# RESEARCH PROCESS SKILLS AND SCIENTIFIC LITERACY OF SCIENCE, TECHNOLOGY, AND ENGINEERING (STE) LEARNERS OF BISLIG CITY NATIONAL HIGH SCHOOL: A DESCRIPTIVE-DEVELOPMENTAL STUDY

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**ABSTRACT**

This study examined the research process skills (RPS) and scientific literacy (SL) of Grade 9 and Grade 10 learners enrolled in the Science, Technology, and Engineering (STE) Program at Bislig City National High School for SY 2024–2025. Guided by inquiry-based science education and the PISA scientific literacy framework, it determined learners' levels across seven RPS domains and four SL domains, identified priority areas needing strengthening, and used the results as basis for a proposed Research Enhancement Program (Bybee et al., 2009; OECD, 2019). A quantitative descriptive–developmental design was employed. The target population was 51 STE learners; however, participation required consent/assent, resulting in 39 respondents (Grade 9 = 20; Grade 10 = 19). Data were gathered using a researcher-adapted RPS–SL assessment questionnaire and analyzed using mean, standard deviation, and rank ordering. Findings indicated high overall RPS (M = 3.98, SD = 0.64), with strongest performance in collecting and organizing data (M = 4.07) and interpreting and analyzing data (M = 4.04), while constructing hypotheses ranked lowest (M = 3.85). Scientific literacy was likewise high (M = 3.98, SD = 0.64), with interpretation of scientific information highest (M = 4.09) and understanding scientific concepts comparatively lower (M = 3.88). Results supported a Research Enhancement Program focusing on inquiry framing, investigation design, conceptual mastery, and application through evidence-based tasks.

Keyword: Research Process Skills; Scientific Literacy; STE Learners; Descriptive–Developmental; Research Enhancement Program; Bislig City National High School

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## 1. INTRODUCTION

Scientific literacy and inquiry competence remain persistent challenges in many education systems, as reflected in international and national assessments that report continuing gaps in learners' ability to interpret data, apply scientific reasoning, and evaluate evidence (Department of Education, 2019, 2023; OECD, 2019, 2023). These competencies are particularly essential in Science, Technology, and Engineering (STE) programs where learners are expected to engage in research-oriented tasks and investigation.

Research process skills (RPS)—including formulating questions, identifying variables, hypothesizing, designing investigations, collecting data, analyzing results, and communicating conclusions—are core inquiry practices emphasized in contemporary science frameworks (National Research Council, 2012; NGSS Lead States, 2013). Scientific literacy similarly requires conceptual understanding and the ability to interpret scientific information and evaluate claims using evidence (Bybee et al., 2009; OECD, 2019).

This study assessed the levels of RPS and scientific literacy among Grade 9 and Grade 10 STE learners of Bislig City National High School and identified priority areas for strengthening. The results were used to propose a Research Enhancement Program aligned with empirically identified needs, consistent with developmental research approaches in education (Richey & Klein, 2014).

## 2. METHODOLOGY

### 2.1 Research Design

A quantitative descriptive–developmental design was used to determine the levels of research process skills and scientific literacy and to derive program inputs from the descriptive results (Creswell & Creswell, 2018; Richey & Klein, 2014).

### 2.2 Research Locale

The study was conducted at Bislig City National High School, Schools Division of Bislig City, Philippines, focusing on learners enrolled in the STE Program during SY 2024–2025.

### 2.3 Respondents and Sampling

All Grade 9 and Grade 10 STE learners (N = 51) were invited through total enumeration; however, actual participation required parent/guardian consent and learner assent. The achieved sample included 39 respondents (Grade 9 = 20; Grade 10 = 19).

Table 1. Respondents (Matrix)

| Respondents | Population | Sample |
| --- | --- | --- |
| Grade 9 STE learners | 28 | 20 |
| Grade 10 STE learners | 23 | 19 |

### 2.4 Research Instruments

A researcher-adapted questionnaire assessed seven Research Process Skills domains and four Scientific Literacy domains using a 5-point Likert scale. The instrument was guided by established inquiry and scientific literacy frameworks (Burns et al., 1985; Padilla et al., 1985; Bybee et al., 2009; OECD, 2019).

Table 2. Instruments and Measures (Matrix)

| Variable | Instrument | Domains/Indicators | Scale/Measure | Key Output |
| --- | --- | --- | --- | --- |
| Research Process Skills | RPS–SL Assessment Questionnaire | 7 RPS domains | 5-point Likert | Mean, SD, rank; descriptive level |
| Scientific Literacy | RPS–SL Assessment Questionnaire | 4 SL domains | 5-point Likert | Mean, SD, rank; descriptive level |

### 2.5 Data Gathering Procedure

Approvals were secured from the relevant education authorities and the school administration. After orientation and consent/assent procedures, the questionnaire was administered in STE classes, retrieved immediately, coded anonymously, and encoded for analysis.

### 2.6 Statistical Treatment

Mean and standard deviation were computed for each domain and overall levels. Rank ordering identified the highest and lowest domains and guided the selection of priority components for the proposed Research Enhancement Program.

## 3. RESULTS AND DISCUSSION

### 3.1 Level of Research Process Skills

Research process skills were high overall (M = 3.98, SD = 0.64; n = 39), indicating that skills were usually demonstrated. The highest domains were collecting and organizing data (M = 4.07) and interpreting and analyzing data (M = 4.04), while constructing hypotheses ranked lowest (M = 3.85). The pattern suggests that learners were relatively stronger in procedural and data-handling competencies than in inquiry framing, which typically requires higher-order reasoning and explicit scaffolding and feedback (OECD, 2019; Richey & Klein, 2014).

Table 3. Research Process Skills by Domain (n = 39) (Matrix)

| Domain | Mean (SD) | Interpretation |
|---|---|---|
| A. Formulating Research Questions | 3.91 (0.71) | High |
| B. Identifying and Defining Variables | 3.99 (0.72) | High |
| C. Constructing Hypotheses | 3.85 (0.85) | High |
| D. Designing Investigations | 3.97 (0.75) | High |
| E. Collecting and Organizing Data | 4.07 (0.85) | High |
| F. Interpreting and Analyzing Data | 4.04 (0.67) | High |
| G. Drawing Conclusions and Communicating Results | 4.03 (0.73) | High |
| Overall RPS | 3.98 (0.64) | High |

### 3.2 Level of Scientific Literacy

Scientific literacy was high overall (M = 3.98, SD = 0.64; n = 39). Interpretation of scientific information ranked highest (M = 4.09), followed by evaluation of scientific claims (M = 4.03), while understanding scientific concepts was comparatively lower (M = 3.88). This indicates that learners were more confident in interpreting information and judging claims than in deeper conceptual consolidation and transfer-oriented application, which are necessary for sustained scientific reasoning (Bybee et al., 2009; OECD, 2019).

Table 4. Scientific Literacy by Domain (n = 39) (Matrix)

| Domain | Mean (SD) | Interpretation |
|---|---|---|
| A. Understanding Scientific Concepts | 3.88 (0.70) | High |
| B. Application of Scientific Knowledge | 3.94 (0.72) | High |

| Domain | Mean (SD) | Interpretation |
|---|---|---|
| C. Interpretation of Scientific Information | 4.09 (0.74) | High |
| D. Evaluation of Scientific Claims | 4.03 (0.74) | High |
| Overall SL | 3.98 (0.64) | High |

### 3.3 Priority Areas Needing Strengthening and Program Basis

Rank ordering identified priority needs. For research process skills, constructing hypotheses, formulating research questions, and designing investigations ranked lowest. For scientific literacy, understanding scientific concepts and application of scientific knowledge were comparatively lower. These results served as the empirical basis for a Research Enhancement Program focusing on inquiry framing, investigation design, conceptual mastery, and application through evidence-based tasks (Bybee et al., 2009; OECD, 2019; Richey & Klein, 2014).

Table 5. Priority Areas for Strengthening (n = 39) (Matrix)

| Priority Area | Mean | Implication |
|---|---|---|
| RPS: Constructing Hypotheses | 3.85 | Strengthen hypothesis writing and evidence-based justification. |
| RPS: Formulating Research Questions | 3.91 | Strengthen problem identification and investigability checks. |
| RPS: Designing Investigations | 3.97 | Strengthen alignment of variables, procedures, and trials. |
| SL: Understanding Scientific Concepts | 3.88 | Strengthen conceptual explanation and connections. |
| SL: Application of Scientific Knowledge | 3.94 | Strengthen transfer tasks and evidence-based decisions. |

Table 6. Proposed Research Enhancement Program Focus Areas (Matrix)

| Program Focus | Target Domain(s) | Key Activities |
|---|---|---|
| Research Question Clinic | RPS-A | Problem-to-question exercises; peer review using a checklist. |
| Hypothesis Writing Workshop | RPS-C | Hypothesis templates; claim–evidence–reasoning practice. |
| Investigation Design Scaffold | RPS-D | Variable control mapping; trial planning; procedure alignment. |
| Concept Mastery Sessions | SL-A | Concept mapping; misconception checks; short explanations. |
| Application and Decision Tasks | SL-B | Real-life cases; data-based decisions; evidence evaluation. |

## 4. CONCLUSIONS

STE learners demonstrated high research process skills and scientific literacy overall. Learners were strongest in data handling, interpretation, and evaluation tasks, while inquiry framing (hypothesis construction and question formulation) and deeper conceptual understanding emerged as priority areas for strengthening. The findings supported the development of a targeted Research Enhancement Program aligned with the lowest-ranked domains.

5. RECOMMENDATIONS

Teachers and school leaders may implement structured supports such as research question clinics, hypothesis writing workshops, and investigation design scaffolds, alongside concept mastery and application tasks that strengthen scientific reasoning. Future studies may implement and evaluate the proposed Research Enhancement Program to determine its effectiveness in improving the identified priority domains.

Schools may enhance communication practices by providing regular progress updates with clear guidance for parents. Home literacy programs may be strengthened through parent reading guides, structured reading routines, and improved access to reading materials. Targeted remediation should prioritize frustration-level learners and monitor progress periodically using Phil-IRI-based assessments.

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