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# The Effect of *Collaborative Learning* Model Combined with *Problem Solving* on Critical Thinking Ability and Mastery of Biology Concept of High School Students in Coffee Plantation Area

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## ABSTRACT

The characteristics of students who live in a school environment near coffee plantations have low learning independence, so it is necessary to have independent learning guided by a teacher in order to foster a scientific attitude in students. The Collaborative Learning model combined with Problem Solving is a combination of two learning approaches, namely cooperative learning and problem-based learning. Both of these learning models make it possible to create a collaborative learning environment. Learning environments that support students to collaborate naturally and effectively are very important because they can develop knowledge through their own experiences. Critical thinking is included in higher order thinking skills that have the potential to increase students' critical analytical power. When students have critical thinking skills, students will carry out decision-making, strategic planning, scientific processes, and problem solving activities. The existence of problem-solving skills will also affect students' mastery of concepts. Concept mastery can be interpreted as the ability to master ideas or ideas about certain objects, events or situations that can be generated because of a number of relevant experiences.

***Keywords:*** *Collaborative Learning, Problem Solving,* Critical Thinking Ability, Mastery of Concept.

## INTRODUCTION

Jember is one of the coffee and tobacco producing areas. So that some areas consist of plantation areas (Suratno et al., 2020). Regions with geographical conditions such as plantation areas can also affect the educational aspects of students who live in the vicinity. Students who live in plantation areas help their parents a lot so that the intensity in learning is less which causes their critical thinking skills to be still low (Suratno et al., 2020).

The characteristics of students who live in a school environment near coffee plantations have low learning independence, so it is necessary to have independent learning guided by a teacher so that they can foster a scientific attitude in students (Faiqoh et al., 2019). The purpose of learning in schools in coffee plantation areas is not only emphasized on concept mastery, but more emphasis on the process, namely how students solve critical problem solving problems given in their own way.

Learning is the process of teaching and learning activities between students and teachers. If the learning process is student-centered rather than teacher-centered, then the quality of learning will be the best because teacher-centered learning often makes students passive and makes them easily bored (Jayawardana, 2017). Biology

is a material that contains a lot of analysis in building its concepts (Munif, 2009).

One of these biological materials is the body's defense. The human body was created with all the advantages it has. The living environment in coffee plantation areas or wherever it is often infested with viruses and bacteria. However, the body has a defense mechanism to prevent bacteria and viruses from entering the body (Hidayat, 2020). Students value biology material as having concepts that are difficult to understand because they have foreign vocabulary (Tasyari et al., 2021).

According to (Nahdi, 2017), Collaborative Learning combined with Problem Solving is a combination of two learning approaches, namely cooperative learning and problem-based learning. Both of these learning models make it possible to create a collaborative learning environment. A learning environment that supports students to collaborate naturally and effectively is important because they can develop knowledge through their own experiences. With the Collaborative Learning model combined with Problem Solving which is supported by problem solving activities, students can make agreements based on their respective natural collaborative processes.

Critical thinking is included in higher order thinking skills that have the potential to increase students' critical analytical power. When students have critical thinking skills, students will carry out decision-making activities, strategic planning, scientific processes, and problem solving (Suratno and Dian, 2018). The low ability to think critically is caused by the learning process which only receives information from the teacher so that the role of the teacher dominates and interaction in the class only goes in one direction. The lack of student activity and the learning model used by the teacher also rarely hold discussions, causing a low level of student understanding (Mubashiroh, 2014). The reality on the ground also shows that the learning process does not include students in teaching and learning activities, so that only the teacher is the center of attention and causes students to become bored (Sari et al., 2019).

The existence of problem-solving skills will also affect students' mastery of concepts. Mastery of concepts can be interpreted as the ability to master ideas or ideas about certain objects, events or situations that can be generalized due to a number of relevant experiences (Widyastuti, 2017). Judging from the various kinds of learning models, the use of problem-centered learning models will be applied. Problem solving creates students who think critically and creatively which can be used as a benchmark for the quality of students in this modern era. This is the provision of students in dealing with problems that arise in the future Based on the background above, it is necessary to conduct research on "The Influence of Collaborative Learning Model combined with Problem Solving on Critical Thinking Ability and Mastery of Biological Concepts of High School Students in Coffee Plantation Areas".

## METHODS

The method used in this study is quasi-experimental, namely by applying the Collaborative Learning model combined with Problem Solving in the experimental class and conventional models in the control class. The place of this research is at SMAN Jenggawah, Jember. The population taken in this study was students of class XI MIPA, then normality and homogeneity tests were carried out to determine the sample in the study. Obtained class XI MIPA 2 as the control class and XI MIPA 3 as the experimental class.

The research design was in the form of a pre-test and post-test, using this design there was a control group and an experimental group, the subjects were selected randomly (random sampling).

The research design can be seen in Table 1.

**Table 1. Research Design**

| Class | *Pre-test* | Treatment | *Post-test* |
|---|---|---|---|
| Experiment | $P_1$ | Y | $P_2$ |
| Control | $O_1$ | X | $O_2$ |

**Information:**
P1: application of the pre-test in the experimental class
P2: application of the post-test in the experimental class
O1: application of the pre-test in the control class
O2: application of the post-test in the control class
Y: class that uses Collaborative learning model
Learning combined with Problem Solving.
X: class that uses Discovery Learning
Data collection methods in this study included observation, interviews, tests and documentation techniques. The observation method is used to determine the implementation of learning during the learning process. The interview method was used to obtain information from informants, namely biology teachers and students. The test method used is the pre-test and post-test to measure the knowledge, abilities and skills of students that have been achieved during the learning process, both before treatment and after treatment. Documentation is used to obtain the necessary data during research.
The data analysis used to obtain data during this study was by using ANCOVA to test the effect of the Collaborative Learning model combined with Problem Solving on students' critical thinking skills. Analysis of the data used to determine the differences in learning with the Collaborative Learning model combined with Problem Solving on students' mastery of concepts using the independent sample t-test.

## RESULT AND DISCUSSION

The research was conducted in class XI MIPA at SMAN Jenggawah which consisted of classes XI MIPA 1, MIPA 2, MIPA 3, MIPA 4, MIPA 5. The class selection was carried out by carrying out a normality test and homogeneity test for five classes X I MIPA at Jenggawah High School obtained from UTS value. The normality test was carried out, namely the *One-sample Kolmogorov-Smirnov* Test to prove that the data for the five classes were normally distributed. The data is normally distributed if the value is > 0.05. the results obtained for each class from XI MIPA 1 to XI MIPA 5 namely, 0.200, 0.200, 0.70, 0.200, 0.53. The data shows a significant >0.05 which means it is normally distributed. The next step is to do a homogeneity test to find out whether the data from the five classes is homogeneous or not. Homogeneous data if the significant value is > 0.05. To test the homogeneity of the data using One-Way Anova. The results of the Levene's homogeneity *test* obtained a significant value, which means that the data for the five classes were homogeneous or had the same variance. From the tests that have been carried out, it shows that the data is normally distributed and homogeneous. After that the experimental class and control class can be determined by means of random sampling and obtained class XI MIPA 3 as the experimental class and class XI MIPA 2 as the control class.
Critical thinking skills consist of 12 indicators which are grouped into 5 aspects of critical thinking skills competencies. The results of students' critical thinking skills were obtained from the results of student discussions in class in groups for 2 meetings. The following are the results of the critical thinking skills of the experimental class and the control class.

**Table 2. Critical Thinking Ability Value of Experiment Class Students**

| Critical Thinking Indicator | Score | Information |
|---|---|---|
| Provide simple explanations ( ask and answer clarifying questions and challenging questions ) | 68.75 ± 12.13 | Enough |
| Building basic skills ( considering the criteria of a source ) | 4 9 , 65 ± 2.08 | Not enough |
| Infer ( make induction and consider induction ) | 93.75 ± 6.33 | Very good |
| Make more explanations ( identify assumptions ) | 93.75 ± 6.33 | Very good |
| Strategy and tactics ( deciding an action ) | 79,16 ± 11.95 | Well |
| **Average** | **76,67 ± 5** | **Well** |

**Table 3. Critical Thinking Ability Value of Control Class Students**

| Critical Thinking Indicator | Score | Information |
|---|---|---|
| Provide simple explanations ( ask and answer clarifying questions and challenging questions ) | 60,41 ± 11.37 | Enough |
| Building basic skills ( considering the criteria of a source ) | 47,91 ± 8.71 | Not enough |
| Infer ( make induction and consider induction ) | 68.75 ± 9.68 | Enough |
| Make more explanations ( identify assumptions ) | 81.25 ± 15.95 | Well |
| Strategy and tactics ( deciding an action ) | 60,41 ± 8.71 | Enough |
| **Average** | **63.75 ± 4.33** | **Enough** |

**Table 4. Average Value of Critical Thinking**

| No. | Class | The number of students | Mean ± SD |
|---|---|---|---|
| 1. | Experiment | 36 | 76.67 ± 5 |
| 2. | Control | 36 | 63.75 ± 4.33 |
| | Difference | | 12.92 |

Based on the overall average value of critical thinking skills in the experimental class and control class shown in table 4, it can be seen that the average value of the experimental class is higher than the average value of the control class, which is 76.67, while the control class obtains value of critical thinking skills of 63.75. Furthermore, the value of critical thinking skills obtained will be tested for normality and homogeneity tests. Once it is known that the data is included in normal and homogeneous data, then the *Independent Sample t-test is performed*. The results of the *Independent Sample t-test* can be seen in table 5 below.

**Table 5. *Independent Sample t-test results***

| | | Lavender's Test for Equality of Variances | | t-test for Equality of Means | | |
|---|---|---|---|---|---|---|
| | | F | Sig. | Q | df | Sig. (2-tailed) |
| Students' Critical Thinking Ability | Equal variances assumed | ,303 | ,584 | 12,113 | 70 | ,000 |
| | Equal variances not assumed | | | 12,113 | 68,971 | ,000 |

*Independent Sample t-test* data analysis in Table 5 it is known that there is a significant difference between the critical thinking skills of the experimental class and the control class, with a significant value of 0.000. This means that < 0.05 or there is an influence on the learning process using the *Collaborative Learning model* combined with *Problem Solving*.

Data analysis of high school students' mastery of concepts in coffee plantation areas was obtained from pre-test and post-test scores. Based on table 6, the average pre-test score for the experimental class was 53.78 and the post-test score was 76.28. The pre-test score for the control class was 46.80 and the post-test for the control class was 60.91. The normality test results for the pre-test for the experimental class were 0.165 and for the post-test for 0.200. The results of the normality test for the pre-test for the control class were 0.123 and for the post-test was 0.179. The significance value is greater than 0.05. So it can be concluded that the data is normally distributed.

**Table 6. Pre-test and post-test scores for students' mastery of concepts**

| Class | The number of students | Pre-test | Post-test | Difference |
|---|---|---|---|---|
| Experiment | 36 | 53,78 | 76,28 | 22.5 |
| Control | 36 | 46.80 | 60,91 | 14,11 |

Furthermore, the data was tested using the ANCOVA test to analyze the effect of the learning model on high school students' mastery of biology concepts in coffee plantation areas. The results of the ANCOVA test show that the significance value of the learning model is less than 0.05, which means that the model applied has a significant effect on the mastery of biology concepts by high school students in coffee plantation areas. The following are the results of the ANCOVA test:

**Table 7. ANCOVA test results**

| Tests of Between-Subjects Effects | | | | | | |
|---|---|---|---|---|---|---|
| **Dependent Variable: Posttest Value** | | | | | | |
| Source | Type III Sum of Squares | df | MeanSquare | F | Sig. | Partial Eta Squared |
| Corrected Model | 4247.347 [a] | 1 | 4247,347 | 56,034 | .000 | .445 |
| Intercepts | 338801.681 | 1 | 338801.681 | 4469703 | .000 | .985 |
| Class | 4247,347 | 1 | 4247,347 | 56,034 | .000 | .445 |
| Error | 5305972 | 70 | 75,800 | | | |
| Total | 348355000 | 72 | | | | |
| Corrected Total | 9553319 | 71 | | | | |
| a. R Squared = .445 (Adjusted R Squared = .437) | | | | | | |

The statistical test results showed that the value of the critical thinking skills of the experimental class and the control class had differences. The experimental class obtained an average value of 76.67 while the control class obtained an average value of 63.75. The average value indicates that there is an increase in scores in the experimental and control classes. Based on the analysis results of each student's critical thinking skills which were tested using the *Independent Sample t-test*, the results showed a significant value of 0.000 <0.05, which means that the learning model applied had an effect on students' critical thinking abilities. This is in accordance with the theory of (Agnafia, 2019) that critical thinking has an important role in solving problems based on evidence and facts. Based on the analysis of mastery of biological concepts by high school students in coffee plantation areas through the *pre-test* and *post-test* scores which were tested using the ANCOVA test. A significance value of 0.000 <0.05 was obtained, which means that the learning model applied influences the mastery of biology concepts by high school students in coffee plantation areas.

The results of research and data analysis of critical thinking skills were measured through student discussion sheets (LDS) which were worked on in groups and exchanged opinions of each member of the group accompanied by the teacher. Before the LDS was given, in the experimental class the researcher gave material about the body's defense system and conducted questions and answers. The body's defense material can be used by students to solve problems in LDS. LDS was given to both classes, namely, the experimental class and the control class in the form of description questions. LDS is given when the teacher has divided the groups. Before working in groups, students will work on the questions individually first so they can understand the questions. After that students will work in groups consisting of 5-6 people. The group that has finished working on the LDS is given time to present the results of their discussion to be discussed with other groups. Critical thinking skills in this study are guided by indicators of critical thinking skills which consist of 12 indicators and 5 aspects. Each indicator has several ranges of values that differ from both the experimental and control classes.

Based on tables 2 and 3 it shows that the experimental class has a higher value compared to the control class. Based on 12 indicators that measured critical thinking skills, the indicator that had the highest score was making more explanations or identifying assumptions of 93.75 in the experimental class and included in the very good category and 81.25 in the control class and included in the good category. This is because students have been encouraged to develop high-level abilities to solve real problems given (Sari *et al* ., 2017).

The indicator that has the lowest score, namely building basic skills or considering the criteria of a source, is 47.91 in the experimental class and 49.65 in the control class, both of which have low scores on these indicators. The third indicator is giving simple explanations or asking and answering clarifying questions and challenging questions. The values obtained in the experimental class were 68.75 and 60.41 in the control class, both of which

were in the sufficient category. This is because both in the experimental and control classes students are able to remember and apply the knowledge they have and are quite capable of identifying the problems given (Sari *et al*., 2017).

The next indicator is concluding or making induction and considering induction, the value obtained is 93.75 in the experimental class and is included in the good category, 68.75 in the control class and is included in the sufficient category. This is because students in the experimental class are able to participate in planning, investigating, and making decisions to solve a given problem (Sari *et al*., 2017). While students in the control class cannot participate in planning, investigating, and making decisions fully to solve a given problem.

The last indicator is strategy and tactics or deciding an action in the experimental class of 79.16 included in the good category and 60.41 in the control class included in the sufficient category. This is because students in the experimental class are able to participate in planning, investigating, and making decisions to solve a given problem (Sari *et al.,* 2017). While students in the control class cannot participate in planning, investigating, and making decisions to solve a given problem.

The general average of the experimental class had higher results, namely 76.67 which was included in the good category and 63.75 which was included in the sufficient category, because the form of critical thinking skills is impossible without the main component, namely knowledge. Knowledge is something that is used for critical thinking and is also obtained as a result of critical thinking *et al.,* 20 20). Critical thinking skills can improve to be better than before, so teachers are encouraged to start introducing and teaching material using various strategies that can train critical thinking skills.

The results and data analysis in table 4.5 also show that the experimental class has better results than the control class. The average value in the experimental class was 76.67 which was included in the good category while the average value in the control class was included in the sufficient category. The difference in value between the experimental class and the control class is 12.92. Based on the results of the analysis and data, it is then followed by conducting an independent *sample t -test*. The purpose of the t-test was conducted to find out whether there was a significant difference in students' critical thinking skills between the experimental class and the control class (Kristin and Rahayu, 2016).

Results The results of the analysis and test data for the t-test showed a significance value of 0.000 or p <0.05, so based on the decision-making basis of the *Independent Sample t-test* $H_0$ was rejected and $H_1$ was accepted. This can be interpreted that there is a significant difference in the value of critical thinking skills between the experimental class. There are differences in the results of critical thinking skills in the experimental class and the control class, because the experimental class has higher abilities when compared to the control class due to the use of different learning models, namely *Collaborative Learning models* combined with *Problem Solving* in the experimental class and conventional learning models in control class. This difference means that the *Collaborative Learning model* combined with *Problem Solving* has a major effect on students' critical thinking skills . This shows that the learning process that applies the *Collaborative Learning model* combined with *Problem Solving* can stimulate students to be more active and critical in finding and obtaining solutions to problems.

Concept mastery is the ability to understand the meaning of material, integrate concepts and be able to use or apply the material that has been studied (Syafi'i, 2011). Based on the results of the research and data analysis in Table 5, it was obtained that the average *pre-test* value in the experimental class was 53.78 and the *post-test average value* in the experimental class was 76.28. While the *pre-test value in the control class was 46.80*

*and the post-test* average value in the control class was 60.91. The results of these average values indicate that there is an increase of 22.5 in the experimental class and 14.11 in the control class.

Based on the results of the ANCOVA test in table 6, it is known that the significance value is 0.000, which is p <0.05, which means $H_{0\ is}$ rejected and H1 is accepted so that there is $_{a}$ significant influence on students' *post-test scores* after different treatment models are applied. It can be concluded that the *Collaborative Learning model* combined with *Problem Solving* has an effect on students' mastery of biology concepts.

Mastery is defined as the ability to understand a material or materials. the process of understanding occurs because of the ability to translate material or materials into other materials. Someone can be said to master and understand something, if that person understands correctly and is able to explain it (Syafi'i, 2011). Before teaching mastery of concepts to students, teachers must understand subject matter that can develop students' thinking skills and understand various learning models that can stimulate students' abilities to learn with careful planning by the teacher. This describes students who have knowledge and mastery of concepts, namely skills in solving problems and drawing conclusions (Seprianingsih, 2017). This research uses the material of the body's defense system. The material for the body's defense system is material in biology that has characteristics that are relatively difficult to study because it contains many concepts that are not easy to imagine, such as the mechanisms that occur in the body when it is actively defending against incoming foreign objects (Hikmawati, 2016).

The *Collaborative Learning model* combined with *Problem Solving* is a collaboration carried out by two or more people who have the same goal, namely to solve a particular problem. This learning makes the process of cooperation between students in solving problems the main thing to be able to construct their own knowledge, armed with the initial knowledge possessed by each student (Nahdi, 2017). The application of learning strategies is not only useful for conveying learning material, but can train students to think using their cognitive structures in a full and directed manner. Thus, it can be said that the learning model can encourage student activity to explore various information and knowledge independently (Aini *et al*., 2018). The importance of students having an understanding of the mastery of this concept is the ability of students not only to understand, but also to be able to apply various kinds of concepts given in solving problems from a problem and to understand new concepts (Yustiqvar *et al* ., 2019).

## CONCLUSION

Based on the results of the research and discussion described above, the Collaborative Learning Model combined with Problem Solving shows that there is a significant difference in students' critical thinking skills. The average value obtained by the experimental class was 76.67 while the average value obtained by the control class was 63.75. The Collaborative Learning model combined with Problem Solving has a significant effect on students' mastery of concepts. The average value of concept mastery obtained by the experimental class for the pre-test value was 53.78 and the post-test value was 76.28 and the average value for concept mastery obtained by the control class for the pre-test value obtained by the control class was 46. 80 and the post test value of 60.91.

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