

## IMPLEMENTATION OF THE PQ4R LEARNING METHOD TO BUILD DISPOSITION AND ENHANCE STUDENT CRITICAL THINKING SKILLS

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**Abstract:** This study aims to determine the role of the PQ4R learning method in building critical dispositions and improving students' critical thinking skills on the subject of the human reproductive system. This research was conducted using the technique pretest-posttest control group design. Data were collected with instruments in the form of critical disposition questionnaires and tests of critical thinking skills. The subjects of this study were 69 students divided into two classes, which were taken from the population of course XI IPS SMAN 7 Mataram using the purposive sampling technique—the data analysis using t-test and test N-gain. The research results show an increase in critical dispositions and critical thinking skills in the experimental class compared to the control class, each of which is indicated by the t-test results of  $0.000 < 0.05$ . Changes (increases) in students' critical dispositions for the experimental class belonged to the medium category, and the control class belonged to the low category. The improvement of critical thinking skills in the experimental class is in the high category, and in the control class, it is in the low category. This research concludes that the PQ4R learning method can build students' dispositions and critical thinking skills. Recommendations from this study: The PQ4R learning method is suggested by teachers as an alternative effort to improve students' critical thinking skills.

**Keywords:** *PQ4R Learning Method, Critical Disposition, Critical Thinking Skills*

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### INTRODUCTION

Critical thinking is one of the skills that must be developed to face the demands of life in the 21st century. Education must be able to encourage each individual to think critically in selecting valid and relevant information, be able to innovate creatively, be capable of working independently and in groups, and be able to solve problems [1,2].

Critical thinking is a reflective way of thinking whose goal is focused on patterns of decision-making about what students do [3]. Critical thinking includes two aspects: disposition and critical thinking skills [4]. Critical thinking skills are a systematic process that allows someone to solve a problem. Critical thinking skills are built by a good disposition. Critical disposition can be interpreted as a tendency to think and behave in a critical way in dealing with problems.

Disposition and critical thinking skills are two sides that cannot be separated. Disposition is essential to critical thinking because critical thinking skills without disposition will not be intact [5]. Therefore, building thinking skills should not only focus on thinking skills but also must be accompanied by disposition.

In the context of learning biology, critical thinking is a systematic process that begins with analyzing assumptions, raising biological inquiries, and making decisions to accept or reject a true or false statement. Critical thinking skills are important in the biology learning process because these skills provide opportunities for students to learn through

discovery [6]. In previous studies on critical thinking skills, only some have developed essential thinking dispositions. So, what is obtained is more of a product of critical thinking and less of exploring critical personalities.

Critical thinking is vital for students to interpret and solve problems carefully, correctly, and regularly, and can be accounted for scientifically. However, it is outside the current condition of learning biology. One of the problems encountered is that the teaching methods used by teachers tend to focus on giving knowledge only so that students only know knowledge without finding out the truth of the knowledge presented, or in other words, the learning methods used have not implemented the development of dispositions and critical thinking skills [7].

Facts on the ground that student learning activities in the learning process tend to be physical activities such as listening, writing information conveyed by the teacher, and low interest in reading. It is proven when students are given a problem. They will look for instant answers from Google without reviewing the responses they get. The low interest in reading and teachers' methods are still conventional, resulting in soft critical thinking skills.

Method PQ4R (Preview, Question, Read, Reflect, Recite, Review) can be an alternative to overcome the phenomena found in the field. The PQ4R method is part of the elaboration method,

which is a process of adding details to make new information more meaningful [8]. The PQ4R method helps students to understand the material better, increases concentration, and becomes a more efficient learning method for reading information [9].

The PQ4R learning method has the advantage of being able to activate students' prior knowledge [10], being able to initiate the process of making connections between new information and what was previously known [11], helping students to remember what they have read [7], easy to apply at all levels of education [10], assist students in improving their skills in asking questions and communicating their knowledge and are very appropriate for teaching declarative knowledge in the form of concepts, definitions, rules, and application knowledge in everyday life and [8].

### RESEARCH METHODS

The type of research used is like an experiment by design Pretest-posttest Control Group. The research was conducted on 59 students of class XI IPS at a public high school in Mataram City, which was divided into an experimental class of 30 students and a control class of 29 students. The research sample was determined using the technique of purposive sampling. Experimental students studied using the PQ4R learning method, and the control class used conventional learning methods.

Table 1. The steps of the PQ4R learning method

Syntax	Student Activity
Preview	Students skim through the learning material to find the main ideas in a text.
Question	Students formulate questions from the results of the preview.
Read	Students read in detail and actively to seek answers to the previously formulated questions.
Reflect	Students discuss the answers that have been obtained with their group mates.
Recite	Students convey the results of their discussions orally in front of the class.
Review	Students make a summary and determine the essence of the material that has been studied.

Data collection techniques are using questionnaires and tests. The instrument is a critical disposition questionnaire developed based on indicators of critical disposition according to Facione, namely truth-seeking, open-mindedness, analytical thinking, systematic thinking, self-confidence, and curiosity [4]. Questionnaires were given to students to see an increase in the growth of students' character or creative disposition using the PQ4R learning method. The creative thinking skills test instrument in 20 multiple choice questions is arranged according to critical thinking skills

indicators, including interpretation, analysis, evaluation, inference, explanation, and self-regulation. The researchers made and compiled the critical thinking skills test instrument on the human reproductive system material for senior high school.

Table 2. The steps of the conventional learning method

Syntax	Student Activity
Phase 1 (Student Orientation)	Students listen to the learning objectives and motivation conveyed by the teacher.
Level 2 (Organize)	Students observe, listen, and record the information provided by the teacher.
Phase 3 (Guiding)	Students work on assignments given by the teacher.
Phase 4 (Check understanding and provide feedback.)	Students collect assignments that have been done and check the correctness of the answers with the teacher.

The research data is in the form of data on the results of a critical disposition questionnaire, which is quantified into a range of scores 1-4, and quantitative data on the results of critical thinking skills tests in the form of scores on a scale of 0-100, processed and analyzed through a different test using the t-test and N-gain. The use of the t-test is intended to see the difference in the treatment results given to the experimental and control classes. Researchers use t-test pooled variance with the following formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Information:

- T = t value count
- $n_1$  and  $n_2$  = The number of samples of the experimental class and control class.
- $\bar{x}_1$  = Average value posttest experimental class
- $\bar{x}_2$  = Average value posttest control class
- S = Combined standard deviation

The N-gain test is intended to determine the categories of improvement in critical dispositions and critical thinking skills in both the experimental and control classes. The N-gain calculation refers to Hake (1999) and is categorized into three categories: high if  $g > 70$ , medium if  $30 \leq g \leq 70$ , and low if  $g < 30$  [12].

**RESULTS AND DISCUSSION**

**Critical Disposition**

Critical disposition can be interpreted as a tendency to think and behave critically toward a problem. Critical disposition has seven indicators: truth-seeking, open-mindedness, analytical thinking,

systematic thinking, self-confidence, curiosity, and maturity. A summary of the research results and the results of the critical disposition statistical tests are presented in Table 3.

Table 3 Value recapitulation Pretest And Posttest, As well as Statistical Test of Students' Critical Disposition

Component	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
The number of students	30	30	29	29
Rata-rata Skor	65	77	66	71
Score Minimum	48	71	54	57
Maximum Score	79	85	80	82
Standard Deviation	6.469	4.191	5.810	5.484
N-gain	0.33		0.14	
Normality test	0.08 (Normal)	0.11 (Normal)	0.07 (Normal)	0.10 (Normal)
Homogeneity Test	0.98 Homogeneous	0.18 Homogeneous	0.98 Homogeneous	0.18 Homogeneous
The mean difference (t' test)	Pretest: ValueSay. (2-tailed) = 0.957 Posttest: ValueSay. (2-tailed) = 0.000			

Disposition of critical thinking in the experimental class and control class with a significance of 0.05

Based on the results of this study, students' critical dispositions can be built by applying the PQ4R learning method. It is based on the results of the hypothesis testing analysis or t-test show value. (2-tailed) of 0.000 or less than 0.05, which means H0 is rejected, or Ha is accepted; in other words, applying the PQ4R learning method is more likely to build a critical disposition than lecture learning methods.

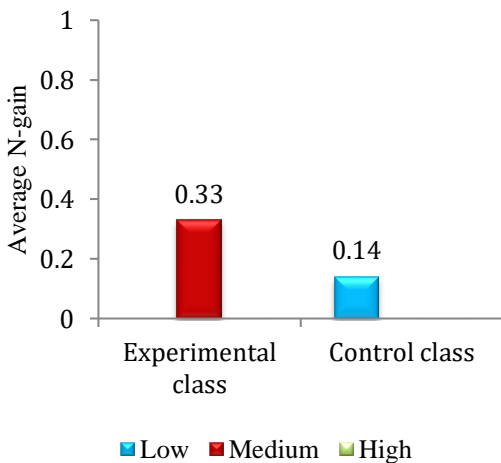


Figure 1 Average value N-gain critical dispositions in the experimental class and control class.

Based on Figure 1 mark N-gain = 0.33, the experimental class is included in the medium category, while the value N-gain = 0.14, the control class is included in the low category.

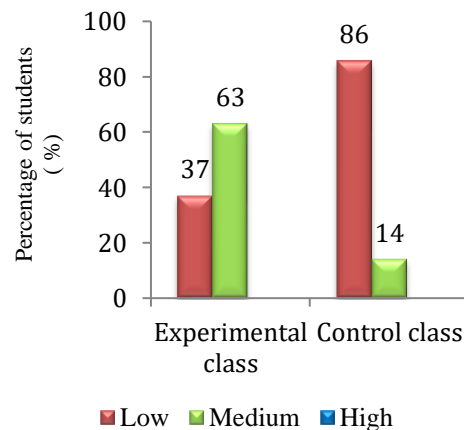


Figure 2 The percentage of students based on grades N-gain critical dispositions in the experimental and control classes.

Based on Figure 2, the percentage of the number of students according to grades N-gain critical dispositions in both the experimental class and the control class in categories medium and low. But in the experimental class, the percentage of students in the category was higher, namely 63%, compared to the control class, only 14%. The percentage of students in the category was low in the experimental class at 37%, which means it is lower than the control class of 86%.

It indicates that applying the PQ4R learning method in the experimental class is better than the conventional method in the control class in building students' critical dispositions. It

is in line with previous research that the PQ4R method is a learning method that requires students to be active in participating in learning [13], helping students improve understanding and memory compared to the lecture method [14].

This phenomenon and results are likely due to the syntax of the PQ4R learning method, which can trigger the growth of indicators of students' critical dispositions. Syntax preview is believed to trigger students' curiosity through reading material and finding the main points of the material regarding the things being studied. Fadila et al. revealed that the PQ4R learning method can motivate student activity in learning to spur students' curiosity about a material [11]. Steps Preview This will also activate students' prior knowledge [10]. This initial knowledge will assist students in identifying material and understanding the material in depth [15].

Syntax Questions trigger students to seek the truth through the development of questions. Making questions can train students to focus more on the material being read [16]. The asking process makes students focus on understanding new or unknown information [17]. Pratiwi et al. also revealed that asking questions will shape students' character to think quickly, respond swiftly, and investigate a problem [18].

After students know the main idea and develop questions, students will develop themselves to answer. Via syntax reading, students are triggered to read details to find answers to questions made in the previous step. Reading will help someone to see problems from various points of view [19]. Reading has many benefits, including helping to develop thinking and increasing students' understanding [20]. The indicators that have been built are analytical and systematic thinking; this is in line with the research conducted by Annisa et al. that analytical and systematic thinking can train the ability to analyze data, understand the relationship between various elements, and apply reasoning and facts to solve a problem [21].

Reflect is a continuation of steps; students and their groups discuss to connect the information obtained and solve each contradiction obtained. This activity is believed to build an open mind (open thinking) through exchanging ideas with other students. Optimal learning occurs when students can interact with others to achieve learning goals [22]. The interaction process in question can occur in discussion activities because, in the discussion process, students will actively communicate their knowledge [8]; discussion is a scientific conversation that contains the exchange of opinions to solve a problem and seek the truth [23].

Syntax Recite requires students to identify and solve problems and then convey ideas obtained orally through percentages; these activities are believed to trigger student confidence. Confidence is an aspect of personality in the form of confidence in

the ability to solve a problem [24]. Facione also revealed that self-confidence is a belief in identifying questions and solving problems [4].

After conducting discussions and presentations, students will develop themselves to conclude. Syntax Review is believed to trigger students to have indicators of maturity through the activity of making conclusions. Facione explained that maturity indicators are dispositions to be wise in making decisions through findings of the learning process [4]. Making conclusions is one way to determine students' understanding of a material [25].

Students' opinions regarding applying the PQ4R learning method were based on responses to the critical disposition questionnaire. Students can arouse their curiosity by asking teachers or friends when they do not understand the material and are more challenged when encountering a difficult problem. Then, become more active, courageous, and confident during the discussion and presentation process by expressing opinions, respecting different opinions, and making good conclusions based on the learning process.

### Critical Thinking Skills

Critical thinking skills are an organized process that allows someone to solve a problem. Skills Think Critical analysis has six indicators: interpretation, analysis, evaluation, inference, explanation, and self-regulation [4]. A summary of research results and statistical tests of critical thinking skills are presented in Table 4.

Based on Table 4, the results of the posttest students' critical thinking skills experiment and the control class differed significantly. t test result shows markSay. (2-tailed) of 0.000 or less than 0.05, which means  $H_0$  is rejected or  $H_a$  is accepted; in other words, the application of the PQ4R learning method can improve students' critical thinking skills.

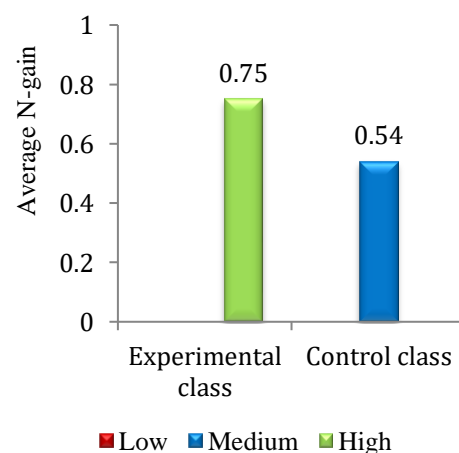


Figure 3 Rate-rate markN-gain experimental class and control class.

Table 4 Value recapitulation Pretest and posttest, As well as Statistical Test of Students' Critical Thinking Skills

Component	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
The number of students	30	30	29	29
Average value	41	86	43	75
MarkMinimum	10	65	10	60
Maximum Value	65	100	65	90
Standard Deviation	13.202	9.531	13.381	7.311
N-Gain	0,75		0,54	
Normality test	0.06 (Normal)	0.06 (Normal)	0.20 (Normal)	0.08 (Normal)
Homogeneity Test	0.986 (Homogeneous)	0.126 (Homogeneous)	0.986 (Homogeneous)	0.126 (Homogeneous)
The mean difference (t-test)	Pretest: ValueSay. (2-tailed) = 0.483 Posttest: ValueSay. (2-tailed) = 0.000			

Skills critical thinking experimental class and control class, with a significance of 0.05

Based on Figure 3 mark N-gain = 0.75, the experimental class is included in the high category, while the value N-gain = 0.54, the control class is included in the medium category.

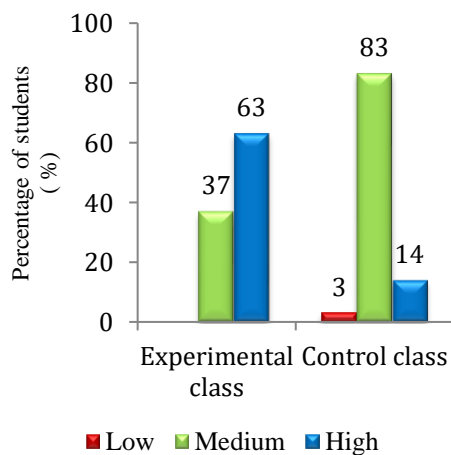


Figure 4 Percentage of students based on N-gain critical thinking skills in the experimental and control classes.

Based on Figure 4, the percentage of students based on general Critical thinking skills in the experimental class is divided into two categories, namely 63% in the high category and 37% in the medium category. On the other hand, the percentage of students in the control class was divided into three categories, namely 14% in the high category, 83% in the medium category, and 3% in the low category.

It indicates that applying the PQ4R learning method in the experimental class is better than the lecture method in the control class in improving students' critical thinking skills. It is in line with the research results of Ariyanti et al. that the involvement of students in exploring material and gathering ideas based on observations and discussions can improve critical thinking skills.

It is believed that the improvement of students' critical thinking skills in this study is due to applying the syntax of the PQ4R learning method, which can trigger indicators of critical thinking skills such as interpretation, analysis, evaluation, inference, explanation, and self-regulation. Syntax previews trigger students' initial knowledge and provide an overview of the things learned. Initial knowledge will greatly affect students' understanding of a material. When students have good initial knowledge, it will be easy to understand a material, and vice versa. If students have low initial knowledge, it will result in them needing help understanding the material and affecting their critical thinking skills [23]. The syntax preview helps students overcome difficulties in understanding their reading as a whole [26].

Syntax Question demands that students develop questions from what has been read in the step preview. It is believed that this activity can trigger interpretation indicators. It is in line with the research conducted by Yustika & Yarman that the interpretation indicator is the ability to identify things that are already known and is the first step in solving a problem [27]. Critical thinking skills are developed through asking and answering questions [26]. Encouraging students to ask questions in the learning process is a teacher's effort to create critical students [28].

SyntaxRead means reading in detail to find answers to the questions asked. It will trigger analysis indicators because students' analytical skills are needed in the process of thinking, especially when reviewing facts or objects in detail to solve a problem [29]. Analytical ability is the ability to identify relationships from various information in an effort to solve a problem [27]. An indicator of analysis is a student's ability to solve a problem based on investigating or identifying the relationship

between statements, facts, data, and concepts [30].

After reading in detail and getting answers to the questions made, students will develop themselves to solve each contradiction obtained. Via syntaxReflect, Students and their groups will discuss connecting the information obtained. This activity is believed to trigger students to have self-evaluation and self-regulation indicators. The evaluation indicator is the ability to assess the credibility of a statement or solution to a question [30]. In contrast, the self-regulation indicator is the ability to self-monitor in solving a problem [27]. Both of these indicators are very necessary in discussion. Evaluation will help students determine the right answer to solve a problem.

In contrast, self-regulation indicators will help students regulate their thinking, especially in questioning, confirming, validating, and correcting answers or results of group mates [4]. By conducting discussions, students are trained to communicate well [31]. Communicating in discussions means providing explanations, responding, and listening to various solutions to a problem [32].

Syntax Recite is believed to be able to trigger an explanation indicator because it goes through the steps students will explain or state the results of their thinking based on evidence, methodology, facts, and data through presentation activities [27]. After making a presentation, students are required to make conclusions from the learning process through syntax review. It is believed that this activity can trigger indicator inference. Inference is identifying and stating the elements needed in drawing conclusions [23]. Critical thinking skills require students to analyze and evaluate information as a basis for drawing valid conclusions [7].

## CONCLUSION

Based on the research results, data analysis, and discussion, applying the PQ4R method can build students' critical dispositions and critical thinking skills in learning biology. Critical disposition changes (increases) from the low to medium categories. Students' critical thinking skills increased from the medium category to the high category.

## REFERENCES

- [1] Sundari, Subali, B., & Marwoto, P. (2022). Analisis berpikir kritis peserta didik pada materi gerak benda dan makhluk hidup. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 9(2), 1819–1824.
- [2] Sukarso, AA., & Muslihatun. (2021). Mengembangkan Keterampilan Berpikir kreatif, Sikap dan Kemampuan Berkerja Ilmiah Melalui Pembelajaran Praktikum Proyek Riset Otentik. *Jurnal Ilmiah Profesi Pendidikan*, 6(3), 467-475.
- [3] Ramdani, A., Jufri, A. W., Jamaluddin, J., & Setiadi, D. (2020). Kemampuan berpikir kritis dan penguasaan konsep dasar ipa peserta didik.

- Jurnal Penelitian Pendidikan IPA*, 6(1), 119–124.
- [4] Facione, P. A. (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction*. California: The California Academic Press.
- [5] Widodo, A. (2021). *Pembelajaran Ilmu Pengetahuan Alam: Dasar-dasar Untuk Praktik*. Bandung: UPI Press.
- [6] Simbolon, E. R., & Tapilouw, F. S. (2015). Pengaruh pembelajaran berbasis masalah dan pembelajaran kontekstual terhadap berpikir kritis siswa SMP. *Edusains*, 7(1), 97–104.
- [7] Agustina, H., & Abidin, Z. (2022). Model pembelajaran yang dapat menumbuhkan sikap berpikir kritis pada siswa. *Jurnal Ilmiah Wahana Pendidikan*, 8(11), 153–159.
- [8] Al-Tabany, T. I. B. (2017). *Mendesain Model Pembelajaran Inovatif, Progresif, Dan Kontekstual*. Jakarta : PT. Kharisma Putra Utama.
- [9] Thomas, E. L., & Robinson, H. A. (1972). *Improving Reading in Every Class*. Amerika Serikat : United States of America.
- [10] Triandono, W. (2021). Peningkatan hasil belajar pkn materi peristiwa sumpah pemuda melalui metode belajar PQ4R. *Bidayatuna*. 4(2), 241–258.
- [11] Fadila, N. R., Syafril, Zen, Z., & J, F. Y. (2022). Pengaruh penerapan metode pembelajaran PQ4R terhadap hasil belajar IPS siswa kelas VII SMPN 40 Padang. *Journal of Multidisciplinary Research and Development*, 5(1), 375–381.
- [12] Hake, R. R. (1999). *Analyzing Change/ Gain Scores*. Indiana : Indiana University.
- [13] Yalindua, A., Raturandang, J. O., & Lumbantoruan, R. (2020). Pengaruh metode pembelajaran PQ4R ( Preview, Question , Read , Reflect , Recite , Review ) Terhadap hasil belajar biologi siswa di SMAN 2 Tondano.
- [14] Octafianelis, D. F., & Sudarmin. (2017). Pembelajaran PQ4R berpendekatan vak untuk meningkatkan hasil belajar dan keterampilan generik sains. *Jurnal Inovasi Pendidikan Kimia*, 11(2), 1979–1987.
- [15] Danil, M. (2021). Pengaruh model problem based learning di kalangan siswa berkemampuan akademik berbeda terhadap kemampuan berpikir kritis pada pembelajaran biologi. *Jurnal Ilmiah Wahana Pendidikan*, 7(1), 392–401.
- [16] Gultom, H. S. B., Ritonga, N., & Sari, N. F. (2019). Pengaruh metode pembelajaran Preview, Question, Read, Reflect, Recite , Riview (PQ4R) terhadap hasil belajar pada materi pokok sistem ekskresi di kelas XI SMA Negeri 1 Bilah Hulu Kabupaten

- Labuhan Batu. *Jurnal Pendidikan Biologi Nukleus*, 5(2), 12–16.
- [17] Zuraida, F., Syamsu, F. D., & Tanjung, H. S. (2019). Analisis ketrampilan bertanya siswa smp kelas viii pada materi sistem pencernaan melalui pendekatan studi kasus di SMPN 5 Seunagan 1. *BIO Natural*, 6(1), 35–44.
- [18] Pratiwi, D. I., Kamilasari, N. W., Nuri, D., & Supeno. (2019). Analisis keterampilan bertanya siswa pada pembelajaran ipa materi suhu dan kalor dengan model problem based learning di SMP Negeri 2 Jember. *Jurnal Pembelajaran Fisika*, 8(4), 269–274.
- [19] Delfi, S. (2012). Kegiatan membaca sebagai penerapan literasi mahasiswa prodi bahasa inggris FKIP Universitas Riau. *Jurnal Bahas*, 7(2), 89–96.
- [20] Mursalim, M. (2017). Penumbuhan budaya literasi dengan penerapan ilmu keterampilan berbahasa (membaca dan menulis). *Journal of Culture, Arts, Literature, and Linguistics (CaLLs)*, 3(1), 31–38.
- [21] Annisa, N., Dwiastut, S., & Fatmawati, U. (2016). Peningkatan kemampuan berpikir analitis siswa melalui penerapan model pembelajaran inkuiri terbimbing. *Unnes Journal of Biology Education*, 5(2), 163–170.
- [22] Apriyani, L., Nurlaelah, I., & Ina, S. (2016). Penerapan model PBL untuk meningkatkan keterampilan berpikir kritis ditinjau dari kemampuan akademik siswa pada materi biologi. *Jurnal Quangga*, 9(1), 41–54.
- [23] Hayudiyani, M., Arif, M., & Risnasari, M. (2017). Penerapan metode pembelajaran diskusi dalam upaya meningkatkan prestasi belajar biologi dengan materi pokok ekosistem dan komponen pendukungnya bagi siswa kelas X semester II SMAN 5 Kota Ternate tahun pelajaran 2013/2014. *Jurnal Ilmiah Edutic*, 14(1), 375–382.
- [24] Sejati, E. O. W., & Widjajanti, D. B. (2019). Pembelajaran kooperatif dalam pendekatan penemuan terbimbing ditinjau dari prestasi belajar, kemampuan berpikir kritis, dan kepercayaan diri. *Jurnal Pendidikan Matematika*, 14(2), 150–162.
- [25] Ariyanti, E., Fadly, W., Anwar, M. K., & Sayekti, T. (2021). Analisis kemampuan membuat kesimpulan menggunakan model contextual teaching and learning berbasis education for sustainable development. *Jurnal Tadris IPA Indonesia*, 1(2), 99–107.
- [26] Asy'ari, Saefi, M., & Cholid, F. (2016). Strategi PQ4R terintegrasi model TEAM quiz berbasis e-learning dalam memperdayakan keterampilan berpikir kritis dan aktivitas siswa. *Jurnal Pendidikan Biologi dan Sains*, 6(1), 80–98.
- [27] Yustika, Y., & Yarman, Y. (2019). Analisis kemampuan berpikir kritis matematis peserta didik kelas VIII SMP Negeri 13 Padang tahun pelajaran 2018/2019. *Jurnal Edukasi Dan Penelitian*, 8(4), 116–121.
- [28] Shanti, W. N., Sholihah, D. A., & Martyanti, A. (2017). Meningkatkan kemampuan berpikir kritis melalui problem posing. *Jurnal Ilmu Pendidikan*, 8(1), 48.
- [29] Maulidya, H. Z., Aprilia, N., & Hanafi, Y. (2021). Studi literatur peningkatan kemampuan analisis siswa melalui model pbl pada pembelajaran ipa biologi. *Journal of Biology Learning*, 3(2), 55–64.
- [30] Agnafia, D. N. (2019). Analisis kemampuan berpikir kritis siswa dalam pembelajaran biologi. *Florea*, 6(1), 45–53.
- [31] Juhanda, A. (2017). Optimalisasi diskusi kelas melalui peer assessment dan self assessment untuk menilai kemampuan komunikasi lisan mahasiswa calon guru. *Jurnal Pendidikan Matematika Dan IPA*, 8(2), 1–9. Doi:10.26418/jpmipa.v9i2.25832
- [32] Senisum, M. (2021). Keterampilan proses sains siswa SMA dalam pembelajaran biologi. *Jurnal Pendidikan Dan Kebudayaan Missio*, 13(1), 76–89.