Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

Predict Observe Explain Learning Model : Implementation and Its Influence on Students' Critical Thinking Ability and Learning Outcomes (A Meta-Analysis Study)

Rina Gustina[1], Intan Dwi Hastuti[2*], Muhammad Nizaar[3], Syaharuddin[4]
[1,2*,3] Elementary School Teacher Education, [4] Mathematics Education,
Universitas Muhammadiyah Mataram
***Corresponding Author. Email: intandwihastuti23@gmail.com**

Abstract: This study aims to examine the application of the POE (Prediction, Observation, and Explanation) learning model in Mathematics and Natural Sciences learning in the last 10 years in terms of advantages and constraints in Mathematics and Natural Sciences learning at elementary school, junior high school, and senior high school levels. The research used meta-analysis with a quantitative approach and data collection of Scopus/WoS and SINTA journals literature studies on POE in MIPA learning combined with MIPA materials for elementary school, junior high school, and senior high school. The data collection techniques of this research were (1) searching journal and repository databases, (2) data encoding & tabulation, (3) JASP software inputs, (4) interpretation & conclusion: JASP output, moderator variables. The research results showed that applying the POE learning model had a greater effect on student Learning Outcome than on student Critical Thinking with an effect of 60%. Then based on the education level, the POE model's influence on Critical Thinking and Student Learning Outcome was greater at the senior high school level, and based on the material field, the POE model had a greater influence on the mathematics material field. Then the moderator variable showed a very drastic decrease in the effect of the POE model on the Critical Thinking and Learning Outcome of students in 2018-2022, with a RE value of 47% smaller than the previous year. In addition, we recommend that the POE model is better applied at the high school level than at the elementary and junior high school levels.

Article History
Received: 14-03-2023
Revised: 23-04-2023
Accepted: 19-05-2023
Published: 16-06-2023

Key Words:
Predict Observe Explain; Critical Thinking Skills; Learning Outcome; Mathematics; Natural Sciences.

How to Cite: Gustina, R., Hastuti, I., Nizaar, M., & Syaharuddin, S. (2023). Predict Observe Explain Learning Model : Implementation and Its Influence on Students' Critical Thinking Ability and Learning Outcomes (A Meta-Analysis Study). *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran, 9*(2), 706-718. doi:https://doi.org/10.33394/jk.v9i2.7388

https://doi.org/10.33394/jk.v9i2.7388

Introduction

The learning model is a pattern that has been carefully planned and guides the implementation of learning, starting from the opening, core, and closing activities, as well as learning assessments that are arranged in such a way as to achieve learning objectives (Salsabila et al., 2022). The learning model describes the broadest level of learning practice and contains a learning philosophy orientation, which is used to select and arrange teaching strategies, methods, skills, and learning activities to emphasize one part of learning (Nasrun et al., 2018). So the learning model is very important to be applied during the learning process to achieve effectiveness and success in the learning process.

When the learning process is carried out, it is still found that many teachers or educators have not properly placed the learning model based on the conditions that occur. As a result, it causes problems that affect students' critical thinking skills and the achievement of learning objectives; this is because the learning activities carried out are still teacher-centered, so students tend to be passive (Ratnawati et al., 2020), (Dari & Ahmad, 2020).

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

Critical thinking that students want is a way of thinking where the student can draw rational conclusions about something that is considered the truth (Lusiana & Tuti Zubaidah, 2020), as well as critical thinking skills that use a decision-making technique to solve problems for reasoned and reflective thinking In the sense that students not only look for answers, but more than that, such as asking questions about answers, facts, or existing information (Delita et al., 2022). To achieve this critical thinking ability, in general, there are 5 indicators of critical thinking skills that the teacher must consider, namely: (1) providing simple explanations (elementary clarification); (2) building basic skills (basic support); (3) making inferences (inferring); (4) making further explanations (advanced clarification); (5) organizing strategies and tactics (Islamiyah et al., 2019).

In addition, students are also expected to improve their learning outcomes, which requires a learning method that can improve cognitive abilities and affective and psychomotor abilities (Algiranto, 2018). However, the problem is the low learning outcomes of students; this is because students need to be fully involved in learning and be trained to explore and process information, make the right decisions, and solve problems. Students are only recipients of information, so they make students' thinking skills low. In other words, learning is felt to be less meaningful (Yupani et al., 2013).

Based on the above problems related to the lack of critical thinking skills and student learning outcomes, a learning model that combines students' cognitive, affective, and psychomotor abilities is needed, namely the POE (Prediction, Observation, and Explanation) learning model. The POE learning model was first developed by White and Gunstone (Rini et al., 2018), (Larasati et al., 2018) which aims to reveal students' ability to make predictions (Nur Hayati et al., n.d.), (Ikhfa et al., 2020). The POE model comes from the words Predict, Observe, and Explain (Khilyatin Ula et al., 2022), (Putra Erawan et al., 2022). POE is a learning model that involves students directly in the learning process by conducting experiments to make the knowledge gained more meaningful (Ulya Ulpa et al., 2019), (Nurfadilah et al., 2022). The POE learning model is a learning model that adheres to the theory of constructivism (Amaliyah & Nasrudin, 2019), (Abdillah & Surya Anggara, 2021) and involves students in thinking critically to understand the material to be learned (Ika Inayah et al., n.d.)(Lantik et al., n.d.). In the POE learning model, the first step is the ability to predict, known as the ability to formulate hypotheses (temporary answers). After that, the teacher writes down what the students predict. The teacher asks students, "Why is that?" to answer these questions, the teacher invites students to make observations, namely, making a series of observations through experiments. The teacher guides the students to conduct the experiment and use the data generated to conclude. The conclusions obtained are then matched with the predictions given by the students. If correct, students will be more confident in the concepts they master. However, if the student's prediction is incorrect, the teacher will help the student find an explanation. Thus students can correct conceptual errors themselves (Shofiah et al., 2017).

Applying the POE learning model to aspects of learning at the elementary, junior high, and high school levels is appropriate for improving students' critical thinking skills and learning outcomes. Such research (Linda Ayu Kusumaningsih et al., 2020) showed an increase in the critical thinking ability of grade V elementary school students through the predict observe explain learning model assisted by scrapbook media. It can be seen from

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

comparing the classical completeness of the evaluation test results obtained in the pre-cycle 37%, cycle I 63%, and cycle II 85%. Then the research (Lusiana & Tuti Zubaidah, 2020) stated that by applying the POE learning strategy to statistics material in class VIII SMP, the results showed that students' critical thinking skills through the POE learning strategy reached a good category with a presentation of very good 12%, good 48%, sufficient 36%, and a category of less good 4%. Furthermore, research (Okta Nurfiyani et al., 2019) compared the success of POE learning in class X SMA through experimental and control classes, with an average score of learning outcomes and students' critical thinking skills in the experimental class of 26.41 and 46.64 while the control class was 19.92 and 35.33. Then (Elistiana Safitri*, Kosim, 2019) research shows that the POE learning model applied to the experimental class has a better effect than the conventional learning model applied to the control class. Furthermore, Hasrul's research shows that the application of the Predict-Observe-Explain (POE) learning model can improve the learning outcomes of VIII grade students at SMPN 1 Liukang Tangaya Pangkep based on data exposure and discussion of research results. The learning test results in evidence increased by 100%, with an average learning test score of 82.66, including in the good category. Some of the research results above show that the POE learning model affects learning outcomes and students' critical thinking skills.

Previous research was limited to discussing the effect of applying the POE model in improving critical thinking skills and student learning outcomes in Mathematics and Natural Sciences material limited to one level of education. Therefore, researchers conducted this study to see the comparative level of the influence of the POE learning model in improving critical thinking skills and student learning outcomes in Mathematics and Natural Sciences material fields at the elementary, junior high, and high school levels.

Research Method

This study is a research that summarizes and analyzes data from previous studies, known as a meta-analysis. Researchers collected data by searching for online articles in Scopus/WoS and SINTA journals. They focused on the "POE learning model" as the dependent variable and used "Critical thinking" and "learning outcome" as independent variables. The steps followed in this study were based on the opinion of (Hardina Aldira, siti et al., 2021) and (Wahyuni et al., 2022).

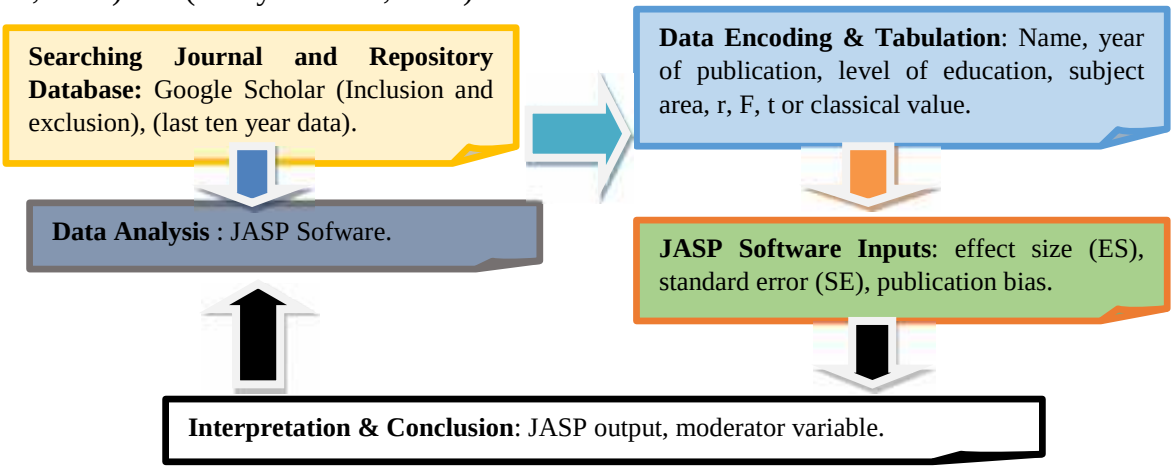

Figure 1. Research Flow Diagram

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

First, researchers collected data from the "Google Scholar" indexer database based on inclusion and exclusion criteria. The inclusion criteria included (1) search keywords, namely "POE learning model" and "Critical thinking", and "Learning outcome"; (2) articles published in 2013-2022; and (3) articles using Indonesian or English. While the exclusion criteria include (1), there is the amount of data (N); (2) education level; (3) material field; (4) there is a correlation coefficient value (r), fisher value (F), t-test value (t) and classical value (k).

The second stage was analyzing data in the form of (1) labeling or numbering articles related to the topic, (2) writing the name of the researcher, the level of education, and the field of education, (3) writing the correlation test value (r), writing the proportional test value (class), and the number of research subjects (N), (4) calculating the effect size (ES) and standard error (SE), (5) conducting data analysis using JASP software (6) analyzing the results found from the articles that become data references (7) writing moderator variables, (8) drawing conclusions and suggestions.

The third stage was calculating the effect size (ES) and standard error (SE) values using the formula from (Mansurah et al., 2021) as follows:

a) Correlation research results (r), fisher (F), and t-test (t)

$$F = t^2 \quad (1)$$

$$t = \sqrt{F} \quad (2)$$

$$r = \frac{t}{\sqrt{t^2+N-2}} \quad (3)$$

$$p = ES = 0{,}5 \times \ln \frac{1+r}{1-r} \quad (4)$$

$$SE = \sqrt{\frac{1}{N-3}} \quad (5)$$

b) Classical Research Results (*k*)

$$p = ES = \frac{k}{N} \quad (6)$$

$$SE = \sqrt{\frac{p(1-p)}{N}} \quad (7)$$

In the fifth stage, the criteria for concluding according to the category of influence level was determined by the Effect Size (ES) and Standard Error (SE) values. ES value categories are according to Table 1.

Table 1. Criteria Effect size (Cohen's, 1988)

Effect Size (ES)	Category
0.00 ≤ ES < 0.20	Very low
0.20 ≤ ES < 0.50	Low
0.50 ≤ ES < 0.80	Medium
0.80 ≤ ES < 1.30	High
1.30 ≤ ES	Very High

The last stage, drawing conclusions from the JASP output results and testing moderator variables to see the level of influence of several other supporting variables.

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

Results and Discussion

The search results from the indexer database obtained as many as 110 publication data based on the last 10 years of research (2013-2022). From this data, complete and incomplete data were obtained. Complete data consists of 70 data, and incomplete data consists of 40 data, with 28 data not having the number of participants (N) and 12 data not having test values (t, F, r, or k). From the 70 complete data, the results of the ES and SE values calculation are as follows.

Table 2. Calculation of ES and SE values

Name	Variable	Level	Field	ES	SE	Category
Study 1	Critical Thinking	JHS	Mathematics	0,79	0,17	Medium
Study 2	Critical Thinking	JHS	Natural Science	0,33	0,17	Law
Study 3	Critical Thinking	SHS	Natural Science	0,13	0,18	Law
Study 4	Critical Thinking	SHS	Natural Science	0,66	0,17	Medium
Study 5	Critical Thinking	JHS	Mathematics	1,15	0,21	High
Study 6	Critical Thinking	JHS	Natural Science	0,24	0,13	Law
Study 7	Critical Thinking	SHS	Natural Science	0,53	0,1	Medium
Study 8	Critical Thinking	SHS	Natural Science	0,19	0,22	Law
Study 9	Critical Thinking	ES	Thematic	0,5	0,13	Medium
Study 10	Critical Thinking	ES	Mathematics	0,44	0,13	Law
Study 11	Critical Thinking	ES	Mathematics	0,23	0,21	Law
Study 12	Critical Thinking	SHS	Natural Science	0,41	0,12	Law
Study 13	Critical Thinking	ES	Mathematics	0,85	0,2	High
Study 14	Critical Thinking	ES	Natural Science	0,5	0,12	Medium
Study 15	Critical Thinking	JHS	Natural Science	0,71	0,23	Medium
Study 16	Critical Thinking	ES	Thematic	0,56	0,13	Medium
Study 17	Critical Thinking	SHS	Natural Science	0,39	0,12	Law
Study 18	Critical Thinking	SHS	Natural Science	0,23	0,28	Law
Study 19	Critical Thinking	ES	Natural Science	0,48	0,16	Law
Study 20	Critical Thinking	SHS	Natural Science	0,66	0,13	Medium
Study 21	Critical Thinking	SHS	Natural Science	0,37	0,13	Law
Study 22	Critical Thinking	JHS	Natural Science	0,14	0,12	Very Law
Study 23	Critical Thinking	ES	Natural Science	0,41	0,15	Law
Study 24	Critical Thinking	SHS	Natural Science	0,98	0,22	High
Study 25	Critical Thinking	SHS	Mathematics	0,15	0,18	Very Law
Study 26	Critical Thinking	ES	Mathematics	0,82	0,21	High
Study 27	Critical Thinking	ES	Mathematics	0,63	0,16	High
Study 28	Critical Thinking	JHS	Mathematics	1,15	0,21	High

Name	Variable	Level	Field	ES	SE	Category
Study 29	Critical Thinking	ES	Natural Science	0,27	0,07	Law
Study 30	Critical Thinking	JHS	Natural Science	0,54	0,17	Medium
Study 31	Critical Thinking	SHS	Natural Science	0,9	0,13	High
Study 32	Critical Thinking	SHS	Natural Science	0,33	0,13	Law
Study 33	Critical Thinking	JHS	Natural Science	0,64	0,12	Medium
Study 34	Learning Outcome	ES	Mathematics	0,98	0,2	High
Study 35	Learning Outcome	JHS	Natural Science	1,31	0,33	Very High
Study 36	Learning Outcome	SHS	Natural Science	0,33	0,18	Law
Study 37	Learning Outcome	SHS	Mathematics	0,31	0,2	Law
Study 38	Learning Outcome	ES	Natural Science	0,13	0,24	Very Law
Study 39	Learning Outcome	SHS	Natural Science	0,36	0,14	Law
Study 40	Learning Outcome	ES	Mathematics	0,26	0,2	Law
Study 41	Learning Outcome	JHS	Natural Science	0,33	0,2	Law
Study 42	Learning Outcome	SHS	Natural Science	2,26	0,13	Very High
Study 43	Learning Outcome	JHS	Natural Science	0,88	0,14	High
Study 44	Learning Outcome	JHS	Natural Science	0,38	0,12	Law
Study 45	Learning Outcome	SHS	Natural Science	0,5	0,13	Medium
Study 46	Learning Outcome	SHS	Natural Science	0,59	0,18	Medium
Study 47	Learning Outcome	SHS	Natural Science	0,14	0,37	Very Law
Study 48	Learning Outcome	SHS	Natural Science	1,64	0,13	Very High
Study 49	Learning Outcome	JHS	Natural Science	0,84	0,16	High
Study 50	Learning Outcome	SHS	Natural Science	0,82	0,19	High
Study 51	Learning Outcome	ES	Natural Science	0,72	0,21	High
Study 52	Learning Outcome	JHS	Natural Science	0,87	0,19	High
Study 53	Learning Outcome	JHS	Natural Science	0,48	0,12	Law
Study 54	Learning Outcome	SHS	Natural Science	1,59	0,15	Very High
Study 55	Learning Outcome	ES	Natural Science	0,93	0,33	High
Study 56	Learning Outcome	SHS	Natural Science	0,32	0,16	Law
Study 57	Learning Outcome	SHS	Natural Science	0,91	0,13	High
Study 58	Learning Outcome	SHS	Natural Science	0,24	0,11	Law
Study 59	Learning Outcome	SHS	Natural Science	0,33	0,13	Law
Study 60	Learning Outcome	ES	Natural Science	0,49	0,13	Law
Study 61	Learning Outcome	SHS	Natural Science	0,12	0,17	Very Law
Study 62	Learning Outcome	SHS	Natural Science	0,25	0,11	Law
Study 63	Learning Outcome	SHS	Natural Science	0,26	0,13	Law
Study 64	Learning Outcome	JHS	Natural Science	0,15	0,16	Very Law

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

Name	Variable	Level	Field	ES	SE	Category
Study 65	Learning Outcome	ES	Natural Science	0,53	0,2	Medium
Study 66	Learning Outcome	SHS	Natural Science	0,29	0,14	Law
Study 67	Learning Outcome	ES	Natural Science	0,68	0,07	Medium
Study 68	Learning Outcome	SHS	Natural Science	0,33	0,13	Law
Study 69	Learning Outcome	SHS	Natural Science	2,51	0,12	Very High
Study 70	Learning Outcome	SHS	Natural Science	0,36	0,16	Law
RE MODEL					**0.60 (0.49, 0.70)**	

Note: ES (Elementary School); JHS (Junior High School); SHS (Senior High School)

Table 2 shows that applying the POE learning model in the teaching and learning process considerably influences students' critical thinking skills and learning outcomes, with the acquisition of a RE value of 60% in the moderate category. Furthermore, the researcher will calculate the effect by using the hypothesis and publication bias tests on the data obtained as follows.

Table 3. Hypothesis test

Coefficients

	Estimate	Standard Error	z	P
intercept	0.595	0.056	10.700	< .001

Note. Wald test.

Based on Table 3, it can be seen that there is no publication bias as indicated by the p-value <001.The value of the funnel plot model according to the following Figure 2:

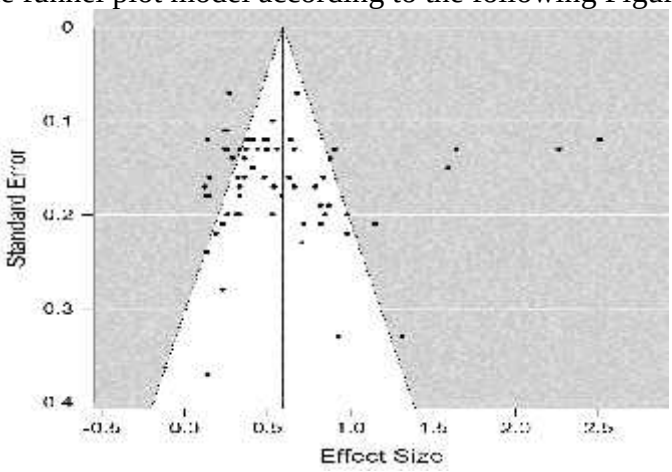

Figure 2. Funnel Plot Standard Error

Figure 2 shows that the shape of the funnel plot is symmetrical, which means that there is no publication bias and the points are above the curve, which means that the ES estimate is accurate, then the overall picture above shows that the points are around the curve, it can be concluded that there is no missing research data.

Table 4. Effect of POE Learning Model based on Variables

Indicator	N	Q-Heterogen	I^2(%)	P – Value	RE
Critical Thinking	34	88.364	65.083	<.001	0.51(0.42,0.60)
Learning Outcome	18	621.712	93.414	<.001	0.66 (0.48, 0.85)

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

Table 4 shows the effect of the application of the POE learning model has a greater effect on student Learning Outcomes than the Critical Thinking ability of students. This can be seen from the RE value of the effect of the POE learning model on Learning Outcome of 66% versus 1% greater than its effect on student Critical Thinking of 51%.

Effect of POE Learning Model on Students' Critical Thinking Ability based on Education Level

Table 2 shows the effect of applying the POE model on students' critical thinking based on their education level is obtained as follows:

Table 5. Data by education level

Level	N	Q- Heterogeneous	I^2(%)	p-Rank Test	P - Value
Elementary School	19	38.236	46.359	0.723	<.001
Junior High School	17	65.173	77.205	0.033	<.001
Senior High School	49	628.695	94.227	0.727	<.001

Table 5. shows the effect of POE learning model on Critical Thinking and Learning Outcome of students based on the level obtained a very large effect at the senior high school level and a very small effect at the elementary school level.

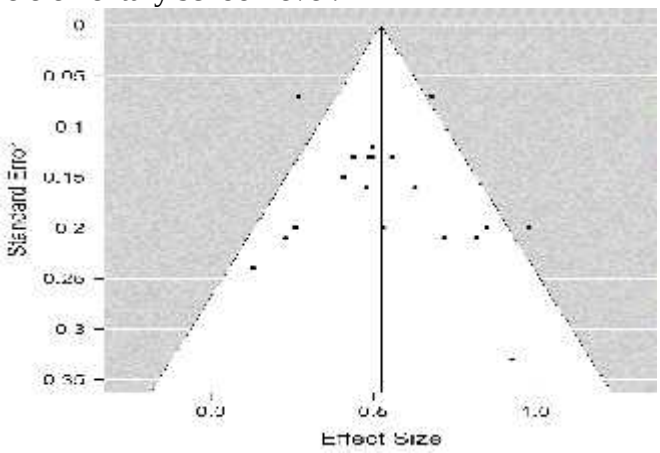

Figure 3. Funnel plot of elementary school level data

From Figure 3 shows the shape of the funnel plot is symmetrical, which means that there is no publication bias and the points are above the curve, which means that the ES estimate is accurate. Then, the overall picture above shows that the points are around the curve, it can be concluded that there is no missing research data.

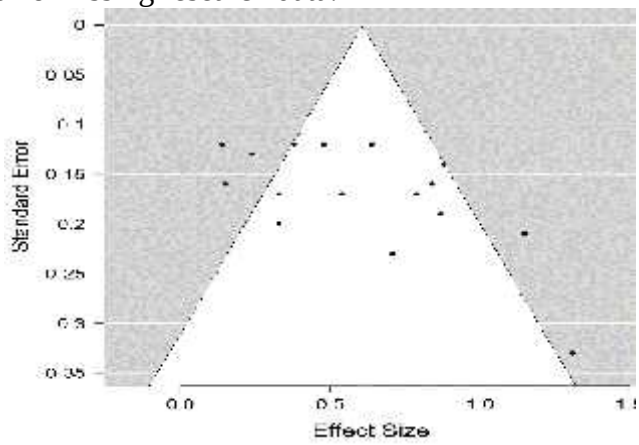

Figure 4. Funnel plot of junior high school data

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index
Vol. 9, No. 2 : June 2023
E-ISSN: 2442-7667
pp. 706-718
Email: jklppm@undikma.ac.id

From Figure 4 shows the shape of the funnel plot is symmetrical, which means that there is no publication bias and the points are above the curve, which means that the ES estimate is accurate, then the overall picture above shows that the points are around the curve, it can be concluded that there is no missing research data.

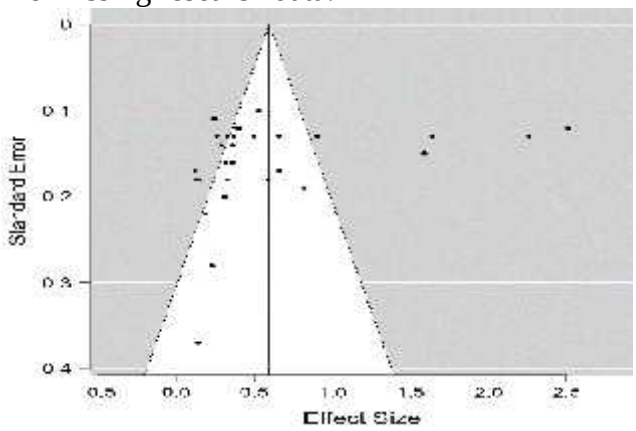

Figure 5. Funnel plot of senior high school data

Figure 5 shows that the shape of the funnel plot is symmetrical, which means there is no publication bias, and the points are above the curve, which means that the ES estimate is accurate. The overall picture above shows that the points are around the curve; it can be concluded that all research data exists.

The Effect of the POE Learning Model on Students' Critical Thinking Skills based on Material Areas

Table 2 shows the effect of applying the POE model on students' critical thinking and learning outcome based on the material field; it is obtained as follows:

Table 6. Data by material field

Field	N	Kendall's	I^2 (%)	P – Value	RE
Natural science	74	0.033	93.606	0.475	0.53 (0.42, 0.63)
Math	80	0.074	91.697	0.690	0.67 (0.40, 0.94)

Table 6 shows the effect of POE learning model on Critical Thinking and Learning Outcome of students is greater in the field of mathematics material with RE value of 67%.

Based on Moderator Variable

Moderator variable analysis is needed to see the classification, year of publication, and amount of data. The results of data analysis using JASP are shown in **Table 7**.

Table 7. Variable Moderator

Variable	Distribution	Estimate	p-Rank Test	RE	Category
Data	< 50	0.572	0.387	0.57 (0.47, 0.68)	Medium
	> 50	0.519	0.286	0.53 (0.36, 0.68)	Medium
Year	2013 - 2017	0.688	0.290	0.69 (0.49, 0.88)	Medium
	2018 - 2022	0.469	0.552	0.47 (0.37, 0.56)	Low

Table 7 shows that a very drastic decrease in the effect of the POE model on Critical Thinking and Learning Outcome of students, namely in 2018-2022 with a RE value of 47% smaller than the previous year.

Discussion

This research provides a breakthrough learning strategy appropriate for educators today in encouraging student interest in learning. It is in line with research (Elistiana Safitri*,

Kosim, 2019), which states that by applying the POE model, the teacher can make students express their initial ideas, motivate students to want to explore concepts and arouse the desire to investigate. POE is also a learning model where the teacher plays a role in exploring students' understanding by asking them to carry out three main tasks, namely prediction (predict), observation (observe), and explanation (Explain) (Shafariani Fathonah, 2016).

The application of POE learning provides findings of an increase in students' thinking skills (Ai Linda Nurmalasari, Asep Kurnia Jayadinata, 2016) and can explore student knowledge (Ula et al., 2022), POE is also an efficient learning model to create student discussions about science concepts. This learning model involves students predicting a phenomenon, making observations through demonstrations, and explaining the results of their previous demonstrations and predictions.

Another finding of this study is that the use of this POE Method, according to (Ponna et al., 2022) has several weaknesses, namely the need for maximum preparation, especially those related to the problems presented and activities carried out in proving the predictions submitted by students, the need for special abilities and skills for teachers so that teachers are required to work professionally, the need for good teacher willingness and motivation for the success of the student learning process.

Conclusion

The results of the above research show that applying the POE learning model has a greater effect on student Learning Outcome than on student Critical Thinking with an effect of 60%. Then based on the education level, the POE model's influence on Critical Thinking and Student Learning Outcome is greater at the senior high school level, and based on the material field, the POE model has a greater influence on the mathematics material field. Then, the moderator variable shows a very drastic decrease in the effect of the POE model on the Critical Thinking and Learning Outcome of students in 2018-2022, with a RE value of 47% smaller than the previous year. It could be due to the emergence of covid-19 in 2020, where teaching and learning activities are online, so the POE model needs to be applied optimally.

Recommendation

We advise teachers to apply the POE learning model in the learning process. Moreover, this learning model goes through three stages: predict, observe, and explain, which can help students improve critical thinking skills and student learning outcomes. Then we suggest that the principal provide a policy to teachers to implement a strategy/model/learning tool to support students' thinking skills and success.

References

Abdillah, C., & Surya Anggara, D. (2021). Analisis pemahaman konsep ipa siswa pada pembelajaran predict-observe-explain ditinjau dari rasa ingin tahu siswa kelas iv sekolah dasar. *Jurnal cakrawala pendas*, *7*(1). 52-61. Https://doi.org/10.31949/jcp.v6i1.2463.

Ai linda nurmalasari, asep kurnia jayadinata, m. (2016). Pengaruh strategi predict observe explain berbantuan permainan tradisional terhadap kemampuan berpikir kritis siswa pada materi gaya. *Jurnal pena ilmiah*, *1*(1), 181–190. ejournal.upi.edu/index.php/penailmiah/article/view/2952/1978.

Algiranto. (2018). Penerapan model pembelajaran poe (prediction, observation, explanation) untuk meningkatkan hasil belajar fisika siswa kelas x 1 sma negeri 1 padang ulak

tanding tahun pelajaran 2016 / 2017. *In quantum: seminar nasional fisika, dan pendidikan fisika*, *25*, 287–292. Seminar.uad.ac.id/index.php/quantum

Amaliyah, m., & nasrudin, h. (2019). Melatihkan keterampilan critical thinking peserta didik melalui strategi predict observe explain (poe) pada materi kesetimbangan natural science kelas xi senior high schooln 11 surabaya training of critical thingking skill s throught the implementation of predict observe explain (poe) strategys on chemical equilibrium for matter class xi senior high schooln 11 surabaya. In *unesa journal of chemical education*, 8 (3). 313-319. Https://ejournal.unesa.ac.id/index.php/journal-of-chemical-education.

Amirullah, g., suciati, r., susilo, s., & handayani, d. (2019). Pengaruh strategi predict observe explain (poe) terhadap kemampuan critical thinking siswa. *Biodik. 5*(2). 173–180. Https://doi.org/10.22437/bio.v5i2.7165.

Dari, f. W., & ahmad, s. (2020). Model *discovery learning* sebagai upaya meningkatkan kemampuan critical thinking siswa elementary school. *Jurnal pendidikan tambusai*. *4*(2). 1469–1479. Https://doi.org/10.31004/jptam.v4i2.612.

Delita, d., rasyid, a., & sugandi, k. (2022). Penerapan model pembelajaran predict observe explain (poe) terhadap keterampilan critical thinking siswa senior high school pada konsep sistem pencernaan manusia. In *mirabilis journal of biology education*. 1(1). 48-57. Https://ejournal.papanda.org/index.php/jm.

Elistiana safitri*, kosim, a. H. (2019). Pengaruh model pembelajaran predict observe explain (poe) terhadap hasil belajar ipa fisika siswa smp negeri 1 lembar tahun ajaran 2015/2016. *Jurnal pendidikan fisika dan teknologi*, *5*(2), 197–204. Https://doi.org/http://dx.doi.org/10.29303/jpft.v5i2.825.

Elselia, helsi. (2021). Penggunaan strategi p.o.e untuk meningkatkan pemahaman siswa pada konsep struktur dan fungsi jaringan tumbuhan. *Jurnal syntax transformation*. *2*(2). 197–203. Https://doi.org/jurnal syntax transformation.

Guna utama, e., lasenior high schoolwan, w., suma, k., study, p., & dasar, p. (2019). Pengaruh model pembelajaran poe (predict, observe and explain) terhadap keterampilan proses sains siswa elementary school kelas v ditinjau dari keterampilan metakognitif. *Jurnal pendidikan dan pembelajaran natural science indonesia.* 9(2). 43-52. Http://ejournal-pasca.undiksha.ac.id/index.php/jurnal_natural science/index.

Hardina aldira, siti, s., sulistina, l., rahmatin, a., & sucipto, lalu. (2021). Adobe flash sebagai media pembelajaran mathematics berbasis android dalam meningkatkan learning outcome: sebuah meta analisis. *Jurnal pemikiran dan penelitian pendidikan mathematics (jp3m)*. *4*(2). 71–80. Https://journal.rekarta.co.id/index.php/jp3m/article/view/459.

Ika inayah, a., aguk wardoyo, a., & jember, u. (n.d.). *Edustream: jurnal pendidikan dasar pengaruh model pembelajaran predict observe explain terhadap higher order thinking skills siswa pada kelas iv sekolah dasar*. Jurnal Pendidikan Dasar. 6(2). 114-119. https://doi.org/10.26740/eds.v6n2.p112-119.

Ikhfa, h, a., priyono, a., prasetyo, b., & subali, b. (2020). Predict-observe-explain strategy with group investigation effect on students' critical thinking skills and learning achievement article info. *Journal of primary education*, *9*(1), 75–83. Https://doi.org/10.15294/jpe.v9i1.29109.

Islamiyah, b. M. W., al idrus, s. W., & anwar, y. A. S. (2019). Pengaruh model pembelajaran predict, observe and explain (poe) terhadap kemampuan berpikir kritis siswa. *Chemistry education practice*, *2*(2), 14. Https://doi.org/10.29303/cep.v2i2.1294.

Khilyatin ula, f., khoiri, n., akmalia, h. A., biologi, j. P., sains, f., & teknologi, d. (2022).

Pengaruh predict-observe-explain terhadap higher order thinking skills siswa pada materi plantae. *Jurnal program study pendidikan biologi.* 12(2). 92-101. Https://doi.org/10.15575/bioeduin.v12i2.20121.

Lantik, v., yudhawardana, h., & fangidae, n. G. (2019). Perbedaan kemampuan critical thinking siswa setelah penerapan model pembelajaran search solve create and share (sscs) dan predict observe explain (poe) dengan metode reflective thinkingdalam pembelajaran fisika. *Jurnal mathematics & ilmu pengetahuan alam.* 19(1). 80-91. Http://jurnalfkipundana.id/.

Larasati, l., poerwanti, j. I. S., & surya, a. (2018). Improved critical thinking skills on science learning by appllyng the predict, observe, explain (poe) model. *Social, humanities, and educational studyes (shes): conference series*. *1*(1). 403–413. Https://doi.org/10.20961/shes.v1i1.23440.

Linda ayu kusumaningsih, fakhriyah, f., & roysa, m. (2020). Penerapan model predict observe explain berbantuan media scrapbook untuk meningkatkan kemampuan berpikir kritis siswa sd. *Progres pendidikan*, *1*(3), 185–192. Https://doi.org/10.29303/prospek.v1i3.24.

Lusiana, l., & tuti zubaidah, dan. (2020). Kemampuan critical thinking siswa melalui strategi pembelajaran prediction-observation-explanation (poe) di kelas viii junior high schooln 18 banda aceh. *Jurnal ilmiah mahasiswa pendidikan mathematics*. *5*(1). 25–32. Https://jim.unsyiah.ac.id/pendidikan-mathematics.

Mansurah, r., wahyuningsih, s., insani, n., & syaharuddin. (2021). Meta-analisis: model kooperatif two stay two stray terhadap learning outcome. *Elementary*. *4*(2). 97–102. Http://journal.ummat.ac.id/index.php/elementary.

Nasrun, n., faisal, f., & feriyansyah, f. (2018). Pendampingan model pembelajaran inovatif di sekolah dasar kecamatan medan selayang kota medan. *Jurnal pengabdian kepada masyarakat*. *24*(2). 671. Https://doi.org/10.24114/jpkm.v24i2.10359.

Nur hayati, m., aji fatkhurrohman, m., & kunci, k. (n.d.). Jurnal pendidikan mipa pancasakti pengaruh poe berbasis blended learning terhadap high order thingking skill (hots) peserta didik smp. *Online) jpmp*, *4*(1), 1–11. https://e-journal.upstegal.ac.id/index.php/jpmp/article/view/1516.

Nurfadilah, n., asra, r., & syaiful, s. (2022). Pengaruh model pembelajaran predict observe explain dan motivasi terhadap higher order thinking skills siswa pada mata pelajaran biologi smpn 9 merangin. *Biodik*, *8*(2), 181–190. Https://doi.org/10.22437/bio.v8i2.12064

Okta nurfiyani, i., suharsono, s., & faisal mustofa, r. (2019). Pengaruh model pembelajaran poe(predict-observe-explain) terhadap hasil belajar dan kemampuan berpikir kritispeserta didik pada konsep keanekaragaman hayati. *Biosfer : jurnal biologi dan pendidikan biologi*, *4*(2), 67–72. Https://doi.org/10.23969/biosfer.v4i2.1928

Ponna, a. S. A., suratman, a., & sugilar, h. (2022). Kemampuan berpikir kritis melalui metode predict-observe-explain berbantuan aplikasi kahoot. *Jurnal perspektif*, *6*(1), 41. Https://doi.org/10.15575/jp.v6i1.166.

Putra erawan, r., solikha, atus, sa, s., arum listyowati, h., sunan gunung djati bandung, n., pendidikan biologi, p., & islam negeri sunan gunung djati bandung, u. (2022). Analisis keterampilan critical thinking menggunakan model pembelajaran poe berbantu liveworksheets pada materi perubahan lingkungan. *32*(2).109-114. Https://doi.org/10.24235/ath.v%vi%i.11802.

Ratnawati, d., handayani, i., & hadi, w. (2020). Pengaruh model pembelajaran pbl berbantu question card terhadap kemampuan berpikir kritis matematis siswa smp the influence

of pbl model assisted by question card toward mathematic critical thinking in jhs. *Jurnal pendidikan matematika*, *10*(01), 46.https://doi.org/10.22437/edumatica.v10i01.7683.

Rini, a. P., suryani, n., & fadhilah, s. S. (2018). *Development of the predict observe explain (poe)-based thematic teaching materials articl e in fo abstract*. International Journal of Educational Research Review. 1(4). 1-7. https://doi.org/10.24331/ijere.458067

Salsabila, marina, n., marhamah, & arafat lubis, m. (2022). Implementasi model pembelajaran poe di sekolah dasar. *Dirasatul ibtidaiyah*. *2*(1). 27–42. Https://doi.org/https://doi.org/10.24952/ibtidaiyah.v2i1.5615.

Shafariani fathonah, f. (2016). Penerapan model poe (predict-observe-explain) untuk meningkatkan keterampilan membaca pemahaman siswa kelas iv sekolah dasar. *Jurnal pendidikan guru sekolah dasar*, *1*(1), 171–178.https://doi.org/10.17509/jpgsd.v1i1.9070.

Shofiah, 1)ria inayatush, bektiarso, 1)singgih, & supriadi, 1)bambang. (2017). Penerapan model poe (predict-observe-explain) dengan metode eksperimen terhadap hasil belajar ipa dan retensi siswa di smp. *Jurnal pembelajaran fisika*, *vol 6*(no. 4), hal 356–363. 6227-301-12667-1-10-20171214.pdf.

Ula, f. K., khoiri, n., & akmalia, h. A. (2022). *Pengaruh predict- observe-explain terhadap higher order thinking skills siswa pada materi plantae*. Jurnal bioedoin. *0417*(2), 92–101. https://journal.uinsgd.ac.id/index.php/bioeduin/article/view/20121.

Ulya ulpa, s., hidayat, s., nuraini, n., biologi, p., keguruan, f., pendidikan, i., palembang, u. M., yani, j. A., palembang, u., & selatan, s. (2019). *P*emberdayaan kemampuan critical thinking siswa kelas viii melalui model pembelajaran predict observe and explain (poe) empowerment of students' critical thinking ability in grade viii through poe (predict observe and explain) learning model, 3(1).43-48. Http://jurnal.um-palembang.ac.id/index.php/dikbio.

Wahyuni, s., ibrahim, m., ratu, h., & negara, p. (2022). Sebuah meta-analisis : metode support vector machine dan modifikasinya dalam peramalan time series data. *Seminar nasional lppm ummat*, *1*, 17–26. Https://journal.ummat.ac.id/index.php/semnaslppm.

Yohansa, m. (2018). Perbandingan kemampuan pemahaman matematis siswa yang diajar menggunakan model predict observe explain dan model novick pada pembelajaran mathematics di junior high school negeri 20 jakarta. *Jurnal mathematics dan pendidikan mathematics*, *3*(1), 33–46. Https://doi.org/https://doi.org/10.31943/mathline.v3i1.81.

Yupani, n. P. E., garminah, n. N., & mahadewi, l. P. P. (2013). Pengaruh model pembelajaran predict-observe-explain (poe) berbantuan materi bermuatan kearifan lokal terhadap hasil belajar ipa siswa kelas iv. *Mimbar pgsd undiksha*, *1*(1), 1–12. Https:// adminjurnal,+334%20(1).pdf.