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Problem-Solving Model in Biology Learning to Improve the Critical Thinking Ability of Students at SMP Negeri 2 Ratahan

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Abstrak

Penelitian ini bertujuan untuk mengetahui, menganalisis, dan menjelaskan penerapan model pemecahan masalah di SMP Negeri 2 Ratahan dengan tujuan untuk meningkatkan kemampuan berpikir kritis siswa. Pendekatan penelitian yang digunakan adalah Penelitian Tindakan Kelas (PTK). Penelitian ini dilakukan dalam dua siklus. Partisipan penelitian terdiri dari 24 siswa kelas IX B. Kurikulum kelas IX B berfokus pada teknik pemecahan masalah. Hasil penelitian mengungkapkan bahwa penerapan model pembelajaran Problem Solving pada pendidikan Biologi meningkatkan kemampuan berpikir kritis siswa. Kemampuan berpikir kritis siswa pada siklus 1 tergolong sedang dengan proporsi sebesar 71,12%. Pada siklus 2 kemampuan berpikir kritis siswa meningkat menjadi 80,5% dan tergolong tinggi. Keterampilan berpikir kritis siswa meningkat dari kategori rendah sebesar 58,64% pada pra siklus menjadi kategori sedang sebesar 67,37%, dan selanjutnya tumbuh menjadi kategori tinggi sebesar 79,07% pada siklus II berdasarkan data observasi.

Kata kunci: *Problem Solving, Pembelajaran Biologi, Berpikir Kritis, Hasil Belajar.*

Abstract

This study aimed to investigate, analyze, and elucidate the implementation of the problem-solving model at SMP Negeri 2 Ratahan with the goal of enhancing students' critical thinking abilities. The research approach used is Classroom Action Research (PTK). The research was conducted in two cycles. The research participants consisted of 24 students in class IX B. The class IX B curriculum focuses on problem-solving techniques. The research findings revealed that implementing the Problem-Solving learning model in Biology education enhances students' critical thinking skills. Students' critical thinking abilities in cycle 1 are classified as medium, with a proportion of 71.12%. During cycle 2, students' critical thinking abilities rose to 80.5% and were classified as high. Students' critical thinking skills improved from a low category of 58.64% in the pre-cycle to a medium category of 67.37%, and further grew to a high category of 79.07% in the second cycle based on observation data.

Keywords: *Problem-Solving, Biology Learning, Critical Thinking, Learning Results.*

INTRODUCTION

Along with the increasingly rapid development of science and technology, it causes changes in almost all areas of life. In line with this development, it has a direct impact on increasingly tight global competition, so quality human resources are needed (Sudarsana, 2015). Efforts to produce good human resources are by developing the quality of education (Purnama, 2016; Domu & Mangelep, 2023). Education is a long-term process that has become an inseparable part of life, and it is only through an excellent educational process that humans can gain and master knowledge for their lives. An excellent educational process can undoubtedly create quality education and quality participants' good education (Pratami & Afriansyah, 2019). The goal of education is the achievement of student learning outcomes after the learning process is implemented (Asmara & Nindianti, 2019; Mangelep et al., 2023).

The learning process greatly influences students' critical thinking abilities, so in the learning process, educators are expected to be able to provide stimulus to students to develop high-level thinking skills or critical thinking. Critical thinking skills are essential for students to have both at school and in everyday life (Haryanti & Febriyanto, 2017; Domu et al., 2023). Students who have critical thinking skills are models for being able to solve problems that occur in their lives because, according to Robert Ennis in Fisher (2012), critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do. Critical thinking also has several benefits: Having many alternative answers and creative ideas, quickly understanding other people's points of view, being a good colleague, being more independent, often finding new opportunities, minimizing misperceptions, and not being easily deceived. Critical thinking is also very important for life and education; critical thinking allows readers to assess evidence for what they read and can identify false or illogical reasoning (Mangelep, 2013; Liska et al., 2021). Critical thinking will also help to make strong arguments (for example, in assignments) (Sriliani, 2022; Kumesan et al., 2023). This means it will look at and justify every claim made based on evidence that has been evaluated.

Learning is a system consisting of various interconnected components. These components include objectives, materials, methods, and evaluation. Teachers must pay attention to these four learning components in selecting and determining what media, strategy models, and approaches will be used in learning activities (Lohonauman et al., 2023). Current biology learning is still centered on teachers and textbooks, so students are less active in learning (Anggraini et al., 2016). This can trigger problems in the classroom, one of which is critical thinking skills (Mangelep, 2015), where critical thinking skills can be categorized as thinking, creative thinking, problem-solving, and decision-making. Critical thinking ability is a process of making decisions in solving problems in a well-directed manner so that it can produce correct information or knowledge (Mangelep, 2017; Tanjung & Nababan, 2018). This can improve students' critical thinking abilities. Because if students are used to making appropriate and correct decisions and are also well-directed, students will be able to think critically and be able to solve problems correctly.

Critical thinking abilities can increase in line with the increasing critical thinking abilities of students through learning. Efforts to improve the learning process to improve student's critical thinking skills require action through classroom action research by

implementing a learning model. According to Anugraheni (2017), a learning model is a pattern used as a guide in planning learning in the classroom, including preparing the curriculum, compiling materials, determining learning objectives, determining learning steps, and managing the classroom and the environment in learning. One lesson that can be applied to solve this problem is applying problem-based learning (Problem Solving) (Mangelep et al., 2023).

The Problem-Solving learning model trains students to search for information and cross-check the validity of that information with other sources. Problem-solving also trains how to think and reason in concluding, for example, through exploration activities, experiments, showing similarities, differences, consistency, and inconsistencies, developing solving skills problems, Developing the ability to convey information or communicate ideas, including through conversations, notes, graphs, diagram maps in explaining ideas (Mangelep et al., 2023). Problem-solving or Problem-Solving, it is hoped that learning will be more meaningful and exciting and stimulate activeness for students because the problem-solving or Problem-Solving approach is the source of Biology learning. After all, various cognitive, affective, and psychomotor aspects are involved.

Based on the results of an interview on Monday, 8 May 2023, with biology teacher Marni Komalig, she said that in the learning process, the teacher uses the lecture method, and in-class learning, the thinking ability of students in the class is still relatively low. This is proven when the teacher teaches and asks questions in class. Some students can answer the teacher's questions correctly, but some need help expressing opinions according to the teacher's learning material. Furthermore, this was also proven during the pre-cycle, based on data on critical thinking skills obtained; only seven students had completed it, while 17 students still needed to complete it. Also, the results of interviews with biology teacher Marni Komalig showed that the problem-solving learning model still needs to be completed. It has been applied in biology learning. Therefore, according to the topic of the Problem, one learning model that can be applied to solve this Problem is problem-solving learning because using the problem-solving learning model can create a different atmosphere in the class, and students are trained in solving problems and finding solutions. So that it can be solved together and can also encourage students to be more severe in learning, students can understand the content of the material and develop thinking skills to be able to repeat the problems they encounter. Students are helped to think and reason in concluding. So that students' critical thinking abilities can increase and they can become more active in learning biology. SMP N 2 Ratahan that students' critical thinking abilities are still meager. So, in biology learning, students cannot provide logical reasons or conclusions in solving problems, and there is also a need for students' understanding when determining the initial formula for solving problems systematically. Therefore, students' critical thinking skills in learning still need to improve. Hence, students need to be trained and accustomed to it so that when faced with problems, they can find ideas, argue, and draw logical, trusted conclusions. To resolve the Problem with the situation.

One way that can solve this problem is by using a learning model. One of the models used in this research is the problem-solving learning model. This learning model is one of the theoretical bases of various learning strategies, which make problems one of the

main issues (Yustina et al., 2015; Runtu et al., 2023). This problem-solving model is a learning model that attempts to discuss problems to find answers. Irawati (2014) states the steps for learning problem solving: Understanding the problem, designing a solution, implementing the solution, and reviewing. Even though the problem-solving learning model is perfect for improving students' critical thinking skills, this model has advantages and disadvantages. Astuti (2017) stated the advantages and disadvantages of the problem-solving learning model, namely: Advantages 1) The problem-solving model can make education in schools more relevant in life, especially in the world of work. 2) The teaching and learning process through problem-solving can familiarize students with dealing with problems skillfully when facing problems in the family and working in the future. This ability is meaningful for human life. 3) The problem-solving model can stimulate the development of students' thinking abilities creatively, critically, and comprehensively because, in the learning process, students do a lot of mental work by highlighting problems from various aspects to find solutions. Meanwhile, the disadvantages are 1) Determining a problem whose level of difficulty is appropriate to the student's level of thinking, school, and class level, as well as the knowledge and experience that the student has, really requires the teacher's abilities and skills. 2) The teaching and learning process involves using and receiving information from the teacher to learn and think a lot about solving problems alone or in groups.

METHOD

This classroom action research design uses the Problem-Solving model. This PTK research will be carried out over two learning cycles or according to the achievement of learning objectives.

This classroom action research (PTK) was conducted at SMP Negeri 2 Ratahan, in Southeast Minahasa Regency. This research was conducted in the Odd Semester of the 2023/2024 Academic Year for 2 months, namely in October-November 2023. The research began with initial observation activities, giving tests for equality tests, cycle one treatment, reflection/follow-up, cycle two treatment, and reflection/follow-up. The research subjects were 24 students.

Data collection methods use critical thinking skills tests, observations, interviews, questionnaires, and critical thinking skills tests. Meanwhile, the instruments used consist of lesson design, chapter design (consisting of various research supporting instruments, including lesson plans, syllabi, modules/LKPD, critical thinking evaluation sheets, question grids, mind mapping, observation sheets, questionnaires, and media selection and learning resources that are by the research theme applied to learning). Then, qualitative, and quantitative data analysis techniques are used.

RESULT AND DISCUSSION

This research was research conducted at SMP N 2 Ratahan. This research uses a quantitative descriptive approach. The research results are successful if the problem-solving learning model can improve students' critical thinking abilities. Problem Solving is a learning model to solve a problem. Problem-solving is the process of thinking about a

problem to find a solution to the problem. Applying this model can train students to solve problems. For students to be able to think systematically and logically in dealing with problems, the Problem-Solving learning model is the best solution. Students will develop into a whole little by little by implementing this model. This means that not only does the knowledge aspect develop, but emotions and skills also develop.

This Problem-Solving model can train students to search for information using other sources, and this problem-solving model can also train students in critical thinking (Firli et al., 2017). This problem-solving model is also a model that helps students' learning process, so that by applying this model, students can be trained to solve existing problems and be trained in critical thinking.

There are several reasons why the problem-solving model is very suitable for solving problems in learning, including: Training how to think, reason and draw conclusions, be consistent and inconsistent, and develop the ability to solve problems. By implementing this problem-solving model, it is hoped that learning will be more meaningful and interesting and stimulate student activity, so that the problem-solving model can be said to be the source of learning.

Test the research instrument

Before the instrument was given to class IX B students who were the samples for this research, this research instrument test was carried out to find out whether the question items met good quality questions or not. What is used in this test includes: test validity and test reliability.

a. Test the validity of the questions

Validity testing is carried out to find out whether the questions used are truly valid or not. The validity of the instrument in this research is the validity of each test item both in the pretest and posttest. Calculation of the validity of each question item can be calculated using SPSS 22. Based on the Bivariate validity test on 10 question items, the data can be seen in table 1 below.

Table 1. Validity test results

No.	Person Correlation	Sig Value	Conclusion	Interpretation
Problem 1	0,857	0,001	Valid	High
Problem 2	0,857	0,001	Valid	High
Problem 3	0,857	0,001	Valid	High
Problem 4	0,752	0,008	Valid	High
Problem 5	0,830	0,002	Valid	High
Problem 6	0,967	0,000	Valid	High
Problem 7	0,674	0,023	Valid	High
Problem 8	0,658	0,028	Valid	High
Problem 9	0,857	0,001	Valid	High
Problem 10	0,770	0,006	Valid	High

b. Reliability Test

After the validity test is carried out, a reliability test is then carried out on the instrument. According to Sugiyono (2017) a reliability test is the extent to which measurement results using the same object will produce the same data. Reliability testing is used to determine the consistency of data. In table 2 below, of the 10 valid questions the reliability value is 0.934.

Table 2. Reliability test results

Cronbach' Alpha	N of items
0,934	10

Data analysis results

The pretest and posttest results of class IX B students can be seen in table 3 below:

Table 3. Value of pretest-posttest results for pre-cycle, cycle 1 and pretest-posttest for cycle 2

No	Student Name	Questionnaire Value Pre cycle	Pretest-posttest Value Cycle 1	Pretest-posttest Value Cycle 2
1	GW	40	65	80
2	MS	25	55	70
3	MSu	40	60	80
4	FK	25	50	75
5	ES	35	65	80
6	NW	40	65	80
7	VL	30	50	75
8	SE	25	55	75
9	VA	30	55	75
10	JK	25	50	70
11	LO	35	55	75
12	MK	30	55	75
13	SA	25	50	70
14	ML	30	60	80
15	ET	40	60	80
16	JP	35	65	75
17	RM	30	55	70
18	DL	35	65	75
19	NP	25	55	70
20	RP	25	50	70
21	EL	30	60	75
22	NA	25	55	70
23	GA	20	50	70
24	FS	30	55	70

From the data table of pretest and posttest scores in class IX B students, above with the help of SPSS, it shows that during the pre-cycle in class IX B the results were obtained with the highest score of 40. In cycle 1 research using the problem-solving model in class IX B saw an increase in scores on the pretest posttest results by getting the highest score of 65, while in cycle 2 there was an increase in pretest posttest scores by getting a score of 80. This shows an increase in students' critical thinking abilities in class IX B.

a. Pre-cycle

Before conducting research, researchers made observations to obtain pre-cycle data. Based on existing data from class IX B, the results obtained from the questionnaire score in class IX B were with the highest score of 40. Based on the total score from observations obtained in the pre-cycle, namely 40, the value in the biology learning process in class IX B is still relatively low.

b. Cycle I

When the researchers conducted research using problem-solving in class IX B, they saw an increase in scores in the pretest-posttest results by getting the highest score of 65. This shows an increase in students' critical thinking abilities in class IX B.

Based on the average score from the pretest-posttest results obtained in cycle I, namely 65, it can be concluded that students' activities in participating in the learning process using the problem-solving model received sufficient scores.

a) Activity planning carried out at this stage the teacher prepares learning tools starting from:
   1) Create a lesson plan by applying a problem-solving model which includes learning steps starting from the introductory stage, core and closing activities.
   2) Prepare an evaluation tool (test), namely a test carried out at the end of each action cycle by the scope of the problem in learning.
   3) Make observation sheets of student and teacher activities
b) Implementation of the First Meeting In conducting this research, the researcher acted as a biology learning teacher. Learning activities in cycle I are by the guidelines that have been created in the learning implementation plan (RPP), namely, applying a problem-solving model to the material Structure and Function of Plants. The steps for implementing the problem-solving model are as follows. (1) Core activity (identifying the problem), the teacher prepares pictures of plants and cardboard according to the learning objectives (2) the teacher sticks the picture on the blackboard (3) (Analyzing the Problem), the teacher gives instructions and gives students the opportunity to pay attention or analyze image (4) (Problem Solving), through group discussion of 4-5 students, the results of the discussion from the analysis of the image are made in the form of mind mapping on cardboard which has been distributed to each group and the teacher pays attention to the problem solving activities of each group (5) (Reviewing or Evaluating Problems), each group is given the opportunity to present the results of their discussion in front of the class (6) each group provides additions, rebuttals and input to the group presenting (7) the final stage of the group can convey conclusions from the learning process that has been obtained and the teacher adds or provides additional

information/reviews the lesson in general. After that the teacher gives LKPD as an individual assignment (8) Conclusion At the first meeting of cycle I, held on Monday 09 October 2023. At this meeting, 20 students were present; this meeting lasted 2 x 35 minutes or two class hours on the picture the teacher sticks on the blackboard. Then, the teacher gives instructions and allows students to pay attention to or analyze the picture and asks students to form groups and discuss with their classmates the material in the pictures of shallots, spinach, peanuts, and grass made in the form of mind mapping. Then, the students are asked to come to the front of the class to present the results of their discussion. At the same time, the other groups pay attention, write essential things, and provide responses, rebuttals, and input to the group presenting.

c) Second Meeting In conducting this research the researcher acted as a biology learning teacher. Learning activities in cycle 1 are in accordance with the guidelines that have been created in the learning implementation plan (RPP) that has been created, namely applying the problem-solving model. The steps for implementing the problem-solving model are as follows. (1) the teacher prepares pictures of plants and cardboard according to the learning objectives (2) the teacher sticks the pictures on the blackboard (3) the teacher gives instructions and gives students the opportunity to pay attention to or analyze the pictures (4) through group discussions of 4-5 participants students, the results of the discussion from the image analysis are made in the form of mind mapping on cardboard which has been distributed to each group (5) each group is given the opportunity to present the results of their discussion in front of the class (6) each group provides additions, objections and input to the group that presentation (7) the final stage of the group can convey conclusions from the learning process that has been obtained and the teacher adds or provides additional information/reviews the lesson in general. After that the teacher gives the LKPD as an individual assignment (8) Conclusion.

d) Observation Based on the actions above, the research provides observations and explains the results of the actions. To get the results of the action process, the researcher looked at the percentage of research results. From the results of observations of teachers and students in learning, researchers found that there were several aspects that had not been implemented well.

Cycle II

During the second cycle of research, by strengthening the use of the problem-solving model in class IX B, it was seen that there was an increase in the pretest posttest score by getting a score of 80. This shows an increase in students' critical thinking abilities in class IX B.

Based on the average score from the pretest-posttest results obtained in cycle II, namely 80, it can be concluded that students' activeness in participating in the learning process using the Problem-Solving model received a good score.

a. Analysis of Students' Critical Thinking Abilities

Increasing students' critical thinking abilities during the teaching and learning process through the application of the Problem-Solving Learning model is calculated using the percentage of students' critical thinking abilities using the formula.

$$E = \frac{n}{N} x\ 100\%$$

Information:
E = percentage of students' classical critical thinking abilities
n = number of critical thinking scores/critical thinking test scores obtained
N = maximum number of critical thinking scores/critical thinking tests

Table 4. Percentage Categories

Average Score Range	Category
89% < E ≤ 100%	Very High
79% < E ≤ 89%	High
64% < E ≤ 79%	Medium
54% < E ≤ 64%	Low
E ≤ 54%	Very Low

Students' Critical Thinking Ability Based on Observation Results

Based on the results of initial observations, the low category is in students' critical thinking abilities with a percentage of 58.64%. Analysis of observation results from cycle I showed that 4 students (10%) were in the very high category, 9 students (22.5%) were in the high category, 18 students (45%) were in the medium category, 7 students (17, 5%) in the low category, and 2 students (5%) in the very low category.

Based on the analysis carried out at the reflection stage in cycle I, there are still students whose critical thinking skills are in the very low category so improvements and re-planning must be carried out to continue cycle II. Cycle II was carried out with the aim of further improving students' critical thinking abilities. Analysis of data from observation results from cycle II shows an increase in critical thinking skills from cycle I to cycle II.

In cycle I, critical thinking skills were classically in the medium category (67.37%), then increased to high category (79.07%) in cycle II. Increasing critical thinking skills can occur because in cycle II students make direct observations to collect data to find the impact of problems and solutions to existing problems. The increase in students' thinking abilities can be seen in the following diagram.

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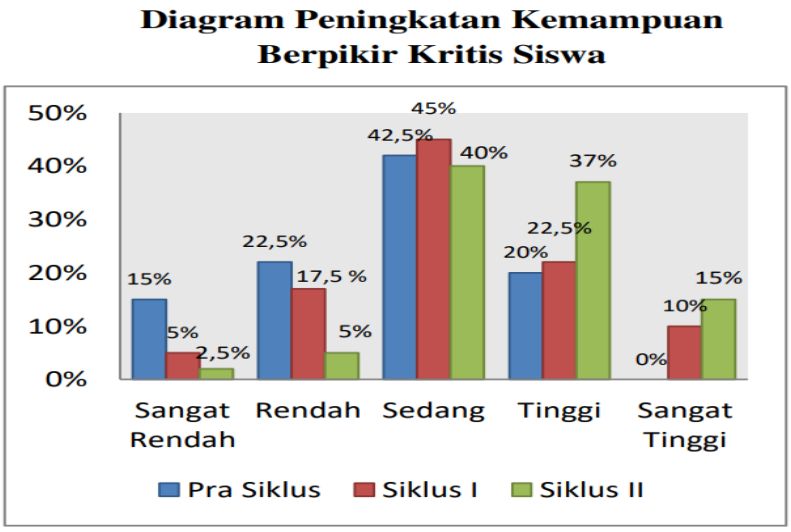

Diagram 1. Improving Students' Critical Thinking Ability

Students' classical critical thinking abilities based on test results in cycle I are in the medium category with a percentage of 71.12%. A total of 11 students (28.20%) were included in the very high category of critical thinking ability, 13 students (33.33%) were in the high category, 7 students 17.94%) were in the medium category, 8 students (20, 51%) in the low category, and there are no students in the very low category. Students' critical thinking abilities based on classical tests in cycle II increased by 9.38% from 71.12% to 80.5% in cycle II. Students with very high critical thinking ability category increased to 15 students (38.07%), critical thinking ability in the high category increased to 21 students (53.84%), critical thinking ability in the medium category decreased to 3 students (7.69%), and there were no students whose critical thinking skills were in the low or very low category.

CONCLUSION

Based on the results of this related research, it is concluded that the application of the Problem-Solving learning model in Biology learning can improve students' critical thinking abilities. Students' critical thinking abilities based on test results in cycle 1 are in the medium category with a percentage of 71.12%. In cycle 2, students' critical thinking abilities increased to 80.5% and were included in the high category. Students' critical thinking abilities based on the results of observations in the pre-cycle were in the low category with a percentage of 58.64%, increased to the medium category with a percentage of 67.37%, and increased again to the high category with a percentage of 79.07% in the second cycle.

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