C40. Muntari

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Meta analysis:the effect of applying project-based learning models to students' science process skills

Meta analysis:the effect of applying project-based learning models to students' science process skills

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Abstract. This study aims to determine the effect of the application of project-based learning models on student's science process skills in science learning (chemistry, physics, and biologi). The research method is a meta-analysis with calculations according to Hunter and Schmidt. Sampel is 12 national journal articles online. The results of the analysis show that there is an effect of the application of project-based learning models on student's science process skills. Effect size value of 0.444 including the medium category.

1. Introduction

Science education has an important role in producing quality human resources. Essentially science encompasses process, product, and attitude. As a process, science focuses on how to gain knowledge. As a product, science stresses more on what can be outcome of knowledge. As an attitude, science pays attention more on the efforts of equipping, training, and infusing positive values to the students. The role of teachers is very important to facilitate the development of these three aspects. Students studying science should be assisted in developing their potentials and also be equipped with needed skills in order that they are able to be creative in solving the problems they encounter [1].

The science learning process should emphasize givig students direct experience through the steps of scientific work as done by scientists. Learning activities through the scientific work process will involve a series of skills called science process skills (SPS) [2]. The science process skills, as well as being a necessary tool to learn and understand the science, italso an important aim in science education. Not only the scientists, but also all individuals in the society should have these skills in order to be scientific literate, and to solve the problems encountered in daily life [3]. Science process skills are the thinking skills that scientists use to construct knowledge in order to solve problems and formulate results [4]. Science process skills are classified into basic and integrated. The basic science process skills are useful in science and non-science situations while the integrated skills are the working behaviour of the scientists and technologists. Thus, both basic and integrated science process skills are relevant and appropriate for all science subjects [5]. Basic science process skills include : observing, measuring, classifying, predicting, inferring, and communicating. Integrated science process skill include: controlling variables, defining, operationally, formulating hypotheses, interpreting data, experimenting, and formulating models [4,5]. Science process skills need to be fostered in science learning so students can master the concepts correctly. Trained science process skills will provide good results in student learning outcomes [6].

Project-based learning models (PjBL) are seen as suitable for training science process skills because the project-based learning model focuses learning by involving students in an investigation [7]. PjBL have enormous potential to make learning experiences meaningful and beneficial for students [8]. Project based learning is a constructivistic learning that students can learn maximally if able to construct artefacts so that students can be more involved in learning activities [9]. Project based learning is an innovative learning approach that implements strategies that lead to the improvement of thinking skill, where the learning is controlled by students and teachers only as facilitators [10].

The research conducted by [11] showed that the application of project-based learning had an effect on the ability of science process skills of science education students at Muhamadiyah University of Sidoarjo. The application of project based learning can foster student"s science process skills [12, 13]. The research conducted by [14] Project based learning makes students independent and can increase student activity because this learning emphasizes student to be active dan become independent learners.These studies have been able to prove the effect of project-based learning on students' science process skills.

2. Methods

This study uses a meta-analysis method by studying several articles in national journals. Meta-analysis is quantitative because use calculation of numbers and statistics for practical purposes, namely to compile and extract information from so much data impossible to do with other methods [15]. This study uses a meta-analysis Hunter and Schmidt's method.

The sample used is 12 articles from national journal online. The sample was chosen because it correspondens to the following criteria : using a project based learning (PjBL) model, science process skills as dependent variables, science subjects (chemistry, physics, and biology), and having statistical values to support analysis (F, t, or r).

The data inputted in the form of the number of samples (N), the value of F, t, or r are analyzed to be rxy, and ryy.Outputs are Effect Size, confidence interval, impact of sampling error, and the impact of other factors. Effect size is a value that shows how much influence a variable has on other variabels. Effect size Cohen's criteria as follows: $0<d<0.20$ (small), $0.20<d<0.8$ (medium), $d\geq 0.8$ (large) [16].

3. Results and Discussion

Research data from several articles are shown in Table 1.

Table 1. Research data from articles of national journals

No	Year	Researcher	N	F	t	rxy
1	2013	IB. Siwa, dkk	128	38.531	6.21	0.48
2	2014	Hotmaria Agustina S	60		2.89	0.35
3	2015	Fenny Mustika Piliang, dkk	60	63.092	7.94	0.72
4	2016	A R Uswatun Chasanah, dkk	60		13.49	0.87
5	2016	Alfiari, dkk	60		2.01	0.26
6	2016	Laila Okta Fitriani	56		4.97	0.56
7	2016	Citra Devi	60		4.8	0.53
8	2016	Fitria Eka Wulandari	26		-29.58	-0.99
9	2016	Nuril Maghfiroh, dkk	77	9.554	3.09	0.34
10	2016	Cut Zaitun Umara, dkk	44		2.68	0.38
11	2017	Novita Salmi, dkk	79	2.039	1.43	0.16
12	2015	Kiki Setyandari	63		3.61	0.42

Based on further calculations, the following data is obtained: varians (0.102), sampling error variance (0.00130), impact of sample errors (1.27), and effect size (0.444). The effect size value shows that there is a statistically significant impact on the project based learning model on science process skills. Refers to Cohen's criteria, the value includes a medium criterion, meaning that there is a moderate, not too high or low effect.

Project-based learning models have a statistically significant effect on students' science process skills. This is indicated by the value of 0.444 Effect size in the 0.40 to 1.07 confidence interval. these results indicate that the project-based Learning Model has a positive effect from various levels of education starting from elementary, junior high school, senior high school, vocational high school and college level.Of course not all learning models can be used at various levels of education. Project based learning models can also be apllied in variety subject, both science and non-science.

The advantage of this project based learning model is inseparable from the coherence of the syntaks used in science learning.The PjBL stage was developed by two experts, The George Lucas Education Foundation and Dopplet. PjBL Syntax [17] :

1. Start with essential question,
2. Design project,
3. Create schedule
4. Monitoring the students and progress of project
5. Assess the outcome
6. Evaluation the experience

Student in PjBL applied class, according to the observation, are more active and creative and think more critically than students in classical learning applied class [17]. Project based learning emphasizes student centered teaching with project assignments. Project based learning provides opportunities for students to work more autonomously, develop their own learning, be more realistic, and produce a product [18]. Project based learning has enormous potential to train students' thinking processes that are part of life skills [19].

The application of project based learning has an influence on students' science process skills. Science process skills consist of ten indicators, namely the skill of observing, grouping, interpreting, predicting, asking question, formulating hypotheses, planning experiments, using tools and materials, applying concepts, and communicating. The result of study [20] showed that students' ability to formulate project design hypotheses included very good categories (96.21%), and predictability including very good categories (87.21%). This is in accordance with the study [21] stating that after the implementation of project based learning, the ability of students in terms of formulating hypotheses increased from being skilled enough to being highly skilled (90.58%). Research conducted by [22] giving results that in the non-test method, the score of students' average science process skills is 72.85 and classical completeness is 80.6%, and 63.89% of students already have good science process skills.

With project-based learning, the ability to think creatively and the activities of students in learning can be improved [23], understanding and learning activities of students increases with the application of project based learning [24], and can improve student learning outcomes and teacher professionalism [25]. The importance of building student learning independence and other skills such as science process skills and character development, can be realized in project based learning model [26].

4. Conclusion

The application of Project Based Learning Model (PjBL) in science learning has a positive influence on students'science process skills. This study shows the influence in the medium category based on the effect size (0.444). Further studies using more articles can certainly provide better results.

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