The Effect of POGIL Assisted by Sevima Edlink on Students' Analytical Thinking Skills in Alternative Energy

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Received: 4th May 2026; **Accepted**: 12th May 2026; **Published**: 30th July 2026
DOI: https://dx.doi.org/10.29303/jpft.v12i2.11361

Abstract - *This study aims to examine the effect of the Process-Oriented Guided Inquiry Learning (POGIL) model assisted by Sevima Edlink on students' analytical thinking skills in the context of alternative energy. The study employed a quasi-experimental method using a posttest-only control group design involving 65 tenth-grade students at SMAS YAB Sukaratu. Data were collected using an instrument consisting of five essay questions developed based on analytical thinking indicators. The results of the independent-samples t-test showed that the calculated t-value (tcalculated = 11.55) was greater than the critical t-value (ttable = 2.00) at α = 0.05, indicating a statistically significant difference in analytical thinking skills between the experimental and control groups. These findings indicate that the integration of the POGIL model with Sevima Edlink can support the development of students' analytical thinking skills through interactive and technology-assisted learning. Therefore, POGIL assisted by Sevima Edlink can be considered an alternative instructional approach for developing higher-order thinking skills in physics education. Future research should involve larger samples, different educational levels, and other physics topics to further examine the effectiveness and long-term impact of this learning approach.*

Keywords*: Alternative Energy; Analytical Thinking Ability; POGIL Model; Sevima Edlink.*

INTRODUCTION

The development of science and technology in the 21st century requires educational systems to produce students who possess higher-order thinking skills, particularly analytical thinking skills. The Merdeka Curriculum was introduced as a response to these demands by emphasizing the development of 21st-century competencies, such as critical, analytical, creative, collaborative, and communicative thinking, while also providing opportunities for student-centered learning. This curriculum encourages learning that is adaptive to students' characteristics, interests, and needs through a differentiated learning approach (Tomlinson, 2017).

The implementation of the Merdeka Curriculum is also directed toward fostering the Pancasila Student Profile, which emphasizes not only cognitive mastery but also the strengthening of students' character and moral values (Martanti et al., 2022). Consequently, the enhancement of analytical thinking skills becomes an integral part of preparing students to face global challenges, both academically and in terms of character development.

Conceptually, analytical thinking skills constitute an essential cognitive domain within Bloom's taxonomy, encompassing the abilities to differentiate, organize, and connect information in order to understand problems logically and systematically (Anderson & Krathwohl, 2001).

However, this ideal condition has not been fully realized in practice. The results of a preliminary study conducted at SMAS YAB Sukaratu revealed that the analytical thinking skills of Grade X students remain in the low category. Students experience difficulties in organizing information, distinguishing concepts, and connecting information acquired during the learning process. These findings are reinforced by

interviews with physics teachers, which indicated that learning is still dominated by lecture-based methods. As a result, students tend to be less active, struggle to manage information, and are not yet accustomed to analyzing problems in depth.

This condition is consistent with the view of Anderson and Krathwohl (2001), who argue that learning methods that do not sufficiently challenge higher-order thinking can hinder the development of students' analytical abilities. Similarly, Fisher (2009) emphasizes that a lack of learning activities that stimulate critical and analytical thinking causes students to experience difficulties in understanding complex concepts and applying them to real-world situations. These findings indicate a gap between the objectives of the Merdeka Curriculum and the actual classroom learning practices.

To address these issues, a learning model that actively engages students is required. One instructional model that can be applied to improve students' analytical thinking skills is the Process Oriented Guided Inquiry Learning (POGIL) model (Amiza & Aloysius, 2024). POGIL is a learning approach that combines guided inquiry and cooperative learning, in which students are actively involved in the learning process to develop independent learning skills (Talakua & Sahureka, 2020).

In addition to instructional models, the use of technology also plays a crucial role in enhancing learning effectiveness. Sevima Edlink is an e-learning platform that provides learning support features such as material distribution, assignment management, discussion forums, and assessment tools (Haz et al., 2023). The integration of Sevima Edlink in learning supports the implementation of POGIL by facilitating online collaboration, providing access to learning materials prior to instruction, and enabling more effective task management.

The topic of alternative energy was selected due to its relevance to scientific advancements and the need for in-depth analysis of energy availability issues and their impacts. Therefore, this study aims to examine the effect of implementing the POGIL model assisted by Sevima Edlink on students' analytical thinking skills in learning alternative energy.

Previous studies have demonstrated that the Process Oriented Guided Inquiry Learning (POGIL) model is effective in enhancing students' analytical thinking skills. However, its implementation has largely remained conventional, with limited integration of digital learning platforms. Conversely, the use of Sevima Edlink in education has been widely explored, yet it has not been pedagogically integrated with inquiry-based learning models. Furthermore, research combining POGIL and Sevima Edlink in physics instruction—particularly on the topic of alternative energy—remains limited. Therefore, this study aims to address this gap by examining the effect of implementing POGIL assisted by Sevima Edlink on students' analytical thinking skills.

RESEARCH METHODS

This study was conducted at SMAS YAB Sukaratu during the second semester of the 2024/2025 academic year. A quasi-experimental method with a posttest-only control group design was employed.

The independent variable in this study was the POGIL instructional model, while the dependent variable was students' analytical thinking skills, measured through three indicators: differentiating, organizing, and relating.

The population consisted of all Phase E (Grade X) students, totaling 65 students

across two classes. A non-probability sampling technique with a saturated sampling method was used, meaning all members of the population were included as the sample. The assignment of experimental and control groups was conducted through random selection, with Class X-1 designated as the experimental group and Class X-2 as the control group. The experimental group received instruction using the POGIL model supported by Sevima Edlink, while the control group was taught using the Direct Instruction model with the same supporting media.

The implementation of the POGIL model followed four main stages: (1) orientation, where students were introduced to initial problems to build learning readiness; (2) exploration, where students worked collaboratively to gather and analyze information; (3) concept formation, where students constructed and formulated concepts based on their exploration; and (4) application, where students applied the acquired concepts to solve new problems.

Sevima Edlink was utilized as a supporting learning medium in three phases: (1) before instruction, for distributing preliminary materials and resources; (2) during instruction, for facilitating discussion and interaction; and (3) after instruction, for assignment submission and evaluation. Its use aimed to enhance student engagement and support flexible, technology-integrated learning.

The research instrument consisted of five essay questions designed to assess students' analytical thinking skills based on three indicators: differentiating, organizing, and relating. Prior to implementation, the instrument was validated by experts, yielding a validity index ($V \geq 0.6$) for all items, indicating that it was valid and appropriate for use. In addition, reliability testing using Cronbach's Alpha produced a coefficient of 0.74, which falls within the high category, confirming that the instrument is reliable and suitable for use in this study.

Data were collected through a posttest administered after the completion of all treatments. The data were analyzed using inferential statistics to examine differences in analytical thinking skills between the experimental and control groups.

The research procedure consisted of three stages: (1) preparation, including the development of instructional materials and research instruments; (2) implementation, involving the application of instructional models according to group assignments; and (3) final stage, including data collection, processing, analysis, and conclusion drawing.

RESULTS AND DISCUSSION

Results

The measurement of students' analytical thinking skills was conducted through a posttest administered after the completion of the entire instructional sequence. The posttest instrument consisted of five essay questions designed to assess students' analytical thinking abilities following the learning process. The posttest score results for both the experimental and control groups are presented in Table 1 below.

Table 1. Descriptive Statistics of Posttest Scores on Students' Analytical Thinking Skills

Statistical Data	Class	
	Eksperimental	Control
Number of student (n)	33	32
Ideal Score	60	60
Highest score	60	50
Lowest score	47	31
Mean	53,8	40,91
Variance	13,28	26,99
Standard deviation	3,64	4,36

Based on Table 1, the mean score of students' analytical thinking skills in the experimental group (53.8) is higher than that of the control group (40.91). In addition, the variance in the experimental group (13.28) is lower than that of the control group (26.99), indicating that the score distribution in the experimental group is more homogeneous.

Further analysis was conducted based on the indicators of analytical thinking skills, namely organizing, differentiating, and relating information. The percentage scores of the posttest for each indicator in both the experimental and control groups are presented in Table 2.

Table 2. Percentage of Posttest Scores by Indicators of Analytical Thinking Skills in the Experimental and Control Groups

Indicator	Percentage (%) Class	
	Eksperimental	Control
Organizing	96,06	82,73
Differentiating	88,48	67,27
Connecting	88,79	60,4

Based on Table 2, all indicators in the experimental group demonstrate higher percentage achievements compared to those in the control group. This finding indicates that the implementation of the POGIL model assisted by Sevima Edlink not only improves overall scores but also has a positive impact on each aspect of analytical thinking skills.

The results of the normality test show that the calculated chi-square value χ^2_{count} for the experimental group posttest data was 6,84, while that of the control group was 2,51. The critical chi-square value χ^2_{table} at a 5% significance level was 9,49. Since both $\chi^2_{count} < \chi^2_{table}$, it can be concluded that the posttest data from both groups are normally distributed at a 95% confidence level. The results of the normality test are presented in Table 3.

Table 3. Results of the Normality Test

Data	N	χ^2_{count}	χ^2_{table}	Description
Posttest scores of the experimental class	33	6,84	9,49	Normally distributed
Posttest scores of the control classl	32	2,51		

The results of the homogeneity test indicate that $F_{count} > F_{table}$ therefore, the alternative hypothesis (H_a) is accepted and the null hypothesis (H_0) is rejected. This implies that the posttest data from the two groups do not have equal variances and are thus not homogeneous. The results of the homogeneity test are presented in Table 4 below.

Table 4. Results of the Homogeneity Test

Data	α	F_{count}	F_{table}	Decision	Conclusion
Posttest scores of analytical thinking ability in the experimental and control classes	0,05	2,03	1,82	H_0 rejected	The two variances are not homogeneous

Since the data are normally distributed but not homogeneous, hypothesis testing was conducted using the t′ test. The results show that the $t_{count} > t_{table}$ (11.55 > 2.00) at a significance level of 0.05, leading to the rejection of H_0 and acceptance of H_a. This indicates a statistically significant difference in analytical thinking skills between students

in the experimental and control groups. The results of the hypothesis test are presented in Table 5.

Table 5. Results of the t′ Test

α	t_{count}	t_{table}	Decision
0,05	11,55	2,00	H_a accepted and H_0 rejected

To further strengthen these findings, the effect size was calculated using Cohen's d, yielding a value of d = 3.21, which falls into the "very large" category. This result indicates that the implementation of the POGIL model assisted by Sevima Edlink has a very strong effect on students' analytical thinking skills.

Discussion

Based on the research findings, there were the results indicate that students in the experimental group demonstrated higher analytical thinking skills compared to those in the control group across all indicators—organizing, differentiating, and relating. This finding suggests that the implementation of the POGIL model assisted by Sevima Edlink is more effective than Direct Instruction in developing analytical thinking skills.

The improvement was reflected not only in test scores but also in students' cognitive processes. The structured stages of POGIL—orientation, exploration, concept formation, and application—encourage students to actively construct knowledge in a systematic manner. This finding is consistent with Moog and Spencer (2019), who reported that structured inquiry-based learning effectively enhances analytical and problem-solving skills.

The use of Sevima Edlink contributed to improved time efficiency and learning quality. The platform allowed students to access materials prior to instruction and facilitated structured discussions and assignment submission.

Sanjaya et al. (2019) found that initial structure and orientation help students develop systematic thinking frameworks before entering exploration and application phases. This aligns with the learning process in the experimental group, where conceptual grounding in the orientation phase supported subsequent POGIL stages, enabling students to develop understanding actively and independently.

In contrast, although the control group had access to the same materials via Sevima Edlink, learning was conducted through Direct Instruction, which tended to be teacher-centered. As a result, students received information passively without engaging in collaborative discussion or independent exploration.

Thus, the fundamental difference between the two groups lies not in the availability of digital media but in the instructional model employed.

From the perspective of each indicator, students' ability to organize information improved through active engagement in grouping and structuring information during the exploration phase. This process facilitated pattern recognition and conceptual structuring, consistent with Hmelo-Silver et al. (2017), who highlighted the effectiveness of inquiry-based learning in developing organizational skills.

In the differentiating indicator, improvement was influenced by the concept formation stage, where students analyzed alternative energy phenomena through examples and discussions. This process fostered deeper conceptual understanding, supporting findings by Yofamella and Taufik (2020) and Malik and Minan (2017).

For the relating indicator, the most significant difference was observed. The application stage required students to

connect concepts with real-world situations, fostering integrative thinking. This finding aligns with Widodo and Mustaji (2021) and OECD (2019), which emphasize the importance of connecting concepts as a key component of higher-order thinking skills.

Conversely, the control group demonstrated lower performance due to limited opportunities for reflective interaction and integrative knowledge construction, as noted by Tyas et al. (2020).

Overall, the findings demonstrate that the POGIL model assisted by Sevima Edlink is effective in enhancing students' analytical thinking skills through structured, collaborative, and technology-supported learning.

However, this study has limitations. The relatively small sample size and single-school setting limit the generalizability of the findings. Additionally, the focus on alternative energy restricts applicability to other physics topics. Future studies are recommended to involve more diverse samples and explore different subject areas.

From a scholarly perspective, this study provides empirical evidence that integrating inquiry-based learning (POGIL) with digital platforms (Sevima Edlink) effectively enhances analytical thinking skills. The findings contribute to the advancement of physics education by integrating pedagogical and technological approaches and offer practical guidance for teachers in designing interactive and student-centered learning environments.

CONCLUSION

The results of this study indicate that the implementation of the POGIL model assisted by Sevima Edlink has a significant positive effect on students' analytical thinking skills, as evidenced by improvements in the indicators of organizing, differentiating, and relating.

Practically, these findings suggest that physics teachers can adopt the POGIL model as an effective alternative for developing higher-order thinking skills, particularly analytical thinking. Additionally, the integration of digital platforms such as Sevima Edlink supports more flexible, interactive, and sustainable learning through structured material delivery, discussion facilitation, and assessment management.

Furthermore, this study contributes to the development of digital learning by demonstrating that technology integration is most effective when aligned with instructional models that emphasize active learning and cognitive processes. Therefore, the combination of the POGIL model and e-learning platforms can serve as an innovative strategy to enhance the quality of physics education in line with 21st-century learning demands.

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