LITERACY : International Scientific Journals Of Social, Education and Humaniora
E-ISSN: 2829-3649
P-ISSN: 2829-3908
Vol. 2 No. 1 April 2023
http://jurnal-stiepari.ac.id/index.php/LITERACY

Meta-analysis Study: The Effect of the Independent Curriculum Integrated Project Based Learning Model on Student Learning Outcomes in Natural Science Materials

Yayat Suharyat [1], Ichsan [2], Agus Supriyadi [3], Tomi Apra Santosa [4], Aulia Sofianora [5]
[1] State Islamic University 45 Bekasi, Indonesia
[2] Pontianak State Polytechnic , Indonesia
[3] Khairun University , Indonesia
[4] Padang State University , Indonesia
[5] Jambi University, Indonesia
Corresponding author: ichanida@yahoo.com

Abstract

In the era of Revolution 5.0, world society experienced rapid development, especially in the world of education. Education today has enabled technology to assist the learning process. The learning process in the Industrial Revolution era (5.0) required students to master learning technology. In addition, teachers have an important role as educators in facilitating students. However, teachers have not been able to carry out learning in accordance with the independent curriculum. The independent curriculum remains the primary impediment for teachers in encouraging student learning outcomes in the classroom. In the independent curriculum, students must be creative and innovative in their learning. Independent curriculum-guided teachers must be able to apply the project-based learning model. The purpose of this study was to analyze the effect of the project-based, integrated learning model of the independent learning curriculum on student learning outcomes. This type of research is a type of meta-analysis research. The data source comes from an analysis of 15 national and international journals indexed by SINTA, Copernicus International, and DOAJ. The search for data sources comes from the Google Scholar database and the Eric Journal. The data collection technique is a direct observation technique that involves tracing articles that have a relationship with the research variables. The search keywords for data sources are the PjBL learning model, independent curriculum, and learning outcomes. The data analysis technique is a quantitative statistical technique, with the help of the OpenMEE application. Data analysis was performed by calculating the effect size, standard deviation, average, and N-gain values. The results of the study concluded that the PjBL learning model integrated with the independent curriculum had a significant influence on student learning outcomes. This can be seen from the effect size value of 2.67, SD of 6.03, average student score of 89.56, and N-Gain of 4.20. The use of the PjBL model in the independent curriculum benefits both teachers and students as they prepare for the twenty-first century. In order to implement the Pjbl model in schools, teachers must be professionals.

Keywords: *PjBL, Learning, Independent Curriculum, Learning Outcomes*

Received Februari 11, 2023; Revised Maret 02, 2023; Accepted April 01, 2023

Abstrak

Era revolusi 5.0 society dunai mengalami perkembangan yang begitu pesat terutama dalam dunia pendidikan. Pendidikan saat ini telah memfungsikan teknologi dalam membantu proses pembelajaran. Proses pembelajaran era revolusi industri 5.0 siswa dituntut wajib menguasai teknologi pembelajaran. Selain itu, guru sebagai pendidik mempunyai peran penting untuk memfasilitasi siswa. Akan tetapi, guru belum mampu melaksanakan pembelajaran yang sesuai dengan kurikulum merdeka. Kurikulum merdeka masih menjadi kendala utama guru dalam mendorong hasil belajar siswa disekolah. Dalam kurikulum merdeka siswa harus kreatif dan inovatif dalam belajar. Kurikulum merdeka guru dituntun harus mampu menerapkan model pembelajaran Proyek Based Learning. Tujuan penelitian ini adalah untuk menganalisis pengaruh model pembelajaran project based learning teringtegrasi kurikulum merdeka belajar terhadap hasil belajar siswa. Jenis penelitian ini adalah jenis penelitian meta-analisis. Sumber data berasal dari analisis 15 jurnal nasional maupun internasional yang terindeks SINTA, Coprenicus Internasional dan DOAJ. Penelususran sumber data berasal dari database google scholar dan Eric Journal. Teknik pengumpulan data adalah teknik observasi langsung dengan menelusuri artikel yang mempunyai hubungan dengan variabel penelitian. Kata kunci pencarian sumber data adalah model pembelajaran PjBL, Kurikulum merdeka dan hasil belajar. Teknik analisis data adalah teknik statistik kuantitatif dengan bantuan aplikasi OpenMEE. Analisis data dilakukan dengan menghitungkan nilai Effect Size, Standar Deviasi, Nilai rata-rata dan N-gain. Hasil penelitian disimpulkan bahwa model pembelajaran PjBl terintegrasi kurikulum merdeka mempunyai pengaruh yang signifikan terhadap hasil belajar siswa. Hal tersebut terlihat dari nilai effect size sebesar 2.67, SD sebesar 6.03, Nilai rata-rata siswa sebesar 89.56 dan N-Gain sebesar 4.20. Penerapan model PjBL dalam kurikulum merdeka sangat efektif bagi guru dan siswa dalam menghadapi abad-21 ini.Seorang guru harus profesional dalam mengembangakn model Pjbl di sekolah.

Kata Kunci: PjBL, Pembelajaran, Kurikulum Merdeka, Hasil Belajar

INTRODUCTION

The industrial revolution 4.0 brought major changes in the world of education today (Öztürk, 2023;Yüzüak & Erten, 2022; Suhaimi eta al., 2022; Fradila et al., 2021). The role of technology in bringing education into a tool that helps students in learning (Kara et al., 2022; Rahimi & Tafazoli, 2022; Yusuf et al., 2020). In addition, technology in education helps students develop all their potential (Jagantara et al., 2014; Festiyed et al., 2022); Ichsan et al., 2022; Suharyat et al., 2023). Students must be able to develop their potential in order to have competitiveness (Oktarina et al., 2021;Chireac & Vegas, 2022). According to (Pratama & Prastyaningrum, 2016) the potential possessed by students serves to solve every problem that occurs in life.

Furthermore, in the learning process students must be encouraged to think critically and creatively (Nilsook et al., 2021;Utami et al., 2015). This is necessary so that students more easily understand and solve problems in learning (Santosa & Yulianti, 2020; Zulkifli et al., 2022). Learning is something that is very important for students to provide new things for the future of the nation (Wright, 2020; Sudarsono et al., 2022; Suharyat et al., 2022); Zorlu & Zorlu, 2021; Fakhrurrozi & Hamdani, 2022). The higher the quality of students in learning, the higher the learning outcomes (Muthoharoh & Elvina, 2022). Learning outcomes determine the extent to which students can understand and apply the subject matter that has been taught.

Science learning is a compulsory subject that guides students to be more creative and think scientifically. According to (Fahrezi et al., 2020) science learning leads students to be more active and emphasizes student learning outcomes. In science learning guides students to be able to solve problems in everyday life (Ningsih et al., 2021;Dewi et al., 2013). Obstacles faced by students have not been able to understand and apply science concepts in everyday life (Wijayanto et al., 2020). In addition, student learning outcomes are still relatively low (Hutapea & Simanjuntak, 2017), so that the ability of students in learning is reduced. In addition, the science learning process is still teacher-centered (Cahyaningsih et al., 2020), so that student learning outcomes are low. So the teacher must update the science learning model.

(Suryaningsih & Koeswanti, 2021) explaining that in science learning teachers must be able to apply learning models that are able to support the potential and student learning outcomes. The Project Based Learning learning model is a learning model that guides students to produce a product in learning (Syawaludin et al., 2022 ;Jalinus et al., 2020; Girgin, 2020; Payoungkiattikun et al., 2022). The Project Based Learning model helps students explore learning material effectively and deeply (Dinantika et al., 2019; Asfihana et al., 2022). In addition, the Project Based Learning learning model is able to encourage students' creativity and innovation in learning (Brewer et al., 2022).

Previous research by (Febriyanti et al., 2020) The Project Based Learning learning model increases students' creativity in learning science. According to (Putri et al., 2019) the Project Based Learning model is able to improve student learning outcomes in science learning. Research by (Tusyadi et al., 2021) explained that the Project Based Learning model fostered students' interest in learning science.(Ichsan et al., 2022) stated

that the Project Based Learning model was able to encourage and grow students' 21st century abilities in science learning. Based on these problems, this study aims to analyze the project-based learning learning model integrated with the independent learning curriculum on student learning outcomes.

METHODS

This research is a kind of meta-analysis research. Meta-analysis research is a type of research by exploring the literature that can be analyzed using statistical methods(Hillmayr et al., 2020; Shi & Kopcha, 2022; Razak et al., 2021; Santosa et al., 2021; Santosa et al., 2021;Suharyat et al., 2023). The source of the data in this study came from an analysis of 24 national and international journals indexed by SINTA, Copernicus International, DOAJ and Scopus. The data collection technique is direct observation by tracing studies related to this research. The keywords used in the data search were the Project Based Learning model, Science Learning, Learning Outcomes and independent curriculum. Furthermore, the data were analyzed with descriptive statistics with the help of the OpenMEE application.

Data analysis was performed by calculating the effect size of each study, the standard deviation, the mean and the N-gain. According to Cohen in (Firman et al., 2019) The steps for carrying out a meta-analysis are 1) understanding the appropriate research topic; 2) collect various kinds of studies that are appropriate to the research topic; 3) Determine the value of the effect size (ES) and 4) draw conclusions and interpret the research results. Complete effect size criteria can be seen in table 1.

Tabel 1. Kriteria *Effect Size*

Effect Size	**Kriteria**
≤ 0.15	Very small
0.15 ≤ ES≤ 0.40	Kecil
0.40 ≤ ES ≤ 0.75	Sedang
0.75 ≤ ES ≤ 1.10	Besar
1.10 ≤ ES ≤ 1.45	Sangat Besar

Sumber: (Nurcahyani et al., 2021; Razak et al., 2021;Santosa et al., 2021; Tamur et al., 2021)

RESULT AND DISCUSSION

RESULT

From the results of an analysis of 57 national and international journals, 24 studies were found related to the influence of the Project Based Learning learning model integrated with the independent learning curriculum on student learning outcomes in science learning. In selecting the data, there were 3 invalid articles, 5 development research articles, 20 articles that matched the research variables and 1 literature review article. The complete process of selecting data in this study can be seen in Figure 1.

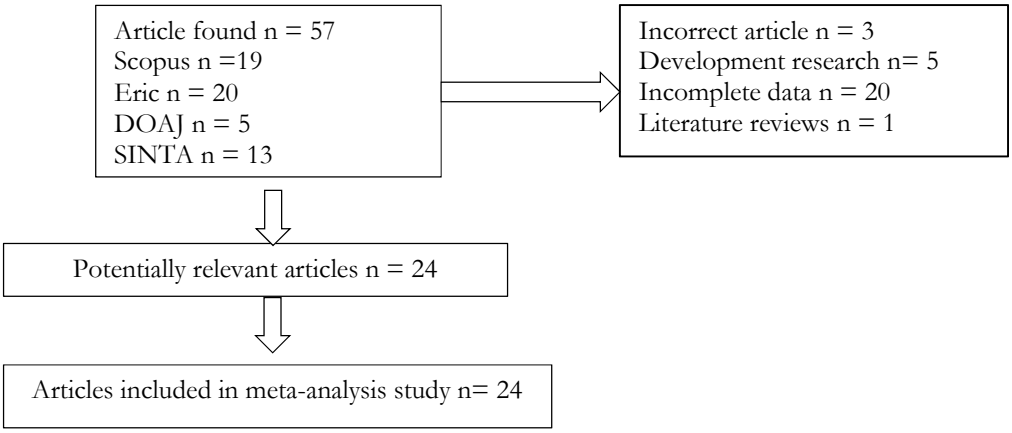

Figure 1. Flow Chart Proses Penyeleksian Artikel

To determine the effect model in the meta-analysis used, a heterogeneity test was performed. The results of the herogenicity test can be seen in table 1.

Table 2. Effect Comparison Results Based on Effect Models

Model	Number Studies	Hedge's g	95 % CL	Null Hypothesis		Heterogenity		
				Z-Value	P-Value	Q-Value	df(Q)	P-Value
Fixed	54	0.671	(0.670;0.891)	23.091	0.000	457.067	37	0.00
Random	54	0.710	(0.750;0.942)	7.102	0.000			

Table 2 explains that the overall effect size of the primary study has a very significant difference. From the results of heterogeneity, it was found that the p-value <0.05 indicated that the pickled random model was better than the fixed model. Therefore, this study uses a random effect model as a basis for conducting analysis. Of

the 54 primary studies on the application of the Project Based Learning learning model which integrates the independent curriculum better than the conventional model.

Furthermore, the application of the Project Based Learning learning model integrated with the independent curriculum has a positive influence on student learning outcomes. This can be seen from the effect size value of each study related to the application of the Project Based Learning model in the student learning process in the classroom. The complete effect size value of each study can be seen in the table. 2

Table. 2 Effect Size Value of Each Study

No	Kode Jurnal	Effect Size	Kategori
1	K1	0.45	Sedang
2	K2	0.32	Kecil
3	K3	0.18	Kecil
4	K4	1.76	Sangat Besar
5	K5	2.90	Sangat Besar
6	K6	0.81	Besar
7	K7	0.20	Kecil
8	K8	0.92	Besar
9	K9	0.41	Sedang
10	K10	0.15	Sangat Kecil
11	K11	0.04	Sangat Kecil
12	K12	0.56	Sedang
13	K13	0.68	Sedang
14	K14	1.20	Besar
15	K15	2.03	Sangat Besar
16	K16	2.14	Sangat Besar
17	K17	1.09	Besar
18	K18	0.70	Sedang
19	K19	0.32	Sedang
20	K20	0.14	Sangat Kecil
21	K21	0.39	Sedang
22	K22	1.87	Sangat Besar
23	K23	0.90	Besar
24	K24	1.04	Besar
Rata-rata Effect size		**0.88**	**Besar**

Based on table 2. Explains the average effect size value of each study of 0.88 with large criteria. It is concluded that the Project Based Learning model integrated with the independent curriculum has a significant influence on student learning outcomes. The Project Based Learning Model students are more creative and innovative in learning. In addition, the Project Based Learning model which is integrated with the independent

curriculum is able to improve student learning outcomes in science learning. Not only that, the Project Based Learning model is effective for application in various types of subjects. This can be seen from the average student score and the N-gain value which can be seen in table.3

Table 3. Value of the Effectiveness of the Project Based Learning Model > Learning Outcomes

Class	Value		Mean	SD	N-gain
	Pre	Post			
Kontrol	60	70	65	**0.29**	**0.63**
Eksperimen	70	90	80		

Based on table 3. The value of the effectiveness of the N-gain Project Based Learning model is 0.63 and the SD is 0.29. So, the Project Based Learning model is integrated with the independent curriculum on student science learning outcomes. In addition, the Project Based Learning learning model really needs to be applied in current student learning. In the independent curriculum students must be able to produce products after the learning process.

Discussion

The application of the Project Based Learning model is a very interesting learning model for students. In science learning the Project Based Learning model which is integrated with the independent curriculum has a significant influence on students' natural science learning outcomes at school. These results can be seen from the effect size value of 0.88 with the large category. This is in line with research (Taupik & Fitria, 2021) explained that the Project based Learning model was able to improve student learning outcomes in science learning. The Project Based Learning model is able to foster students' active attitudes in learning (Mursid et al., 2022). (Suwarno et al., 2020) explained that the Project Based Learning model which is integrated with the independent curriculum encourages students to think critically and have better science learning outcomes.

The application of the Project Based Learning learning model that is integrated with the independent curriculum fosters motivation and student learning outcomes to study science (Fisher, 2021; Sanjaya et al., 2022; Kılıç, 2022). In learning science, students are guided to have a more in-depth knowledge of science (Utami & Astawan,

2020). Knowledge is all information obtained by students in learning science (Ferry et al., 2020; Suharyat et al., 2022). In addition, in the science learning process students must be more creative and innovative in producing works (Jazuli et al., 2019). Therefore, a teacher must be effective in applying the Project Based Learning model in science learning.

In the results of this study the Project Based Learning model which is integrated with the independent curriculum is effective in encouraging students' natural science learning outcomes. This can be seen from the N-gain value of the effectiveness of the Project Based Learning model in science learning of 0.63. This is supported by research (Chasanah et al., 2016) Project Based Learning models are very effective for improving critical thinking skills and student learning outcomes in science learning. (Naila, 2020) Project Based Learning model is able to encourage students' creativity in learning science. Besides that, learning science is expected that students are able to apply science concepts in their environment.

Teachers are educators who are guided to be able to apply the Project Based Learning model in the science teaching and learning process (Ichsan et al., 2022;Holder et al., 2017). In the independent curriculum students must be able to apply science concepts in everyday life. Besides that, (Kristiana & Radia, 2021) the Project Based Learning model that is integrated with the independent curriculum is able to apply and solve natural science problems in life. Science learning guides students to be able to solve various scientific phenomena (Rofik et al., 2022;Ridwan et al., 2022).

CONCLUSION

From the results of this study it can be concluded that the application of the Project Based Learning model which is integrated with the independent curriculum has a positive influence on students' natural science learning outcomes. This can be seen from the effect size value of 0.88 with the large criteria and the N-gain of 0.63. Therefore, a teacher must be able to apply this model in science learning so that students are more creative. The Project Based Learning model encourages students to be more active and motivated in learning science.

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