Studies in Philosophy of Science and Education
Homepage: https://scie-journal.com/index.php/SiPoSE
Email: sipose@scie-journal.com

p-ISSN: 2722-3523; e-ISSN: 2721-9267
SiPoSE, Vol. 4, No. 2, July 2023
Page: 66-76

Effectiveness of POE Learning Model on Science Process Skills in Temperature and Heat of Elementary Students

***N C Uriyah[1], Z A I Supardi[2], Suryanti[3]**
[1]Master of Basic Education Study Program, Faculty of Education, Universitas Negeri Surabaya, Indonesia
[2]Department of Physics, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Indonesia
[3]Basic Education, Faculty of Education, Universitas Negeri Surabaya, Indonesia

Article Info

Article history:

Received May 15, 2023
Revised July 9, 2023
Accepted July 24, 2023
Available Online July 31, 2023

Keywords:

POE
Science process skills
Temperature and heat

ABSTRACT

This research aims to explain the effectiveness of the Predict-Observe-Explain (POE) learning model on elementary students' science process skills on temperature and heat material. This research was conducted on fifth-grade students at SDN Kalirungkut I/264. This research method is a quasi-experiment with a non-equivalent control group research design. The data was collected through test and non-test (observation) techniques. Based on the N-Gains score test, the score in the experimental group was 58.12697%, which is quite effective. Based on the analysis using effect size on experimental and control class students, it is known that the effect size value is 1.131611, which means that learning with the POE model on temperature and heat material has a high influence on students' science process skills. Based on the results of the research conducted, it can be concluded that the POE learning model is more effective than conventional learning of scientific process skills. This research will help students improve their fundamental scientific process skills using the POE model. In prior research, no one has tried to examine the topic of temperature and heat and no one has calculated the effectiveness of the POE model on science process skills using effect size.

https://doi.org/10.46627/sipose

INTRODUCTION

Education is one of the important processes in human life that cannot be separated (Fatmawati & Mariana, 2022). Education allows for a learning process that can improve the quality and quality of a person. The learning process allows educators, students, and learning resources to interact in a learning environment (Government of the Republic of Indonesia, 2015). The learning process is not only about improving students' cognitive, but the learning process also plays a role in changing behavior and thinking skills for the better. The learning process makes students good at dealing with and solving a problem that is being faced by students.

The purpose of learning is that humans can obtain information and knowledge from experiences that have been obtained so that students can have new things and succeed in the learning process (Cindikia et al., 2020). In a learning process, there is interaction between educators, students, and learning resources to obtain information that can achieve learning goals. Students are directed to develop critical, creative, innovative attitudes and behaviors, and the desire to advance Science and Technology (IPTEK) in order to improve quality in line with national education goals (Anggraini et al., 2018). These educational goals must be supported by a good learning process in order to compete competitively and have good quality.

Elementary schools in Indonesia implement the 2013 curriculum which emphasizes three domains, namely attitudes, knowledge, and skills that are achieved through scientific, thematic,

inquiry, and discovery approaches, by producing a work (Minister of Education and Culture, 2016). The scientific approach is designed so that students take an active role in constructing a concept, principle, or law. The process of construction is through the phases of observation, problem formulation, hypothesizing, collecting data, analysis, concluding, then communicating (Hosnan, 2014). In the application of the scientific approach, learning is no longer based on what the teacher should teach, but what students do (Furqani et al., 2018). The learning process changes from teacher-centered to student-centered through active interaction during learning.

Science learning is a content contained in the 2013 curriculum in elementary schools. Teaching by linking material with students' lives is good to do. Students have an awareness that science learning is close to life and important to learn. In science learning, students can be given the opportunity to make a hypothesis, observe, and conclude which is useful for building the necessary skills, so that students feel the need to learn it. Based on interviews with teachers at SDN Kalirungkut I/264, science topics such as temperature and heat are considered difficult subjects for students. This can be seen from the average student score on the material is only 53.75. Similar to other science topics, temperature and heat require not only a basic understanding of what temperature and heat are but also complex thinking to understand what they affect and how they change. In learning activities, teachers do not maximize the active participation of students, so their role and involvement tend to be passive in the classroom (Lolotandung et al., 2017). In essence, teachers are authorized to develop learning activities that are relevant to student needs, real school conditions, and connect students to the environment (Suprapto et al., 2021).

The learning process can be done well if students can experience themselves directly because through this method, students get real experience and complete knowledge (Azizah et al., 2016). Science is a subject that requires direct application of the process, but teachers still minimize the involvement of students. A teaching approach that allows students to undergo the process of discovering a concept as a science process skill is called process skills (Yulianti et al., 2018). Science process skills are used in order to develop science teaching competencies. Optimizing the teaching and learning process through the application of scientific methods can develop the ability to understand, develop, and discover science (Nuraini et al., 2014).

Science learning in elementary school is done by observing what happens, trying what is observed, using new knowledge to predict what will happen, and testing that these predictions are correct (Samatowa, 2006). This is in accordance with the syntax of the POE learning model, where students are asked to make predictions about what will be observed, test what is observed, then confirm predictions through trials that students have done. Science process skills play an important role in the progress of society because they contribute to the emergence of new knowledge and technology (Sholahuddin et al., 2020). Mastery of science process skills of students in Indonesia shows low results. Previous research examined as many as 43.48% of students in Jambi had low science process skills profiles, 30.43% were moderate, and 26.09 were classified as high (Sukarno et al., 2013). The overall science process skills of elementary school students in Sumedang Regency are still low because they have an average KPS score of 9.8 and as many as 49.7% of students in Sumedang are categorized as having low science process skills (Rahayu & Anggraeni, 2017). In order for students to construct their understanding, science process skills must be developed. This is the gap with the reality of the low science process skills of students so that students cannot construct their understanding. It is hoped that the science process skills of students will increase by the way students can be actively involved in learning activities so that they can construct their understanding and practice higher-level thinking skills.

In the 2013 curriculum, mastery of science process skills is described in the basic skills of core competency 4, namely skills (Widayanti, 2016). Building understanding to improve students' science process skills can be done through an activity, namely practicum activities. Students are expected to build their knowledge through practical experience in learning through practicum activities (Yulianti et al., 2018). The knowledge that is built based on experience with the constructivism approach is expected to improve science process skills. The constructivism approach makes the cultivation of concepts in the learning carried out more meaningful.

Teachers can use learning models that embed concepts through the constructivism approach. One of the models that can be used to instill concepts in students is POE. White & Gunstone in 1992 developed the POE model as a model that can bring up and explain students' ideas in learning (Kearney et al., 2001). In the POE learning model, students are asked to make predictions, make observations, and explain the results of observations by comparing predictions and observations made (Ozedmir et al., 2011). The POE model is constructivist, freedom is given to students to think about the problems posed, then asked to think, practice and look for explanations to build their own knowledge (Suparno, 2013).

The POE model can be used to increase active student participation to construct their understanding. Students are asked to make predictions about a phenomenon to be studied whose material is close to students' lives. Furthermore, students are asked to make observations when conducting practicum or experiments through discussion and cooperation activities that are useful for collecting supporting data. At the explanation stage, students can conclude by linking the results of experiments and predictions made, besides that, they can also work on questions given by the teacher (Syamsiana et al., 2018).

Previous studies have stated that the application of the POE learning model affects not only critical thinking skills and learning activities of Class X MIPA, but also critical thinking skills and learning activities (Astuti et al., 2023). There is an increase in the learning activity in environmental pollution material with the application of the POE model characterized by an increase in the average value of each indicator in the experimental class, students' higher-order thinking skills have also increased because the post-test value in the experimental class is higher than the control class, and through the application of the POE model students give a positive response in the learning process of environmental pollution material in class XI IPA (Alfarizi et al., 2023). Application of the POE learning model had a significant impact on the science learning outcomes of grade 4 students at MIS Al-Fitrah Kupang, with the mean score of the experimental class being 12.06 points higher than the mean score of the control class (Muhsam, 2023).

Science process skills with heat and its transfer material can be improved through the POE model (Rozana et al., 2018). Using heat material, the POE model can be used to train science process skills (Sinulingga et al., 2015). The science process's coordination system material skills are positively impacted by the POE model (Yulianti et al., 2018). Students taught using the POE model have a positive difference in process skills compared to those using conventional models (Utama, 2019). In prior research, no one has tried to examine the topic of temperature and heat and no one has calculated the effectiveness of the POE model on science process skills using effect size. Many previous studies used class action research without calculating the effectiveness of the POE model.

Learning using the POE model is suitable for application in science subjects, such as temperature and heat material. Temperature and heat material are one of the materials that students encounter very often in everyday life. Students can learn to predict, observe and draw conclusions using the concepts of temperature and heat. Students can also use the POE model for first-hand learning experience as they develop their skills in the scientific process. The purpose of this study is to illustrate the effectiveness of the POE learning model for elementary school students' scientific process competencies related to temperature and heat materials, building on existing research. Researchers try to see the effect of the POE model on science process skills, whether it is effective if applied to temperature and heat material, especially for fifth grade elementary school students.

RESEARCH METHOD

This research method is a quasi-experiment with a non-equivalent control group research design. Both class groups were given the same learning (learning objectives, materials, time, evaluation). The difference lies in the application of the learning model used. The conventional model was used as a treatment in the control class to be used as a comparison with the POE model.

At the beginning of the meeting, they were given a pretest to determine the initial condition of science process skills. After the results were known, researchers gave treatment in the form of

applying the POE learning model and conventional model. To find out the final condition after the treatment, a posttest was conducted.

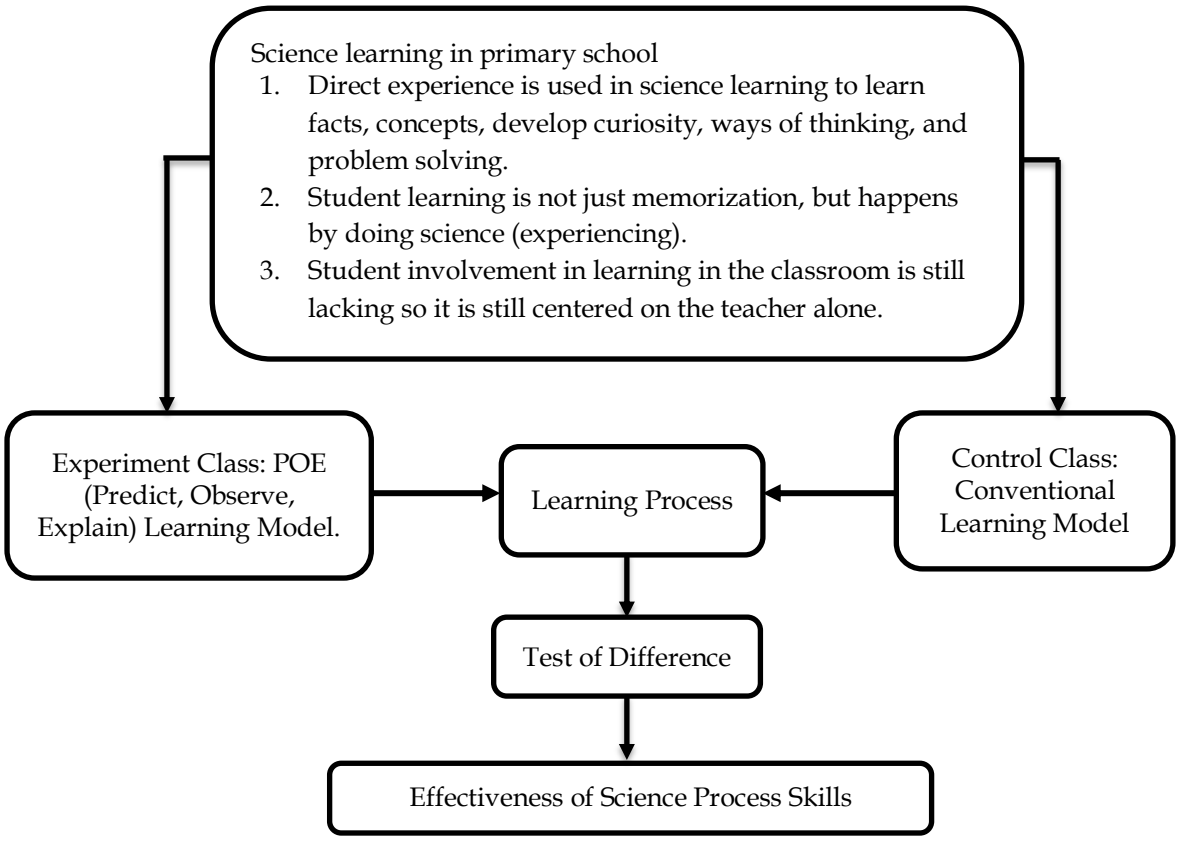

Figure 1. Frame of mind

120 fifth-grade students from SDN Kalirungkut I/264 Surabaya City in the even semester of the 2022/2023 school year made up the sample for this study. 60 students from the fifth grade were placed in the experimental group and 60 students in the control group. Purposive sampling was chosen as the sampling technique in the study. This sampling technique is based on the consideration of the average score of science subjects that are not much different.

In the initial phase, syllabuses, lesson plans, student worksheets, observation sheets, and questions on scientific process skills were developed in multiple-choice question format. The research instruments were validated by 3 material experts. Furthermore, the science process skills questions were validated for grade VI students who had received temperature and heat material. If the significance value is less than 0.05, we can conclude that each question item is declared valid. Furthermore, questions that have been valid are tested for instrument reliability using the SPSS for windows programs with the split half formula.

Furthermore, it is tested for differential power, to determine the magnitude of the differential power index, it must be separated between upper group students (highest score) and lower group students (lowest score). A question has been considered to meet the requirements if it has a differentiating index of at least 0.20 (Masyhud, 2018). The question was then tested for question difficulty. A test item is considered to meet the requirements, if it has a difficulty index between 10% - 90%.

When determining the type of statistical data analysis to be used, t normality and homogeneity tests were first performed as prerequisites. After the prerequisite test is completed, hypothesis testing is then carried out. A normality test is performed to determine if the obtained data are normally distributed. Researchers use his SPSS program for Windows, namely Shapiro Wilk. If the Shapiro-Wilk significance is greater than α (sig > 0.05), we accept Ho and conclude that the data are normally distributed. Homogeneity test is used to determine whether the two groups of data have the same variety. The SPSS for windows program, Levene's with α = 0.05,

was used by researchers in testing homogeneity. If the significant value of F is greater than α (sig>0.05), it can be concluded that the respondent groups have similar variances (homogeneous).

Hypothesis testing was carried out with an independent t-test using the SPSS for windows program. Quantitative data obtained is the test results of students' science process skills during pretest and posttest. The decision-making guidelines for hypothesis testing are as follows.

Ha: There is a difference in science process skills in classes that use the POE learning model and classes that are taught with conventional models.

Ho: there is no difference in students' science process skills in classes that use the POE learning model and classes that are taught with conventional models.

After independent t-tests, N-gain tests were performed to further determine effect sizes. Effect sizes in research are used to determine the impact of using her POE model in learning on students' science process skills. The effect size in this study was calculated using Cohen's formula.

RESULTS AND DISCUSSION

Based on the validation of the syllabus, the average value of syllabus validation from the three validators is 90.3 (very valid). The validation of the lesson plan obtained the average value of the lesson plan validation from the three validators is 93.5 (very valid). In the validation of student worksheets, the average value of validation from the three validators is 94.6 (very valid). The average value of validation of science process skills questions from the three validators is 92.4 (very valid).

At the beginning of the validation test, there were 30 questions, then after testing the validity and reliability of the science process skills questions using SPSS 26, 22 valid and reliable questions were obtained for use in research. After that, the difference test and the test of the difficulty level of the question were carried out. Next, the research data in the form of pretest and posttest were tested for normality.

Table 1. Test of normality

Class		Shapiro-Wilk		
		Statistic	Df	Sig.
Science process skills	Experiment group	.974	60	.234
	Control group	.965	60	.081

It is known that the normality test of multiple-choice tests (science process skills) obtained the significance value of the Shapiro Wilk test of normality in the pretest and posttest of the experimental group was 0.234, while in the pretest and posttest in the control group was 0.081 with a significance level of 0.05. From this we can conclude that the data used are normally distributed as the significance value is greater than α (sig > 0.05).

Table 2. Test of homogeneity of variance

		Levene Statistic	df1	df2	Sig.
Science process skills	Based on Mean	3.060	1	118	.083
	Based on Median	3.139	1	118	.079
	Based on Median and with adjusted df	3.139	1	114.496	.079
	Based on trimmed mean	3.100	1	118	.081

It can be seen from Table 2 that the homogeneity test on the multiple-choice test (science process skills) using Levene statistics in the experimental and control classes yields a pre-test and post-test score of 0.83, which is significant. From this we can conclude that the sample variants used were homogeneous. From this we can conclude that the sample variants used were homogeneous.

Based on the results of the parametric assumption test consisting of the normality test and homogeneity test, it can be concluded that the research data has met the requirements for hypothesis testing. Hypothesis testing is carried out using predetermined data analysis techniques.

Table 3. T-test results

Group	N	Mean	Std. Deviation	Sig (2tailed)
Experiment	60	26.63	12.430	0.000
Control	60	17.18	9.802	0.000

The sig. value = 0.000 is obtained, which means it is smaller than sig 0.05. So, it can be concluded that there is a difference in the gain score of students' science process skills in the experimental class and the control class. Furthermore, to find out which experimental group or control group has a significant influence on students' science process skills, descriptive analysis was carried out with the following SPSS 26 results.

Table 4. Descriptive analysis results

Group	N	Mean	Std. Deviation	Std. Error Mean
Experiment	60	26.63	12.430	1.605
Control	60	17.18	9.802	1.265

The average value of student process skills gain score in the experimental group was 26.63 and in the control group was 17.18. So, it can be concluded that there is a significant influence on the experimental class using the POE model on improving the science process skills of fifth-grade students of SDN Kalirungkut I/264.

To determine the effectiveness of the use of learning models in experimental classes and control classes, the N-Gain test was then conducted. The results of the N-Gain Score of students of SDN Kalirungkut I/264 are shown in Table 5.

Table 5. N-gain results

Experiment		Control	
Mean N-Gains	58.1269	Mean N-Gains	35.5342
Maximum	90.91	Maximum	71.88
Minimum	0,00	Minimum	-27.78
Std. Deviation	19.76852	Std. Deviation	20.15972
Criteria	Effective enough	Criteria	Ineffective

The N-gains score of the experimental group is 58.12697% and is quite effective in improving students' science process skills. While the N-Gain score in the control group is 35.5342% and is included in the criteria for being ineffective in improving students' science process skills.

Effect size can also be considered as a measure of the success rate of research. The effect size analysis using Cohen's d formula on experimental and control class students shown in the following table.

Table 6. Effect size results

Experiment Group		Control Group	
Mean (*M*)	58.1269	Mean	35.5342
Standard deviation	19.76852	Standard deviation	20.15972
Sample size	60	Sample size	60
Effect size		1.131611 (high)	

Based on the analysis using the effect size calculator for t-test on experimental and control class students, each of which amounted to 60 students, the effect size value was 1.131611. When viewed based on the effect size interpretation table, the value obtained shows that the treatment carried out by researchers has a high influence on the value of students' science process skills. This means that learning with the POE model on temperature and heat material has a high influence on the science process skills of fifth grade students of SDN Kalirungkut I/264.

Both models have an influence on students' science process skills seen from the results of the average post-test scores in the experimental and control groups which both increased. However, after the effectiveness test, it was found that the POE model was quite effective in improving students' science process skills. While the conventional model is not effective in improving

https://doi.org/10.46627/sipose.v4i2.283

students' science process skills, the POE model is proven to be effective in improving students' science process skills (Wibowo et al., 2022). The POE model can be used as a learning model so that students can carry out cognitive thinking activities through the scientific method so as to improve science process skills. This is in line with the statement that the POE learning model has an influence on students' science process skills (Rozana et al., 2018).

In the posttest results in the experimental group, there was an increase in percentage in each aspect. The increase in percentage in the aspects of predicting, observing, and concluding is due to the implementation of the POE learning model in the learning process carried out. In the POE learning model students are actively involved in all forms of learning activities carried out so that students can carry out cognitive thinking activities and in the end, the value in each aspect of science process skills increases. This is in accordance with the opinion that the POE model can be used as a learning model so that students can carry out cognitive thinking activities through the scientific method to improve science process skills (Wibowo et al., 2022).

The increase that occurs in each aspect of students' science process skills is due to the activities carried out in learning that led to the aspects of science process skills tested. In addition, students have also learned to connect the results of predictions and experiments that have been carried out. This is because students actively practice doing an experiment. This is in line with the opinion that the POE Strategy allows students to play an active role in the learning process through the process of predicting, observing, and explaining (Hilario, 2015). Figure 2 is the percentage of observation results regarding students' science process skills.

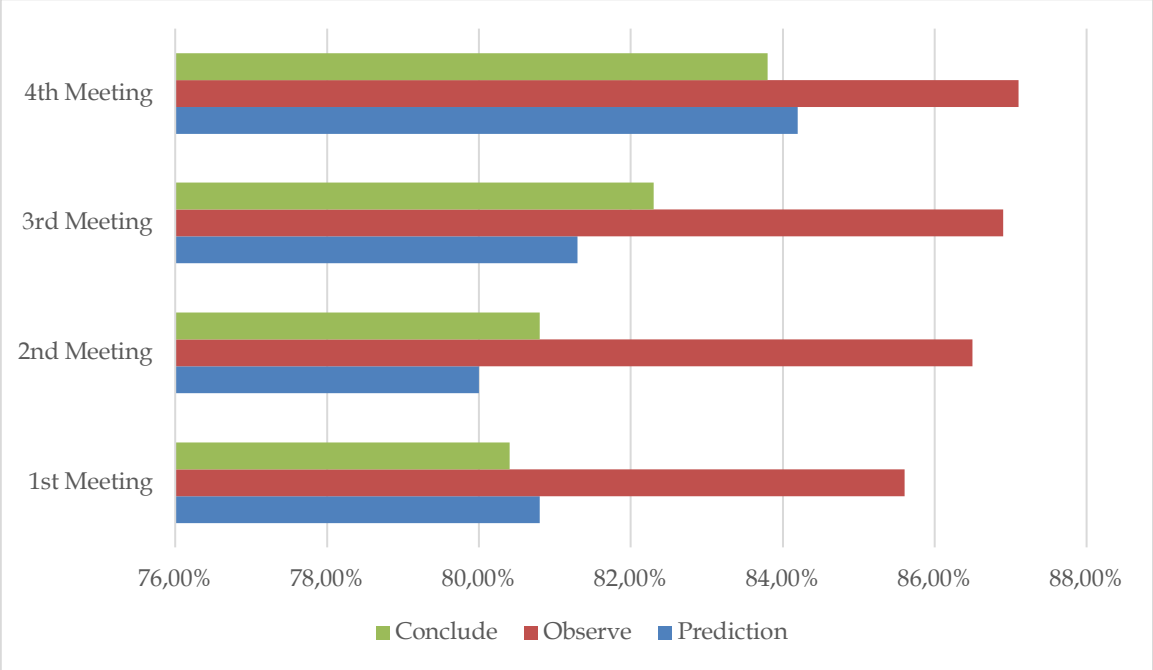

Figure 2. Percentage of observation of science process skills

The average percentage of science process skills from the first meeting to the fourth meeting has increased in each aspect of science process skills obtained from the observation results during the learning process. At the first meeting, students were still confused by the steps on the learner worksheet because students were less familiar with the POE learning model where students had to predict, observe, and conclude. From the second meeting to the fourth meeting, they were getting used to the POE model because students had the experience they had learned in the first meeting. Students became active from the first meeting to the fourth meeting because in the learning activities of the POE model, they could combine their prior knowledge and the new knowledge they gained through the activities in the learner worksheet. This is in line with Adebayo & Olufunke (2015), using the POE model makes students more participatory in learning because students get the opportunity to build and combine prior knowledge with new knowledge.

The application of the POE learning model involves student experience in learning activities, this is because each step can train students' science process skills so that they increase from each meeting. This is in line with the constructivism theory underlying the POE learning model through the process of exploring students' prior knowledge and then interpreting it (Wu & Tsai, 2005). Students' experience in learning by using the POE learning model will last longer because students experience and understand what they learn for themselves, this also makes students more confident in the results of their experiments. The POE learning model can also increase student activity, namely increasing students' ability in experimental activities, increasing the enthusiasm of students who ask and answer in discussions, and increasing students' ability to work on student worksheets. This is in accordance with the opinion that students gain knowledge through exploration with their senses such as seeing, hearing, touching, feeling, smelling, and so on (Widyaningrum et al., 2013).

Based on the results of descriptive analysis, it is known that the average posttest value of students' science process skills in the experimental group and control group has a significant difference. In the experimental group, the average value of students' process skills was 82.58 while in the control group was 70.0 so there was a significant difference between the two groups. One of the causes of students' process skills scores being lower than the experimental class is the lack of student participation in learning activities so that students only remember the material presented by the teacher. This is in accordance with the opinion that states the lack of student roles in learning using the lecture method so that here the role of students is only as passive observers (Asmani, 2011). As for the experimental class, students were actively involved in POE learning through predicting, observing, and explaining activities. This is what causes students' science process skills scores on the post-test to be better than the control class. This is in line with the opinion that prediction activities, observation, and explaining the results of observations will be able to form students' cognitive structures well (Warsono & Hariyanto, 2012).

CONCLUSION

The sig value = 0.000 is obtained, which means it is smaller than sig 0.05. Thus, Ho is rejected and Ha is accepted. So it can be concluded that there is a difference in the gain score value of students' science process skills in the experimental class and the control class. Furthermore, based on descriptive analysis, the average value of students' process skills gain score in the experimental group was 26.63 and in the control group was 17.18. So it can be concluded that there is a significant effect on the experimental class using the POE model on improving the science process skills of fifth-grade students of SDN Kalirungkut I/264. Based on the results of the research, data analysis, and discussion that has been done, it can be concluded that the POE learning model is more effective than conventional learning (lecture method) on the science process skills of fifth-grade students of SDN Kalirungkut I/264 Surabaya City on the material of the effect of heat on changes in temperature and form of objects in everyday life. Based on the N-Gains score of the experimental group of 58.12697%, the criteria is quite effective in improving students' science process skills. Based on the analysis using the effect size calculator for the t-test on experimental and control class students, each of which amounted to 60 students, the effect size value was 1.131611, which means that learning with the POE model on temperature and heat material has a high influence on science process skills in fifth-grade students of SDN Kalirungkut I/264.

Based on the presentation of the research results, several suggestions can be made. Firstly, the POE learning model demonstrates a significant impact on students' science process skills. However, to ensure accurate and consistent analysis results, it is recommended to adjust the research instrument, adhering to the standards of a good instrument with a balanced mix of difficult, moderately easy, and easy questions.

Secondly, elementary level teachers can consider adopting the POE learning model as an alternative to enhance their students' science process skills. However, it is essential for teachers to possess the necessary knowledge, abilities, skills, and competencies to effectively develop and integrate this model into their teaching methods.

Lastly, for future researchers interested in further studies, they can explore and develop research on other science concepts using the POE model. This will help expand our understanding of the model's effectiveness and its potential applications in various educational contexts.

ACKNOWLEDGEMENTS

The researcher would like to thank the school for giving permission to conduct this research activity. The researcher would also like to thank the students for being enthusiastic about carrying out various activities in the research.

REFERENCES

Adebayo, F., & Olufunke, B. T. (2015). Generative and predict-observe-explain instructional strategies: Towards enhancing basic science practical skills of lower primary school pupils. *International Journal of Elementary Education*, *4*(4), 86–92. https://doi.org/10.11648/j.ijeedu.20150404.12

Alfarizi, M. A. S., Maknun, D., & Mulyani, A. (2023). Penerapan model pembelajaran predict observe explain untuk meningkatkan higher order thinking skill siswa pada materi pencemaran lingkungan di SMAN 6 Tambun Selatan. *Jurnal Pendidikan Biologi Indonesia*, 1–8.

Anggraini, N. D., Purwanto, A., & Sakti, I. (2018). Pengaruh model inkuiri terbimbing terhadap keterampilan proses sains siswa pada materi usaha dan energi kelas X IPA SMAN 3 Bengkulu Tengah. *Jurnal Kumparan Fisika*, *1*(8), 20–27.

Asmani, J. M. (2011). *Tips menjadi guru inspiratif, kreatif, dan inovatif*. Diva Press.

Astuti, T. W., Ariyanto, J., & Dwiastuti, S. (2023). Pengaruh model pembelajaran predict observe explain (poe) terhadap kemampuan berpikir kritis dan keaktifan belajar siswa. *Jurnal Penelitian Sains Pendidikan*, *3*(1), 1–14.

Azizah, N., Sujana, A., & Isrok'atun. (2016). Penerapan pendekatan somatis auditori visual intelektual pada materi sumber energi bunyi untuk meningkatkan hasil belajar siswa. *Jurnal Pena Ilmiah*, *1*(1), 491–500.

Cindikia, M., Achmadi, H. R., Prahani, B. K., & Mahtari, S. (2020). Profile of students' problem solving skills and the implementation of assisted guided inquiry model in senior high school. *Studies in Learning and Teaching (SiLET)*, *1*(1), 52–62. https://doi.org/10.46627/silet.v1i1.22

Fatmawati, R. D., & Mariana, N. (2022). Penerapan pembelajaran STEAM melalui aktivitas make a non stop fountain untuk meningkatkan kreativitas siswa di sekolah dasar. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar*, *10*(16), 1248–1260.

Furqani, D., Feranie, S., & Winarno, N. (2018). The effect of Predict-Observe-Explain (POE) strategy on students' conceptual mastery and critical thinking in learning vibration and wave. *Journal of Science Learning*, *2*(1). https://doi.org/10.17509/jsl.v2i1.12879

Government of Republic of Indonesia. (2015). *Peraturan pemerintah republik indonesia nomor 13 tahun 2015 tentang perubahan kedua atas peraturan pemerintah nomor 19 tahun 2005 tentang standar nasional pendidikan*.

Hilario, J. S. (2015). The use of Predict-Observe-Explain-Explore (POEE) as a new teaching strategy in general chemistry-laboratory. *International Journal of Education and Research*, *3*(2), 37–48.

Hosnan. (2014). *Pendekatan saintifik dan kontekstual dalam pembelajaran abad 21*. Ghalia Indonesia.

Kearney, M., Treagust, D. F., Yeo, S., & Zadnik, M. G. (2001). Student and teacher perceptions of the use of multimedia supported predict-observe-explain tasks to probe understanding. *Research in Science Education*, *31*, 589–615. https://doi.org/10.1023/A:1013106209449

Lolotandung, R., Ruminiati, & Atok, A. R. A. (2017). Pendekatan SAVI terhadap keaktifan bertanya dan mengemukakan ide siswa dalam proses pembelajaran. *Prosiding TEP & PDs Transformasi Pendidikan Abad 21 Pascasarjana Universitas Negeri Malang*, 901–907.

Masyhud, M. S. (2018). *Metode penelitian pendidikan*. Lembaga Pengembangan Manajemen dan Profesi Kependidikan (LPMPK).

Minister of Education and Culture. (2016). *Peraturan menteri pendidikan dan kebudayaan nomor 22 tahun 2016 tentang standar proses pendidikan dasar dan menengah*. https://repositori.kemdikbud.go.id/4790/2/Permendikbud_Tahun2016_Nomor022_Lampiran.pdf

Muhsam, J. (2023). Pengaruh model pembelajaran Predict Observe Explain (POE) berbasis media konkret terhadap hasil belajar IPA siswa kelas IV MIS Al-Fitrah Kota Kupang. *Anthor Educational and Learning Journal*, *2*(2), 224–231.

Nuraini, N., Karyanto, P., & Sudarisman, S. (2014). Pengembangan modul berbasis POE (Predict, Observe, and Explain) disertai roundhouse diagram untuk memberdayakan keterampilan proses sains dan kemampuan menjelaskan siswa kelas X SMA Negeri 5 Surakarta (Penelitian dan pengembangan materi pencemaran lingkungan). *Bioedukasi*, *7*(1), 37–43.

Ozedmir, H., Bag, H., & Bilen, K. (2011). Effect of laboratory activities designed based on Prediction-Observation-Explanation (POE) strategy on pre-service science teachers' understanding of acid base subject. *Wastern Anatolia Journal of Educational Science*, 169–174.

Rahayu, A. H., & Anggraeni, P. (2017). Analisis profil keterampilan proses sains siswa sekolah dasar di kabupaten Sumedang. *Jurnal Pesona Dasar*, *5*(2), 22–33.

Rozana, T., Jufrida, & Basuki, F. R. (2018). Penerapan model pembelajaran POE untuk meningkatkan keterampilan proses sains kelas XI SMAN 11 Jambi. *Jurnal Edufisika*, *3*(2), 66–80.

Samatowa, U. (2006). *Bagaimana membelajarkan IPA di Sekolah Dasar*. Depdiknas.

Sholahuddin, A., Yuanita, L., Supardi, Z. A. I., & Prahani, B. K. (2020). Applying the cognitive style-based learning strategy in elementary schools to improve students' science process skills. *Journal of Turkish Science Education*, *17*(2), 289–301.

Sinulingga, P., Hartanto, T. J., & Adwitya, W. (2015). Melatih keterampilan proses sains siswa melalui penerapan model pembelajaran POE (Prediction, Observation, Explanation). *Jurnal Vidya Karya*, *30*(1), 7–14.

Sukarno, Permanasari, A., & Hamidah, I. (2013). The profile of Science Process Skill (SPS) student at secondary high school (Case study in Jambi). *International Journal of Scientific Engineering and Research*, *1*(1), 79–83.

Suparno, P. (2013). *Metodologi pembelajaran fisika konstruktivistik & menyenangkan*. Penerbit Universitas Sanata Dharma.

Suprapto, N., Prahani, B. K., & Cheng, T. H. (2021). Indonesian curriculum reform in policy and local wisdom: Perspectives from science education. *Jurnal Pendidikan IPA Indonesia*, *10*(1), 69–80. https://doi.org/10.15294/jpii.v10i1.28438

Syamsiana, F., Suyatno, S., & Taufikurahmah, T. (2018). The effectiveness of using POE (Predict-Observe-Explain) strategy on students' learning result of reaction rate chapter in SMA. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *7*(2), 1507-15.12. https://doi.org/10.26740/jpps.v7n2.p1507-1512

Utama, E. G. (2019). Pengaruh model pembelajaran POE (Predict, Observe and Explain) terhadap keterampilan proses sains SD kelas V ditinjau dari keterampilan metakognitif. *Jurnal Pendidikan Dasar Indonesia*, *4*(2), 46–52.

Warsono, & Hariyanto. (2012). *Pembelajaran aktif: Teori dan assesmen*. Remaja Rosdakarya.

Wibowo, A. S. B., Suryanti, & Supardi, Z. A. I. (2022). Penggunaan media pembelajaran IPA model POE (Predict Observe Explain) untuk melatih kemampuan HOTS siswa SD. *Edukatif: Jurnal Ilmu Pendidikan*, *4*(4), 6343–6352.

Widayanti, E. Y. (2016). Penguasaan keterampilan proses sains dasar siswa madrasah ibtidaiyah (Studi pada madrasah mitra STAIN Ponorogo). *Kodifikasia*, *9*(1), 171. https://doi.org/10.21154/kodifikasia.v9i1.465

Widyaningrum, R., Sarwanto, & Karyanto, P. (2013). Pengembangan modul berorientasi POE (Predict, Observe, Explain) berwawasan lingkungan pada materi pencemaran untuk meningkatkan hasil belajar siswa. *Bioedukasi*, *6*(1), 100–117.

Wu, Y.-T., & Tsai, C.-C. (2005). Effects of constructivist-oriented instruction on elementary school students' cognitive structures. *Journal of Biological Education*, *39*(3), 113–119. https://doi.org/10.1080/00219266.2005.9655977

Yulianti, S. H., Juanengsih, N., & Mardiati, Y. (2018). POE learning model: The effect on student science process skills on the coordination system concept. *Jurnal Penelitian Pendidikan Sains*, *8*(7). https://doi.org/10.26740/jpps.v8n1.p%25p

Author (s):

* Novita Cahyatul Uriyah (Corresponding Author)
Master of Basic Education Study Program, Faculty of Education,
Universitas Negeri Surabaya,
Jl. Lidah Wetan, Surabaya 60213, Indonesia
Email: novita.19044@mhs.unesa.ac.id

Zainul Arifin Imam Supardi
Department of Physics, Faculty of Mathematics and Natural Science,
Universitas Negeri Surabaya,
Jl. Ketintang, Surabaya 60231, Indonesia
Email: zainularifin@unesa.ac.id

Suryanti
Basic Education, Faculty of Education,
Universitas Negeri Surabaya,
Jl. Lidah Wetan, Surabaya 60213, Indonesia
Email: suryanti@unesa.ac.id