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Reflective Writing Strategies and Their Effects on Grade 11 Students' Reflection Skills and Academic Achievement: An Action Research

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ABSTRACT

Reflection is a core affective-domain competency emphasized in the Philippine Professional Standards for Teachers (PPST), yet few studies have examined structured reflective writing in Philippine public secondary science classrooms. This action research examined whether Reflective Writing Strategies (RWS) embedded in Physical Science lessons were associated with changes in students' reflection skills and achievement, and explored the relationship between the two. One four-week action research cycle (Kemmis & McTaggart, 1988) was implemented with one intact class of 29 Grade 11 students in Ilocos Norte, Philippines, using a single-group pretest-posttest design without a control group. Reflection was measured with the 16-item Questionnaire for Reflective Thinking (QRT; Kember *et al.*, 2000) and rubric ratings of journals, essays, and artifacts; achievement with a 20-item teacher-made test. Experts reviewed the instruments for content validity. Data were analyzed using descriptive statistics and Pearson product-moment correlation. The self-reported composite QRT mean rose from 2.31 (disagree with reservation) before the intervention to 4.09 (agree only with reservation) after it. Mean achievement rose from 6.07 (SD = 2.05) to 12.31 (SD = 3.05) out of 20 (gain = 6.24). Posttest score distributions shifted toward higher performance bands relative to the pretest, and reflection journals, essays, and artifacts were rated from satisfactory to exemplary across rubric criteria. A statistically significant, moderate positive correlation was found between students' reflection skills and academic achievement ($r = .43$, $p = .020$). Embedded reflective writing was associated with higher reflection and achievement scores, adding school-level evidence where it is scarce. Thus, findings support integrating structured reflective writing into science instruction. Controlled, multi-cycle studies involving embedded reflective writing are needed.

INTRODUCTION

Reflection, the deliberate, evaluative consideration of one's own experience, is widely recognized as a driver of deep and durable learning, yet it is frequently crowded out of classroom practice by time pressure and an emphasis on cognitive and psychomotor outcomes (Denton, 2010). A recent correlation meta-analysis of 22 studies likewise reported a medium pooled relationship between reflective thinking and learning achievement ($r = .527$) (Chamdani *et al.*, 2022). In the Philippine context, the Department of Education's Philippine Professional Standards for Teachers (PPST) positions teachers as designers of learning environments that are responsive to learner diversity and supportive of learner responsibility (Department of Education, 2017), yet explicit provision for reflection remains inconsistently implemented at the classroom level.

Despite a substantial international literature base linking reflective practice and metacognitive instruction to learning outcomes, including recent school-level studies in biology and general science (Famarin, 2024; Sadykova *et al.*, 2024), comparatively few studies have examined reflective writing interventions in Philippine public secondary science classrooms, and fewer still have tested the empirical relationship between students' reflection skills and their academic achievement within the same intervention. A preliminary needs assessment conducted by the researcher at the study site provided the impetus for the present study. The researcher administered a survey adapted from Grant (2005) to 85 respondents (21 Grade 10, 29 Grade 11, and 24 Grade 12 students, and 11 teachers) to gauge the extent to which reflection was practiced and perceived in the classroom.

The composite result, a "slightly negative" perception of reflection among both students and teachers, was corroborated in brief follow-up interviews. Students reported difficulty connecting classroom concepts to everyday life and uncertainty about how to reflect even when asked to do so, while teachers acknowledged providing opportunities for reflection but observed that students often reproduced course content rather than engaging in genuine application or self-evaluation. These findings framed the research problem this study addressed: Grade 11 students' limited manifestation of reflection skills, operationalized through Dewey's (1933) three-step reflective process of perceiving difficulty, reasoning toward a solution, and evaluating that solution.

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Table 1: Baseline survey of students' and teachers' perceptions of reflection skills (needs assessment, n = 85)

Respondent Group	n	Mean	Interpretation
Grade 10 Students	21	2.70	Slightly Negative
Grade 11 Students	29	2.45	Quite Negative
Grade 12 Students	24	3.22	Slightly Negative
Composite (all students)	74	2.79	Slightly Negative
Teachers	11	3.19	Slightly Negative
Composite (all respondents)	85	2.89	Slightly Negative

Note: Adjectival ranges: 1.00–1.50 Extremely Negative; 1.51–2.50 Quite Negative; 2.51–3.50 Slightly Negative; 3.51–4.50 Undecided; 4.51–5.50 Slightly Positive; 5.51–6.50 Quite Positive; 6.51–7.00 Extremely Positive.

Research Objectives

This action research examined whether a structured Reflective Writing Strategies (RWS) intervention, embedded in existing Grade 11 Physical Science lessons, was associated with change in students' reflection skills and academic achievement, and whether these two outcomes were related. Specifically, the study addressed the following questions:

1. To what extent do Grade 11 students manifest reflection skills (a) before and (b) after the implementation of the RWS?
2. What are the pretest and posttest academic achievement scores of Grade 11 students before and after the implementation of RWS?
3. Is there a significant relationship between students' reflection skills and their academic achievement?

The findings are intended to inform classroom-level instructional design and contribute Philippine secondary science evidence to the broader literature on reflective pedagogy, in line with the PPST's expectation that teachers use evidence to improve practice (Salandanan *et al.*, 2013).

LITERATURE REVIEW

This section situates the study within the theoretical and empirical literature on reflection and reflective writing, moving from foundational dimensions to models of reflective development, the specific role of reflective journals as a pedagogical tool, empirical evidence linking reflection to academic achievement, and recent work on reflection and reflective writing in science education. The section closes with a synthesis identifying the gap the present study addresses.

Theoretical Foundations of Reflection

The term reflection carries multiple definitions depending on disciplinary context, but most converge on the idea of thought occurring in consideration of a past action or experience (Schön, 1983). Dewey (1933) offered the most influential formulation, defining reflective thinking as the active, persistent, and careful consideration of a belief or form of knowledge in light of the grounds that support it and the further conclusions to which it tends. Dewey (1933) proposed that reflective thought unfolds through three interrelated steps from the learner's perspective: perceiving a problem or difficulty, developing a solution through rational thinking, and monitoring that solution for its suitability. Critically, Dewey (1933) did not intend these steps to occur once within a single lesson; rather, he saw them as a recurring process that should be integrated across a learner's academic development.

Boud, Keogh, and Walker (1985) extended this idea specifically to learning contexts, describing reflection as "a generic term for those intellectual and affective activities in which individuals explore their experiences in order to lead to new understandings and appreciations" (p.19). They argued that experience alone is not sufficient for learning; learners must be made aware of the possibilities for learning within their experience and must take active control of the reflective process, since, as they put it, only learners themselves can reflect on their own experience. Boud *et al.* (1985) further characterized reflection as a complex interplay of feeling and cognition rather than passive mind-wandering, and cautioned that conventional assessments such as tests and routine assignments do not by themselves allow students to fully process and relate new input to what they already know.

These accounts converge on a constructivist theoretical foundation: learners construct their own understanding and knowledge of the world through experience and through reflection on that experience, with meaning-making understood as a fundamentally mental, internal act (Murphy, 2014). This constructivist framing, rooted in the work of Dewey (1933) and Schön (1983), served as the theoretical foundation for the present action research.

Levels and Characteristics of Reflective Thinking

Beyond definitions, several scholars have proposed models describing how reflective capacity develops and what distinguishes stronger from weaker reflections. Grossman *et al.* (2009) proposed that reflective activity differentiates into four levels along a continuum. The first, content-based reflection, involves developing one's reflection in light of a particular learning experience

and guiding objective. Hatcher and Bringle (1997) suggested this can be promoted by connecting learning objectives to learning experiences, offering regular opportunities for reflection, and providing feedback on students' reflective work. The second level, metacognitive reflection, involves awareness and knowledge of one's own thinking; Grossman *et al.* (2009) proposed a four-step model for cultivating it, involving describing one's own and others' perceived thoughts, adopting alternative viewpoints through case study, relating content to personal experience, and reflecting at a highly descriptive level. The third and fourth levels, self-authorship and transformative reflection, are more advanced; self-authorship involves assessing one's own thinking from a metacognitive stance and understanding its effects on one's own behavior (Kegan, 1994), while transformative reflection involves changing one's personal perspective through the adoption of alternative viewpoints (Mezirow, 1997). Grossman *et al.* (2009) noted that both these higher levels typically require an emotionally engaging experience, such as service learning, to develop.

Rodgers (2002), as cited in Denton (2010), offered a complementary account, arguing that reflection is characterized by continuity, the weaving of discrete experiences into a coherent whole, as when a journal-writer builds connections from one entry to the next, as well as by rigor and discipline, interactionality (reflection occurring among learners in a community through communication), and the adoption of intellectually honest attitudes toward one's own knowledge and abilities. Brown (1997) noted that open questions remain about the environmental and instructional conditions that best support reflective thinking, including the specific roles of the teacher and how classrooms can be organized to maximize students' reflective capacity. Addressing this gap in the context of preservice teacher training, Spalding and Wilson (2002) found that students' capacity for reflective thinking improved through explicit instruction, defining terms, discussing examples, and applying an organizational model, rather than through the mere provision of reflective opportunity. Growth in reflective capacity, in their account, could be observed in students' growing ability to distinguish narration from reflection, to write different kinds of reflection according to a taught model, and to connect learning activities through reflective writing.

Reflection Journals as a Pedagogical Strategy

Among the instructional strategies available for cultivating reflective thinking, including debate, video recording, computer-assisted teaching, concept mapping, portfolios, and structured discussion, reflective journal writing is consistently identified as one of the most effective (Cengiz & Karataş, 2015). In reflective teaching more broadly, the learner is positioned as an active decision-maker and the teacher as a facilitator and guide; evaluation becomes process-oriented, with the teacher using students' reflective products to diagnose learning deficiencies and target subsequent instruction, making learning more meaningful and durable (Cengiz & Karataş, 2015). Recent work continues to treat reflective journal writing as a pedagogical tool for nurturing students' lifelong learning skills: Alt *et al.* (2022) analyzed 1, 312 journal entries from higher education students to derive a generic scheme of reflective-thinking dimensions, and then designed and validated a questionnaire on students' perceptions of their reflective writing experiences.

In reflective journals, learners record and think through current learning and teaching activities as they write, which allows them to recognize how they learn and express what they have learned in an original, personally meaningful form; this active participation is associated with more durable learning (Kazu & Demiralp, 2012). Research indicates that keeping reflective journals helps learners construct meaningful knowledge, practice and consolidate what they have learned, organize their thinking, identify gaps in their understanding, solve problems, and manage stress, with corresponding benefits for self-inquiry and metacognitive skills (Cengiz & Karataş, 2015).

Reflection and Academic Achievement: Empirical Evidence

A growing body of empirical work has examined whether reflective practice is associated with academic and cognitive gains, though, as noted above, relatively few studies have investigated its relationship with academic achievement specifically. Murphy (2014) found that high school science students who engaged in reflective practice reported significantly higher levels of reflection than students who did not, and that students' levels of reflective thinking predicted their critical thinking dispositions on dimensions such as mental focus and cognitive integrity. Cengiz and Karataş (2015) found that feedback-supported reflective journal keeping improved pre-service science teachers' achievement scores in a general chemistry laboratory course, and that most participants believed that the activity had also benefited their metacognition and learning more broadly. More recent syntheses and larger samples point in the same direction. A correlation meta-analysis of 22 studies published between 2012 and 2021 reported a significant pooled relationship between reflective thinking and learning achievement ($r = .527$) (Chamdani *et al.*, 2022). Among more than 560 Turkish secondary school students in grades 5 to 8, reflective thinking skills for problem solving were strongly and positively related to metacognitive awareness ($r = .726$), with similar strength across gender and grade level (Zerdali & Eğmir, 2025). Evidence that reflection-related classroom conditions independently predict achievement is, however, mixed: among Grade 6 pupils, a self-control and self-reflection dimension of the learning environment did not significantly predict test scores when entered with other dimensions ($p = .253$), whereas overall student engagement correlated positively with performance ($r = .57$) (Olvidado & Doronio, 2026).

Sabel, Dauer, and Forbes (2017) reported that enhanced answer keys paired with reflection questions helped introductory biology students engage in metacognition

and develop a deeper understanding of biological concepts, while Angra and Gardner (2017) similarly highlighted the role of reflective, metacognitively oriented tasks (such as reflecting on graph construction) in strengthening students' science practices. Demirel, Derman, and Karagedik (2015) found a moderate, statistically significant positive relationship between students' reflective thinking skills toward problem solving and their attitudes toward mathematics. Taken together, this literature suggests a consistent, if not always large, positive association between reflective thinking and academic achievement across science and mathematics domains and across educational levels from pre-service teacher training to secondary schooling.

Recent Evidence on Reflection and Reflective Writing in Science Education

Recent syntheses reinforce the instructional value of reflection while also showing where the evidence remains thin. In a systematic review of 32 Web of Science articles (2009-2025) on metacognition in science, physics, chemistry, and biology education, Benek and Şekercioğlu (2026) reported that incorporating metacognitive strategies into instruction was associated with gains in academic achievement, motivation, problem solving, and self-regulation, and that structured metacognitive activities were effective in reducing misconceptions and improving attitudes towards learning. Participants in the reviewed studies were predominantly university-level teacher candidates and secondary school students, and reflective thinking forms were among the commonly used data collection tools. Focusing on writing specifically, a systematic review of higher education studies published between 2018 and 2024 concluded that reflective practice embedded in reflective writing can enhance academic performance, particularly reflective writing skills and self-reflection, across disciplines (Sudirman *et al.*, 2024).

Primary studies in science and science-related courses point in the same direction. In a US university sample of 348 undergraduates, Swanson *et al.* (2024) examined a four-week sequence of reflective surveys delivered after a metacognitive learning strategies workshop; completing the sequence was associated with a semester grade point average about 0.23 points higher after accounting for prior academic achievement and student background, and students who reported greater confidence in the first week were roughly twice as likely to complete it. The authors noted that completion may partly reflect pre-existing motivation, so the association should not be treated as causal. In a lower-year public health biology course, Ezezika and Johnston (2023) designed and evaluated a reflective writing assignment built on Gibbs' (1988) reflective cycle and concluded that such assignments can support learning and course enjoyment, help students apply disciplinary knowledge to real-world issues, and give instructors a way to evaluate that application, a purpose close to the daily-life connection targeted in the present study. In physics, Sijmkens *et al.* (2023) gave science and engineering students discipline- and topic-specific reflective prompts after problem solving, delivered through a digital companion that offered multiple-choice reflection prompts; students who used the prompts frequently showed more strategic problem solving and greater conceptual understanding, and the pattern held after controlling for prior metacognitive ability. Similarly, Zarestky *et al.* (2022) reported that reflective writing activities embedded in a graduate computational science and engineering course supported students' metacognitive awareness, self-regulated learning behaviors, problem solving, and critical thinking, based on student reflective writing and surveys.

Evidence from school-level science classrooms is also emerging. In a quasi-experimental study of 120 eighth-grade biology students in two Kazakhstani schools, Sadykova *et al.* (2024) used small-group metacognitive prompt cards, including reflection questions about problem-solving approaches and reasoning, over ten weeks; the experimental classes outperformed the control classes on a biology comprehension posttest and on the Metacognitive Awareness Inventory in ANCOVA analyses, although reflection prompts were discussed in groups and the study did not include a written-reflection component. A related issue concerns how written reflections in science are assessed. Wulff *et al.* (2022) analyzed the written reflections of 81 mostly preservice physics teachers and 68 preservice teachers from other subjects using machine-learning and natural-language-processing methods; they found that the physics teachers' reflections were longer and contained more physics-specific content, but cautioned that such features do not directly measure reflective competence and that agreement among human raters was only partial. These cautions underline the value of explicit rubrics and rater training when reflective writing is used as evidence in science education.

Among the sources identified for this review, evidence from Philippine science classrooms was limited. Makiaway *et al.* (2024) examined reflective journaling among 22 Biochemistry students at a Philippine college using a descriptive-quantitative design; students' metacognitive awareness was fairly observable (83.63%), their motivation toward science learning was adequate (M = 3.72), and they rated reflective journaling as a moderately acceptable learning innovation (M = 3.96). At the secondary level, Famarin (2024) reported an experimental pretest-posttest control-group study of 90 Grade 9 General Science students in a Philippine technical high school, in which students taught with metacognitive instruction scored significantly higher on the posttest than those taught traditionally. Closest in design to the present study, Arban *et al.* (2025) compared journal writing with conventional paper-and-pencil assessment in two intact Grade 10 geometry classes of 40 students each in a Philippine public secondary school. Students who used journals to record their reasoning, reflections, and conceptual insights improved from M = 9.88 (SD = 2.88) to M = 12.15 (SD = 2.62) on a 25-item test content-validated by six experts and checked for reliability with KR-20 (mean

gain = 2.28), whereas the comparison class changed little (M = 8.48 to 8.65; mean gain = 0.18); students also described clearer understanding, more reflection, and better retention.

Synthesis and Research Gap

Four conclusions can be drawn from this literature. First, reflection is a theoretically well-grounded, multidimensional construct spanning content-based, metacognitive, self-authorship, and transformative levels, and it requires deliberate instructional scaffolding rather than incidental opportunity to develop (Denton, 2010). Second, reflective journal writing is repeatedly identified as an effective, low-cost strategy for cultivating this construct within ordinary classroom instruction (Cengiz & Karataş, 2015; Kazu & Demiralp, 2012; Sudirman *et al.*, 2024). Third, an emerging empirical base links reflective practice and metacognitive scaffolding to achievement, problem solving, and motivation in science and mathematics education (Arban *et al.*, 2025; Cengiz & Karataş, 2015; Chamdani *et al.*, 2022; Demirel *et al.*, 2015; Murphy, 2014; Benek & Şekercioğlu, 2026; Sabel *et al.*, 2017; Sijmkens *et al.*, 2023; Swanson *et al.*, 2024). Fourth, many of the recent primary studies identified for this review were conducted mostly with university students, and several rely on correlational, descriptive, or self-reported evidence rather than controlled comparison (Makiaway *et al.*, 2024; Swanson *et al.*, 2024; Zarestky *et al.*, 2022), although school-level studies are emerging (Famarin, 2024; Sadykova *et al.*, 2024; Zerdali & Eğmir, 2025) and science metacognition research more broadly includes many secondary school participants (Benek & Şekercioğlu, 2026). Among the sources identified for this review, few tested a structured reflective writing intervention within Philippine public secondary science instruction, and fewer still directly tested the statistical relationship between students' reflection skills and their academic achievement within the same intervention cycle. The present action research addresses this gap by implementing and evaluating a structured Reflective Writing Strategies intervention with Filipino Grade 11 science students and by directly testing the relationship between their resulting reflection skills and academic achievement.

MATERIALS AND METHODS

Research Design

This study used an action research design following the four-phase cycle of Kemmis and McTaggart (1988) – plan, act, observe, and reflect – implemented for a single intervention cycle because of the time constraints of one academic quarter. A single-group pretest-posttest design without a control group evaluated changes in reflection skills and academic achievement across the cycle.

Research Setting and Participants

The study was conducted in a public secondary school in Ilocos Norte, Philippines, during the last quarter of the academic year. Participants were drawn from one intact class of 29 Grade 11 students taught by the researcher, using non-probability, convenience sampling appropriate to the action research design. The section comprised 13 male (44.8%) and 16 female (55.2%) students. For group activities, students were randomly assigned to six groups of five to six members each.

Intervention: Reflective Writing Strategies (RWS)

Reflective Writing Strategies (RWS) were implemented across three topics of the Grade 11 Physical Science curriculum, Consumer Products, Across the Universe, and Motion and Life Science, over four lesson logs delivered across four weeks. Each lesson combined cooperative-learning group tasks with an individual reflective-journal prompt linking the topic to students' daily lives (e.g., the importance of reading product labels; the effects of Earth's motion on daily life; the relevance of linear motion to everyday routines). Group-based artifacts (a formal laboratory report and a PowerPoint presentation) were also required and were assessed by peers and the teacher using criterion-referenced rubrics.

Instruments

This study used four research instruments, each of which underwent expert validation.

Questionnaire for Reflective Thinking (QRT). A 16-item instrument adapted from Kember *et al.* (2000), rated on a 5-point scale (1 = definitely disagree to 5 = definitely agree), administered before and after the intervention to assess students' self-reported manifestation of reflective thinking.

Teacher-made pretest/posttest. A 20-item multiple-choice test aligned with the content and performance standards of the three topics covered, administered before and after the intervention to measure academic achievement.

Reflection journal and essay rubrics. Two rubrics were adapted to score students' written reflections: an analytic rubric from NCTE/IRA (2006) assessing depth of reflection, use of textual evidence and context, language use, and conventions; and a holistic rubric adapted from Jones (IUPUI Center for Service and Learning) assessing clarity, relevance, analysis, interconnections, and self-criticism across four levels of reflective practice.

Rubrics of Students' Artifacts (RSA). Criterion-referenced rubrics were used to assess each group's formal laboratory report and PowerPoint presentation.

Data Collection Procedure

Following the reconnaissance phase, the researcher obtained permission from the school head to implement the intervention. Prior to instruction, students completed the QRT and the 20-item pretest. Over the following four weeks, the researcher delivered the four RWS-integrated lesson logs, during which students kept individual reflection journals, produced group artifacts, and peer-assessed group participation using a rubric. Field notes and exit-pass responses were collected throughout to support interpretation of the quantitative results. After the cycle,

students completed the QRT and the achievement test again as posttest measures, and the rubrics were used to score their reflection journals, essays, and artifacts.

Data Analysis

Descriptive statistics (frequency counts, percentages, and means) summarized QRT responses, achievement test scores, and rubric ratings. Pearson product-moment correlation was used to test the relationship between students' composite reflection score and their academic achievement score. Pre–post differences in QRT and achievement test scores are reported descriptively.

Ethical Considerations

The intervention was embedded in regular, curriculum-aligned classroom instruction, and permission to conduct the study was secured from the school head prior to implementation. Informed consent documents were also obtained from the participants.

RESULTS AND DISCUSSION

Results are presented in five parts corresponding to the research questions: (a) students' reflection skills before and after RWS, (b) academic achievement before and after RWS, (c) rubric ratings of reflection journals and essays, (d) rubric ratings of group artifacts, and (e) the relationship between reflection skills and academic achievement.

Reflection Skill Before and After RWS

The composite QRT mean increased from 2.31 (Disagree with Reservation) before the intervention to 4.09 (Agree Only with Reservation) after it. The largest positive shifts (more than 2.7 points; pre M = 1.48–1.83, post M = 4.24–4.62) were observed on items concerning challenging firmly held ideas, reappraising one's own actions, and continually engaging with the course material. Two of these items moved from "definitely disagree" to "definitely agree," and the third moved from "disagree with reservation" (M = 1.83) to "definitely agree." One item, "If I follow what the teacher says, I do not have to think too much on this subject", remained in the "uncertain" band across both administrations (pre M = 2.76; post M = 3.38).

A student's remark illustrates the residual difficulty captured by the one item that did not shift out of the "uncertain" band: "Although I follow the instructions given by my teacher, I still have difficulty [with] thinking [about] the uses of these we are learning in class" (Student 7). This suggests that while RWS was associated with broad gains in self-reported reflective engagement, translating classroom content into perceived personal relevance remained a residual difficulty for some students.

Table 2: Composite pre- and post-assessment means on the questionnaire for reflective thinking (n = 29)

QRT Domain Summary	Pre-assessment M	Interpretation	Post-assessment M	Interpretation
Highest-gain items (e.g., challenge to held ideas; reappraisal of actions; continual engagement)	1.48 – 1.83	Definitely Disagree – Disagree with Reservation	4.24 – 4.62	Definitely Agree
Smallest-gain item (reliance on following teachers' instructions)	2.76	Uncertain	3.38	Uncertain
Composite mean (16 items)	2.31	Disagree with Reservation	4.09	Agree Only with Reservation

Note: Scale (Kember et al., 2000): 4.21–5.00 Definitely Agree; 3.41–4.20 Agree Only with Reservation; 2.61–3.40 Uncertain; 1.81–2.60 Disagree with Reservation; 1.00–1.80 Definitely Disagree.

Academic Achievement before and after the RWS

Table 3 summarizes the distribution of pretest and posttest scores on the 20-item teacher-made test (n = 29). On the pretest, most students (59%) scored in the "fair" band, and none scored "very satisfactory" or "outstanding". On the posttest, scores shifted toward the higher bands: 34% scored "satisfactory," 31% scored "very satisfactory," and 24% scored "outstanding," with no students scoring "poor."

Table 3: Distribution of pretest and posttest scores by performance band (n = 29)

Score Range	Interpretation	Pretest f	Pretest %	Posttest f	Posttest %
0 – 3	Poor	5	17	0	0
4 – 7	Fair	17	59	3	10
8 – 11	Satisfactory	7	24	10	34
12 – 15	Very Satisfactory	0	0	9	31
16 – 20	Outstanding	0	0	7	24
Mean (SD)		6.07 (2.05)		12.31 (3.05)	

Ratings of Reflection Journals and Reflective Essays

Using the NCTE/IRA (2006) analytic rubric shown in Table 4, students' reflection journals and essays received a composite mean of 4.39 (Exemplary). Depth of reflection and convention were rated "advanced," while use of textual evidence/historical context and language use were rated "exemplary".

Using the Jones (IUPUI Center for Service and Learning) rubric shown in Table 5, students were rated "Aware Practitioner" on clarity, relevance, and analysis, and "Reflective Practitioner," the highest level on interconnections and self-criticism, for a composite rating of "Aware Practitioner" (M = 3.56).

Table 4: Mean ratings of students' reflection journals and essay (NCTE/IRA rubric)

Skill	Mean	Interpretation
Depth of Reflection	4.20	Advanced
Use of Textual Evidence and Historical Context	4.84	Exemplary
Language Use	4.40	Exemplary
Convention	4.12	Advanced
Composite Mean	4.39	Exemplary

Note: Scale: 4.21–5.00 Exemplary; 3.41–4.20 Advanced; 2.61–3.40 Proficient; 1.81–2.60 Basic; 1.00–1.80 Below Basic.

Illustrative excerpts from students' journals reflect these ratings. On the relevance of physical science to daily life, one student wrote: "We need to look for the expiration date in the products that we buy so that we would be aware. . . As we look for the expiration dates, we have the chance to avoid any outcome that'll happen" (Student 17). Connecting scientific concepts with personal experience, another student wrote about Earth's place in the universe: [T]he question [of] where am I in the universe is a question that requires me to think deeply as well as creatively. . . I am living in a very colorful life together with my loved ones" (Student 24).

Table 5: Level of reflection using the Jones (IUPUI) rubric

Skill	Mean	Level
Clarity	3.12	Aware Practitioner
Relevance	3.25	Aware Practitioner
Analysis	3.16	Aware Practitioner
Interconnections	4.12	Reflective Practitioner
Self-criticism	4.15	Reflective Practitioner
Composite Mean	3.56	Aware Practitioner

Note: Scale: 4.00–5.00 Reflective Practitioner; 3.00–3.99 Aware Practitioner; 2.00–2.99 Reflection Novice; 1.00–1.99 Unacceptable.

Ratings of Group Artifacts

Formal laboratory reports as shown in Table 6 received a composite mean of 3.61 ("Satisfactory"), with materials and data sections rated "Exceptional" and the remaining five criteria rated "Satisfactory." PowerPoint Presentations, as shown in Table 7, received a composite mean of 3.19 ("Accomplished"), with the presentation criterion rated "Exemplary" and the remaining three criteria rated "Accomplished".

Table 6: Mean ratings of group laboratory reports

Skill	Mean	Level
Introduction	3.50	Satisfactory
Experimental Hypothesis	3.00	Satisfactory
Materials	4.00	Exceptional
Procedures	3.50	Satisfactory
Data	4.00	Exceptional
Analysis	3.50	Satisfactory
Conclusion	3.75	Satisfactory
Composite Mean	3.61	Satisfactory

Note: Scale: 4.00–5.00 Exceptional; 3.00–3.99 Satisfactory; 2.00–2.99 Unsatisfactory; 1.00–1.99 Poor.

Table 7: Mean ratings of group PowerPoint presentations

Skill	Mean	Level
Purpose	2.75	Accomplished
Understanding	3.00	Accomplished
Presentation	4.00	Exemplary
Conventions	3.00	Accomplished
Composite Mean	3.19	Accomplished

Note: Scale: 3.41–4.00 Exemplary; 2.61–3.40 Accomplished; 1.81–2.60 Developing; 1.00–1.80 Beginning.

Relationship Between Reflection Skills and Academic Achievement

Pearson product-moment correlation revealed a statistically significant, moderate positive relationship between students' composite reflection scores and their academic achievement scores, r = .431, p = .020, as shown in Table 8.

Table 8: Correlation between reflection skills and academic achievement

Variable	Reflection r	Academic Achievement r	Sig. (2-tailed)	N
Reflection Skills	1.000	.431*	.020	29
Academic Achievement	.431*	1.000	.020	29

*Note: *Correlation is significant at the 0.05 level (2-tailed).*

Discussion

Reflection Skills

The shift in composite QRT means from "disagree with reservation" to "agree only with reservation" suggests that embedding structured reflective writing prompts within existing science lessons was associated with a change in students' self-reported reflective engagement. This pattern echoes Murphy's (2014) finding that students who engaged in reflective practice in science class reported significantly higher reflection than those who did not, and is consistent with Cengiz and Karataş's (2015) account of reflective teaching as a process-oriented cycle in which learners become more active in evaluating their own learning. Comparable gains in self-reported metacognitive awareness followed a ten-week prompt-based biology course for eighth-graders (Sadykova *et al.*, 2024), and the strong association between reflective thinking and metacognitive awareness among secondary school students (Zerdali & Eğmir, 2025) is consistent with the view that the two develop together. Philippine pre-service teachers likewise rated the evaluation and reflection dimension of self-regulated learning highly (M = 4.14 of 5) and agreed that reflecting on progress raised their confidence (Dela Cruz *et al.*, 2026); as in the present study, these are self-reported perceptions that may be influenced by social desirability. That one QRT item, concerning reliance on following the teacher's instructions rather than independent thinking, remained in the "uncertain" band across both administrations, suggesting that a single four-week cycle may be insufficient to shift more deeply held beliefs about the locus of thinking in the classroom, a pattern consistent with Grossman *et al.* (2009) observation that higher levels of reflective capacity (self-authorship, transformation) typically require sustained, emotionally engaging experience beyond a single short intervention.

Academic Achievement

The shift in the posttest score distribution toward higher performance bands, with no students remaining in the "poor" band and 55% of students reaching "very satisfactory" or "outstanding," is consistent with prior findings that reflective-journal interventions are associated with improved achievement outcomes, for example among pre-service science teachers in general chemistry laboratory coursework (Cengiz & Karataş, 2015) and in supporting metacognitive engagement with biological concepts (Sabel *et al.*, 2017). Recent school-level studies report the same direction: Grade 8 biology students whose lessons included metacognitive and reflection prompts outperformed control classes on a posttest (Sadykova *et al.*, 2024), as did Philippine Grade 9 General Science students taught with metacognitive instruction (Famarin, 2024). Arban *et al.* (2025) found a larger gain in a Grade 10 geometry class that used journals than in a class assessed conventionally.

Relationship Between Reflection and Academic Achievement

The significant, moderate positive correlation between reflection skills and academic achievement (r = .43, p = .020) aligns with the broader literature linking reflective thinking to academic achievement, including Demiral *et al.* (2015) finding of a positive relationship between reflective thinking towards problem solving and attitudes towards mathematics, and Sabel *et al.* (2017) finding that

reflection-supported metacognition is associated with stronger conceptual understanding.

Pedagogical Implications

These findings suggest that reflective writing can be integrated into existing science lesson sequences without requiring additional instructional time, by pairing content-based group tasks with a short individual reflective journal prompt that explicitly links the lesson to students' daily experience. Given that the item most resistant to change concerned students' reliance on teacher direction, teachers may need to make the purpose and process of reflection more explicit, for example, through worked examples of strong versus weak reflective entries and rubric-referenced feedback, consistent with Spalding and Wilson's (2002) finding that explicit instruction, not mere opportunity, drives growth in reflective capacity. Discipline- and topic-specific reflective prompts, like the lesson-linked journal prompts used here, have likewise been associated with more strategic problem solving and greater conceptual understanding in physics (Sijmkens *et al.*, 2023). At the institutional level, findings support continued investment in structured, feedback-supported reflective writing as a low-cost strategy for supporting both affective-domain growth and academic achievement.

CONCLUSION

A single cycle of Reflective Writing Strategies (RWS), embedded within regular Grade 11 Physical Science instruction, was associated with descriptive gains in students' self-reported reflection skills, rubric-rated reflective writing quality, and academic achievement, and reflection skills were significantly and positively correlated with achievement. These findings are broadly consistent with prior international literature linking reflective practice to learning outcomes, while extending this evidence base to a Philippine public secondary science context. Future research should replicate this intervention across multiple cycles and classes to generate stronger evidence to guide policy and practice around reflective pedagogy in Philippine schools.

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