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The effect size analysis of process oriented guided inquiry learning (POGIL) model on cognitive aspects of science learning

Eprian Nur Ilman*, Aulia Putri, Lidya Juliven Sianturi, Rizhal Hendi Ristanto, Hanum Isfaeni
Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta, R. Mangun Muka Raya Street, East Jakarta City, Special Capital Region of Jakarta, 13220, Indonesia
*Corresponding author: epriannurilman@gmail.com

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ABSTRACT

Process Oriented Guided Inquiry Learning (POGIL) model is designed to make students actively participate in study groups. The aim of this research is to analyze the effectiveness of the influence of the POGIL model in learning science on cognitive aspects or student learning outcomes. This research used a meta-analysis method with research subjects as 11 national articles with PRISMA guidelines. The guidelines for meta-analysis research include collecting data, calculating the effect size for each research subject, assessing the impact of using POGIL model on learning outcomes which include cognitive aspects of students, drawing conclusions. The results of this research showed that there was a difference between the experimental class and the control class regarding the cognitive aspects of science learning. POGIL model can improve science learning outcomes based on the results of the analysis. It is ranging from 9.43% to the 37.18% with an average of 19.85%. The results of the effect size analysis showed that the POGIL learning model has a strong category with 1,794 in score. This showed that POGIL model can influence cognitive aspects and critical thinking skills. This research is anticipated to encourage educational practitioners to be creative in designing instructional that utilize the POGIL model.

INTRODUCTION

One of human needs is education, education continues to develop and change towards the best version according to human needs and life on earth. According to Sujana (2019), the government has attempted various ways to improve the quality of education. Several efforts that have been made by the government have not had an optimal impact so that the quality of education in Indonesia has not increased. The potential of Indonesian students must be used as a direction and basis in designing education in Indonesia to be religious, high minded, active, spiritual, character, discipline, intelligence, and servable themselves, society and the nation (Handayani et al., 2022). There is a subject of education in Indonesia called Science Learning.

Science learning is a part of Natural Science subjects. Natural Science is a scientific discipline that is characterized by systematic observation of knowledge related to various phenomena and everything that occurs in nature. Science learning often involves studying concepts and facts, but apart from that, science is also considered a scientific process that can foster scientific thinking behavior and attitudes (García-Carmona, 2020). Science learning is deliberately designed to be in line with the nature of science it-self in order to provide basic knowledge and skills related to problem solving (Mutakinati et al., 2018). Starting from elementary school (ES), junior high school (JHS), to senior high school (SHS) in Indonesia, everyone studies science. However, in the 2013 Curriculum and the *Merdeka* Curriculum that was implemented in Indonesia, science appears to be an integrated subject called science at JHS, where as it is taught thematically at ES (Tarsini & Ningsih, 2021). At the SHS, science is taught separately through specific disciplines of biology, physics and chemistry. In general, science or science learning disciplines have the same characteristics and principles, namely observation and explanation of natural phenomena, symptoms and issues as an inquiry process (Wen et al., 2020).

Some students in Indonesia do not like learning science because they consider it difficult (Kurniawan et al., 2019). Moreover, many studies on science learning have obtained low results on knowledge or cognitive aspects (Kurnaeni et al., 2019). Conventional learning is still widely applied by teachers in science learning in Indonesia, where the teacher is the center of learning (Noviani et al., 2021). This makes students less interested during the learning process and feel bored. Science learning should require student learning activities that involve the active participation of the students themselves in order to train high-level thinking skills, processing skills and problem-solving skills.

There are many media and learning models that can be applied in the learning process in today's classrooms. However, not many of them have any influence on learning. This is because the understanding abilities of each student are different, so it is necessary to carry out experimental research (Wijaya & Handayani, 2021). One learning model that can be used as an alternative for learning is the Process Oriented Guided Inquiry Learning (POGIL) model.

According to Mamombe et al. (2021), the POGIL learning model is designed in order students can participate actively through study groups. The POGIL model is a type of guided inquiry learning that is centered on the students' own learning process. Learning that uses this model is expected to improve mastery of subject matter in line with developing students' thinking abilities, problem solving, learning strategies and evaluation (Toyo et al., 2019). The advantage of POGIL compared to other inquiry learning models is that it is contextual (Yuliastini et al., 2018).

Nowdays, many researchers have published research on POGIL in Indonesian articles (Wijaya & Handayani, 2021). The large number of research studies has given rise to the idea that it is necessary to examine these studies through a systemic method called meta-analysis. The meta-analysis method uses data from others existing research (Retnawati et al., 2018). Meta-analysis is used to calculate effect size. This needs to be done so that the consistency of the findings is tested, due to the increasing number of similar studies and also to increase the variability of the findings. Based on this, the aim of this research is to analyze the POGIL model in learning science disciplines regarding cognitive aspects.

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METHODS

This research is a meta-analysis research by reviewing, summarizing, and evaluating the results of previous research (Santosa et al., 2021). Meta-analysis is a literature search method in scientific research that compares and combines the findings of experimental studies using statistical methods in a consistent and coherent way and takes into account the size of the research effect size (Cohen et al., 2020). The search for this article was carried out in November 2023 using the Google Scholar database, with predetermined keywords such as POGIL, cognitive, science in the publish or perish application. The initial search yielded results of 154 articles. The data from the initial search results was checked again, and the same data was deleted, then selection was carried out using the procedure in Figure 1 in accordance with the PRISMA Flow Diagram guidelines.

This research aims to determine the effectiveness of using the POGIL model in science learning. Purposive sampling technique was used in this research and it was found that 11 articles in national articles that were published met the following criteria: 1). The article is an experimental research method; 2). The research was conducted from 2018 to 2023; 3). Analysis is in Indonesia; 4). Quantitative research and meet statistical effect sizes; 5). Examining the impact of the POGIL model on learning outcomes which include cognitive aspects of students; and 6). Elementary school (ES), junior high school (JHS) and senior high school (SHS) education levels.

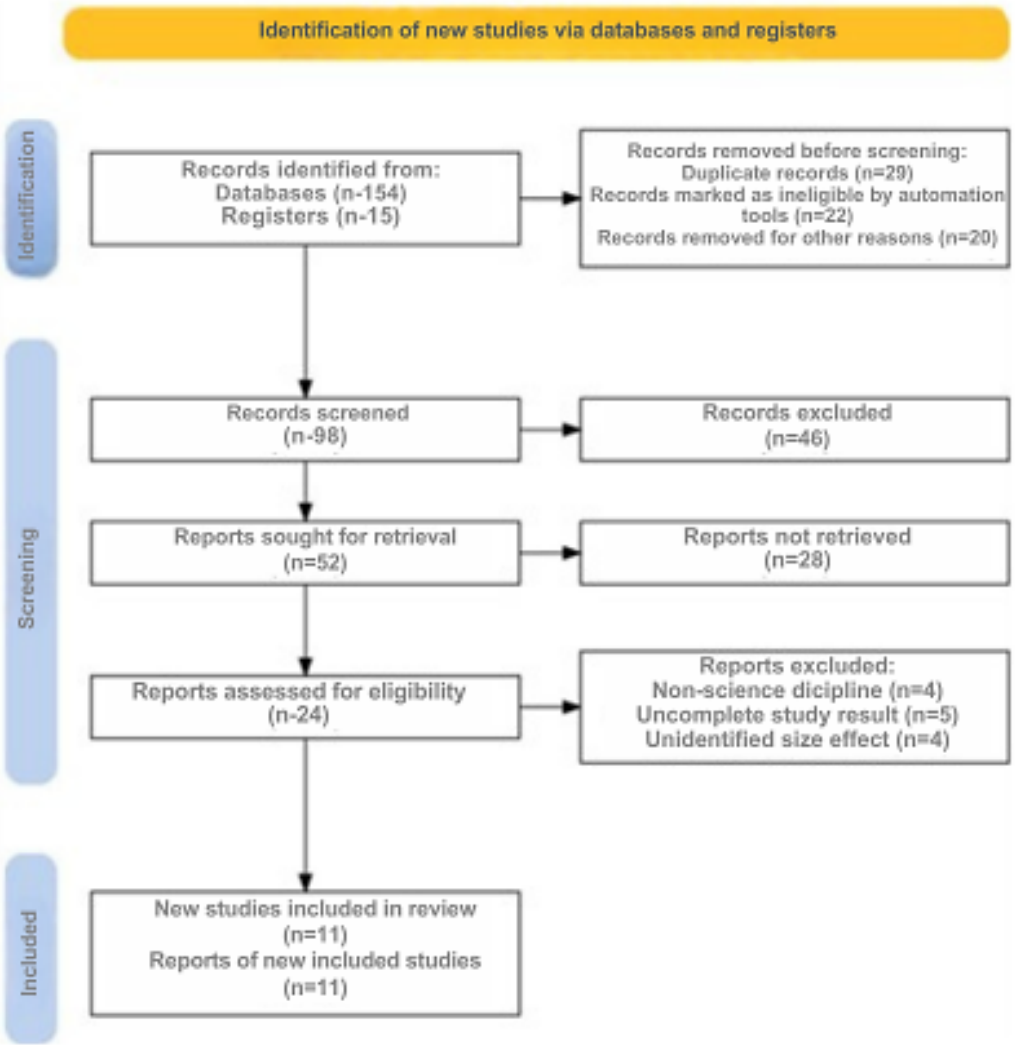

Figure 1. PRISMA flow diagram

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The data analysis technique uses a comparative method for implementing the POGIL learning model by comparing the learning outcome scores before and after the POGIL learning action, then dividing the scores (in the form of %). This analysis technique was carried out to determine the effect of the POGIL model on improving science learning outcomes. This meta-analysis research is to relate the effect of using POGIL on student learning outcomes in cognitive aspects by providing a comparison of the effects obtained from previous research results with Cohen's standardized effect size and determining the differences between the experimental and control classes to combine standard deviations using the following formula:

$$ES = \frac{Me - Mc}{SD}$$

Formula 1

Explanation:
ES : Size Effect
Me : Mean for experimental class
Mc : Mean for control class
SD : Standard deviation

$$SD = \sqrt{\frac{(Ne-1)(SDe)^2 + (Nc-1)(SDc)^2}{Ne + Nc - 2}}$$

Formula 2

Explanation:
Ne : Experimental class data number
Nc : Control class data number
SDe : Experimental class standard deviation
SDc : Control class standard deviation

Data analysis used Microsoft Excel to determine the Cohen effect size percentage with an effect size range of 0.20 grouped in the poor category, 0.50 in the strong category, and 0.80 in the very strong category.

RESULTS AND DISCUSSION

In this section, research data is presented and elaborated with related theories and relevant research results. Results and discussions are made in one continuous unit. Results should be clear and concise. If there is more than one research parameter, several subheadings can be created.

This section is the main part of the research result article in which the final results are presented. The data analysis processes, such as statistical computing and hypothesis testing, are not necessary to be served. The materials reported are the analysis results and hypothesis testing results. In addition, tables and figures are also can be shown to enunciate the verbal narration. Tables and images must be given a comment or discussion. The details of qualitative research are written in some sub-topics which directly related to the focused category.

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Topic and lesson material in POGIL Articles

In this research, the results of a search for articles that match the title of this research have been carried out, and 11 articles have been obtained which have been downloaded from various national articles sources with research topic criteria related to the influence of the POGIL model, student cognitive aspects, learning outcomes, critical thinking skills, and science learning. The analysis results obtained from the articles review show that the POGIL model can improve students' cognitive aspects in science learning. Based on these 11 articles, the research topic, name of the researcher and year of publication of the POGIL learning model articles were analyzed. It is known that from several articles about POGIL, 11 articles were analyzed. Articles about the POGIL learning model based on the last 5 years: 1 article in 2018, 2 articles in 2019, 1 article in 2020, 1 article in 2021, 2 articles in 2022, and 4 articles in 2023. The following are 11 research topics in the POGIL learning model articles. used as data in meta-analysis research can be seen in Table 1.

Table 1. Topic and lesson material in POGIL Articles

No.	Topic and Lesson Material	Researcher	Year of Publication
1.	Pengaruh Model POGIL *Process,* Hasil Belajar Siswa, Struktur dan Jaringan Tumbuhan	Silaban et al.	2023
2.	Efektivitas LKS, *Blended Learning* Dengan Strategi POGIL, Ikatan Kimia SMA	Mufarohah & Dwiningsih	2018
3.	Pengaruh Model POGIL, Literasi Sains dan Hasil Belajar Kognitif IPA Siswa	Yani et al.	2023
4.	Pengaruh Model POGIL, Hasil Belajar dan Kemampuan Berpikir Kritis Siswa	Sudartik et al.	2023
5.	Penerapan Metode POGIL, Konsep Mol	Manampiring et al.	2019
6.	Pengaruh Model POGIL, Kemampuan Berpikir Kritis Siswa, Hukum Archimedes	Devi et al.	2019
7.	Pengaruh Model POGIL, Literasi Sains dan Hasil Belajar Kognitif IPA Siswa	Yani et al.	2023
8.	Penggunaan Model POGIL, Hasil Belajar	Handayani et al.	2022
9.	Pengaruh Model POGIL, Kemampuan Berpikir Kritis Siswa	Wijaya & Handayani	2021
10.	Pengaruh Model POGIL, Hasil Belajar Siswa, Titrasi Asam Basa	Memah et al.	2020
11	Pengaruh Model POGIL, Pemahaman Konsep Fisika	Dani & Qurana	2022

Analysis results of effect size based on education level and learning materials that can improve students' cognitive aspects

In the study of analysis data from 11 research journals, there were differences in the learning outcomes scores for implementing POGIL in experimental and control classes. Based on the data, there are some researchers who do not use a control class because the type of experimental method used is a posttest only control design and some researchers do not include pretest or posttest scores in their research. The results obtained regarding student learning using the POGIL learning model in the cognitive domain show differences in pretest and posttest results in each study. The learning results that students obtained showed a change in student learning outcomes between the results of the posttest and pretest.

This result of student learning with POGIL learning model related to the results of meta-analysis research on these 11 journals, which showed changes in posttest and pretest results.

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Based on the data, there is a comparison of the percentage of posttest and pretest in the experimental class with the POGIL model. In the cognitive domain, it shows an increase in learning outcomes starting from the lowest 9.43% to the highest 37.18% with an average of 19.85%. Student learning outcomes at the next point also experienced an increase, which can be seen in the data in Table 2.

Table 2. Analysis results of effect size based on education level and learning materials that can improve students' cognitive aspects

A	Level	Subject	Experiment (%)			Control (%)		ES	Category
			Pretest	Posttest	Δ	Pretest	Posttest		
A1	SHS	Biology	33,11	70,29	37,18	31,89	69,78	0,067	Strong
A2	SHS	Chemistry	42,00	74,67	32,67	-	-	2,690	Very Strong
A3	JHS	Science	63,44	78,20	14,76	54,40	57.40	1,802	Very Strong
A4	JHS	Science	44,16	76,54	32,38	30,64	63,22	0,695	Strong
A5	SHS	Chemistry	74,04	83,47	9,43	-	74,04	1,290	Very Strong
A6	JHS	Science	42,30	76,60	34,30	39,90	53,20	1,755	Very Strong
A7	JHS	Science	63,44	78,20	14,76	54,40	57,40	1,802	Very Strong
A8	ES	Science	73,58	87,00	14,80	72,63	81,44	0,733	Strong
A9	ES	Science	73,58	87,00	13,42	72,63	81,44	0,733	Strong
A10	SHS	Chemistry	71,53	81,80	10,27	-	71,53	1,124	Very Strong
A11	SHS	Physics	62,50	76,40	13,90	-	62,50	2,096	Very Strong

A: Article, Δ: Difference, ES: Effect Size

Analysis results of effect size value based on research year

Based on the effect size calculation based on research year, it showed the largest result was obtained, namely 2.690, which shows that the POGIL learning model is very strong, which can have a very big influence on the cognitive aspects of science learning in 2018. Also, in the calculation of the effect size based on research year, the smallest result was obtained, namely amounting to 0.733, which shows that the POGIL learning model can have a big impact on the cognitive aspects of science learning in 2021 which can be seen in the data in Table 3. This is in accordance with previous research conducted by Manampiring et al. (2019) shows that implementing the POGIL learning model in the classroom can improve students' cognitive aspects.

Table 3. Analysis results of effect size value based on research year

Article Amount	Year of Publication	Effect Size Value	Category
1	2018	2,690	Very Strong
2	2019	1,523	Very Strong
1	2020	1,124	Very Strong
1	2021	0,733	Strong
2	2022	1,165	Very Strong
4	2023	1,091	Very Strong

Analysis results of effect size value based on educational level

Student learning outcomes do not always improve significantly when using the POGIL learning model every year. Based on Table 3, it shows that the use of the POGIL learning model experienced a decrease in value in 2019 by 45.99% from the previous increase in 2017 of 55.00%. Many factors influence this, such as student activities, teachers, teaching strategies or methods, learning tools, and evaluation (Sinambela, 2008). The fourth result of this research is the effect size value

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obtained by reviewing based on educational level. The levels of education available include elementary school (ES), junior high school (JHS), and senior high school (SHS) (Table 4).

The effect size values obtained are different at each level of education, where the Junior High School (JHS) education level has the highest effect size figures. The effect size at the junior high school level is 1.514. This indicates that the use of the POGIL model in science learning at junior high school level has a very strong influence. The Senior High School (SHS) level has the same criteria as Junior High School (JHS). High school level has an effect size of 1.454. The elementary school (ES) level has the smallest effect size number among the other levels. The elementary school level has an effect size of 0.484 (Table 4). This means that the POGIL model has a modest influence on science learning at the elementary school level. An effect size with a very high category can improve critical thinking skills. According to Dwijananti & Yulianti (2010), students are accustomed to using critical thinking habits when completing lesson assignments. This finding is in line with the theory which states that critical thinking habits gradually have a tendency to make children more interested in looking at the world around them with curiosity and finding meaning in it.

Table 4. Analysis results of effect size value based on educational level

Article Amount	Educational Level	Effect Size Value	Category
5	SHS	1,454	Very Strong
4	JHS	1,514	Very Strong
2	ES	0,484	Poor

Analysis results effect size value based on subjects

The next result of this research is that the effect size value obtained is reviewed based on POGIL which is implemented in several subjects in science learning. These learning subjects are Science, Biology, Chemistry and Physics (table 5). The most frequently obtained articles were about science subjects with six articles and the least was one article about physics. The subject that has the highest effect size number is the physics subject of 2.096. This shows that the POGIL model has a very strong influence on physics subjects. The subject that has the lowest effect size is biology at 0.067. This shows that POGIL has a strong category for Biology subjects based on the articles studied (Table 5).

Table 5. Analysis results effect size value based on subjects

Article Amount	Subject	Effect Size Value	Category
6	Science	1,170	Very Strong
1	Biology	0,067	Strong
3	Chemistry	1,702	Very Strong
1	Physics	2,096	Very Strong

CONCLUSION

Based on the analysis of meta-analysis studies that have been carried out using 11 research subjects, there is an influence of the POGIL learning model which can improve students' cognitive aspects starting from the lowest 9.43% to the highest 37.18% with an average of 19.85%. The results of the effect size analysis show that the POGIL learning model has a very strong category, namely 1,794. Based on the educational level aspect, the POGIL learning model has a very strong effect size at the high school and middle school levels and a strong category at the elementary

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school level. Based on the research year aspect, student learning outcomes do not always improve significantly when using the POGIL learning model every year. This shows that there is an influence of the POGIL learning model in improving students' cognitive aspects in science learning. POGIL learning model research on cognitive aspects based on education level and year of research is still limited to 11 research subjects, the more research subjects will provide stronger data for meta-analysis research. Researchers can increase the number of articles for meta-analysis research. Future researchers can strengthen the number of articles to add meta-analysis studies to obtain stronger data. This research shows that there is an influence of the POGIL learning model which can be used as an option to improve students' cognitive aspects in science learning.

REFERENCES

Cohen, L., Manion, L., & Morrison, K. (2020). *Research methods in education (6th ed.)*. Routllege Falmer.

Dani, A. U., & Qurana. (2022). Pengaruh model pembelajaran process oriented guided inquiry learning terhadap pemahaman konsep fisika. *JPF (Jurnal Pendidikan Fisika) Universitas Islam Negeri Alauddin Makassar*, *10*(1), 56–60.

Devi, E. K., Sulistri, E., & Rosdianto, H. (2019). Pengaruh model pembelajaran process oriented guided inquiry learning (POGIL) terhadap kemampuan berpikir kritis siswa pada materi hukum archimedes. *KONSTAN - Jurnal Fisika dan Pendidikan Fisika*, *4*(2), 78–88.

Dwijananti, P., & Yulianti, D. (2010). Pengembangan kemampuan berpikir kritis mahasiswa melalui pembelajaran problem-based instruction pada mata kuliah fisika lingkungan. *Jurnal Pendidikan Fisika Indonesia*, *6*(2), 108–114.

García-Carmona, A. (2020). From inquirybased science education to the approach based on scientific practices: A critical analysis and suggestions for science teaching. *Science & Education*, *29*(2), 443–463.

Handayani, S. Y., Aprinawati, I., Kusuma, Y. Y., Muffarizudin, M., & Ananda, R. (2022). Penggunaan model pembelajaran POGIL (Process Oriented Guided Inquiry Learning) terhadap hasil belajar sekolah dasar. *Muallimuna: Jurnal Madrasah Ibtidaiyah*, *8*(1), 82–95.

Kurnaeni, N., Sudarto, S., & Ramlawati, R. (2019). Pengaruh model pembelajaran guided discovery terhadap peningkatan hasil belajar IPA peserta didik kelas VII SMP Negeri 15 Makassar (Materi pokok ekosistem). *Jurnal IPA Terpadu*, *3*(1), 1–11.

Kurniawan, D. A., Astalini, A., & Kurniawan, N. (2019). Evaluasi sikap siswa SMP terhadap IPA di kabupaten Muaro Jambi. *Lentera Pendidikan: Jurnal Ilmu Tarbiyah Dan Keguruan*, *19*(1), 124–139.

Mamombe, C., Mathabathe, K. C., & Gaigher, E. (2021). Teachers' and learners' perceptions of stoichiometry using POGIL: A case study in south africa. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(9), 1–11.

Manampiring, G. V., Santoso, I., & Kapahang, A. (2019). Penerapan metode POGIL pada materi konsep mol di kelas X IPA SMA Negeri 2 Langowan. *Oxygenius*, *1*(2), 72–76.

Memah, R. A., Gugule, S., & Gumolung, D. (2020). The effect of process oriented guided inquiry learning (POGIL) model on student learning outcomes in acid bases titration material in SMA Negeri 1 Kakas, Minahasa regency. *Oxygenius Journal of Chemistry Education*, *2*(1), 16–22.

Mufarohah, S. L., & Dwiningsih, K. (2018). The effectiveness of blended learning-oriented LKS with pogil strategy on high school chemical bond subject. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, *3*(2), 53–62.

Mutakinati, L., Anwari, I., & Kumano, Y. (2018). Analysis of students' critical thinking skill of middle school through STEM education project-based learning. *Jurnal Pendidikan IPA Indonesia*, *7*(1), 54–65.

Noviani, N. M. T., Dantes, N., & Suastra, I. W. (2021). Pengaruh pembelajaran saintifik berbasis masalah terhadap hasil belajar IPA ditinjau dari tingkat kemampuan berpikir kritis siswa kelas

DOI: https://doi.org/10.17509/aijbe.v7i1.65514
e-ISSN 2621-7260

V Sekolah Dasar di Gugus II Kecamatan Bangli tahun pelajaran 2018/2019. *PENDASI: Jurnal Pendidikan Dasar Indonesia*, *5*(1), 43–52.

Retnawati, H., Apino, E., Djidu, H., & Kartianom, K. (2018). *Pengantar Analisis Meta*. Parama Publishing.

Santosa, T. A., Razak, A., Lufri, L., Zulyusri, Z., Fradila, E., & Arsih, F. (2021). Meta-analisis: Pengaruh bahan ajar berbasis pendekatan STEM pada pembelajaran ekologi. *Journal of Digital Learning and Education*, *1*(1), 1–9.

Silaban, S., Situmorang, M. V., Silaban, W., & Silalahi, M. V. (2023). Pengaruh model pembelajaran process oriented guided inquiry learning terhadap hasil belajar siswa pada materi struktur dan jaringan tumbuhan. *Tut Wuri Handayani : Jurnal Keguruan Dan Ilmu Pendidikan*, *2*(1), 28–40.

Sinambela, P. N. J. M. (2008). Faktor-faktor penentu keefektifan pembelajaran dalam model pembelajaran berdasarkan masalah. *Generasi Kampus*, *1*(2), 74–85.

Sudartik, S., Sutarto, S., & Budiarso, A. S. (2023). Pengaruh model POGIL terhadap hasil belajar dan kemampuan berpikir kritis siswa SMP. *Tarbiyah Wa Ta'lim: Jurnal Penelitian Pendidikan Dan Pembelajaran*, *10*(2), 121–134.

Sujana, I. W. C. (2019). Fungsi dan tujuan pendidikan Indonesia. *Adi Widya: Jurnal Pendidikan Dasar*, *4*(1), 29–39.

Tarsini, T., & Ningsih, T. (2021). Integrasi pembelajaran IPS dan IPA kelas IV di Madrasah Ibtidaiyah pembina pengamalan agama (MI P2A) Meri Kurtasari Purbalingga. *Jurnal Ilmiah Mandala Education*, *7*(3), 382–388.

Toyo, E., Aji, S. D., & Sundaygara, C. (2019). The effect of POGIL model toward science process skills and physics acquisition of student. *Berkala Ilmiah Pendidikan Fisika*, *7*(3), 157–163.

Wen, C. T., Liu, C. C., Chang, H. Y., Chang, C. J., Chang, M. H., Fan Chiang, S. H., Yang, C. W., & Hwang, F. K. (2020). Students' guided inquiry with simulation and its relation to school science achievement and scientific literacy. *Computers & Education*, *149*, 103830.

Wijaya, S., & Handayani, S. L. (2021). Pengaruh process oriented guided inquiry learning (POGIL) terhadap kemampuan berpikir kritis siswa di sekolah dasar. *Jurnal Basicedu*, *5*(4), 2521–2529.

Yani, A., Haerunnisa, H., & Hikmah, A. N. (2023). Pengaruh model pembelajaran process oriented guided inquiry learning terhadap literasi sains dan hasil belajar kognitif IPA siswa Madrasah Tsanawiyah. *Quagga: Jurnal Pendidikan Dan Biologi*, *15*(1), 87–93.

Yuliastini, I. B., Rahayu, S., Fajaroh, F., & Mansour, N. (2018). Effectiveness of POGIL with SSI Effectiveness of POGIL with SSI context on vocational high school students' chemistry learning motivation. *Jurnal Pendidikan IPA Indonesia*, *7*(1), 85–95.

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