

THE INFLUENCE OF PROBLEM-BASED LEARNING MODELS ON THE CRITICAL THINKING ABILITY OF PHYSICS STUDENTS AT THE UNIVERSITY OF FLORES

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Abstrak

Tujuan dari penelitian ini adalah untuk mengetahui pengaruh *problem based learning* terhadap kemampuan berpikir kritis mahasiswa fisika Universitas Flores. Jenis penelitian adalah penelitian eksperimen dengan desain penelitian yaitu *pre-experimental design* dengan pendekatan kuantitatif. Populasi penelitian ini adalah semua mahasiswa yang mengikuti mata kuliah pengantar fisika zat padat yang berjumlah 17 orang dengan teknik pengambilan sampel yaitu sampling jenuh dimana semua anggota populasi dijadikan sampel. Hasil penelitian menunjukkan ada pengaruh penggunaan *problem based learning* terhadap keterampilan berpikir kritis mahasiswa fisika Universitas Flores. Hal ini dibuktikan dari hasil analisis data yang diperoleh yaitu taraf sig. (2-tailed) < 0,05 berarti H_0 ditolak dan H_1 diterima dan didukung dengan perhitungan uji t dimana diperoleh nilai $t_{hitung} > t_{tabel}$ yaitu $51,85 > 1,746$.

Kata Kunci: Kemampuan Berpikir Kritis, *Problem Based Learning*.

Abstract

The purpose of this research is to determine the influence of problem-based learning on the critical thinking abilities of physics students at Flores University. The research type is experimental research with a pre-experimental design and a quantitative approach. The research population includes all students enrolled in the introductory course on solid-state physics, totaling 17 individuals, using a saturated sampling technique, where all population members are taken as samples. The research results indicate that there is an influence of problem-based learning on the critical thinking skills of physics students at Flores University. This is evidenced from the results of the analysis of the data obtained, namely the sig. (2-tailed) < 0.05 means H_0 is rejected and H_1 is accepted and is supported by t test calculations where the calculated $t_{value} > t_{table}$ is obtained, namely $51.85 > 1.746$.

Keywords: Critical Thinking Ability, *Problem Based Learning*.

INTRODUCTION

Developments in science and technology have an impact on the

progress of the nation and state. The progress of a nation and state is not only measured and based on the

abundant natural resources that a nation possesses, but is also seen on the availability and superiority of quality human resources. Quality resources are one of the factors that can determine the future of the nation and state. To improve quality human resources, one of which is through the world of Education. The government is trying to improve the quality of education through improving facilities and infrastructure, teacher quality and curriculum changes. This improvement is expected to produce human resources that are ready and able to compete in facing challenges in the 21st century.

In facing the challenges of the 21st century, several skills are required including: (1) learning and innovation skills which include critical thinking and ability to solve problems, creative and innovative, as well as being able to communicate and collaborate; (2) skilled to use media, technology, information and communication (ICT); (3) the ability to lead a life and career, including adaptability, flexibility, initiative, self-development, social and cultural skills, productivity, trustworthiness,

leadership and responsibility (Kemendikbudristek, 2022).

To face the challenges of the 21st century, what is needed is critical thinking abilities. Critical thinking ability to analyze and evaluate information obtained from observation, experience, reasoning and communication to decide whether the information can be trusted so that it can provide rational and correct conclusions (Simanjuntak et al., 2019). Another opinion states that critical thinking ability is the ability to focus on things that make sense and are reflective, so that you are able to draw conclusions to believe something and carry out what you decide (Jayadinata et al, 2016). Critical thinking is a 21st century skill that students must have in order to work successfully.

Critical thinking skills can be developed by using appropriate learning models. One learning model that can be used is the problem based learning (PBL) is a learning model that prioritizes solving general problems that commonly occur in everyday life. As stated by Shoimin (2017, hlm. 129) that problem based

learning means creating a learning atmosphere that leads to everyday problems.

The advantage of the Project Based Learning (PBL) learning model is that it is based on contextual problems in the surrounding environment, and is easy to apply in introductory solid state physics courses. Problems can originate from genuine problems in everyday life around students. The ability to think critically to students is not taught specifically as a subject, however, in every subject taught by the teacher, critical thinking abilities should have a primary place because with critical thinking students are able to develop understanding, insight and skills in students. solve problems in daily life so teachers need to continue to explore students' thinking abilities, considering that critical thinking skills are very necessary for students in the learning process (Junaidi, 2020).

METHODS

The research approach used is a quantitative approach. The quantitative approach is an approach

to collecting, processing, presenting, analyzing and interpreting data in the form of numbers. While the type of research used in this study is a type of experiment. This type of experiment was carried out to see the effect of a treatment. This research was used to examine critical thinking skills through a problem-based learning model for students taking an introductory solid state physics course.

The research design used was pre-experimental designs (one shot case study). One shot case study is an experiment in which a group is given treatment and then the results are observed (Sugiyono, 2021).

Place and time of research. This research was carried out by the Physics Education Study Program at the University of Flores. This research was carried out for approximately 3 months.

Population and Research Sample. The population in this study were all students who programmed the introductory solid-state physics course, totaling 17 people, using the sampling technique, namely saturated

sampling where all members of the population were sampled.

The data collection technique used in this study was a test technique, namely posttest questions. In this study the data used is the ability to think critically (final test). The purpose of the final test is to measure the critical thinking skills obtained by students after applying the problem-based learning model. The data collection instrument used in this research is a question sheet in the form of a description.

The data collected in this study is quantitative data which will be analyzed using statistical techniques. The normality test is used to prove that the sample data is normally distributed or not. The data normality test can be carried out in various ways, namely: Kolmogorof Smirnof test, Shapirowilk test and chi square test (Zainal Arifin, 2012).

Hypothesis testing criteria are:

(1) $H_0 < 70$; The problem-based learning model does not have a significant effect on the critical thinking abilities of students who take introductory solid state physics courses (2) $H_0 \geq 70$; The problem-

based learning model has a significant effect on the critical thinking abilities of students taking introductory solid state physics courses. (3) Determine the significance level value. The significance level used (α) = 0.05. (4) Determine the degrees of freedom (dk)= $n-1$. (5) Choose a test statistic (one sample statistical test) for hypothesis testing. (6) Conclusion

a.) $t_{\text{count}} > t_{\text{table}}$ then H_0 is accepted

b.) $t_{\text{count}} \leq t_{\text{table}}$ then H_0 is rejected

RESULTS AND DISCUSSION

After being given treatment, the ability of the sample class was measured by being given a critical thinking ability test. The score data and critical thinking ability test scores were tested again to determine whether the data met the analysis requirements. The analysis prerequisite test is to determine whether the data is normally distributed or not. From the SPSS calculation results with a significance level of 0.05, a 2-tailed significance of 0.245 was obtained. The assumption is that if the 2-tailed significance value is above 0.05, it

can be stated that the data is normally distributed.

Table 1. Tests of Normality

		Kolmogorov-Smirnov ^a		Shapiro-Wilk			
		Statistic	df	Sig.	Statistic	df	Sig.
Critical Ability	Thinking	.209	17	.057	.933	17	.245

From table 1 above, it can be seen that the critical thinking ability data is normally distributed, meaning that the hypothesis testing

requirements are met. so that it can be continued with hypothesis testing. The hypothesis testing results following on Table 2.

Table 2. Hypothesis test (One-Sample Test)

		t	df	Sig. (2-tailed)	(2-Mean Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Critical Ability	Thinking	51.852	16	.000	75.294	72.22	78.37

From Table 2 above it can be seen that the sig. (2-tailed) < 0.05 means Ho is rejected and H1 is accepted. in other words, the proposed hypothesis is accepted. The conclusion: problem-based learning has a significant effect in improving the critical thinking ability of students taking introductory solid state physics courses. and supported by the calculation of the t test where the value of $t_{count} > t_{table}$ is obtained, namely $51.85 > 1.746$.

This is because the problem-based learning model trains students to

solve problems, become more independent and active individuals in gathering relevant information, analyzing information and realizing the need to re-examine the results obtained. Students are said to be successful if students are not only able to remember, but are also able to solve the problems they face so that conceptually students have strong basic knowledge, are more responsible and dare to make quick and precise decisions that can spur student curiosity which can directly

influence the achievement of higher learning achievement.

The process of the problem-based learning model in the introductory solid-state physics course is in the first stage of organizing students on a problem where the lecturer divides students into small groups consisting of 4 people, then the lecturer submits demonstrations or stories to bring up the selected problem. Through this stage, students are trained to think critically in finding solutions to solve these problems. The second stage is organizing students to study. From this stage, students are able to define and organize the assignments given by the lecturer. The third stage guides individuals and groups. At this stage students collect appropriate information, carry out experiments to get explanations and ways of solving problems, while the lecturer controls and guides students in solving problems. The fourth stage is developing and presenting the work, the lecturer assists students in preparing the results of the discussion then representatives from each group are asked to report the results of the discussion. From this stage, students

are trained to think critically in asking questions and expressing opinions so that other groups can understand the questions given as well as in conveying opinions that are truly in accordance with the current problem. The fifth stage analyzes and evaluates the problem-solving process, the lecturer helps students to reflect or evaluate the results of the discussion. This stage is carried out with the aim of giving motivation back to students to better understand the material being studied and to improve students' critical thinking skills in evaluating the results of group discussions.

This research is supported by research that has been conducted by (Ahmad Farisi et al., 2017) with the title "the influence of problem-based learning models on critical thinking skills in improving student learning outcomes on the concept of temperature and heat". The results of the hypothesis test obtained $t_{\text{count}} 6.71$ and $t_{\text{table}} 1.68$, so it can be concluded that $t_{\text{count}} > t_{\text{table}}$, in other words H_a is accepted. The conclusion of this study is that there is an effect of using the problem based learning (PBL)

learning model on students' critical thinking skills on the concept of temperature and heat at SMP Negeri 1 Kaway XVI. And also supported by research from (Abrami et al., 2015) which states PBL has been proven as one of the most effective methods of teaching critical thinking by a large number of studies and is also supported by research from (Sulaiman, A., & Azizah, S., 2020) which stated assessing the effectiveness of Problem-Based Learning (PBL) in improving students' critical thinking skills in Indonesia and testing the extent to which the studies conducted had the strength of good scientific methodology. The results of the systematic literature review identified 20 studies which showed that the majority (n= 17) reported a significant influence of the problem-based learning approach on the analytical capacity of Indonesian students.

CONCLUSION

Berdasarkan hasil dan pembahasan yang telah dilakukan, didapatkan bahwa bahan ajar berbasis

proyek pada materi difraksi cahaya untuk membangun *scientific creativity* dan kemampuan berkolaborasi peserta didik dinyatakan valid secara desain dengan nilai sebesar 2,98 dan valid secara isi dengan nilai sebesar 3,25. Selain itu, bahan ajar berbasis proyek pada materi difraksi cahaya untuk membangun *scientific creativity* dan kemampuan berkolaborasi peserta didik juga dinyatakan sangat praktis untuk digunakan berdasarkan penilaian yang didapatkan dari persepsi pendidik sebesar 92% dengan kategori sangat baik, respon peserta didik sebesar 79,5% dengan kategori baik dan uji keterbacaan dengan presentase sebesar 74% dengan kategori baik.

Saran yang dapat diberikan adalah perlunya penelitian tambahan terhadap bahan ajar yang dikembangkan ini, yaitu penelitian untuk mengukur hasil belajar siswa atau efektifitas dari bahan ajar ini.

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