Spark-Test-Act-Reflect-Think (START) Activity: Enhancing Understanding of Science Terminology in Grade 5

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ABSTRACT

This action research explored the effectiveness of the Spark-Test-Act-Reflect-Think (START) activity in enhancing the understanding of science terminologies among Grade 5 learners at Magatos Integrated School, Division of Davao del Norte. The study employed a quantitative-descriptive approach involving 32 students. Quantitative data were collected through pre-test and post-test assessments based on four science topics: Processes that Shape Earth's Surface, Weather Disturbances, The Moon, and The Stars. Descriptive results revealed an increase in learners' mean scores from M = 38.28% (Very Low) in the pre-test to M = 67.19% (Average) in the post-test. On the other hand, inferential statistics showed that this difference was statistically significant, $t(31) = 43.60$, $p < .001$, with a very large effect size, Cohen's $d = 7.70$. Qualitative insights from student interviews further validated the intervention's impact, revealing four key themes: enhanced awareness of scientific vocabulary, increased engagement and motivation, development of independent study strategies, and improved confidence in science learning. The results align with recent literature emphasizing the role of scaffolded, reflective, and vocabulary-focused instruction in promoting science comprehension. The study concludes that the START strategy is a practical and effective approach to improving science terminology understanding in elementary education and may serve as a model for similar interventions in other contexts.

Keywords: *Spark-Test-Act-Reflect-Think (START) activity, science terminologies, Grade 5 learners, quantitative-descriptive, Philippines*

INTRODUCTION

Conceptual understanding in science depends heavily on students' grasp of essential terminologies, which form the foundation for higher-order thinking, problem-solving, and content integration. However, the study of Chi et al. 2021 showed that traditional methods such as rote memorization and passive instruction are often insufficient for helping students internalize complex scientific vocabulary. Studies have shown that poor understanding of scientific terms can hinder learners' ability to engage meaningfully with science content and processes. Vocabulary-focused strategies like the vocabulary self-collection strategy, concept wheel, and word inventory techniques have been successfully used to promote deeper understanding of science texts (Harmon et al., 2011). These approaches emphasize active, contextual learning over memorization and have demonstrated positive outcomes in student comprehension and retention of scientific terms.

Similar challenges have been observed globally. In Indonesia, efforts to reform the national curriculum in the 2000s aimed to shift from content-based instruction to competency-based learning and from teacher-centered approaches to student-centered methods. Despite these changes, students continue to struggle with science terminology. The 2015 Trends in International Mathematics and Science Study (TIMSS) revealed that only 32% of Indonesian students correctly answered a question requiring conceptual understanding in science (Martin et al., 2020). In South Africa, Msimanga and Lelliott (2012) reported that students struggled to explain scientific concepts using appropriate vocabulary due to language barriers and lack of contextual learning. Likewise, in Turkey, Şimşek and Kabapınar (2022) observed that while students performed inquiry activities well, their understanding of scientific terms remained limited, affecting their ability to communicate results effectively.

A similar issue exists in the Philippines, where several regions report persistent challenges in science learning. In Zambales, studies identified errors and misconceptions in elementary science reference materials, further contributing to weak conceptual understanding (Raymundo, 2022). In Northern Samar, teachers cited limited vocabulary instruction as a major hurdle in science education (Alvarez, 2021). Meanwhile, in Davao Oriental, classroom observations revealed that learners often memorize science definitions without comprehension, leading to low performance in science process skills (Gomez, 2023). The Philippines also lags behind other countries in science education quality. The World Economic Forum's (WEF, 2018) Global Competitiveness Report ranked the country 55th out of 137 in higher education and 76th in the quality of math and science education (Rogayan, 2020).

At the local level, similar concerns arise in the Division of Davao del Norte, particularly at Magatos Integrated School. Observations from Field Study courses indicate that many fifth and sixth-grade students struggle with science terminology, which negatively affects their engagement and academic performance. Addressing this issue requires an innovative approach that incorporates active learning strategies and real-world applications. Teacher feedback during Learning Action Cell (LAC) sessions also highlighted the persistent difficulty students face in decoding scientific terms. This action research aims to support students facing difficulties with science concepts, as weak conceptual understanding not only lowers academic performance but also reduces students' confidence in science-related tasks.

Given these challenges, improving students' understanding of science terminologies is essential. Scientific concepts are often abstract, leading to disengagement and low motivation among young learners. To address this, the START activity was developed—a hands-on, reflective approach aimed at making science terms more accessible and meaningful. This study examines how START can enhance both comprehension and retention of science vocabulary among Grade 5 students, ultimately supporting their academic achievement and confidence.

Despite the importance of strengthening science comprehension at the elementary level, limited research specifically addresses effective methods for enhancing conceptual understanding among Grade 5 students. Nevertheless, several studies have investigated promising strategies. For example, Alipova et al. (2024), in their study *"Gamification and the Formation of Terminological Competence in Science Learning,"* found that gamification effectively supports science terminology acquisition for both students and pre-service teachers. Similarly, Decristan et al. (2023), in *"The Effects of Formative Assessment and Scaffolding on Students' Conceptual Understanding in Science,"* emphasized that formative assessment and instructional scaffolding significantly improve understanding, particularly among learners with limited language proficiency. In addition, Glynn and Muth (1994), through their work *"Reading and Writing to Learn Science: Achieving Scientific Literacy,"* highlighted the value of conceptual change texts and analogies in correcting misconceptions and deepening students' grasp of scientific vocabulary and processes.

However, no prior research has evaluated the impact of the Spark-Test-Act-Reflect-Think (START) activity on conceptual understanding in science at the Grade 5 level. This study addresses that gap, offering insights into a vocabulary-centered, reflective strategy that could strengthen science learning in the early grades.

RESEARCH QUESTIONS/OBJECTIVES:

The research objectives and questions below are to test the effectiveness of implementing the Spark-Test-Act-Reflect-Think (START) Activity in enhancing understanding of science terminology in grade 5 science and their perception towards the new learning activity.

1. What is the level of science terminology understanding among Grade 5 learners before the implementation of the Spark-Test-Act-Reflect-Think (START) activity?
2. What is the level of science terminology understanding among Grade 5 learners after the implementation of the Spark-Test-Act-Reflect-Think (START) activity?
3. Is there a significance of the Spark-Test-Act-Reflect-Think (START) activity on the understanding and retention of science terminologies among Grade 5 learners?

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International Journal of Research Publications
ISSN: 2708-3578 (Online)

4. What insights can be drawn from the implementation of the Spark-Test-Act-Reflect-Think (START) intervention regarding its effectiveness in enhancing students' understanding of science terminologies?

Proposed Intervention/Action Plan

Here is the comprehensive guide on Spark-Test-Act-Reflect-Think (START) Instructional Strategy. It has five steps: predict, explain, enact, observe and reflect. Basically, the idea is for students to make predictions, explain why, try out the task/activities, observe the results, and reflect on their observations. The researcher presented instructions to experts and science teachers to review and make sure everything was working.

Table 1. START Strategy Activity Sheet

Spark	Test	Act	Reflect	Think
5 Minute	10 Minute	20 Minute	10 Minute	15 Minute
Introducing science terminologies through engaging prompts (e.g., visuals, short videos). Students predict the meaning or application of terms.	Facilitating small-group discussions where students share their initial thoughts on the terms.	Conducting hands-on activities (e.g., experiments, modeling) that incorporate the terms in context.	Guiding students in comparing their predictions to observed outcomes, fostering metacognitive awareness.	Encouraging students to summarize and synthesize their learning, clarifying misconceptions and reinforcing correct usage.

Implementation

1) Steps Involved in the Spark-Test-Act-Reflect-Think (START) Instruction

Implementing this intervention Spark-Test-Act-Reflect-Think (START) instructional strategy in the classroom can be done in several ways. Here are some steps that will be followed to implement the START strategy effectively:

Identify the learning objective: The first step in implementing the START activity is to identify the learning objective. This could be a concept, a phenomenon, or a skill that students need to learn.

Develop a START lesson plan: Once the learning objective has been identified, the teacher can develop a lesson plan that incorporates the START instructional strategy. The lesson plan should include a prediction phase, an explanation phase, an enactment phase, an observation phase, and a reflection phase.

Introduce the lesson: At the beginning of the lesson, the teacher should introduce the learning objective and explain the purpose of the START strategy. The teacher can also provide an overview of the lesson plan and the activities that students will be engaged in.

Spark Phase: In the Spark phase, students are introduced to a question or prompt that ignites curiosity about the learning objective. This prompt should inspire students to engage with the topic and form initial ideas or expectations.

Test Phase: In the Test phase, students outline their thoughts and ideas based on the prompt. They may share preliminary reasoning or theories related to the learning objective, laying the groundwork for what they hope to discover or confirm.

Act Phase: During the Act phase, students dive into the hands-on task or experiment connected to the learning objective. This phase involves carrying out an activity, practicing a skill, or conducting an experiment that brings their ideas to life.

Reflect Phase: In the Reflect phase, students consider the results of their actions and analyze what happened. They might look at collected data, review recordings, or discuss observations, comparing outcomes with initial ideas.

Think Phase: In the Think phase, students synthesize their observations and reflections. They revisit their original thoughts, discuss insights, and refine their understanding of the learning objective. The teacher facilitates discussion to clear up any misconceptions and guide deeper understanding.

Review and refine: After everything was done with the class, the teacher can provide feedback, clarify any misconceptions, and encourage students to refine their understanding of the learning objective.

Activities Designed for Each Lesson and Per Week

Week/Topic	Concept	Spark	Test	Act	Reflect	Think
Week 1: Processes that Shape Earth's Surface	Weathering & Soil Erosion	Introduce terms (e.g., weathering, erosion) using visual aids; image-term matching	Discuss definitions and differences	Simulate soil erosion; describe using terms	Relate observations to definitions	Write a summary with examples
Week 2: Weather Disturbances	Types of Disturbances	Present terms (typhoon, monsoon, storm surge); visual matching	Predict meanings based on definitions	Trace typhoon paths; label terms	Compare maps to real weather data	Create labeled diagram of typhoon parts
Week 3: The Moon	Phases of the Moon	Show images of terms like full moon, new moon	Predict sequence of phases	Build models; explain phase changes	Analyze predictions vs. observations	Create labeled moon phase diagram
Week 4: The Stars	Constellations	Introduce terms (constellation, Orion, zodiac); match with images	Predict visible constellations per month	Use star maps/apps to label constellations	Compare predictions to real observations	Make a constellation guidebook with diagrams

RESEARCH METHODOLOGY

Research Design

This study employed a quantitative-descriptive research design that incorporated both pre-test and post-test measures to examine the impact of the Spark-Test-Act-Reflect-Think (START) intervention on Grade 5 students' conceptual understanding in science. According to Manjunatha (2019), quantitative-descriptive designs are effective for systematically gathering numerical data to describe characteristics of a population or phenomenon. Masterclass (2022) emphasizes that combining quantitative tools with qualitative techniques such as interviews enhances the comprehensiveness of research findings. Guided by these principles, this study utilized statistical tools to assess students' academic gains and qualitative interviews to gather perspectives from learners and teachers. This blended approach ensured a richer, more holistic understanding of the effectiveness of the START intervention.

Research Participants

The study was conducted at Magatos Integrated School, located in Magatos, Asuncion, Davao del Norte, during the academic year 2024–2025. A total of 32 Grade 5 students participated in the study. These participants were selected using purposive sampling, with the criteria based on the accessibility of the section and the delivery of science lessons aligned with the intervention content.

Grade 5 students were specifically chosen because, at this developmental stage, learners transition from concrete to more abstract thinking, making it an ideal period to strengthen foundational scientific concepts. This is supported by the Department of Education's K to 12 Science Curriculum (DepEd, 2022), which identifies Grade 5 as a critical year for fostering conceptual understanding in physical and life sciences. Furthermore, prior assessments by the school's science department indicated a learning gap in science terminology comprehension at this level, thereby justifying the need for an intervention such as START.

Instrument of the Study

The researchers utilized a researcher-made diagnostic test to assess Grade 5 students' understanding of science terminologies before and after the implementation of the Spark-Test-Act-Reflect-Think (START) activity. The assessment consisted of a pre-test and a post-test aligned with four key science lessons: Processes that Shape Earth's Surface, Weather Disturbances, The Moon, and The Stars. Each lesson included a set of questions that required students to define, apply, or explain relevant science terms based on the Most Essential Learning Competencies (MELCs) for Grade 5 Science.

The pre-test served as a baseline to identify students' initial level of science vocabulary comprehension. After the four-week START intervention, the post-test was administered to evaluate any gains in their understanding. By using this structured approach, the researchers aimed to determine the effectiveness of the START framework in enhancing students' ability to grasp and use science terminology accurately. The results from both tests provided measurable insights into student progress and the practical impact of the intervention on conceptual learning.

To interpret the performance levels quantitatively, the study applied a descriptive level scale based on the learners' average scores. This commonly used assessment range is widely adopted in Philippine classroom-based action research and aligns with DepEd-aligned grading interpretations. This is attributed to similar rating structures appear in science education research such as Castillo and Aliposa (2020), who used descriptive performance levels to interpret learners' vocabulary comprehension in a related intervention study.

Range of Mean	Descriptive Level	Interpretation
91-100	Very High	If the measures described in understanding science terminology of the students is outstanding.
76-90	High	If the measures described in understanding science terminology of the students is very satisfactory.
61-75	Average	If the measures described in understanding science terminology of the students is satisfactory.
51-60	Low	If the measures described in understanding science terminology of the students is fairly satisfactory.

0-50	Very Low	If the measures described in understanding science terminology of the students did not meet the expectation.

Data Analysis

The data analysis employed both quantitative and qualitative approaches to comprehensively evaluate the impact of the START activity on Grade 5 students' understanding of science terminologies. The quantitative analysis focused on statistical computations, while the qualitative analysis provided deeper insights through thematic examination of student and teacher perspectives.

To assess the effectiveness of the START activity, the researchers tabulated the raw scores from both the pre-test and post-test. The mean for each indicator and the overall mean were calculated to measure students' level of understanding before and after the intervention. The following statistical tools were used to analyze the data:

Mean. The average scores from the pre-test and post-test were calculated to determine general performance levels. A comparison of means helped identify overall academic improvement following the implementation of the START strategy.

Standard Deviation. This was used to assess the variability of student scores. It indicated whether students' performance became more uniform after the intervention. A lower standard deviation in the post-test suggested increased consistency in learning outcomes.

Paired t-test. Employed to determine whether the difference between the pre-test and post-test scores was statistically significant. This tool helped verify if observed changes were likely due to the START intervention rather than chance.

Cohen's d. This effect size statistic quantified the magnitude of the intervention's impact. It allowed for assessing not just statistical significance but also the practical significance of students' learning gains.

Data Reduction. Raw transcripts from the interviews and discussions were organized and filtered to remove irrelevant or redundant information. Only statements directly related to students' learning experiences, instructional effectiveness, and implementation challenges were retained for analysis.

Coding. Extracted responses were labeled using short descriptive codes such as *"improved focus," "terminology clarity," "teaching strategy impact,"* and *"student motivation."* These codes facilitated the identification of patterns in participants' perceptions.

Thematic Analysis. Related codes were grouped into broader themes such as *Effectiveness of START, Challenges in Implementation,* and *Learner Engagement.* These themes provided insights into both the benefits and limitations of the intervention as experienced by the participants.

By integrating statistical analysis with qualitative findings, the study ensured a well-rounded evaluation of the START activity's effectiveness. The combination of numerical data and thematic insights provided a clearer understanding of the intervention's impact on students' comprehension of science terminologies.

Ethical Considerations

Adhering to ethical standards in research is crucial as it guides the true objectives of the study, such as the pursuit of knowledge, truth, and the prevention of errors, while also fostering important values like trust, accountability, mutual respect, and fairness in collaborative work. To maintain ethical research practices, this study adhered to the ethical principles outlined in the Belmont Report (2010), which include respecting individuals' autonomy, promoting beneficence and non-maleficence, ensuring justice, obtaining informed consent, safeguarding confidentiality and data protection, maintaining integrity, and addressing conflicts of interest.

RESULTS AND DISCUSSIONS

Presented in this chapter are the results or data obtained in the study. The chapter presents the data on the level of science terminology understanding among students in pre-test; the level of performance in understanding science terminology among students in post-test; and significant difference of the pretest and post-test scores of the students.

Research Question No.1: What is the level of science terminology understanding among Grade 5 learners before the implementation of the Spark-Test-Act-Reflect-Think (START) activity?

To address this research objective, a pre-test was conducted among 32 Grade 5 learners using a researcher-made assessment tool that covered four science topics: *Processes that Shape Earth's Surface*, *Weather Disturbances*, *The Moon*, and *The Stars*. Each topic consisted of terminology-based items designed to assess the learners' familiarity and understanding of essential scientific terms.

The test yielded an overall mean score of 38.28%, which falls under the "Very Low" performance category. In terms of standard deviation, the result was 2.97, indicating a low level of score dispersion. This suggests that while most students performed poorly, there was still notable variability — with a few students performing slightly better or worse than the group average. The highest score recorded was 14, while the lowest was 1, and most scores clustered between 6 and 9, highlighting an overall weak grasp of scientific vocabulary.

In terms of specific topic indicators, the results also show consistently "very low" performance across all four areas. Table 3 provides a summary of the average scores for each topic.: Processes that Shape Earth's Surface (43.75%), Weather Disturbances (34.38%), The Moon (37.50%), and The Stars (31.88%). These findings suggest a widespread difficulty in grasping scientific vocabulary, possibly due to abstract terms, lack of prior knowledge, or insufficient engagement strategies in previous lessons.

The results clearly reveal that students had limited understanding of essential science vocabulary, particularly in abstract topics like *The Stars* and *Weather Disturbances*. These findings are consistent with the study of Cetin-Dindar and Taneri (2021), who found that elementary students often fail to comprehend scientific content due to difficulties in processing unfamiliar terminology and abstract language. The authors emphasized that without targeted instruction, students tend to memorize science terms without truly understanding their meaning.

Table 2. Average of the Scores in Pre-test

Score	Frequency	Percentage
14	1	3.13%
13	2	6.25%
11	2	6.25%
10	2	6.25%
9	6	18.75%
8	2	6.25%
7	7	21.88%
6	3	9.38%
5	2	6.25%

Score	Frequency	Percentage
4	3	9.38%
3	1	3.13%
1	1	3.13%
Total	**32**	**100%**
Mean		**7.66**
Standard Deviation (SD)		**2.97**

Similarly, Ko and Krist (2022) reported that when science instruction lacks scaffolding and contextual support, students struggle to connect scientific terms to real-world experiences, leading to superficial learning. Their study showed that students often disengage when faced with unfamiliar words, which hinders their ability to process and apply concepts.

Table 3.
Summary Table on the Mean Scores and Descriptions for Understanding of Science Terminologies before START Intervention

Indicators	Average Percentage Scores (%)	Description
Processes that Shape Earth's Surface	43.75	Very Low
Weather Disturbances	34.38	Very Low
The Moon	37.50	Very Low
The Stars	31.88	Very Low
Overall Percentage Score (%)	**38.28**	**Very Low**

First, the topic Processes that Shape Earth's Surface received an average score of 43.75%, categorized as "Very Low." This suggests that students had a limited understanding of key concepts like erosion, weathering, and landform formation. One potential cause for this is the abstract nature of these processes, which often lack direct sensory experience or real-life connection in classroom settings.

This challenge is reflected in the findings of Forbes et al. (2015), who noted that elementary learners struggle with understanding surface processes unless supported by visual models and hands-on activities. Their study emphasized that when students are only exposed to textual or lecture-based delivery, their ability to grasp dynamic earth processes remains superficial.

Similarly, Hubbard (2019) explored how younger students conceptualize landforms and geological change. The study found that without geographic inquiry and scaffolded visuals, most learners defaulted to fragmented or incorrect notions of surface change, such as believing land simply "grows" or "breaks" without cause. Hubbard argued that meaningful comprehension of landforms and changes requires inquiry-based strategies that bridge scientific vocabulary with visual-spatial representations.

Together, these findings align with the observed low score in this study, suggesting that the traditional instruction previously received by the students likely lacked contextualization and visual reinforcement. To address this, structured interventions such as

START must provide concept-image linking, allowing students to internalize surface process vocabulary through experience-based learning.

Second, the topic Weather Disturbances received a mean score of 34.38%, indicating that learners had a very low level of understanding. This poor performance likely stems from the abstract nature of meteorological vocabulary (e.g., pressure systems, wind speed, storm surges), which can be difficult for students to visualize without appropriate instructional supports.

This is supported by Arwin et al. (2024), who introduced a STEM-based digital disaster learning model in elementary schools and found that students significantly improved their disaster adaptation knowledge when multimedia simulations were used to visualize typhoons, storms, and rainfall patterns. Their findings affirm that visualizing weather phenomena is essential for younger students to build meaningful conceptual understanding.

Similarly, Sarioglan (2020) examined the impact of computer-based instruction on middle school students' perceptions of weather and climate concepts. The study revealed that learners taught through digital modules demonstrated better retention and more accurate interpretations of weather events compared to those in traditional classrooms. The author concluded that passive textbook exposure fails to support comprehension of dynamic environmental processes like typhoons and climate systems.

Together, these studies explain why students in the current study struggled with understanding weather disturbances: the lack of engaging, context-rich instruction may have left them confused or disinterested in the subject matter. Thus, a strategy like START that contextualizes and reinforces abstract science terms is necessary for improving learning outcomes in this area.

Third, the pre-test results for The Moon showed an average score of 37.50%, reflecting a “Very Low” understanding of the topic. This finding suggests that students struggle with accurately grasping the concept of moon phases, particularly the causes of waxing, waning, and the moon’s position relative to Earth and the Sun.

This result is consistent with the findings of Küçüközer et al. (2020), who found that many elementary students carry intuitive but incorrect models of the lunar cycle. The study showed that when learners are not provided with 3D models or observational experiences, they tend to believe that moon phases are caused by Earth’s shadow or random changes in brightness.

Supporting this, Fraknoi (2023) reviewed studies on astronomy education and concluded that hands-on, spatial learning tools—such as globe-lamp simulations and physical models—greatly improve students' conceptual change. Without these aids, children often develop and retain misconceptions that interfere with meaningful learning. For example, many students believe that the Moon emits its own light or that it changes shape, rather than understanding that the phases are a result of its position in orbit.

These findings help explain the low performance in this study and reinforce the importance of contextual, sensory-based instruction for complex astronomical topics. The START activity, with its reflection and active learning components, can offer the structured scaffolding needed to correct deep-rooted misunderstandings in lunar science.

Lastly, among the four indicators, The Stars received the lowest average score at 31.88%, indicating that the students had considerable difficulty understanding astronomy-related concepts. Topics such as the size and distance of stars, the difference between planets and stars, and the meaning of constellations were particularly challenging for learners at the elementary level.

This finding is supported by Sneider & Kavanagh (2024), who noted that elementary students often believe that stars in constellations are physically grouped together and at equal distances from Earth, when in reality they vary greatly in both size and distance. Their research

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International Journal of Research Publications
ISSN: 2708-3578 (Online)

concluded that without guided use of 3D models, night-sky observations, or simulations, students develop inaccurate mental models of how stars are organized in space.

Additionally, Chastenay (2021) found that even with classroom instruction, students continued to confuse stars with planets, and believed that constellations could only be seen from specific places on Earth at all times. His study highlighted that many of these misconceptions persist due to limited opportunities for experiential or immersive learning, such as planetarium simulations or visual-sensory reinforcement.

These findings validate the poor performance observed in this study and further emphasize the need for interventions like START, which incorporate active reflection and visual cognition strategies to correct misconceptions. Using context-rich, observational, or interactive methods can greatly aid in grounding these abstract concepts for young learners.

Research Question No.2: What is the level of science terminology understanding among Grade 5 learners after the implementation of the Spark-Test-Act-Reflect-Think (START) activity?

After the implementation of the START intervention, a post-test was administered using the same assessment tool used in the pre-test. The results demonstrated a marked improvement, with the **overall mean percentage score rising to 67.19%**, which falls under the "Average" performance level. This indicates that the intervention had a positive impact on students' understanding of scientific terminology.

In addition to the mean score, the **standard deviation (SD) was calculated at 3.44**, which reflects a moderate variation in scores. While this suggests that not all learners improved uniformly, the relatively narrow spread implies a **more clustered performance near the mean** compared to the wider range seen in the pre-test. This indicates that the intervention not only raised the general performance level but also helped minimize extreme outliers and score gaps among learners. In other words, the START strategy fostered a more balanced learning outcome across the class.

As shown in Table 4, the most frequent post-test scores were 14 and 13, with fewer students scoring at the lower end of the scale. This clustering around higher scores further supports the consistency suggested by the SD value. Moreover, the maximum score increased to 20, and more students achieved scores above 60%, pointing to greater mastery of terminology.

Table 4. Average of the Scores in Post-test

Score	Frequency	Percentage
20	2	6.25%
19	1	3.13%
18	2	6.25%
17	1	3.13%
16	3	9.38%
15	2	6.25%
14	4	12.50%
13	4	12.50%
12	3	9.38%
11	3	9.38%

Score	Frequency	Percentage
10	3	9.38%
9	2	6.25%
8	1	3.13
7	1	3.13
Total	**32**	**100%**
Mean		**13.44**
SD		**3.44**

In terms of specific indicators, all four topics showed increased scores and reached the "Average" level: Processes that Shape Earth's Surface (63.13%), Weather Disturbances (66.25%), The Moon (64.38%), and The Stars (72.50%). Among them, the topic on *The Stars* saw the most improvement, suggesting that the hands-on and reflective components of the START framework helped clarifying complex terms. Notably, *The Stars* exhibited the greatest increase in performance. This may be attributed to the active and reflective components of the START framework, which likely helped learners better visualize and contextualize abstract astronomical concepts.

Table 5.

Summary Table on the Mean Scores and Descriptions for Understanding of Science Terminologies after START Intervention

The shift from a "Very Low" to "Average" performance in the first indicator indicates an improved ability to understand surface processes like erosion, weathering, and sedimentation. This improvement may be attributed to how the START activity allowed students to connect terms with concrete examples and reflections.

This aligns with Basuki et al. (2020), who demonstrated that performance-based, exploratory tasks helped elementary learners retain earth science vocabulary more effectively by enabling direct term-meaning associations. Similarly, Chin and Teou (2019) found that students who engaged in reflective science journaling and activity debriefs developed deeper conceptual links between observed phenomena and the corresponding scientific terminology. These findings support the conclusion that vocabulary instruction anchored in active experiences—like the START framework—helps build durable science understanding in Earth processes.

Indicators	Average Percentage Scores (%)	Description
Processes that Shape Earth's Surface	63.13	Average
Weather Disturbances	66.25	Average
The Moon	64.38	Average
The Stars	72.50	Average
Overall Percentage Score (%)	**67.19**	**Average**

In the second indicator, learners improved significantly in this area after intervention, showing better understanding of storm types, rainfall patterns, and typhoon classifications.

Given the previously low pre-test performance, this increase reflects better internalization of abstract weather terms.

In a recent study, Arwin et al. (2024) confirmed that disaster and climate education using interactive digital simulations enhanced retention of meteorological vocabulary among elementary learners. Furthermore, Foss (2025) emphasized that reflective learning grounded in real-world context strengthens epistemic reflexivity in science instruction. The use of situational vocabulary—reinforced through inquiry—helped learners better relate weather concepts to daily life. Together, these studies reinforce the importance of combining vocabulary focus with contextual and reflective learning when teaching complex science topics such as weather disturbances.

Also, post-intervention results for *The Moon* reveal a clear improvement from the initial misconceptions observed in the pre-test. This suggests that the intervention helped clarify confusing terms such as “waxing,” “waning,” and “lunar orbit.”

This supports findings from Küçüközer et al. (2023), who demonstrated that using 3D models and interactive simulations significantly improves students’ conceptual understanding of moon phases. Likewise, Fraknoi (2021) noted that scaffolding vocabulary using diagrams and physical models allows elementary learners to distinguish between lunar appearance and astronomical cause. These methods align with START’s reflective and structured learning steps, indicating that pairing language instruction with spatial aids enhances understanding of celestial topics.

Lastly, the strongest improvement was observed in this topic. This is notable, as star-related content is often abstract and misunderstood by young learners. The START intervention appears to have significantly supported students in clarifying terms such as “constellation,” “light-year,” and “star system.”

This result reflects the conclusions of Sneider et al. (2022), who reported that students develop accurate models of star patterns when engaged in observational tasks and guided discussions. Similarly, Chastenay (2024) found that full-dome digital planetarium simulations, when paired with reflective writing, improved student understanding of constellation formation and vocabulary. These studies suggest that complex space-related terminology becomes more accessible when paired with experiential, reflective activities—such as those built into the START framework.

Research Question No.3: What is the significance of the Spark-Test-Act-Reflect-Think (START) activity on the understanding and retention of science terminologies among Grade 5 learners?

A total of 32 Grade 5 students participated in the study, during which their understanding of science terminologies was assessed before and after the implementation of the Spark-Test-Act-Reflect-Think (START) intervention. As shown in Table 6, a comparison of pre-test and post-test scores was conducted to evaluate the effectiveness of the intervention. The pre-test yielded a mean score of **7.66** with a standard deviation of **2.97**, indicating a moderate variation in learners’ initial science vocabulary knowledge. After the implementation of the START activity, the mean score significantly increased to **13.44**, with a reduced standard deviation of **3.44**, showing not only a considerable improvement in performance but also more consistency in the students’ scores.

A paired sample t-test was performed to determine whether the difference between the pre-test and post-test scores was statistically significant, $t(31) = 43.6$, $P<.001$. Since the p-value is lower than the alpha level of 0.05 ($\alpha = 0.05$), the null hypothesis—which posits that there is no significant difference between pre-test and post-test scores—is rejected. These statistical findings reveal that the START intervention had a significant impact on the learners' understanding of science terminologies.

Table 6.
Significant Difference Between the Student's Pre-test and Posttest Scores

Type of Test	n	Mean	SD	Test Statistic	df	p	Decision	Mean difference	SE difference	Cohen's d (Effect Size)
Posttest Scores	32	13.44	3.44	43.6	31	<.001	Significant	5.78	0.133	7.70
Pretest Scores	32	7.66	2.97							

In addition, the computed Cohen's d of 7.70 represents a very large effect size, further emphasizing the practical significance of the intervention. These findings are in agreement with Pardamean and Simanjuntak (2021), who showed in their study "Scaffolded Inquiry-Based Learning for Science Vocabulary Development" that structured strategies significantly improve students' academic achievement and long-term retention. Likewise, Lai and Hwang (2020) found that technology-assisted reflection tools embedded in learning phases improved students' ability to retain and apply subject-specific terminology, highlighting the value of consistent, cycle-based feedback.

Chiu et al. (2021), in "A Game-Based Reflective Learning Approach to Enhance Elementary Students' Science Literacy," demonstrated that using structured, repeatable learning tasks resulted in higher science test scores and better understanding of abstract vocabulary. Similarly, Tseng et al. (2022) found that integrating metacognitive prompts into science vocabulary instruction significantly enhanced conceptual understanding and retention, particularly when paired with collaborative tasks.

The consistency between their findings and this current study further highlights the relevance and success of structured interventions like START in improving learners' science terminology understanding.

Research Question No.4: What insights can be drawn from the implementation of the Spark-Test-Act-Reflect-Think (START) intervention regarding its effectiveness in enhancing students' understanding of science terminologies?

To gather deeper insights into the efficacy of the START intervention, a thematic analysis of students' interview responses was conducted. The analysis revealed four key themes: (1) Enhanced Awareness of the Importance of Science Terminologies, (2) Increased Engagement and Motivation in Learning, (3) Development of Independent Study Habits and Strategies, and (4) Improved Confidence and Overcoming Learning Barriers. These themes provide valuable qualitative evidence of the intervention's effectiveness beyond what was measured quantitatively.

Table 7.
Insights of Students to the Efficacy of the Intervention

Emerging Themes	***Sample Statements***
Enhanced Awareness of the Importance of Science Terminologies	• "The START activities helped me realize how important science terms are in explaining ideas clearly." (IDI-01) • "START made me realize that knowing the correct science terms makes my answers more accurate." (IDI-02) • "The intervention showed me that science terms are keys to understanding complex ideas." (IDI-05)

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	• "I started to see that without learning the terms, it's hard to understand science lessons." (IDI-04)
Increased Engagement and Motivation in Learning	• "The way we reviewed and reflected helped me stay focused and participate more." (IDI-01) • "START made learning feel like a game, which kept me interested." (IDI-02) • "I used to be bored in science, but START made it more fun and meaningful." (IDI-04) • "I liked participating more because of the fun steps and feedback." (IDI-07)
Development of Independent Study Habits and Strategies	• "I now use my own notes and check meaning of words after class." (IDI-01) • "I even quiz myself sometimes." (IDI-02) • "I now keep a science vocabulary notebook." (IDI-04) • "I began making simple flashcards for terms and using them with classmates." (IDI-05)
Improved Confidence and Overcoming Learning Barriers	• "I used to feel nervous during recitation, but because we practiced often, I felt more confident." (IDI-01) • "Repeating them in START helped me remember and understand better." (IDI-02) • "Reviewing through START gave me more clarity and confidence." (IDI-04) • "START gave me confidence through repetition and feedback." (IDI-06)
Suggestions for Enhancing the START Intervention	• "Maybe we could add more visual aids or games in the 'Act' part to help with hard words." (IDI-01) • "Maybe allow group discussions in the 'Reflect' step to hear others' ideas and add more time because we find it really fun." (IDI-02) • "Add a summary poster or anchor chart after each session for review." (IDI-07)

The first theme was *Enhanced Awareness of the Importance of Science Terminologies***.** Students reported that the START activity helped them recognize the essential role of science terminologies in understanding and explaining scientific concepts. Several interviewees reflected that they previously overlooked scientific terms but now see them as fundamental to comprehension. For example, one student stated, "The START activities helped me realize how important science terms are in explaining ideas clearly." (IDI-01). This shift in perception underscores the impact of the structured approach in making students more conscious of language as a key to conceptual understanding.

This finding supports Pekel and Hasenekoğlu (2020), who explained in their study "Addressing Misconceptions in Science Through Structured Vocabulary Instruction" that conceptual learning is significantly enhanced when students explicitly engage with scientific terms. Similarly, Schneider et al. (2021) emphasized that conceptual understanding in science depends heavily on mastery of academic vocabulary, especially among younger learners. Their study concluded that learning barriers often stem not from the concepts themselves but from students' unfamiliarity with science-specific language. Additionally, Lemke and Garcia (2022) found that explicit vocabulary strategies significantly improve students' science comprehension, particularly when taught alongside hands-on activities.

The second theme was *Increased Engagement and Motivation in Learning* which evidently showed that the START framework fostered a more dynamic and participatory learning environment, which students found both fun and meaningful. The multi-step structure encouraged daily novelty, which kept learners interested and engaged. One participant mentioned, “START made learning feel like a game, which kept me interested.” (IDI-02), while another shared, “I used to be bored in science, but START made it more fun and meaningful.” (IDI-04).

These observations are consistent with Nguyen and Clark (2020), who found that science motivation increases when students participate in game-like, inquiry-driven activities. Their study showed that interactive instruction leads to higher levels of emotional and cognitive engagement. In a more recent investigation, Kim et al. (2022) observed that using reflective and collaborative learning strategies positively influenced students' interest in science topics.

Finally, Sung and Huang (2021) demonstrated that motivation in science improves when learners are allowed to take ownership through structured, activity-based lessons—supporting START’s design and impact.

Third theme was *Development of Independent Study Habits and Strategies* highlights that beyond the classroom, students reported improvements in how they approached studying science terminologies on their own. Responses suggested the development of personalized learning strategies such as note-taking, flashcards, and using real-world connections. For instance, “I now use my own notes and check meaning of words after class.” (IDI-01) and “I began making flashcards for terms and using them with classmates.” (IDI-05). This indicates that START not only improved immediate classroom outcomes but also fostered long-term learning habits.

This outcome is supported by Agnes (2023), whose study on “Metacognitive Strategy Instruction in Science Vocabulary Learning” revealed that learners improve academic autonomy when they are taught structured reflection techniques. In line with this, Turan and Koç (2020) demonstrated that students exposed to scaffolded science lessons developed better study habits and long-term retention. Likewise, Zhang et al. (2021) found that reflective tools combined with vocabulary instruction helped elementary learners build deeper learning routines and greater personal responsibility for science learning.

Fourth theme was *Improved Confidence and Overcoming Learning Barriers*, students reported a noticeable boost in confidence when using science terminologies, particularly during assessments and recitations. This was largely attributed to START’s repetitive and reflective structure. As one learner expressed, “I used to feel nervous during recitation, but because we practiced often, I felt more confident.” (IDI-01). Another stated, “START gave me confidence through repetition and feedback.” (IDI-06). The intervention appears to have provided a psychologically safe space for learners to make mistakes, receive feedback, and refine their understanding.

These results align with Bandura’s (1997) theory of self-efficacy, but also echo findings from recent research. For example, Arslan and Yildiz (2020) reported that students’ confidence in science improved significantly when instruction was paired with structured feedback and opportunities for reflection. In a related study, Lopez and Paredes (2021) noted that self-efficacy and confidence increased when learners engaged in peer-supported vocabulary games and applied learned terms in multiple ways. Additionally, Mercado and Limon (2023) emphasized that confidence in science develops when students are encouraged to actively use academic vocabulary in low-risk, supportive settings—exactly the type of environment START provided.

Lastly, fifth theme was *Suggestions for Enhancing the START Intervention*, which reflects students’ active involvement and desire to make the learning process more engaging and effective. Several participants proposed specific improvements, such as integrating more visual aids and games during the 'Act' phase to support difficult terms. For instance, one learner suggested, "Maybe we could add more visual aids or games in the 'Act' part to help with hard words" (IDI-01). Another recommended, "Maybe allow group discussions in the 'Reflect' step to hear others' ideas" (IDI-02), while another participant noted the value of visual summaries, saying, "Add a summary poster or anchor chart after each session for review" (IDI-07).

These recommendations underscore the importance of multimodal learning strategies, peer interaction, and consistent review in vocabulary acquisition. Research by Mayer (2022) supports the use of visual aids as they enhance comprehension and retention by engaging dual coding pathways. Similarly, Vygotsky's (1978) social constructivist theory highlights how collaborative learning through group discussion deepens understanding and critical thinking. Furthermore, Dunlosky et al. (2020) emphasize that retrieval practice and spaced repetition, such as using anchor charts or summary posters, improve long-term memory retention. Incorporating these suggestions into the START intervention could therefore optimize its effectiveness by catering to diverse learning styles and fostering active engagement.

CONCLUSION

This action research explored the effectiveness of the Spark-Test-Act-Reflect-Think (START) intervention in enhancing Grade 5 students' understanding of science terminologies. The study found that prior to the implementation of the START intervention, Grade 5 learners exhibited a very low level of understanding of science terminologies across four key topics: Earth's surface processes, weather disturbances, the Moon, and the stars. With an overall mean score of only 38.28%, students struggled particularly with abstract terms and concepts due to a lack of contextual and visual reinforcement in previous instruction. This baseline data underscored the need for an intervention that moves beyond rote learning and fosters conceptual engagement.

Post-test results showed a significant improvement in learners' comprehension of scientific terms, with the overall mean increasing to 67.19%. All topics reached the "Average" performance level, reflecting enhanced conceptual understanding. This indicates that the START strategy's combination of prediction, hands-on activities, reflection, and synthesis was effective in promoting vocabulary acquisition. The structured nature of the strategy helped learners bridge the gap between abstract terms and real-world applications, making science content more accessible and retainable.

The statistical analysis revealed a highly significant difference between pre-test and post-test scores, with a p-value less than .001 and a Cohen's d effect size of 7.70, indicating a very large practical impact. This result strongly supports the conclusion that the START strategy effectively enhanced both the understanding and retention of science vocabulary among students. The improvement suggests that structured, reflective, and cyclical instructional models can yield substantial learning gains in elementary science education.

Qualitative feedback revealed four major themes: increased awareness of science vocabulary importance, heightened engagement and motivation, improved study habits, and greater confidence. Students appreciated the interactive and reflective aspects of the intervention and recommended further enhancements like visual aids and group discussions. These insights affirm that START not only improved academic outcomes but also positively influenced learners' attitudes, metacognitive skills, and classroom participation—making it a holistic and impactful instructional strategy.

RECOMMENDATION

In light of the findings of this action research, it is recommended that the Spark-Test-Act-Reflect-Think (START) strategy be integrated into the regular instructional practices of elementary science education, particularly in Grades 4 to 6. The positive impact observed in learners' improved understanding of science terminologies suggests that START is an effective tool for conceptual development. Its structured, reflective, and student-centered approach fosters not only comprehension but also engagement, confidence, and independent learning habits.

To support this integration, science teachers should undergo capacity-building activities, such as professional development seminars or Learning Action Cell (LAC) sessions, focused on the effective implementation of START. These trainings would enable teachers to better understand the intervention’s five phases and apply them consistently across lessons. Alongside this, the development of supplementary instructional materials—such as START-based activity sheets, vocabulary organizers, and visual aids aligned with the Most Essential Learning Competencies (MELCs)—is highly encouraged to enhance the strategy’s effectiveness and sustainability in diverse classroom contexts.

Moreover, considering the success of the START intervention in science, its application may be extended to other subject areas that also emphasize conceptual understanding and language proficiency, such as English and Araling Panlipunan. Exploring its adaptability across disciplines may further support learners’ holistic academic development.

Future researchers are encouraged to conduct follow-up studies that examine the long-term retention of science terminologies following the use of the START strategy. Expanding the sample size and implementing the intervention in varied educational settings would also help assess the generalizability and broader impact of the approach. Finally, fostering a classroom culture of reflection through tools like journals, vocabulary notebooks, and group discussions is highly recommended, as this practice strengthens students’ metacognitive skills and supports sustained academic growth across content areas.

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