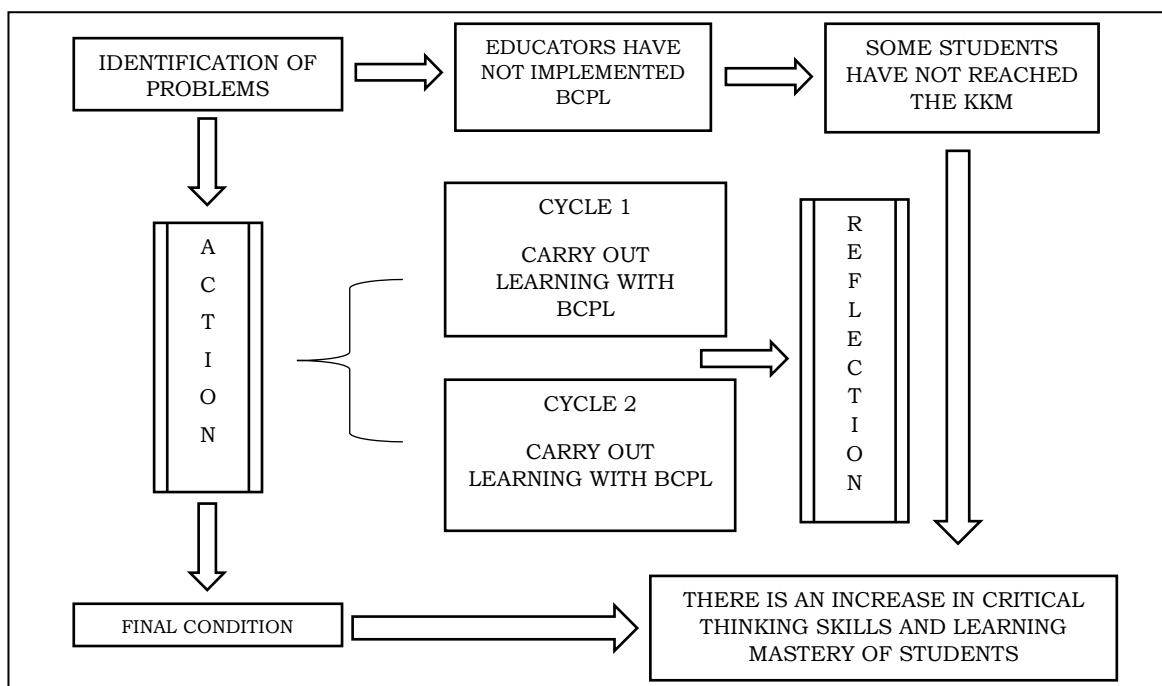


Figure 2. Framework for classroom action research coursework

Learning is held 4 times in November 2021. The initial discussion meeting prepares material for presentations based on problems determined by the educator for each group which is delivered online before learning activities in class. Next meeting 1 and 2 presentations to equalize the perception of the material so that the concepts compiled are correct. Cycle 1 on hemophilia, albino, thalassemia, and color blindness; followed by the -1 daily assessment and ended with reflection. Next meeting 3 and 4 (cycle 2) on Syndactyly, Blood Types, Abnormalities on the Y chromosome, Cycle cell anemia and how to avoid the appearance of hereditary abnormalities and ends with the 2nd Daily Assessment. The following are the steps for BCPBL syntax adaptation from Arends (2008):

Table 1. The syntax of blended collaboration problem based learning

No	Syntax	Description	Implementasion
1	Problem orientation	- The teacher gives an explanation and orientation of the lesson, and forms a heterogeneous group	On line (synchronous)
2	Organizing students in learning	- Collaborative groups make observations to find real learning about KD problems. 3.7 Human heredity in senior high school by focusing on cases/problems of each group in learning.	<i>Off-line</i> (asynchronous)
3	Guiding individual and group investigations	- Collaborative groups analyze problems by focusing on standard processes and determine the root of the problem by searching literature from source books, online media and asking educators through the WA group. Learners are trained for reading literacy in preparing presentation materials	<i>Off-line</i> (asynchronous)
4	Developing and presenting the work	- Groups complete the draft solution plan collaboratively, then present the results of group work with an explanation of the related material	<i>On-line</i> (synchronous) - Tatap muka di kelas
5	Analyze and evaluate problem solving	- Other groups ask questions and provide feedback regarding the material presented by the presenter group. - Educators review the understanding of students who have not been correct. - The results of the discussion are uploaded to Google Classroom.	Blended learning (synchronous) - Tatap muka di kelas - <i>On-line</i> melalui zoom

RESULTS AND DISCUSSION

To develop thinking skills with the BC-PBL model, students are divided into heterogeneous groups, each group is given a problem that is integrated into the human heredity material. Each group prepares material from source books, and online media and asks educators through class WAG.

The teacher compiles the rubric. for group discussion assessment, observing the activity of students; Creating an observation format to observe the implementation of syntax by students with a problem-based learning model during the learning process; Carry out direct face-to-face learning in class and online learning (synchronous). Students present the results of group discussions that have been carried out asynchronously at face-to-face meetings in class; The presentation group provides an opportunity for other groups to ask questions, refute or answer questions from other groups or from groups who make presentations during the presentation discussion.

Educators and collaborators evaluate the results of observing the learning process at the end of the cycle I and end with daily assessments. Based on the results of observations of learning activities and the results of the daily assessment of performance indicators, the performance indicators have not been achieved so it is continued in cycle II. Subsequent actions are required in order to achieve a minimum level of completeness according to the specified indicator standards. Students are motivated again to be more active in asking and expressing opinions and collaborating with each other in groups to deliver material to attract the attention of other

groups. Educators provide reinforcement. The existence of group discussions, guidance, reinforcement from educators, and combined conventional and online learning supports active and motivated students to solve problems in human nature which in turn increases mastery of concepts and critical thinking skills. The results of the class action research on heredity material in humans carried out by the author through actions in cycle I and actions in cycle II, as follows:

Table 2. Recapitulation of student activity in initial conditions, cycle I and cycle II

Total students	Initial Condition	Cycle I	Cycle II	Reflection of Initial Conditions To Final Conditions
36	63.89 %	75.00%	80.56%	There is an increase

Based on Table 2, individual activity increased from 63.89% pre-action to 75.00% in the first cycle and increased to 80.56% in the second cycle. This condition exceeds the performance indicator target that has been set, which is 80%, or it can be concluded that the results of the overall activity are on average either 80.56% or 29 students. In discussions, students exchange opinions in groups to analyze problems, convey ideas and solutions, and equate perceptions in the context of making decisions and solving problems based on evidence and learning experiences, here the development of critical thinking occurs, in line with (Diep, Zhu, Struyven, & Blicke, 2007). 2017). For more details at figure 2.

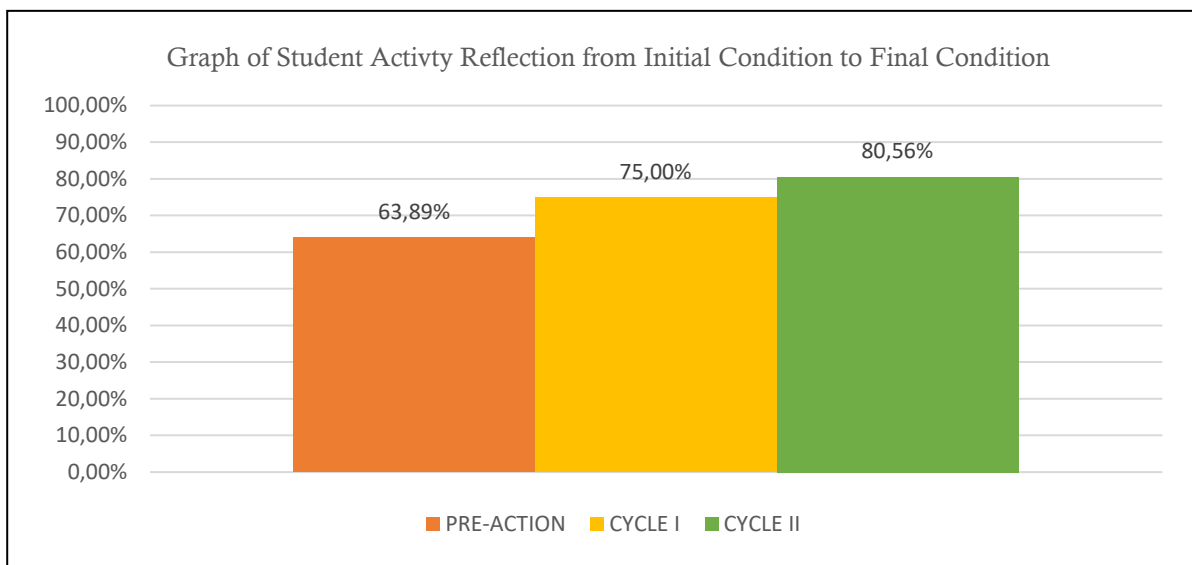


Figure 3. Graph of pre-action activity recapitulation, cycle I, cycle II

Based on graph 2, there is an increase in the activeness of students in participating in the face-to-face learning process in class. In the pre-action, only some of the active students were limited to answering questions from the teacher. the level of individual learning activity is only sufficient, namely an average of 63.89%, in the first cycle 75% activeness consists of 52.78% good and 22.22% very good, then increasing in the second cycle 80.56% is good and very good, this shows that students have started to train their critical thinking skills, it is proven that there are already those who are willing to respond to answers from other groups and answer questions that are not addressed to their group. There is mutual interpretation during the presentation discussion. Observations were carried out intensively and continuously between educators and collaborators, regarding individual activity in participating in the presentation discussion process and group activity in conveying the results of the discussion. Each group is required to make questions to the presenter group, groups that do not submit questions are required to respond to answers from the material presenting team so that all students in the group take an active role in the learning process.

Results of Observation of Group Activity in the Presentation of Cycle I and Cycle II

In the initial conditions of conventional learning students are less active, while the first and second cycles of learning with BPCBL which is a mixed learning between face-to-face and online with the presentation discussion method to encourage students to actively collaborate with each other, communicate to analyze group problems, seek literacy from book sources and online media.

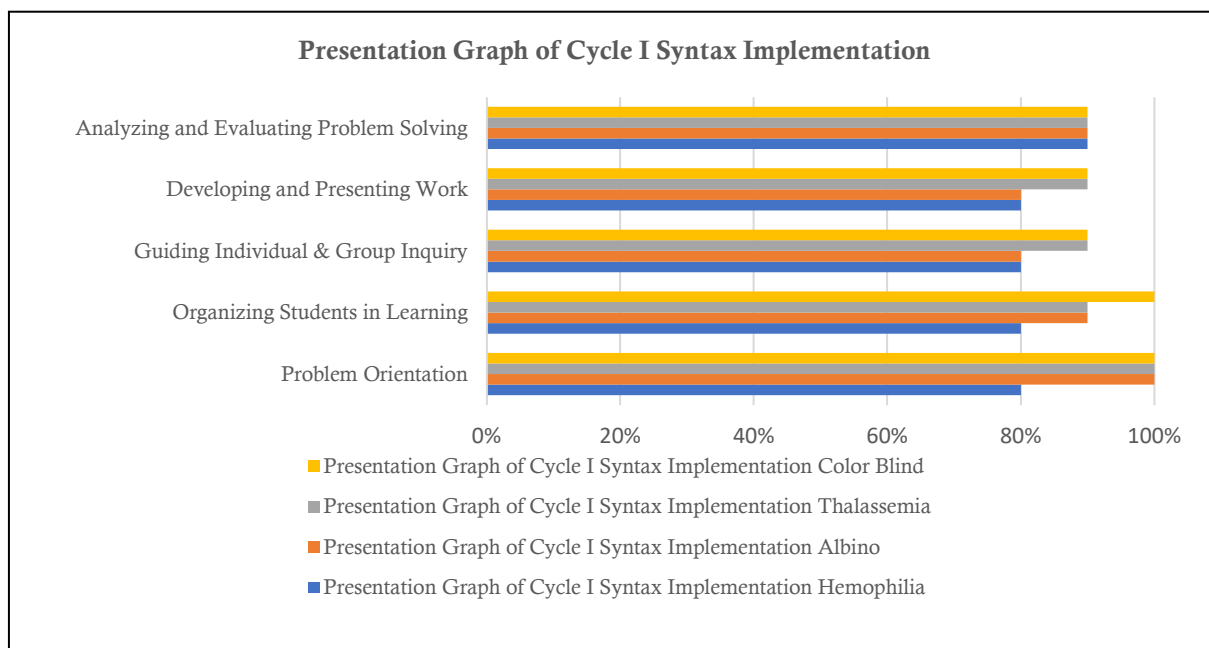
Table 3. Group activity in the learning process

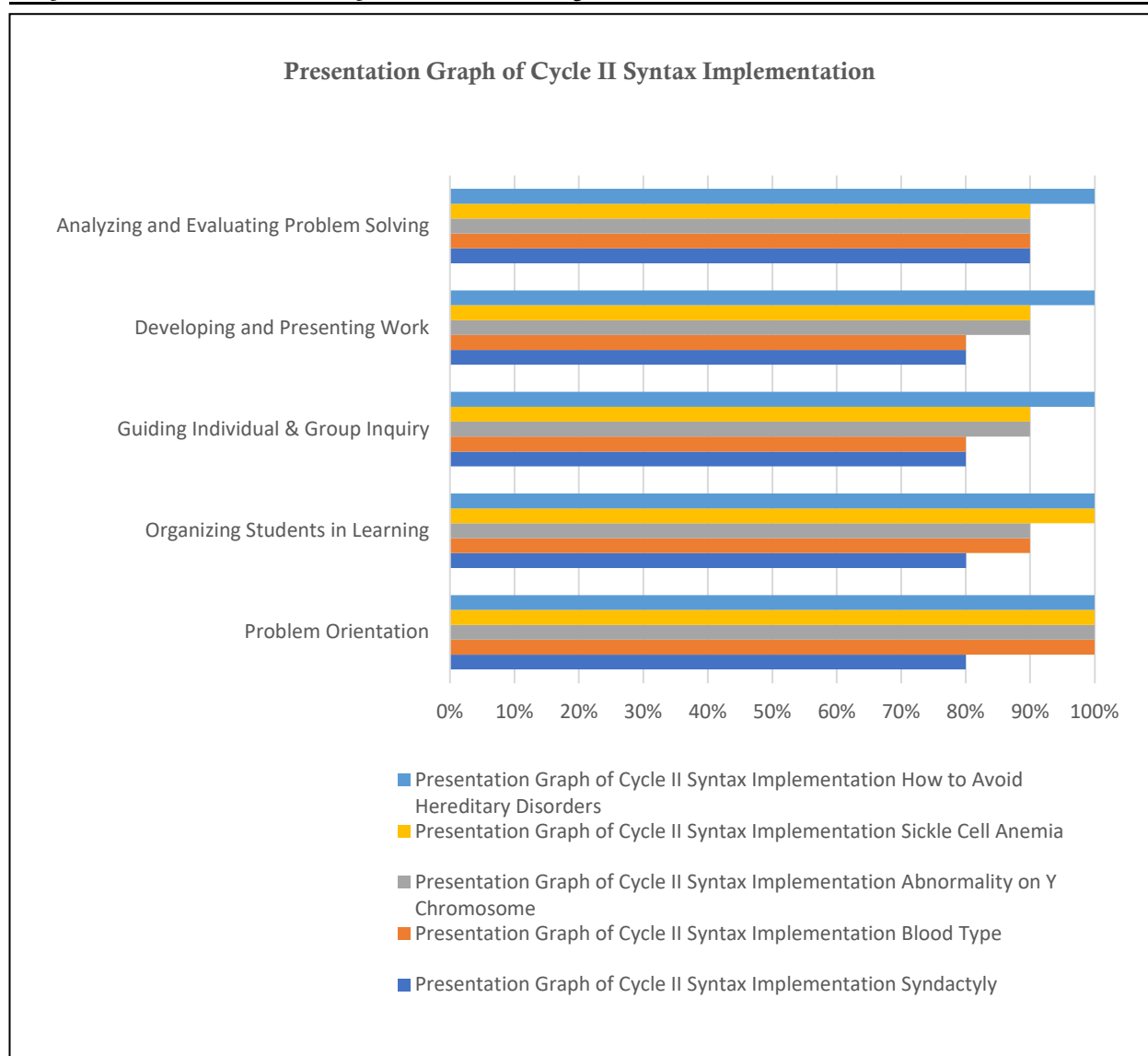
Amount Group	Initial Condition	Cycle I	Cycle II	Reflection of Initial Conditions To Final Conditions
9	-	87.50	91.60	There is an increase

Table 3 shows that there was an increase in a group activity. Activity increased when material preparing and presenting material because they had listened to the presenter group and received guidance from researchers and collaborators after reflection in cycle I. Students in groups were willing to respond to answers from other groups. and analyze possible questions from other groups. This is because they are motivated to present better group presentations and are motivated to answer questions because they are ready with the material being discussed.

Syntax Implementation by Students

The implementation of syntax by students in learning with blended collaboration problem-based learning shows an increase from an average of 89.00% in the first cycle to 93.60% in the second cycle.





Biology Learning Outcomes

Table 4. Recapitulation of pre-action daily assessment, cycle I and cycle II

Value Aspect	Pre Action	Cycle I	Cycle II	Reflection Of Initial to End Conditions
Highest Value	88.00	92.00	96.00	Occur Enhancement
Lowest Value	58.00	66.00	70.00	
Average Value	76.17	78.94	81.72	
	23	28	31	
Value \geq 75	63.89%	77.78%	86.11%	
	13	8	5	
Value < 75	36.11%	22.22%	13.89%	
Total Students	36	36	36	

From the table above, it can be seen that the average value of the daily assessment of students has increased from an average pre-action of 76.17 to 78.94 in the first cycle and increased to 81.72 in the second cycle. The factor that causes the increase is because the PBL syntax is stimulated by problems that are the subject of each group that must be prepared by students for presentations when face to face in class. This is also following the opinion of Rusdi, Evriyani, and Praharsih (2016). In addition, students have also been trained to look for material not only from source books and educators but also through online media, so that problem

solving is more optimal and faster according to Gurubatham (2013) and Musyaddad, Suyanto (2019) that knowledge will last longer if exploration is done via the internet. Furthermore, the results of the presentation are uploaded to Google Classroom so that they can be re-studied. The number of students who have completed also increased from 63.89% in the pre-action to 77.78% in the first cycle and increased to 86.11% in the second cycle, meaning that it has exceeded the target performance indicators that have been set, namely 85% of students that have completed. The thing that affects this increase is because students are facilitated by discussions in small groups to identify and collaborate to solve group problems, this is in line with the research of Yudasmini et al. (2015) Furthermore, in analyzing and evaluating student group problems not only from source books but also through online media so that the presentation material is more perfect and they are more ready to learn (Suparini et al., 2020). More details can be seen in Figure 4.

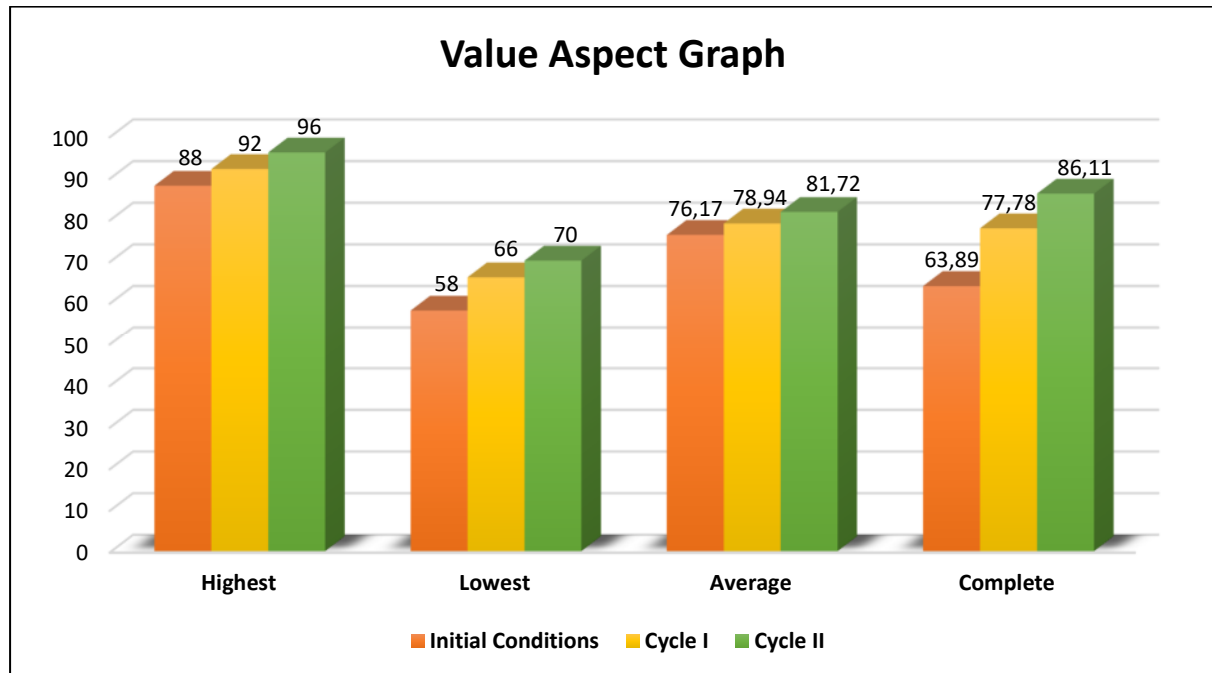


Figure 4. Graph of recapitulation of pre-action daily assessment results, cycle I, cycle II.

Based on the graph, it can be concluded that all assessment indicators have increased. The achievement of critical thinking indicators in building basic skills or C4 cognitive domains of students with the application of BCPBL learning strategies is very good. There is a need for habituation in explaining the material or problems in detail with the selection of appropriate models and methods so that all critical thinking indicators increase more optimally and critical thinking becomes a life skill

Student Responses to Learning with BCPBL

The assessment of BCPBL learning for 36 students was carried out by distributing a questionnaire containing 10 questions related to the learning process that had been implemented. The summary of the results of student responses to learning is shown in Table 5.

Table 5. Student responses about BCPBL

No	Response	Percentage			
		SA	A	D	SD
1	Conditioning students to be ready to learn	13.95%	69.45%	15.00%	2.80%
2	Developing active student learning	19.40%	75.00%	2.80%	2.80%
3	Encourage students to think and work on their own initiative	26.40%	70.85	2.80%	-
4	Develop an attitude of cooperation and mutual respect	25.00%	72.2%	2.80%	-
5	Develop critical thinking skills	23.60%	76.40%	-	-
6	Carry out learning in class and online	13.90%	75%	11.10%	-

7	The existence of group discussions and presentations as well as problem-based learning makes the learning process more resistant	19.40%	72.2%	8.30%	-
	Total	141.65%	511.10%	8.30%	5.60%
	Mean	20.24%	73.01%	7.13%	2.80%

*Note: SA (Strongly Agree); A (Agree); D (Disagree); SD (Strongly Disagree).

Based on Table 5, the response to the human heredity material with the application of BCPBL as a whole showed agreement about increasing mastery of human heredity material well by 93.25%. This is evidenced by the response statements that strongly agree 20.24% and agree 73.01%.

BCPBL on human heredity material can develop students' critical thinking skills by 100% where students state strongly agree 23.60% and agree 60.40%. Learning with the BCPBL model can improve students' ability to solve problems by compiling answers in their language through reading literacy and searching for literature from online media independently with the guidance of educators. Learners can analyze and conclude a phenomenon that exists in society regarding declining diseases (human heredity). Critical thinking skills will affect mental, social, and even spiritual maturity so that they become more mature in their efforts to improve mastery learning outcomes at high thinking levels (Zubaidah et al., 2015).

CONCLUSION

Based on the classroom action research that has been carried out and the results of data analysis, it can be concluded that the use of the Blended Collaboration Problem-Based Learning (BCPBL) strategy can improve critical thinking skills and minimal learning mastery of students. This is because students must be active in reading literacy from various sourcebooks, using online media, and ask educators to prepare material/group problems to be presented. The integration between online learning and conventional learning, which is based on problem-based learning, can be used as a prospective effort to be implemented in biology learning in the classroom because it can motivate and increase student activity.

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