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PROBLEM BASED LEARNING MODELS ON STUDENTS' CRITICAL THINKING SKILLS ON RNA AND DNA STRUCTURE MATERIAL

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ABSTRACT

This study aims to evaluate the effect of the Problem Based Learning (PBL) model on students' critical thinking skills in understanding the material of RNA and DNA structures. The PBL model is applied as an active learning approach that involves students in solving real problems and is relevant to the biology material being studied. This study used an experimental design with a control group and an experimental group where the experimental group was taught using the PBL model, while the control group used conventional learning methods. Data collection was carried out through critical thinking skills tests before and after the intervention, as well as observations during the learning process. The results of the analysis showed that students who were taught using the PBL model experienced a significant increase in critical thinking skills compared to the control group. These findings indicate that the application of the PBL model can improve students' understanding and analytical skills of the structure of RNA and DNA, and can be an effective alternative in the biology learning process in schools. This study provides recommendations for the wider application of the PBL method in the context of science education to improve students' critical thinking skills.

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INTRODUCTION

Education is a learning process activity to obtain a learning goal. Education in Indonesia currently still faces many challenges. The condition of education in Indonesia can be said to be still low. The problem that must be paid attention to is that the teaching staff who teach are not in accordance with their latest education. Problems like this often occur in rural areas. The lack of teaching staff in rural areas means that many teaching staff do not teach according to their last level of education. One example: At the junior high school level, the school still lacks social studies teaching staff so that the teaching staff with their final education record is a science education degree, so in this condition the teaching staff have to fill in social studies subjects, so that the lesson material received by students is not optimal. .

In the 21st century, quality human resources are needed who are able to face various challenges and technological changes quickly and effectively (Mardhiyah, 2021). Education is an important factor in creating quality human resources that are able to compete. This is written in the National Education System Law Number 20 of 2003 article 3 concerning the function and objectives of education. According to Yanuarta *et al* (2022) education in the 21st century encourages students to have several very important skills such as skills in thinking, acting and living everyday life. *The Partnership for 21st Century Skills* emphasizes that one of the life skills that students must have in the 21st century is critical thinking skills. The critical thinking skills that students possess are provisions for facing real life, understanding technology and information and being able to communicate and collaborate in the 21st century (Hasibuan & Prastowo, 2021; Simatupang et al., 2023).

There are several appropriate solutions to deal with this problem:

1) Improving the Quality of Educators.
2) Additional facilities in the form of student learning tools.
3) Implement learning that is not monotonous so that students do not feel bored.

Education is a basic, planned effort to create a learning atmosphere and learning process for students in a way active develop potency himself to have religious spiritual strength, self-control, personality, intelligence, morals, life knowledge, general knowledge and skills required for society based on the law . According to Ki Hajar Dewantara (Father of Indonesian National Education) explains the meaning of education, namely: Education is the demands in the life of children's growth, as for the meaning, education is to guide all the natural strengths that exist in children, so that they become human beings and as members of society can achieve the highest safety and happiness.

Think is Wrong One things that differentiate one human from another. According to Irdayanti (2018) Thinking is the process of producing new mental representations through information transformation which involves complex interactions including reasoning, imagination and problem solving activities. According to Ahmadi and Supriyono (Najla' 2016) "Thinking is a "dialectical" process, meaning that as long as we think, our minds are in a state of question and answer, to be able to establish the relationship between our knowledge." In thinking we need a tool, namely reason (ratio).

According to Adinda (Azizah et al., 2018) People who are able to think critically are people who are able to conclude what they know, know how to use information to solve problems, and are able to look for relevant sources of information to support problem solving.

The facts that occur in the field regarding students' critical thinking in learning RNA and DNA are still low and still need to be developed. The low critical thinking of students is caused by the learning process which still uses rote memorization methods, which has an impact on learning outcomes. Therefore, educators are obliged to help students develop the critical thinking skills needed to solve their problems.

Based on this, teachers need to plan learning that can build students' potential in using their thinking skills to solve problems. One of these learning models is *Problem Based Learning* . This learning model directs the problems presented by the teacher, then students solve these problems by involving students' knowledge and skills from sources that can be obtained.

Writing ability is one of the most important abilities for students, but students' writing abilities, especially in RNA and DNA structure subjects, are rarely explored in depth, students only fill in questions related to RNA and DNA structure material. Students' critical thinking abilities are only measured by how much Students can answer questions related to the subject matter.

Students' abilities in RNA and DNA structure material do not only consist of complete explanations but must also be accompanied by the use of *Problem Based Learning* . *Problem Based Learning* is a learning model that involves active students to always think critically and always be skilled in solving a problem.

The researcher here tries to apply the Problem Based Learning learning model in science learning. Where this model will create learning that is not rigid and full of cooperation between students and train students' readiness in understanding the material given by the teacher. Therefore, this study is entitled "the effect of the problem based model on students' critical thinking skills in the material of RNA and DNA structures" of class IX students of SMP NEGERI 5 Stabat in the 2023/2024 academic year".

METHOD

This research is quantitative research using a *quasi experimental research design* . This research was designed using an experimental class and a control class based on a *pretest-posttest experimental research design* . The research design will be presented in table 1.

Table 1. ***NonequivalentPretest - Posttest Control Group Design***

Class	*Pretest*	*Treatment*	*Posttest*
Experiment	O^1	X	Q^1
Control	O^2	Y	Q^2

Information:

Q1 : states initial observation (*posttest*) of the experimental class
Q2: states the initial observation (*posttest*) of the control class
X : treatment with *project based learning*
Q1: states the final observation (*posttest*) of the experimental class
Q2: states the final observation (*posttest*) of the control class

Population And Sample In this research, class IX of SMP Negeri 5 Stabat, Langkat Regency, odd semester 2023/2024. Class IX ^{2} was used as the experimental class and class IX ^{4} was used as the control class. The experimental class uses the *Problem Based Learning learning model* while the control class uses the conventional learning model.

RESULTS AND DISCUSSION

The research that the researchers will carry out is grouped into two groups. First group is group experiment that is participant students who receive biology learning treatment with the application of Problem Based Learning. The second group is the control group, namely students who received RNA and DNA learning treatment using the *quasi-experimental model* . The two groups are assumed to be the same in relevant respects and differ only in depth treatment given .

Table 2. Results Analysis Model Learning *Problem Based Learning*

No.	Percentage			%
	Pretest Score	Score Posttest	Gains	Gain %
1.	65.90	89.60	23.70	35.96
2.	47.66	70.60	22.94	48.13
3.	67.00	83.50	16.50	24.62
4.	62.92	72.08	10.60	16.84
5.	53.63	74.19	20.56	38.33
6.	50.86	81.57	30.71	60.38
7.	53.92	80.24	26.32	48.81
8.	66.10	82.60	16.50	24.96
9.	67.88	88.85	20.97	30.89
10.	56.45	85.30	28.85	51.10
11.	35.50	69.00	33.50	94.36

12.	39.00	69.00	30.00	76.92
13.	51.93	82.09	30.16	58.07
14.	57.00	81.30	24.30	42.63
15.	50.12	79.16	29.04	57.94
16.	24.00	83.75	59.75	24.89
17.	48.88	83.88	35.00	71.60
18.	64.30	88.60	24.30	37.79
19.	71.43	79.28	7.85	10.98
20.	69.86	74.83	4.97	7.11
Model Learner PBL	**n**	**55.21**	**79.97**	**21.18**	**43.11**

Based on results analysis the that learning model *Problem Based Learning* can increase ability think critical student school base start from the lowest 7.11% to the highest 94.36% with an average of 43.11%.

Table3. *Paired Sample Statistics*

		Means	N	Std. Deviation	Std.Error Mean
Pie r 1	Pre- Test	55.2170	20	12.43733	2.78107
	Post Test	79.9710	20	6.42372	1.43639

Tabel 4.*Paired Samples Correlations*

		N	Correlation	signature.
Pair 1	Pre- Test & Post - Test	20	,360	,119

Table 5. *Paired Sample Test*

		Paired Difference						
	Means	Std. Deviation	Std.Error Means	confidence . Interval from that Difference		Q	df	signature. (2- tail)
				Lower	On			
Pair 1	Pre-Test- Post-Test	-24.75400	11.76372	2.63045	- 30.25959	- 19.24841	-9,411	19	,000

From the research that has been done done , can concluded that learning using *the Problem Based Learning* model can increase ability think critical student School Basic.Because model This is model ang based problem with hook existing events in environment around , so student will more easy understand And can increase ability think critical .

Table 2. Journal citations based on the material

No.	Number of citations	Author	Title	Year	Journal
1	15	Abidin, Z	*Model Pembelajaran Problem Based Learning untuk Meningkatkan Keterampilan Berpikir Kritis Siswa*. Jurnal Pendidikan dan Pengajaran	2018	Jurnal Pendidikan dan Pengajaran
2	10	Bahar, M., & Adnan, A	*Pengaruh Model Pembelajaran Problem Based Learning terhadap Pemahaman Konsep Siswa dalam Biologi*	2020	Jurnal Biologi Pendidikan
3	14	Hidayat, R., & Nurul, F	*Efektivitas Model Problem Based Learning dalam Meningkatkan Keterampilan Berpikir Kritis pada Mata Pelajaran Sains di Sekolah Menengah Pertama*. Jurnal Pendidikan Sains	2021	Jurnal Pendidikan Sains
4	16	Kumar, D., & Thomas, M	*Critical Thinking and Problem-Based Learning: An Exploration of Outcomes in Science Education*	2019	International Journal of Science Education
5	15	Lestari, M., & Yuliana, R	*Strategi Pembelajaran Berbasis Masalah dalam Meningkatkan Kemampuan Kognitif Siswa pada Materi Biologi*.	2019	Jurnal Pendidikan dan Teknologi,
6	15	Miller, K., & Cummings, R.	*The Role of Problem-Based Learning in Enhancing Students' Critical Thinking Skills*	2017	Journal of Educational Research
7	11	Nugraha, S., & Purnamasari, D	*Pengaruh Model Pembelajaran Berbasis Masalah terhadap Kemampuan Analisis dan Kritis pada Materi Genetika*	2022	Jurnal Biologi dan Pendidikan
8	14	Wahyudi, T., & Sari, D	*Implementasi Problem-Based Learning dalam Pembelajaran Biologi: Dampak terhadap Keterampilan Berpikir Kritis dan Pemahaman Materi*	2023	Jurnal Pendidikan Biologi
9	15	Wang, H., & Zhang, X.	*Exploring the Impact of Problem-Based Learning on Students' Critical Thinking and Academic Performance in Biology*	2018	Educational Review
10	14	Zulkarnain, M., & Hasibuan, L	*Penggunaan Model Problem Based Learning dalam Meningkatkan Pemahaman Materi Biologi pada Siswa Sekolah Menengah Atas*	2021	Jurnal Pendidikan Sekolah
11	8	Eva Sagita, Vivi Amalia, Non Dwishiera C.A.	Studi Literatur: Model Problem Based Learning dalam Pembelajaran IPA di Sekolah Dasar	2024	Jurnal Pendidikan Guru Sekolah Dasar
12	16	Ayuni, R., & Duharman	Pengaruh Penerapan Model Pembelajaran Discovery Learning Terhadap Hasil Belajar Siswa Di MTS Al-Huda Mardiharjo	2022	*Jurnal Multidisiplin Dehasen*
13	3	Fahrudin, F., Ansari, A., & Ichsan, A. S.	Pembelajaran Konvensional dan Kritis Kreatif dalam Perspektif Pendidikan Islam. *Hikmah*	2022	*Jurnal Pendidikan Tambusai*

14	9	Ismawati, S., Perdiansyah, F., & Amaliah, A	Pengaruh Metode Discovery Learning terhadap Hasil Belajar IPA Siswa Kelas V SDN Jelambar 01 Pagi	2022	*Jurnal Pendidikan dan Konseling*
15	8	Mukaramah, M., Kustina, R., & Rismawati	Analisis Kelebihan dan Kekurangan Model Discovery Learning Berbasis Media Audiovisual dalam Pembelajaran Bahasa Indonesia	2020	*Orphanet Journal of Rare Diseases*
16	11	Ningsih, D. A., Nurhasanah, & Fadillah, L	Efektivitas Pembelajara Di Luar Kelas Dalam Pembentukan Sikap Percaya Diri Peserta Didik Pada Mata Pelajaran IPA Di Kelas V SDN 190 Cenning	2019	*Jurnal Pendidikan Dasar dan Keguruan*,
17	4	Prilliza, M. D., Lestari, N., Merta, I. W., & Artayasa, I. P	Efektivitas Penerapan Model Discovery Learning Terhadap Hasil Belajar IPA. *Jurnal Pijar Mipa*	2020	Jurnal Pijar Mipa

CONCLUSION

From the results of meta- analysis on study This concluded that use of learning models *Problem Based Learning* (PBL) is effective For increase think critical students , because of this model based problem with explain And give motivation For solve problem , then organize student on duty Study Which relate with problem that , apart from motivating Also give encouragement For student gather information so that can carry out experiment with method prepare appropriate works that on Finally can evaluated by teachers for get evaluation or addition from Teacher.

Problem Based Learning learning model has a positive influence on improving the critical thinking skills of junior high school students, so educators need to apply it in learning. Not only using the *Problem Based Learning learning model* , educators can also use other learning models to improve students' critical thinking abilities.

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