Learning Model Meta-Analysis Study Problem Based Learning (PBL) on Learning Outcomes

Nuzul Hidayat[*], Ahmad Arif, Usmeldi, Nizwardi Jalinus, Ridwan, Rijal Abdullah

Universitas Negeri Padang
[*]*Corresponding author. Email:* nuzulhidayat@ft.unp.ac.id

ABSTRACT

This study aims to analyse how much impact the learning model of Problem Based Learning (PBL) has on learning outcomes. The research model used is usually quantitative analysis which allows researchers to integrate data from various studies and generalize to the population contained in national e-journals. The impact of research that applies PBL learning is analysed by implicit meta-analysis. The results of the study revealed that in general from the data analysis carried out that problem-based learning has an influence on student learning outcomes with an estimated impact of 0.219 for the elementary school level in the medium category, 0.076 for the junior high school level in the medium category, 0.124 for the high school level in the medium category and 0.136 for tertiary institutions in the moderate category and this is a direct impact on learning outcomes. Problem Based Learning (PBL) has also shown impact and appeal in terms of instructive levels, and pre-test and post-test learning outcomes. Next is that the Problem Based Learning (PBL) model is more feasible in developing thinking skills in learning compared to other learning models.

Keywords: Meta-analysis, Education level, Problem Based Learning.

1. INTRODUCTION

Guidelines for the Preparation of Learning and Culture Number 22 of 2016 concerning Guidelines for the Preparation of Main and Supporting Learning states that the preparation of learning in lesson units is carried out in a smart, motivating, fun, challenging way, invites students to be interested effectively, and provides adequate space for activity, resourcefulness creativity and freedom according to their talents, curiosity, and the physical and mental improvement of students. The 2013 educational program in learning science emphasizes a logical approach. To advance this approach, it is essential to apply inquiry-based learning to empower students' capacities to create problem-solving works [1].

One example that has been widely embraced to support a student-enabled and student-engaged learning approach is Problem-Based Learning (PBL). Agree with Tan, PBL has learning characteristics ranging from providing issues, as a rule issues have settings with the real world, students effectively define issues and distinguish gaps in their information, and report settings on issues. While the teacher is more encouraging [2]. The learning steps of Problem Based Learning (PBL) are as follows: introduction of students to problems, student organizations for learning, directing group meetings, creating and displaying works, analyzing and assessing the handle of problem understanding.

Toharudin, stated that Problem Based Learning (PBL) is a learning or training that has the characteristics of using problems as individual or person contexts in learning critical thinking skills and problem solving and acquiring knowledge. Problem-based learning that corresponds to learning objectives exists at two levels, namely: students must solve a specific problem and understand the related material and students must develop problem-solving skills and become independent students.

The Problem Based Learning (PBL) learning model can be interpreted as a series of learning activities that emphasize the process of solving a real problem. Problem-based learning is closely related to the real life realities of students so that students learn not only in the area of knowledge, but also experience and feel [3].

The meta-analysis technique is a statistical method for combining quantitative results from several studies to produce an overall summary of empirical knowledge on a particular topic. It is used to analyze central tendencies and variations in study results, and to correct

errors and biases in research [4]. In this study, researchers will use several samples in the form of previous studies with similar topics to obtain information and can analyze the magnitude of the influence on previous studies. Based on the problem on attitudes showed positive results in terms of improving attitudes, but the magnitude of the influence obtained was in the low category with a price of 0.44 on the Hedges provisions from Kindergarten to College level. The results of the meta-analysis of the Problem Based Learning model in improving critical thinking skills in elementary schools towards 23 research articles show that this model is able to improve students' thinking skills starting from the lowest 2.87% to the highest 33.56% with an average of 12.73%[5] . From some of the research above, it can be seen that the meta-analysis of Problem Based Learning (PBL) needs to be studied and carried out based on the level of the educational unit so that it is clear the level of effectiveness of implementing learning using this model.

2. BASIC THEORY

A learning model is a plan or pattern that can be used to design a teaching mechanism including learning resources, learning subjects, learning environment and curriculum. The model has stages: (1) syntax/stages is an explanation of the operation of the model; (2) the social system how the explanation of the role of teachers and learners; (3) the principles of reaction explain how teachers should behave and respond to student activities; and (4) the support system explains the things needed as a complete model outside of humans [6].

"PBL (Problem-Based Learning) can be defined as an inquiry process that resolves questions, curiosities, doubts, and uncertainties about complex phenomena in life. A problem is any doubt, difficulty, or uncertainty that invites or needs some kind of resolution." In this quote it can be defined that PBL is a process of inquiry to answer questions, curiosity, doubts in one's mind, and uncertainty about complex life phenomena. The use of problems in this case is very closely related to some doubts, difficulties or uncertainty over something interesting or the problem requires some kind of appropriate solution.

Problem-based teaching can be a learning event based on guidelines using problems as a starting point for the acquisition and integration of new information. Problem-based learning can be demonstrative learning that is based on constructivism and requires student association in learning and locks in relevant problem solving. Problem-Based Learning is often referred to as problem-based learning, which is a learning tool that exposes students to real problems that encourage them to ask questions, describe, and find solutions. Problem-based learning is very closely related to the substance of students' real lives so that students learn not as in the reach of information, but rather from experiences and feelings. The questions in PBL make use of ill-structured and open-ended true questions as a setting for students to develop problem-solving skills and basic thinking as well as construct unused information.

From some of the definitional concepts, the problem-based learning model is a learning design that focuses on solving problems so that learning objectives can be carried out in a student cantered learning way that experiences and experiences directly with contextual life.

There are three main characteristics of the problem-based learning approach. First, it is a learning activity, meaning that in its implementation there are a number of activities that must be carried out by students. In problem-based learning it is not expected that students just listen, see, record, and memorize subject matter, but students actively think, communicate, search, and process data and draw conclusions. Second, learning activities are directed at solving problems. Third, problem solving is carried out using a scientific thinking approach. The process of scientific thinking is carried out systematically and empirically. Systematic means going through certain stages, while empirical means the process of solving problems based on clear data and facts.

The 2013 educational program follows the fundamental view that information is essentially non-exchangeable from teacher to student. Study preparation is not a cash show or a simple exchange of information, but or perhaps a stimulus arrangement for students so they can think fundamentally and become problem solvers. Learners are subjects who have the capacity to effectively explore, handle, develop, and utilize information. So learning Problem Based Learning shows similarities with the introduction of learning centres are students. Lesson sentence structures are common sense steps that teachers and students will take in learning exercises. There are many hypotheses that reveal the language structure or learning steps of Problem Based Learning (PBL). These speculations can be used in learning according to extreme learning objectives, both for learning abilities and learning assessments. In general, the learning stages of Problem Based Learning (PBL) are deciding problems, analysing

Problem-Based Learning is also inseparable from its preferences and obstacles. For this reason, in general it can be stated that the characteristics of actualizing problem-based education include: students will be accustomed to dealing with problems (issue posing) that exist in everyday life (genuine world); develop social solidarity by having regular discussions with friends in gatherings and courses; increasingly familiarizing instructors with students; and it is possible that a problem has to be understood through experimentation; this will also familiarize students to apply the test

method. Problem-based learning can advance students' inner and social abilities. Other benefits of learning Problem Based Learning (PBL) are: increasing ability to understand learning material; improve important information centres; empowering judgment; build collaboration, administration, and social talent; construct consider aptitude (lifelong learning aptitude); and stimulate students [7].

Usman also revealed that the drawbacks of Problem Based Learning (PBL) learning were not only the need for time in planning lessons, but also for students. Students who do not have interest or do not have certainty that the problem being discussed is difficult to solve, then they will feel hesitant to do it and without understanding why they are trying to solve the problem under consideration, students will not do it. learn what they need to memorize [8] . The interesting things and obstacles of Problem Based Learning learning described above show that it is still important to choose learning that is appropriate to the conditions in which the type of concept material and the time needed and costs must be incurred. the instructor pays attention to, because not all learning is able to take advantage of problem-based learning demonstrations. (PBL) to achieve learning objectives.

Meta-analysis can be a factual strategy for describing the results of two or more comparable thoughts so that combined quantitative data can be obtained. Currently, meta-analysis is the most widely used for clinical trials. This is often justified, because clinical trials are more standardized in planning and provide stronger evidence of a causal relationship. However, a meta-analysis can also be performed on a variety of observational observations to draw conclusions from a combination of investigation results [1]. Meta-analysis pertains to investigative investigations. Meta-analysis refers to a measured examination of the large body of explanations that have emerged from the human mind for the purpose of integrating findings. This can't be an overly simplified choice to loose, dialogue accounts from the usual questions of pondering to form a rapidly growing sense of questions about writing.

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Table 1. Stages of Meta-Analysis

Stages Systematics Reviews	Explanation
Formulate topic (*Topic formulation*)	Question centered, hypothesis, objective
Design studies in a manner whole (*Overall study design*)	convention improvement; indicate the problem/condition, population, setting, intercession and origin; ponder the determination by comprehensive criteria and select
Sampling (*Sampling*)	make inspection arrangements; check the investigative unit; all-inclusive thinking of all important considerations; get consideration.
collection (*Data collection*)	Data origin (extracted) from study to standardization forms
Data analysis (*Dataanalysis*)	Describe the data (quality check, sample, and study intervention characteristics; calculate effect sizes); calculating effect sizes and assessing heterogeneity (meta-analysis); put together meta-analyses, moderate and subgroup analyses, sensitivity analyses, publication analyzes and sample bias; meta-regression; description of the results in the form of narrative, tables and graphs; interpretation and discussion; policy implications, practice and further research.

3. RESEARCH METHODS

The investigation strategy used is expressive investigation, which is an examination that shows the results of a logical investigation of the distribution in electronic diaries broadly related to the impact of problem-based learning (PBL). Graphical study is an investigation to provide an overview of social miracles or side effects that are considered by describing the value of an independent variable, either one variable or more (autonomous) based on the factors examined for investigation and classification by describing a number of factors that are not significant. to address the familiar and comparative among existing investigative factors.

The population in this study are articles that are logically distributed in the frame of diaries on a national scale in Indonesia in relation to the use of problem-based learning (PBL) learning demonstrations in 2010-2019. The tests taken were articles with a logical distribution in Problem-Based Learning (PBL) learning on the concept of material by taking various research categories, namely: (1) articles made by general researchers and students; (2) the article uses an exploratory investigative strategy; (3) national level articles come from diaries that have received permission from the Indonesian Agency for Research, Innovation and Higher Education (RISTEKDIKTI) at Sinta Indonesia and have been recorded at http://sinta2.ristekdikti. go.id/; (4) articles can be in the form of quantitative investigations and meet measurable

information effect sizes; (5) articles distributed in the last 10 years, i.e. 2010-2019; (6) articles with the topic of Problem Based Learning (PBL); (7) The examination for the level of teaching in the article is at the level of Elementary School (SD), Junior High School (SLTP), and High School (SLTA), Higher Education (PT); and (8) the scope of the investigation regarding the various articles carried out within the territory of Indonesia.

The basic unit of the meta-analysis study is Impact Estimation, so that to answer the detailed questions about the problem, calculations using impact estimation investigation techniques are used. An impact measure can be a value that reflects the severity of the treatment effect (more generally) the quality between two factors, usually a unit in a meta-analysis. Compute impact estimates for each consideration, evaluate the consistency of impact over reflection and calculate impact outlines.

Piggot said that there are three important types of Impact Measurement, namely: standard hardness differences, correlation coefficients, and log chance proportions. Standard hardness differences are the most common impact estimation framework when considerations are centered between two autonomous bunches such as treatment and control bunches. The correlation coefficient is more often than not used when synthesizing observational thinking, when the question of address relates to evaluating the quality of the relationship (affiliation) between two measures. The log odds proportion can be calculated to compare the

suspicion between the two groups. The impact size equation used is the eta-square equation (η2) as follows: The experiment investigated that because it included two bunches, namely the test group and the control group, using a comparative investigation with the t-test investigation strategy. At that time use the following impact size equation [11]:

$$\eta^2 = r^2 = \frac{t_o{}^2}{t_o{}^2 + db}$$

(1)

The criteria used to form the interpretation of the

0.09), moderate effect (0.1 $\leq \eta^2 \leq$ 0.25) and large effect ($\eta^2 >$0.26) can be seen in Table 2. Effect Size Based on Category.

The results of investigating the information in Table 4.1 show that there are 8 logical distribution articles with small impact measurement costs, 9 logical distribution articles with direct impact measures and 3 logical distribution articles with large impact measurement costs. From the calculation, it is obtained that the full impact estimate is 0.1532 which is included in the expansive category and the standard deviation is

Table 2. Effect Size Based on Category

No	Code Article	Amount Sub effects size	effects size	Category	N Article
1	2 [12]	1	0.04	Effect Small	
2	3 [13]	1	0.06		8
3	4 [14]	1	0.04		
4	6 [15]	1	0.08		
5	11 [16]	1	0.06		
6	15 [17]	1	0.05		
7	17 [18]	1	0.04		
8	20 [19]	1	0.08		
9	1 [20]	1	0.25		
10	5 [21]	1	0.14		
11	7 [22]	1	0.10		
12	8 [23]	1	0.15	Effect Currently	9
13	10 [24]	1	0.14		
14	12 [25]	1	0.10		
15	13 [26]	1	0.21		
16	14 [27]	1	0.20		
17	18 [28]	1	0.14		
18	9 [29]	1	0.50	Effect Big	3
19	16 [30]	1	0.35		
20	19 [29]	1	0.31		
Average *Effectsize*				0.1532 (Effect currently)	
Amount Sub *effects size*		20			
SD				0.1206	

effect size results using references are [11]:

Small effect : 0.01 $\leq \eta^2 \leq$ 0.09

Moderate effect: 0.09 $\leq \eta^2 \leq$ 0.25

Large effect : $\eta^2 >$0.25

4. RESULTS AND DISCUSSION

Big data effect (effect size) scientific publication articles on Problem Based Learning (PBL) by category consists of three criteria, namely small (0.01 $\leq \eta^2 \leq$

0.1206.

Effect Size Result Data Based on Education Level

The instructive level is one point of view that can be analyzed, which consists of the higher education level, the upper secondary education level (SLTA) and the junior high school level (SLTP) as well as elementary school. Information on the impact size of Problem Based Learning (PBL) based on the level of teaching can be seen in Table 3.

From Figure 1 it shows that the magnitude of the influence on both levels of elementary education with a value of 0.219 at the higher education level with a value of 0.136 at that time at the high school education level

criteria so in conclusion they had to be killed and no meta-analysis was performed on the articles.

Based on the estimated cost impact information, the

Table 3. Effect Size Based on Education Level

No	Educational level	N Articles	*Effect Size*
1	College	3	0.136
2	Senior High School	9	0.124
2	Junior High School	3	0.076
3	Elementary School	5	0.219

with a value of 0.124, three are in the medium category so that at this level it is very feasible to implement PBL and those in the small category at the junior high school level
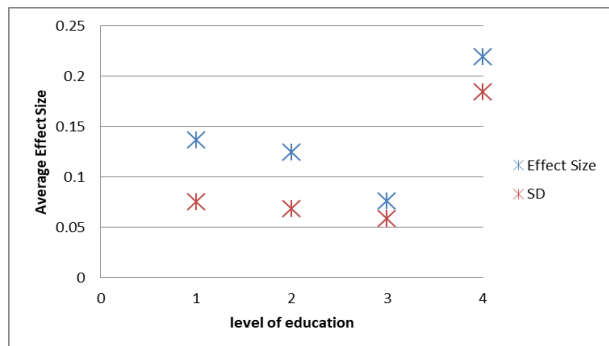

Figure 1. Influence Based on the level of education

Figure1. It can be revealed that the highest influence occurs in Elementary Schools, Senior High Schools and Higher Education and in low variation at the Junior High School Level in using the Problem Based Learning (PBL) learning model in learning.

Discussion

Impact estimation, indicating the magnitude of the impact of a treatment or the quality of the relationship between two factors, is the most important unit in meta-analysis because it is able to supply data from the origin of the outline. By determining the estimated impact of each contemplation, as a whole it can be known and decided how big the impact of a treatment is. Of the seventy logical articles collected and summarized in the coding framework, it turns out that twelve logical distribution articles meet the criteria and can be estimated.

Estimated impact by calculating using a predetermined equation. Impact size calculations are performed on the raw information contained in the quantified information of the logical distribution articles. The results of these calculations form the basis for the subsequent meta-analysis. There were many articles of logical distribution that could not be handled to calculate the effect estimates due to lack of data and specified article

impact of Problem Based Learning (PBL) on instructive level points (see translated in Table 4.2) is able to extend the assurance of student learning outcomes in the test group by 0.219 for the basic level. School level, 0.124 for SMA and 0.136 and 0.076 for College. for middle school instruction. The application of Problem-Based Learning (PBL) shows that at both levels this secondary learning has a broad impact in the same category, both have an impact on the size of the cost with direct criteria, especially $0.10 <0.25$. This shows that the use of Problem-Based Learning (PBL) feasible and suitable for implementation at the elementary, high school, and university levels. Learning (PBL) has a greater normal impact than its application at the higher education level and tertiary education.

4. CONCLUSION

After carrying out this meta-analysis investigating Problem Based Learning (PBL) at all levels of teaching, the most interesting use of Problem Based Learning (PBL) shows at the Elementary School, College and Higher Instruction level while for the level of mood influencing it is at the secondary school level First. For this reason, the application of Problem Based Learning (PBL) can provide assistance in increasing student scores because this will improve students' abilities in terms of remembering and solving problems.

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