

META-ANALYSIS EFFECTIVENESS OF PROBLEM-BASED LEARNING MODEL IN SOCIAL SCIENCES

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Abstract

This research is intended to analyze the effectiveness of problem-based learning in social sciences settings. The study employed a quantitative approach using a meta-analysis method which is defined as the analysis of the same topic existing literature. This study referenced 4 out of 9 representative journals and was determined as the analysis unit. Subsequently, it is decided to make six sub-study out of four analysis unit. Glass' effect size equation is employed as the data analysis. This study revealed, (1) the overall effect of the problem-based method on the students' learning achievement standard deviation was 0,795, (2) the utilization of problem-based method showed significant result on the highly motivated and gifted students; (3) this learning method is relevant to all educational stage.

Keywords: Meta-analysis, problem-based learning model, Social Science learning, motivation, IQ.

INTRODUCTION

Social sciences refer to the branch of sciences that related to human socio-cultural aspects. This learning subject prepared students to have a sense of crisis, which is empathically responded to their surroundings (e.g, the current Covid-19 pandemic). This empathy is categorized as compassionate empathy, trying to put ourselves into someone's shoes and willingly taking action to help those who are in need. That being said, one of the main points of social sciences learning is to shape students' social empathy skills not only academically but also socially.

A person who has high intelligence (IQ), social empathy, high emotional intelligence (EQ), and spiritual intelligence (SQ) will likely help our country a better place to live in particularly amid the current pandemic crisis. Many social sciences graduates encounter a lack of social skills, given that their absence in various social activities within the

community or beyond (Syaodih, 2018, p. 2). Since the ineffective learning model in most schools generates social misfit among students' learning progress besides, an insufficient amount of creativity in processing information (Fauziah et al, 2007, p. 282).

Regarding the context and goals of the social sciences learning mentioned above, a compatible learning method is required to aim its essential outcome based on the given context. According to Kronberg and Griffin (2000) developing students' critical thinking skills can be done through problem-based learning method applications. In the U.S alone, the government urged the utilization of problem-based learning on its educational stages to prepare students for college life or higher educational institutions with a degree in STEM (Science, Technology, Engineering, and Mathematics Academy). The instructional base of STEM strategy, particularly Texas Science, Technology, Engineering, and Mathematics Academy (T-STEM) is problem-based learning and project-based learning models (Odell et al., 2019).

Problem-based learning is defined as an active learning approach where the students collaborate in groups to understand and solve complex and unstructured problems (Lu et al., 2014). The students have to share ideas, knowledge, solutions, and give constructive logical arguments in solving disorganized and jumbled decided problems (Lu et al., 2014). Marpaung (2005) asserted that the utilization of PBL roots back in the problem-solving method. Numerous claims of PBL are convinced that it can boost students' problem-solving skills (Gijnels et al., 2005). Similarly, this method benefits students' self-efficacy, increases students' performance in the classroom (Allen et al., 2011). This method also can be applied as the core curriculum competencies for several lecture subjects (Alrahlah, 2016).

Campbell & Norton (2009) affirmed that PBL develops an in-depth learning approach. Correspondingly, PBL is believed increasing students classroom performance, learning motivation, critical thinking skills, and

academic achievement (See Alita et al., 2019; Anindyta & Suwarjo, 2014; Anugraheni, 2018; Darmawan, 2010; Jailani & Retnawati, 2016; Moner & Gunansyah, 2013; Nafiah & Suyanto, 2014; Rahmadani & Anugraheni, 2017; Rahmasari, 2016; Samiadji, 2013; Setyorini et al., 2011; Sumitro H et al., 2017; Susanti & Suwu, 2016; Widyaningrum & Gregorius, 2013). Various experts argue that there is no empirical evidence on the significance of PBL in increasing students' classroom performance, at least at the rate of sufficient resources in PBL curriculum development. Hence, Colliver (2000) mentioned the insignificant relationship between learning theory and research (basic and applied research).

According to previous studies concerning social sciences learning that applied the PBL approach has prompted this research employing a meta-analysis approach. To best of author's knowledge, there was scarce empirical evidence has been garnered on meta-analysis study of problem-based learning methods. Besides, this article is focused on the effectiveness of PBL in social sciences learning at elementary school (SD) and middle school (SMP). The effectiveness of PBL is measured based on the social sciences average achievement score and the average value of influenced aspects in PBL applications such as motivation and IQ.

THEORETICAL BASES

The effectiveness of problem-based learning

Problem-based learning refers to a learning model that trains scientific reasoning (Noly & Wulandari, 2018, p. 33), the students will be able to identify common sense to make an appropriate decision in solving the problem. Otherwise, PBL also contains ill-structured or open-ended which is projecting the practical problem through learning stimuli (Fogarti, 1997, p. 54). Meanwhile, Duch (1995) stated that PBL refers to students' learning efficacy where students are challenged to study efficiently.

PBL has four distinctive characteristics, the following will be mentioned below based on Savoie and Hughes (1994) as quoted from Wena (2010): **Firstly**, it begins with a problem statement; **secondly**, the interconnection of various disciplines; **thirdly** authentic investigation; **fourthly**, collaborative work. PBL emphasized complex problems without absolute right answers (Hmelo-Silver, 2004). As students solving unstructured complicated problems, they start developing common sense skills and independent learning initiatives. Consequently, Lu et al. (2014), stated that PBL improved students' ability to transfer new insights to understand complex problems and to comprehend coherent knowledge.

According to Duch et al. (2001), PBL emerged students' critical analysis skills, practical problem-solving, teamwork, and communicative skills either spoken or written. Gijbels et al. (2005) reported that PBL has a positive effect on principle knowledge that connects to a concept. Furthermore, Dohcy et al. (2003) found that students who are exposed to PBL learning presumably have sharp memories and highly creative.

Social Science Learning

Social studies term was first coined by the committee of social studies in the U.S. Nonetheless, social studies or social sciences refer to human socio-cultural aspects (Lubna et al., 2010, p. 6). It was designed to understand certain social phenomena.

According to the goals of social sciences learning the students not only accomplish the social skills to understand social phenomena but also individual skills to strive in the community as social beings. Ideally, social sciences learning material is designed in two-dimensional aspects, theoretical and practical dimensions; conceptual and factual dimensions. The theoretical dimension originated from basic concepts of social sciences (history, geography, economics, sociology, anthropology, politics, socio-

psychology) which is the core of social studies. While the practical dimension is the embodiment of practical conditions within society.

Practical social concepts are valuable to our social life where the community solves the problem together. PBL is relevant to prepare students' real-life game changer situations in the future.

As quoted in Bining & Bining (1952) social sciences referred to the integrative study of social disciplines and humanity and aimed to improve community social competence in a democratic and plural environment (Tasrif, 2008, p. 1). Correspondingly John Jarolimek (1997, p. 224) asserted that "the social studies as... subject-matter content from the social science, history, sociology, political science, social psychology, anthropology, and economics. The social studies have been defined as " those portion of the social science... selected for instructional purpose". Winataputra (2005, p. 4), assumed that social sciences learning is a fusion of social discipline, state ideology, that is organized into the other social problems scientifically and psychologically at elementary and middle stage educations.

Thus, social sciences learning have defined as a broad discipline and comprehensive. As to why it compressed into an interdisciplinary approach at each educational stage. It is no surprise that social sciences are also defined as human knowledge and its social life aspects (Sumaatmadja, 1980, p.6). Particular views on the social science context learning may lead to various social interpretation in its application. Specifically, in the Indonesian context, there are many different terms of social studies at distinct educational levels, such as history, geography, economics, sociology, anthropology, accountancy, politics for the higher education stage. Unlike other subjects such as mathematics using the same terms unless the different levels of educations.

Meta-Analysis

Meta-analysis is a statistical analysis that combines multiple empirical studies. This statistical method was first developed by Karl Pearson in 1904 on medical studies. Whilst, on the 1970s this method was adapted for educational field purposed (e.g. Glass et al., 1981; Glass, 1982; Schmidt, 1994; and Hunter & Schmidt, 2004). Glass described that meta-analysis is a qualitative approach using several data and measured using the statistical method from huge sample to complete the research (Glass, 2016; in comparison to Sukamto, 1989, 1991, p. 50). It is required to use the same topic references in a meta-analysis study.

There are several steps in a meta-analysis study according to (Merriyana A., 2006), as mentioned in the following table below:

Tabel 2. Several steps in a meta-analysis study

Stages	Activity
Step 1	Decide a problem or topic that will be studied
Step 2	Decide the period of the analysis unit or data source
Step 3	Lookup for the sorted topic that will be studied.
Step 4	Read title and abstract of related topics
Step 5	Focus on the problem statement, method, and research outcome.
Step 6	Categorize the research based on the paradigm
Step 7	Compare all the research based on the category, and then find the standard deviation using effect size equation.
Step 8	Analyze the conclusion by examining the study results.
Step 9	Draw the meta-analysis conclusion according to points 7 and 8.

Meta-analysis coding can easily help the process of finding the analysis units. It is important to use detailed and good related topics that provided complete statistical analysis. This matter is based on Glass (1981) that the weakness of meta-analysis is we cannot qualify good research out of its quality. A researcher who conducts a meta-analysis study is required to analyze, sort the qualified references particularly based on the methods for the proper publications in the future.

METHODE

This research employed a quantitative approach with a meta-analysis method. Meta-analysis refers to the use of the same related topics which is a problem-based learning model on social sciences at elementary and middle-level educations (SD and SMP). 4 journals out of 9 of the same topic studies were referenced to determine the analysis unit based on the representative ones. As from the four analysis units, 6 sub-unit then settled. The researcher used the data coding sheet as the main instrument to complete the information on the influence of problem-based learning.

Glass' effect size formula is employed to measure the standard deviation, the formula is as written below:

$$\Delta = \frac{\bar{X}_E - \bar{X}_K}{S_k}$$

Where:

Δ = *effect size*

\bar{X}_E = Average of experiment group.

\bar{X}_K = Average of the control group.

S_k = Standard deviation of the control group

The calculation of this equation was conducted to measure the related variables in problem-based learning. While to calculate the average of the magnitude phenomenon another equation was employed:

$$\bar{\Delta} \pm = \frac{1.96 \times \sigma_{\bar{\Delta}}}{\sqrt{n}}$$

Where:

$\bar{\Delta}$ = average of effect size

$\sigma_{\bar{\Delta}}$ = standard deviation *effect size*

1,96 = value of Z ($\alpha = 0,05$)

N = total of sub-analysis

RESULT AND DISCUSS

According to the result of the average value of the magnitude phenomenon of problem-based learning that involved the other variables is displayed below.

Tabel 3. The average value of the PBL magnitude of the phenomenon with the other variables

Statistic	1	2	3	4	5	6	Mean
N	39	30	20	20	60	60	38,16
Δ	1,10	1,39	0,43	1,05	0,45	0,35	0,795
σ_{Δ}	6,29	3,60	2,94	5,67	12,76	10,8	7,01
σ_{Δ}/Δ	5,72	2,59	6,84	5,40	28,36	30,86	13,295

Where:

- 1 = Problem-based learning only
- 2 = Problem-based learning and high motivation
- 3 = Problem-based learning and low motivation
- 4 = Problem-based learning and integrated learning
- 5 = Problem-based learning and high IQ
- 6 = Problem-based learning and low IQ

Data on table 3 showed that the average value of the magnitude phenomenon of problem-based learning is high when it paired with high motivation and followed by learning method without the other variables, problem-based learning and integrated learning, problem-based learning and high IQ, problem-based learning and low motivation, and the lowest is pointed by low IQ variable. Variance coefficient of problem-based learning (1, 2, 3, 4, 5, and 6) are 572%, 259%, 540%, 2836%, and 3086%. Thus, the spread in data towards the average of effect size with the other variables involved and problem-based learning the order average of each magnitude phenomenon is (2, 1, 4, 5, 3, dan 6).

This meta-analysis study consists of 4 analysis units coupled with 6 sub-unit. The effect size value reached at number 0,795. This value means the utilization of problem-based methods on elementary and middle school students in the social sciences class has been significantly effective compared to the result of the experiment groups.

This current study corresponds to Lu et al. (2014) where PBL has significant influence to enhance student's achievement to polish their critical thinking skills in contrast to the conventional learning method.

It is also simply summed up that this method applies to all educational stages, specifically in the social sciences learning context.

The result of each subunit showed various average values of effect size. The highest value hits at number 1,39 which referred to the comparability of problem-based method and conventional learning one. Whilst, the lowest number reached at 0,35 that students who have lower intelligence performed poorly on the problem-based learning in comparison to the conventional method.

The finding results above revealed that high intelligence students presumably perform better in problem-based learning compared to the lower intelligence and low motivated ones. In comprehending problem-based learning the students should have prior skills of organizing problems apart from a mere discipline. Inconsequent to the application of this learning model, high responsibility is mandatory for students to learn independently beyond the classroom. Highly motivated learners are also prepared to follow this method. Following the requirements of PBL where students have to redemonstrate what they have learned in the previous classes. In conclusion, it is necessary to consider the students' intelligence and motivation beforehand.

CONCLUSION

It is showed that highly motivated students have greater chance to be compatible or to be prepared for problem-based learning method compared to their low motivated peers, also this method fits best to students who possessed higher intelligence rather than who do not.

This learning method applies to all educational stages; from primary to tertiary schools. There was no significant difference in its all stage application given that it is utilized based on syntax.

To sum up, this learning method provided an alternative learning model for educators, particularly in developing students' critical thinking skills and problem-solving skills as well.

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