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The Effectiveness of the POE (Predict-Observe-Explain) Learning Model on IPAS Learning Outcomes of Grade V Students

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ABSTRACT

This study aims to investigate the effectiveness of the Predict-Observe-Explain (POE) learning model on the IPAS (Natural and Social Sciences) learning outcomes of Grade V students at SD Negeri 2 Sorong City. A quantitative pre-experimental approach was employed using a One-Group Pretest-Posttest Design, involving 25 Grade V students selected through a saturated sampling technique. Data were collected using a structured observation sheet and a 20-item performance test administered as both pretest and posttest. Instrument reliability was confirmed using Cronbach's alpha, yielding coefficients of 0.603 (pretest) and 0.882 (posttest), both exceeding the minimum threshold of 0.60. The Shapiro-Wilk normality test confirmed that both pretest (sig. = 0.059 > 0.05) and posttest (sig. = 0.706 > 0.05) data were normally distributed. The paired-samples t-test yielded a calculated t-value of 12.850, which exceeds the critical t-value of 2.025 (df = 24, sig. = 0.001 < 0.05). The pretest mean score was 45.55, which increased to 80.00 following the POE intervention. These results confirm that the POE learning model has a statistically significant positive effect on IPAS learning outcomes, demonstrating its effectiveness

as an innovative instructional approach for Grade V elementary school students.

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INTRODUCTION

Education constitutes one of the most fundamental necessities in human life. It represents an essential aspect that must be attended to in the process of human self-development and serves as the cornerstone of both individual growth and societal progress. As defined by the Indonesian National Education System Law (Undang-Undang No. 20 Tahun 2003), education is a conscious and planned effort to create a learning environment and learning process that enables students to actively develop their potential, capabilities, and talents. Education is also broadly understood as a purposeful activity directed toward fully developing human potential both as individual persons and as members of society (Purwanto, 2014; Santrock, 2019).

Education is a conscious and planned effort to realize a learning environment and instructional process through which students are actively enabled to develop their own potential, encompassing spiritual and religious strength, self-discipline, personality, intelligence, noble character, and the skills required by individuals, society, and the nation (Undang-Undang Nomor 20 Tahun 2003). According to Harianto, education constitutes a deliberately and systematically planned endeavor to bring about a learning environment and process through which learners can actively develop their inner potential, cultivating spiritual strength, virtuous character, self-regulation, intellectual capacity, and the practical skills demanded by the wider community.

At the elementary school level, students are generally situated within the concrete operational stage of cognitive development (Piaget), during which they learn most effectively through direct, hands-on engagement with their physical environment. It is at this stage that students must be provided with foundational knowledge and basic skills that will underpin their learning across subsequent educational levels. One subject area of central importance within the Indonesian Merdeka Curriculum at the elementary level (SD/MI) is IPAS (Ilmu Pengetahuan Alam dan Sosial-Natural and Social Sciences). IPAS is an integrative discipline that examines living organisms and inanimate matter within the universe and their interactions, as well as human life as individuals and as social beings in relation to their environment. In its broadest sense, IPAS constitutes a systematic and logical synthesis of various forms of knowledge, organized according to principles of causality (Kamus Besar Bahasa Indonesia, 2016). The integration of natural and social sciences within a unified subject reflects a curricular commitment to holistic, interdisciplinary scientific literacy from the earliest stages of formal education.

Effective learning is contingent upon the coherent integration of all instructional components. When any component fails to function cohesively with the others, the learning process encounters significant obstacles that impede the attainment of learning objectives and optimal learning outcomes (Robiyanto, 2021). Among these components, the teacher occupies a position of particular centrality: learning serves as the primary medium through which human beings develop their potential, adapt to their social environment, and contribute to constructive social change. The strategic importance of education is most fully realized through its role in personality formation and the cultivation of human capital (Izzah et al., 2023). It is therefore essential that teachers are equipped with diverse, research-informed instructional strategies that are responsive to the learning needs and developmental characteristics of their students.

Based on observations and interviews conducted with the Grade V class teacher at SD Negeri 2 Sorong City, the dominant instructional approach employed in IPAS learning was conventional lecture-based teaching. This method is characterized by limited interactivity and low student engagement, conditions that restrict students' opportunities for active exploration and meaning-making. The limited involvement of students in the learning process was identified as a principal factor contributing to suboptimal learning outcomes. These findings prompted the present researchers to seek innovative instructional alternatives capable of enhancing the quality of learning in this context. Lazonder and Harmsen (2016), in a comprehensive meta-analysis of inquiry-based learning research, demonstrate that guided inquiry approaches, in which students are supported in formulating predictions, conducting observations, and constructing explanations, produce significantly superior learning outcomes compared to traditional expository instruction, particularly in science education contexts.

One approach considered particularly promising as a solution to these instructional challenges is the POE (Predict-Observe-Explain) learning model. The POE model is a constructivist instructional framework in which students develop understanding by engaging in three structured sequential activities: predicting (Predict), observing (Observe), and explaining (Explain) phenomena (Putri et al., 2018). The POE model is specifically designed to develop students' predictive reasoning capacity, including the articulation of rationales for their predictions about natural phenomena, as a means of deepening conceptual understanding in science (Sandy, 2018). Coştu (2016) documents that POE-based strategies (and their derivatives) are particularly effective in identifying and addressing student misconceptions in science, confirming that the predict-observe-explain cycle creates productive cognitive conflict that stimulates conceptual restructuring.

The POE learning model encompasses three primary stages: (1) predicting, in which students formulate and record their hypotheses about a phenomenon prior to observation; (2) observing, in which students conduct experiments or direct observations to test their predictions; and (3) explaining, in which students reconcile observed outcomes with their prior predictions and construct evidence-based explanations. The model offers several distinct pedagogical advantages: it stimulates creative thinking by requiring students to articulate and defend predictions; it reduces passive verbalism by engaging students in hands-on experimental activity; it renders learning more engaging and motivating; and it provides students with the opportunity to compare their initial predictions with empirical evidence, thereby strengthening the credibility and durability of their conceptual understanding.

The benefits of the POE model extend further to include its capacity to surface and activate students' prior knowledge through the prediction phase, to stimulate productive discussion between students and between students and their teacher, and to motivate students to investigate concepts not yet fully understood in order to verify the accuracy of their predictions (Shofiah et al., 2017). Research indicates that the POE model promotes critical thinking (Amal & Kune, 2018), enhances scientific process skills (Muna, 2017), and significantly influences students' mental models of scientific phenomena. Suryawati and Osman (2018) further confirm that innovative, contextually grounded instructional approaches, sharing core features with the POE model including active student involvement and scientific inquiry, are effective in developing students' scientific attitudes and improving natural science learning outcomes across diverse school contexts. In the Indonesian elementary school context specifically, Rahmah et al. (2022) document significant improvements in science learning outcomes among Grade IV students following the implementation of the POE model, providing strong empirical grounding for the present investigation at the Grade V level. Fitriani and Asrul (2024) similarly document the effectiveness of guided inquiry approaches, closely aligned in structure with POE—in improving IPAS learning outcomes among Grade V students in the Sorong City elementary school context, providing a directly proximate evidence base for the current study.

This study therefore aims to investigate the effectiveness of the POE learning model on IPAS learning outcomes of Grade V students at SD Negeri 2 Sorong City. The findings are expected to provide evidence-based guidance for elementary school teachers seeking to enhance the quality and outcomes of IPAS instruction through structured, student-centered inquiry learning approaches.

METHODS

This study employed a quantitative approach with a pre-experimental design method. The pre-experimental design (Pre-Experimental Design) was selected on the basis that the study involved a single experimental group without a control group (Sugiyono, 2014). Specifically, the research adopted a One-Group Pretest-Posttest Design, in which a single group of participants was assessed both before (pretest) and after (posttest) the implementation of the POE learning model intervention. This design enables a direct within-group comparison of IPAS learning outcomes before and after exposure to the POE treatment, thereby providing an indicator of the intervention's effectiveness.

Table 1. One-Group Pretest and Posttest Research Design

Pretest	Treatment	Posttest
O_1	X	O_2

Notes: O_1 = Pretest (initial assessment prior to treatment); X = Treatment (instruction using syllable card media); O_2 = Posttest (final assessment following treatment)

The study was conducted during the odd semester of the 2024/2025 academic year, from November 4 to November 14, 2024, at SD Negeri 2 Sorong City, located in Remu Selatan, Sorong Manoi District, Sorong City, Southwest Papua Province. The research population comprised all Grade V students at SD Negeri 2 Sorong City. According to Sugiyono (2014), a sample is a subset of the population that possesses the same characteristics as that population. To determine the sample for this study, a saturated sampling technique (sampling jenuh) was applied, in which the entire population was designated as the research sample due to the limited number of class members. Accordingly, the study involved all 25 Grade V students as research participants.

Data collection instruments comprised two primary tools: (1) a structured observation sheet used to monitor and document student activity and learning behaviors during POE-based instruction; and (2) a performance test in the form of a 20-item multiple-choice IPAS instrument, administered as both a pretest and a posttest. Prior to administration, all instruments were validated by an expert lecturer in the field of natural science education to confirm their content validity. Instrument reliability was subsequently assessed using Cronbach's alpha coefficient, whereby an alpha value greater than or equal to 0.60 is considered indicative of adequate reliability (Taber, 2018). Data analysis procedures included reliability testing, normality testing, and hypothesis testing using the paired-samples t-test, conducted using SPSS Statistics for Windows v. 30.0.

RESULTS AND DISCUSSION

Instrument Validation and Reliability Testing

Prior to administration, the research instruments, comprising a teaching module, a 20-item test, and a student activity observation sheet, were submitted for content validity review to an expert lecturer in natural science education. Following expert validation and confirmation of content validity, the instruments were administered to the research participants.

Table 2. Pretest Reliability Statistics (Cronbach's Alpha)

Cronbach's Alpha	Number of Items
0.603	20

Based on the reliability test using SPSS v. 30.0, the Cronbach's alpha coefficient for the pretest instrument was 0.603. This value exceeds the minimum acceptable reliability threshold of 0.60 (Taber, 2018), confirming that the pretest instrument meets the reliability requirements and is suitable for use in this study.

Table 3. Posttest Reliability Statistics (Cronbach's Alpha)

Cronbach's Alpha	Number of Items
0.882	20

The Cronbach's alpha coefficient for the posttest instrument was 0.882, substantially exceeding the 0.60 reliability threshold. This value indicates a high level of internal consistency, confirming that the posttest instrument possesses strong reliability and is appropriate for use as a data collection tool in the assessment of IPAS learning outcomes.

Normality Testing

To verify that the data met the parametric assumptions required for the paired-samples t-test, normality testing was conducted using both the Kolmogorov-Smirnov test and the Shapiro-Wilk test. The Shapiro-Wilk test was prioritized as the primary basis for the normality decision, as this test is specifically recommended for samples of fewer than 50 observations (n = 25 in the present study). The results are presented in Table 4.

Table 4. Normality Test Results (Kolmogorov-Smirnov and Shapiro-Wilk)

Variable	K-S Statistic	K-S df	K-S Sig.	S-W Statistic	S-W df	S-W Sig.
Pretest	0.260	25	< 0.001	0.923	25	0.059
Posttest	0.111	25	0.200	0.972	25	0.706

Based on the Shapiro-Wilk test results, the significance value for the pretest data was 0.059, which exceeds the significance threshold of $\alpha = 0.05$. This indicates that the pretest data are normally distributed. The significance value for the posttest data was 0.706, which likewise exceeds 0.05, confirming that the posttest data are also normally distributed. Both datasets therefore satisfy the normality assumption required for parametric hypothesis testing. The Kolmogorov-Smirnov result for the pretest (sig. < 0.001) is noted, but the Shapiro-Wilk test is considered more appropriate and reliable for this sample size, and its findings are consistent with the posttest normality confirmed by both tests.

Hypothesis Testing: Paired-Samples t-Test

Following confirmation of normality, hypothesis testing was conducted using the paired-samples t-test to determine whether a statistically significant difference existed between pretest and posttest IPAS learning outcomes following the implementation of the POE learning model. The results are presented in Table 5.

Table 5. Paired-Samples t-Test Results

Pair	Mean Difference	Standard Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pair 1 Pretest–Posttest	−19.600	7.627	1.525	-22.748	−16.452	-12.850	24	0.001

Decision Based on Sig. (2-Tailed)

Based on the paired-samples t-test results presented in Table 5, the significance value (2-tailed) is 0.001, which is less than the significance threshold of $\alpha = 0.05$ ($0.001 < 0.05$). Accordingly, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. It is therefore concluded that the POE (Predict-Observe-Explain) learning model has a statistically significant positive effect on the IPAS learning outcomes of Grade V students at SD Negeri 2 Sorong City.

Decision Based on t-Test Comparison

The calculated t-value ($t^{calculated}$) obtained from the paired-samples t-test was 12.850. The critical t-value (t□αϐle) was determined based on the degrees of freedom $df = n - 1 = 25 - 1 = 24$ and a significance level of $\alpha/2 = 0.025$, yielding t□αϐle = 2.025. Since $t^{calculated}$ (12.850) > t□αϐle (2.025), the null hypothesis is again rejected. This provides additional confirmation that the POE learning model is statistically effective in improving IPAS learning outcomes.

Discussion of Findings

The research findings demonstrate that the POE (Predict-Observe-Explain) learning model has a significant positive effect on IPAS learning outcomes of Grade V students at SD Negeri 2 Sorong City. The mean pretest score of 45.55 increased to a posttest mean of 80.00 following the implementation of the POE model, representing a substantial improvement of 34.45 points. This outcome is consistent with the findings of Rahmah et al. (2022), who report significant improvements in science learning outcomes among elementary school students following POE implementation and with Shofiah et al. (2017), who demonstrate that POE combined with experimental methods produces superior science learning outcomes compared to conventional instruction in junior high school contexts.

The effectiveness of the POE model in this study can be understood through the constructivist learning mechanisms embedded within its three-stage structure. During the Predict phase, students were required to activate their prior knowledge and articulate hypotheses about the IPAS phenomena under investigation, creating a state of cognitive readiness and intellectual investment in the learning content. This predictive engagement is consistent with the findings of Lazonder and Harmsen (2016), who demonstrate that guided inquiry approaches, in which students are scaffolded through prediction, observation, and explanation, are significantly more effective than didactic instruction in promoting deep conceptual understanding in science. During the Observe phase, students conducted direct observations and experiments that either confirmed or contradicted their predictions, creating productive cognitive conflict that stimulated conceptual reorganization (Coştu, 2016). The Explain phase then required students to reconcile observational evidence with their prior predictions, constructing evidence-based explanations that deepened conceptual ownership.

The observational data gathered during the POE intervention indicate that students in all three activity phases, preliminary activities, core learning activities, and closing activities, demonstrated high levels of active engagement, a marked contrast to the passive, disengaged behavior characteristic of the conventional lecture-based instruction observed prior to the study. This finding is consistent with Muna (2017), who reports that POE effectively enhances both conceptual understanding and science process skills by positioning students as active investigators rather than passive recipients of information, and with Amal and Kune (2018), who document that POE-oriented science learning stimulates critical thinking and promotes higher-order process skills. Suryawati and Osman (2018) similarly confirms that contextually grounded, inquiry-oriented instructional approaches enhance students' scientific attitudes and performance, providing convergent international evidence for the pedagogical value of active inquiry strategies such as POE.

The reliability coefficients obtained for both instruments (pretest α = 0.603, posttest α = 0.882) confirm that the assessment tools used in this study provided consistent and dependable measurements of IPAS learning outcomes, in accordance with the reliability standards articulated by Taber (2018). The markedly higher reliability of the posttest instrument may reflect the greater discrimination capacity of posttest items in capturing the range of post-intervention learning outcomes, as well as the increased familiarity of students with the test format following the pretest experience. Saputro et al. (2023) further affirm that the systematic implementation of innovative learning models in the Sorong City elementary school context is associated with significant improvements in both motivation and IPAS learning outcomes, providing institutional-level support for the present findings.

Winarni and Purwandari (2021) additionally confirm that project- and inquiry-based learning approaches improve scientific literacy among elementary students, a competency closely aligned with the IPAS learning objectives assessed in this study. Taken together, these converging lines of evidence from national and international research confirm that the POE learning model constitutes a theoretically grounded and empirically validated instructional approach for improving IPAS learning outcomes in the Indonesian elementary school context. The significant pre-to-post improvement documented in this study, with a mean gain of 34.45 points and a highly significant t-test result, provides strong evidence in support of the broader adoption of POE-based instruction in IPAS classrooms at the elementary level.

CONCLUSION

Based on the results of the paired-samples t-test, it is concluded that the

POE (Predict-Observe-Explain) learning model exerts a statistically significant positive effect on the IPAS learning outcomes of Grade V students at SD Negeri 2 Sorong City. The significance value (2-tailed) of 0.001 is less than the significance threshold of $\alpha = 0.05$, and the calculated t-value of 12.850 exceeds the critical t-value of 2.025 (df = 24). The mean IPAS score improved from 45.55 (pretest) to 80.00 (posttest), representing a mean gain of 34.45 points. These findings confirm that the POE learning model is effective in enhancing IPAS learning outcomes, attributable to its structured three-phase inquiry cycle, predict, observe, and explain, which actively engages students, promotes critical thinking, and deepens conceptual understanding through the productive integration of prediction and empirical observation.

Teachers are encouraged to adopt and further develop the POE learning model for a broader range of IPAS topics within the Merdeka Curriculum framework, adapting experimental activities to the specific conceptual and procedural demands of each content area. Future research is recommended to employ quasi-experimental or experimental designs with randomized control groups, larger and more diverse samples drawn from multiple schools, and longitudinal follow-up measures to more rigorously establish the sustained effects of POE-based instruction on IPAS learning outcomes and broader scientific competencies. Researchers may also explore the integration of POE with digital technologies, such as virtual simulations and augmented reality, to further enhance student engagement and inquiry outcomes in the elementary science classroom.

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Declarations

Author Contribution	:	A. R. Tuzzahra: Conceptualization, Data Collection, Formal Analysis, Writing – Original Draft; Asrul: Supervision, Validation, Writing – Review & Editing; A. A. Fitriani: Methodology, Supervision, and Writing – Review & Editing.
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