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THE EFFECTIVENESS OF PROBLEM BASED LEARNING MODEL ON UNDERSTANDING CONCEPTS AND SCIENCE PROCESS SKILLS AS IMPLEMENTATION INDEPENDENT CURRICULUM

Andriono Manalu[1], Aprido Simamora[2], Ika Damayanti Purba[3], Novita Sinaga[4]
[1*] Fakultas Keguruan dan Ilmu Pendidikan, Universitas HKBP Nommensen Pematangsiantar, Indonesia
[2] Fakultas Keguruan dan Ilmu Pendidikan, Universitas HKBP Nommensen Pematangsiantar, Indonesia
[3] Fakultas Keguruan dan Ilmu Pendidikan, Universitas HKBP Nommensen Pematangsiantar, Indonesia
[4] Fakultas Keguruan dan Ilmu Pendidikan, Universitas HKBP Nommensen Pematangsiantar, Indonesia
Corresponden E-mail: andriono.manalu@uhnp.ac.id

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ABSTRACK

Learning outcomes in the science subjects emphasize the competencies of conceptual understanding and process skills. Learning outcomes in science, especially physics, are essentially related to how to systematically find out about nature, so that science is not only the mastery of a body of knowledge in the form of facts, concepts, or principles but also a process of discovery through investigation or experimentation. Investigation or experimentation can train students to acquire scientific process skills. In addition to developing scientific process skills, physics learning is expected to encourage students to become active learners and think critically in analyzing and applying concepts to solve problems in everyday life. Related to the above problem, there is a need for a model that orients learning to real problems that can create student involvement in the teaching and learning process to cultivate, develop scientific process skills and foster conceptual understanding in solving students' problems. Getting used to scientific work is expected to foster habits of thinking and acting that reflect students' mastery of scientific knowledge, skills, and attitudes, so that the learning model will automatically result in increased scientific knowledge, skills, and attitudes of students as a result of learning. The characteristics of the model above are in the Problem-Based Learning Model. One characteristic of problem-based learning is that the problems presented are expected to have no single answer or single solution. This provides a very broad opportunity for students to explore their potential. Students have the freedom according to their nature in different or differentiated ways. Differentiated learning is creating a diverse class by providing opportunities to acquire content, process an idea and improve the results of each student, so that students can learn more effectively. By using the Problem Based Learning model integrated with differentiated learning, it is hoped that it can facilitate students in expressing their freedom in learning. The output to be achieved is publication in a SINTA-accredited journal, which can be cited by other researchers.

Kata Kunci
Problem Based Learning;
Pemahaman Konsep;
Keterampilan Proses Sains

ABSTRAK

Capaian pembelajaran Mata pelajaran rumpun IPA/sains ditekankan pada kompetensi Pemahaman konsep dan keterampilan proses. Dalam capaian pembelajaran sains khususnya fisika pada dasarnya berkaitan dengan bagaimana cara mencari tahu tentang alam secara sistematis, sehingga sains bukan hanya penguasaan kumpulan pengetahuan yang berupa fakta, konsep atau prinsip saja tetapi juga merupakan suatu proses penemuan melalui penyelidikan atau percobaan. Penyelidikan atau percobaan dapat melatih siswa untuk memperoleh keterampilan proses sains. Selain untuk mengembangkan keterampilan proses sains pembelajaran fisika diharapkan dapat mendorong siswa untuk menjadi

pembelajar yang aktif dan berpikir kritis dalam menganalisis serta mengaplikasikan konsep untuk memecahkan masalah-masalah dalam kehidupan sehari-hari. Berkaitan dengan masalah di atas maka perlu adanya model yang mengorientasikan pembelajaran pada masalah-masalah nyata yang dapat menciptakan keterlibatan siswa dalam proses belajar mengajar untuk menumbuhkan, mengembangkan keterampilan proses sains dan menumbuhkan kemampuan pemahaman konsep dalam memecahkan masalah siswa. Membiasakan bekerja ilmiah diharapkan dapat menumbuhkan kebiasaan berpikir dan bertindak yang merefleksikan penguasaan pengetahuan, keterampilan dan sikap ilmiah yang dimiliki siswa, sehingga dengan sendirinya model pembelajaran itu akan berakibat pada meningkatnya pengetahuan, keterampilan dan sikap ilmiah siswa sebagai hasil belajar. Karakteristik model di atas ada pada Model Pembelajaran Berbasis Masalah (Problem Based Learning).Salah satu ciri pembelajaran berbasis masalah yaitu masalah yang disuguhkan diharapkan tidak memiliki jawaban tunggal atau penyelesaian tunggal. Hal ini memberi kesempatan yang sangat luas kepada siswa dalam mengeksplorasi potensi dirinya. Siswa memiliki kebebasan sesuai kodrat yang dimilikinya dengan cara yang berbeda atau berdiprensiasi. Pembelajaran diferensiasi adalah menciptakan suatu kelas yang beragam dengan memberikan kesempatan dalam meraih konten, memproses suatu ide dan meningkatkan hasil setiap murid, sehingga siswa bisa lebih belajar dengan efektif. Dengan menggunakan model Problem Based Learning yang terintegrasi dengan pembelajaran berdiprensiasi diharapkan dapat memfasilitasi siswa dalam mengekspresikan kemerdekaannya dalam belajar. Adapun luaran yang akan dicapai adalah terbit pada jurnal terakreditasi SINTA, dapat disitasi oleh peneliti lainnya.

1. INTRODUCTION

Sercara special For eye lesson science clusters as stated in Balitbangbuk No. 028 of 2021 concerning achievements learning emphasized on competency in understanding concepts and process skills. (Rahmi Fitria et al., 2024) In the achievement science learning basically related with How method look for know about natural in a way systematic, so that science is not only mastery gathering knowledge in the form of fact (Wibawa & Purwanto, 2018), draft or principle just but it is also a a process of discovery through investigation or experiment (Sibarani et al., 2021). Investigation or test can practice student For get science process skill (Simanjuntak et al., 2024). In addition to develop science process skills, (Almulla, 2019) said that learning physics expected can push student For become active and thinking learners critical in analyze as well as apply draft For solve problems found in life daily (Sari, 2018).

In essence, social learning places more emphasis on the process (Zahra et al., 2019). This is in line with Dahar's (Padang et al., 2023) opinion which states that science process skills are ability student For apply method scientific in understand, discover and develop knowledge knowledge besides that, science process skills are also necessary trained and

developed Because science process skills have role as following : 1) Help student develop his mind, 2) Giving chance to student For do discovery, 3) Improve Power remember, 4) Give satisfaction intrinsic when student has success do something, 5) Help student learn scientific concepts (Fauziah, 2022).

Responding to the above problems need the existence of a model that orientates learning on real problems that can create involvement student in the learning process teach For grow, develop science process skills and foster ability understanding draft in solve problem students (I. R. Kurnia & Mukhlis, 2023). Getting used to Work scientific expected can grow habit thinking and acting that reflects mastery knowledge, skills and attitudes scientific knowledge owned students, so that with learning model itself That will resulting in increased knowledge, skills and attitudes scientific student as results Study (Fidan & Tuncel, 2019).

According to Arends (Yasa & Bhoke, 2018) the model learning based Problem Based *Learning* is a learning model that organizes learning around questions and problems, through submission situation life authentic and meaningful reality, which encourages student For carry out the investigation and inquiry process, with avoid answer simple, and allows existence various type solution from situation mentioned (Jumiarti et al., 2021). In learning based on problem activity student more prioritized Because activity in problem-based learning covering analysis of problem, formulate hypothesis is, planning study until its implementation, until get A conclusion which is the answer or solution to the problem given (Iskandar, 2014).

Based on the description related to the government's plan to implement a prototype curriculum that emphasizes the differentiated learning process, especially in science subjects that emphasize learning outcomes in the aspects of understanding concepts and process skills through various relevant learning models, one of which is the problem-based learning model, it is necessary to research the effects of using a problem-based learning model with differentiated learning strategies (Sartika, 2019). on students' understanding of science concepts and process skills through research entitled: " The Effectiveness of *the Problem Based Learning* Model on Understanding Concepts and Science Process Skills as an Implementation of the Independent Curriculum ".

Procurement A device learning as a role model for the implementation of the independent curriculum in science subjects by using the PBL Model integrated with Diversified Learning towards understanding concepts and process skills. Devices developed learning will printed become books that have an ISBN and will registered become Right Riches Intellectual Property (IPR) (Royani & Imran, 2020).

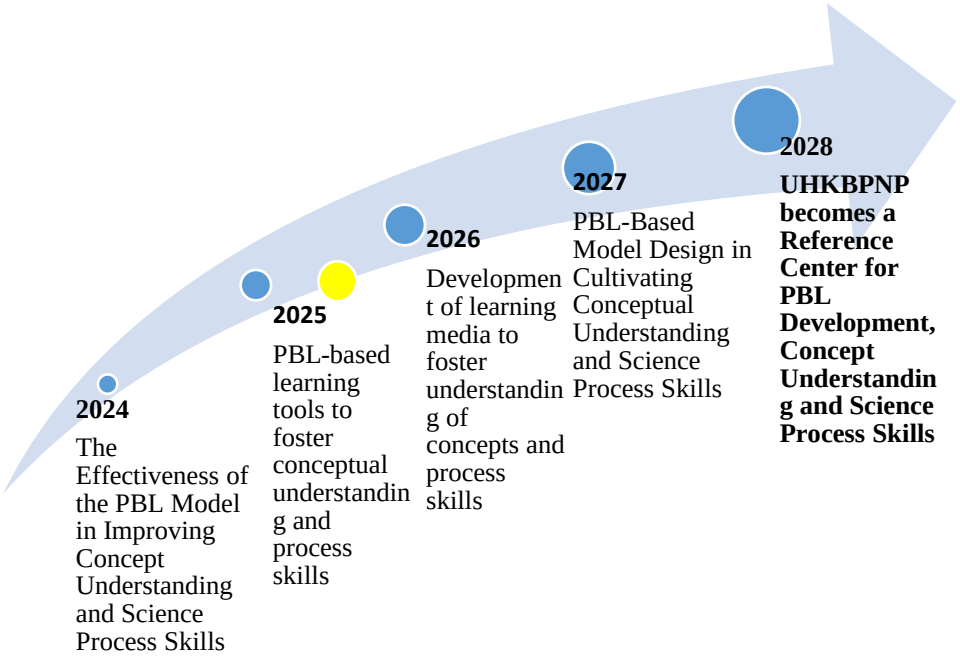

Figure 1. Research Roadmap

2. METHOD

Research Design

Design study This is a One-Group Pretest-Posttest Design included in pre-experimental research (Fajarianingtyas & Hidayat, 2020). Treatment given to the class experiment is use of the Problem Based Learning (PBL) model.

Table 1. One group Pretest post design

Pre-test	*Treatment*	*Post-test*
O_1	X	O_2

Information.
O 1 : Pretest Value of Conceptual Understanding and Process Skills before learning
O2 : Posttest Value of Concept Understanding and Process Skills after learning
X : PBL Learning

Data collection technique

Result data study collected with use instrument study in the form of test ability understanding concepts, process skills, sheets observation activity study, and questionnaire response students who have created and developed by researchers, and validated by validators (Rachmawati et al., 2017). The data from the results research (value pre-test and post-test) obtained collected Then analyzed. The score reflect ability understanding student concepts and process skills during study taking place and the tests given before learning and after learning weighty The same (Disi Prasetya et al., 2022).

Data Analysis Techniques

Capability data understanding concepts and process skills first formerly tested prerequisite For see normality and linearity of data (Anggraini et al., 2022).

Data Normality Test

To determine whether the sample data has a normal distribution or not, the Kolmogorov-Smirnov normality test is used with the help of SPSS software version 25 (Meliala & Maria, 2018). The test is carried out at a significance level (α) of 0.05 (Lattuserimala et al., 2020). The decision-making criteria are based on the significance value (Sig.): if Sig. > 0.05, then the data is declared to be normally distributed; conversely, if Sig. < 0.05, then the data is considered not normally distributed (Sumiantari et al., 2019). After the data meets the normality and linearity tests, the research hypothesis test will be carried out using the T test (Tumanggor, 2023).

Hypothesis Testing

testing in this study was conducted using a t-test to determine whether PBL was effective in understanding concepts and science process skills. With the formula (Hutahaean, 2019),

$$t_{hit} = \frac{\overline{X_1 - X_2}}{S\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \text{ with } S^2 = \frac{(n_1-1)s_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}$$

With the hypothesis

H_0 = There is no effectiveness of PBL learning on the ability to understand concepts and science process skills.

H_a = There is effectiveness of PBL learning on the ability to understand concepts and science process skills

3. RESULT AND DISCUSSION

Ability test results understanding science process concepts and skills in pretest and posttest with the PBL model is as following:

Table 2. Ability test results understanding science process concepts and skills

No	Student Code	Concept Understanding		K. Process Science	
		Pre	Post	Pre	Post
1	Student - 1	12	19	10	19
2	Students - 2	18	22	7	14
3	Students - 3	17	20	13	19
4	Students - 4	11	17	12	19
5	Students - 5	7	12	7	12
6	Students - 6	19	24	19	24
7	Students - 7	16	21	16	21
8	Students - 8	6	12	6	12
9	Students - 9	6	14	6	17
10	Students - 10	14	19	18	22
11	Students - 11	2	13	17	20

12	Students - 12	19	23	19	23
13	Students - 13	11	17	9	16
14	Students - 14	10	18	10	18
15	Students - 15	15	19	13	19
16	Students - 16	18	24	12	18
17	Students - 17	7	15	10	19
18	Students - 18	17	22	11	16
19	Students - 19	6	14	7	16
20	Students - 20	14	19	15	19
21	Students - 21	14	18	14	20
22	Students - 22	13	19	14	24
23	Students - 23	13	20	12	19
24	Students - 24	7	14	4	14
25	Students - 25	8	16	10	16
26	Students - 26	8	16	9	16
27	Students - 27	9	16	7	15
28	Students - 28	4	14	17	22
29	Students - 29	15	18	12	18
30	Students - 30	10	16	10	19

Normality Test

Normality test done For know what data is used ? normally distributed or no. Normality test This using the Kolmogorov test Smirnov who aims For know whether residual values are normally distributed or No with SPSS 25.0 program assistance (A. Kurnia, 2021). The following is normality test results using the Kolmogorov-Smirnov test with SPSS 25.0 program assistance.

Table 3. Normality Test

		Pre-Test	Post-Test
N		30	30
Normal Parameters[a,b]	Mean	11,53	17,70
	Std. Deviation	4,769	3,405
Most Extreme Differences	Absolute	,104	,095
	Positive	,104	,095
	Negative	-,098	-,082
Test Statistic		,104	,095
Asymp. Sig. (2-tailed)		,200[c,d]	,200[c,d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

From the table calculation normality via SPSS 25.0 above can concluded that the data is normally distributed.

Hypothesis Test Analysis

Based on prerequisite test analysis, pre-test and post-test results data were obtained normally distributed. Next will done testing with using the t-test (paired sample t-test) to know effectiveness of the PBL model on ability understanding students' science concepts and process skills (Manurung, 2020). A t-test was conducted using SPSS software version 25.0 as following (Fitriyani et al., 2022):

Table 4. Hypothesis Test Analysis

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pre-Test - Post-Test	-6,167	1,931	,353	-6,888	-5,446	-17,489	29	,000

$_{calculated}$ t value = 17.489 and the t $_{table\ value}$ = t $_{(0.05;30)}$ = 2.042. The $_{calculated\ t\ value}$ > t $_{table,}$ so Ho is rejected with the consequence that Ha $_{is}$ accepted, which means that there is effectiveness of PBL learning on the ability to understand concepts and science process skills (Handayani, 2023).

4. CONCLUSION

Based on results study The calculated t value was found to be 17.489 and the value ttable = t(0.05;30) = 2.042. Tcount > ttable then Ho is rejected with Ha's consequences are accepted which means It was concluded that there was effectiveness PBL learning towards ability understanding science process concepts and skills

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