Evaluating the Relationship between Students' Learning Experience and Science Process Skills through Environmental Project-Based Instruction

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ABSTRACT

This study aimed to determine the relationship between the students' learning experience and science process skills through environmental project-based instruction. The study employed descriptive-correlational research design and gathered data through survey questionnaires from 80 Grade 12 STEM students at Pasig National High School during the first semester of the school year 2025-2026. Descriptive statistics revealed that the students possessed very good learning experience through environmental project-based instruction, $M = 3.99$. They also possessed very good science process skills, $M = 3.98$. Meanwhile, inferential statistics, such as Pearson's correlation, revealed that a highly significant relationship was found between students' learning experience and science process skills, with correlation values ranging from 0.394 to 0.612 ($p<0.01$). These results that improving aspects of learning experience in environmental project-based instruction could lead to improved science process skills. Furthermore, this study recommends that teachers may further enhance students' learning experience and science process skills through integrating project-based instructions. Future research may build upon the present study by employing mixed-methods or experimental research designs to strengthen causal inferences. Experimental studies comparing project-based instruction with traditional approaches could further clarify the mechanisms through which specific instructional features influence scientific skill development.

Keywords: Learning Experience, Science Process Skills, Environmental Project-Based Instruction, Project-Based Learning, STEM Education

INTRODUCTION

Learning experience provides information on how students perform in the classroom. As cited by Cents-Boonstra et al. (2021), student learning experience and engagement is associated with students' motivation to learn, and their persistence to complete school. Effective engagement is significant in which students develop deeper connections with their peers, teachers and institutions, while offering rich opportunities for learning and development (Delfino, 2019)

However, classroom practices, including textbook-based work, repetitive exercises, and memorization of facts brought a negative impact on student experience (Urias, 2022). This results in a limited depth, superficial knowledge retention, and inadequate mastery of skills.

In science education, the development of science process skills is significant, as these skills enable students to observe, hypothesize, experiment, analyze, and draw evidence-based conclusions. Conventional teaching approaches are generally teacher-directed and where students are taught in a manner that is conducive to sitting and listening (Tularam, 2018). This results in students who can recite facts but struggle with applying scientific inquiry to real-world issues, hindering their ability to become proactive problem-solvers in sustainability contexts.

In fact, according to Ignacio et al. (2022), the recent released by the Programme for International Student

Assessment (PISA) showed that the Philippines was ranked as one of the lowest in science among 79 participating countries. The country also ranked low in the Trends in International Mathematics and Science Study (TIMSS).

Recent studies underscore the importance of this concern. Firdausi (2024) found that implementing project-based learning (PBL) significantly improves students' science process skills, suggesting that this learning approach as viable alternative to traditional, memorization-based instruction. Similarly, Munawwarah and Side (2025) found that project-based learning significantly improves students' scientific process skills, including critical thinking, problem-solving, and data analysis. Additionally, this approach enhances students' motivation and engagement in the learning process.

Existing studies highlight the importance of project-based learning in improving science process skills; however, few directly examine how variations in students' learning experiences relate to science process skills. This lack of nuanced, context-specific data leaves educators without evidence-based guidance on which aspects of learning matter most for science process skills development.

Moreover, given the growing need for students to engage with environmental issues, there is an urgent demand for educational models to develop scientific competencies of the students in meaningful contexts. Environmental project-based instruction offers authentic, real-world tasks that can foster deeper understanding, collaboration and scientific thinking. In line with this, the researchers want to investigate the relationship between the students' learning experiences and science process skills through environmental project-based instruction.

Statement of the Problem

This study focused on determining the relationship between the Grade 12 STEM students' learning experiences and science process skills through environmental project-based instruction. Specifically, this study sought answers to the following questions.

1. How may the students' environmental project-based learning experience be described in terms of:

a. learning engagement;
b. conceptual understanding;
c. real-life relevance?

2. How may the students' science process skills be described in terms of:

a. observing;
b. classifying;
c. measuring;
d. communicating;
e. inferring; and
f. predicting?

3. Is there a significant relationship between students' learning experience and science process skills?

Hypothesis

The hypothesis below was tested in the study.

1. There is no significant relationship between students' learning experience and science process skills.

METHODOLOGY

This section presents the methods and techniques utilized in the study. This includes research design, sampling procedures, and data analysis scheme.

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Research Design

This study utilized descriptive correlational research design. The collection of data was done through survey questionnaires to obtain and measure the students' learning experience and science process skills through environmental project-based instruction. Consequently, the relationship between students' learning experience and science process skills were assessed.

Sampling Procedure

The respondents of this study comprise Grade 12 STEM students at Pasig National High School during the first semester of the school year 2025-2026. The researchers utilized Slovin's formula to determine the number of respondents. According to Anurgraheni et al. (2023), this formula is utilized to determine the sample size from a population. From the given population of 100 Grade 12 STEM students, the researchers utilized 80 respondents and were chosen through random sampling technique.

Table 1. Respondents of the Study

Respondents	Number of Students	Sample Size
STEM 12 – Diamond	34	27
STEM 12 – Ruby	33	27
STEM 12 – Sapphire	33	26
Total	100	80

Research Instrument

The researchers utilized five-scale survey questionnaires to determine the students' learning experience and science process skills through environmental project-based instruction. The survey questionnaire intended for student-respondents is composed of three parts. Part I of the questionnaire focuses on the demographic profile of the respondents. Meanwhile, Part II of the questionnaire deals with the students' learning experience, which covers the researcher-made questions. On the other hand, Part III of the questionnaire deals with the students' basic process skills, which is adapted from Mellona and Angeles (2025) titled Exploring the Relationship Between Attitudes Toward Science and Basic Process Skills Among Grade 12 STEM Students. These parts were modified by the researchers to fit the study.

The instruments utilized in this study underwent content validity through expert validation. The survey questionnaire was reviewed by three science experts, to ensure the clarity, relevance and alignment of the items. The suggestions and revisions provided by the validators were integrated to improve the quality and ensure the accuracy of the research instruments.

Moreover, reliability test was established through Cronback alpha to determine the internal reliability of the items in survey questionnaires. The Statistical Package for Social Science (SPSS) was utilized to treat the reliability of the survey questionnaires. The research instrument obtained an overall Cronbach alpha of 0.881. This value indicates good reliability, as cited by Otibar et al. (2023), where Cronbach's alpha values of 0.7 or higher align with the generally accepted standard for reliability.

Data Analysis

The researchers utilized descriptive and inferential statistics to analyze the data. The descriptive statistics include weighted means to describe the Grade 12 STEM students' environmental project-based learning experience in terms of learning engagement, conceptual understanding, and real-life relevance. This is also utilized to describe their science process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting.

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Meanwhile, inferential statistics include Pearson's correlation to determine the relationship between students' learning experience and science process skills. As mentioned by Mellona and Peria (2025), although the data gathered use Likert-scale responses, composite scores were computed for each variable through summing responses across multiple items leading them to be treated as interval scale. Moreover, to determine the strength of correlation between variables, the researchers utilized the correlation coefficient and strength of relationship outlined by Ahmad et al. (2019), which is presented in table 2.

Table 2. Correlation Coefficient and Strength of Relationship

Correlation Coefficient	Strength Relationship
± 1	Perfect
$\pm 0.7 < r < \pm 1$	Strong
$\pm 0.3 < r < \pm 0.7$	Moderate
$0 < r < \pm 0.3$	Weak
0	Zero

RESULTS AND DISCUSSION

This chapter deals with the presentation, analysis and interpretation of the data collected and the results of the statistical treatment employed in the study. This focuses on determining the relationship between the students' learning experience and science process skills through environmental project-based instruction.

Students' Learning Experience

Learning experience is significant for students as it affects their academic performance, personal growth and future career. The assessments of students' learning experience in terms of learning engagement, conceptual understanding, and real-live relevance are summarized in table 3.

Table 3. Students' Learning Experience

Learning Experience	Weighted Mean	Verbal Interpretation
Learning Engagement	3.74	Very Good
Conceptual Understanding	4.03	Very Good
Real-Life Relevance	4.20	Very Good
Overall Mean	3.99	Very Good

Legend: 4.21 – 5.00 (Excellent); 3.41 – 4.20 (Very Good); 2.61 – 3.40 (Good); 1.81 – 2.60 (Fair); 1.00 – 1.80 (Poor)

Table 3 presented the assessment of students' learning experience through environmental problem-based instruction with an overall mean of 3.99 which possesses a verbal interpretation of "very good". This implied that students perceived the significance of environmental project-based instruction in engaging them, helping them to understand scientific concepts, and connecting the lessons to real-life situations.

This aligned with the study of Zhang and Ma (2023) stated that project-based learning, as compared to traditional teaching model, significantly improved students' learning outcomes and positively contributed to academic achievement, affective attitudes and thinking skills.

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Students' Science Process Skills

Science process skills are crucial to students for cultivating their scientific literacy by acquiring the information, organizing, analyzing and interpreting the collected data and drawing conclusions. The assessments of students' science process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting, are summarized in table 4.

Table 4. Students' Science Process Skills

Science Process Skills	Weighted Mean	Verbal Interpretation
Observing	4.09	Very Good
Classifying	4.01	Very Good
Measuring	4.16	Very Good
Communicating	3.80	Very Good
Inferring	3.84	Very Good
Predicting	3.95	Very Good
Overall Mean	3.98	Very Good

Legend: 4.21 – 5.00 (Excellent); 3.41 – 4.20 (Very Good); 2.61 – 3.40 (Good); 1.81 – 2.60 (Fair); 1.00 – 1.80 (Poor)

Table 4 presented the assessment of students' science process skills with an overall mean of 3.98 which possess a verbal interpretation of "very good". This implied that students demonstrate proficiency in foundational science process skills, suggesting that engaging students in environmental project-based instructions helps them develop a broad range of basic and practical science skills.

This is highlighted in the study of Nurrramdhani et al. (2023) confirmed that there was an increase in scientific process skills and knowledge learning outcomes after applying the project-based learning model. Similarly, Dacumos (2023) emphasized that this approach enables learners to use fundamental and integrated science process skills which are essential components of scientific inquiry.

The Relationship between Students' Learning Experience and Science Process Skills

Table 5 summarized the results of the correlational analysis performed to determine the significant relationship between Grade 12 STEM students' learning experience and science process skills.

Table 5. Results of the Correlation Analysis Between the Students' Learning Experience and Their Science Process Skills

Learning Experience	Science Process Skills					
	Observing	Classifying	Measuring	Communi-cating	Inferring	Predicting
Learning Engagement	0.539** (0.000)	0.533** (0.000)	0.519** (0.000)	0.353** (0.001)	0.535** (0.000)	0.612** (0.000)
Conceptual Understanding	0.587** (0.000)	0.576** (0.000)	0.537** (0.000)	0.401** (0.003)	0.505** (0.000)	0.608** (0.000)
Real-Life Relevance	0.394** (0.000)	0.496** (0.000)	0.499** (0.000)	0.477** (0.000)	0.550** (0.000)	0.523** (0.000)

Legend: ** = significant ($p \leq 0.01$) Numbers in the upper entry are correlation values (r-values)
Numbers enclosed in parentheses are probability values (p-values)

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The data revealed that a highly significant relationship was found between students' learning experience in terms of learning engagement, conceptual understanding, and real-life relevance, and their science process skills in terms of observing, classifying, measuring, communicating, inferring, and predicting. This is manifested by the computed values that range from 0.000 to 0.001 for these variables, which is less than the 0.01 significance level. Further examination of the results revealed that moderate positive correlation existed between these variables ranging from 0.394 to 0.612. Among the dimensions of learning experience, conceptual understanding and learning engagement demonstrate consistently stronger correlations with higher-order science process skills such as predicting and inferring. This pattern suggests that when students are cognitively engaged and develop deeper conceptual clarity during environmental project-based activities, they are more likely to apply reasoning skills that require synthesis, interpretation, and anticipation of outcomes. In contrast, real-life relevance showed relatively weaker but still significant associations with basic skills such as observing and classifying, indicating that contextual authenticity may primarily support foundational inquiry behaviors rather than more abstract scientific reasoning.

These findings may be explained by the structure of environmental project-based instruction, which often prioritizes collaborative problem-solving, sustained inquiry, and reflective thinking. This implied that improving aspects of learning experience in environmental project-based instruction could lead to improved science process skills. This also emphasized the experience of the students in teaching instructions matters as much as what is taught.

This is aligned to the study of Corbano-Reyes (2023) reported that significant gains in science process skills of the students after project-based learning exposure, indicating that this approach effectively supports a range of science process skills. Moreover, Novianto (2023) confirmed that the implementation of the project-based instruction model has also proven effective in enhancing student engagement in learning and facilitating the development of social skills.

CONCLUSION

The Grade 12 STEM students possessed very good learning experience through environmental project-based learning in terms of learning engagement, conceptual understanding and real-life relevance. The findings also demonstrated that students possessed a very good utilization of their science process skills in terms of observing, classifying, measuring, communicating, inferring and predicting. Moreover, a highly significant relationship was found between Grade 12 STEM students' environmental project-based learning experience and science process skills.

RECOMMENDATION

This study suggested that teachers may further enhance students' learning experience and science process skills through integrating project-based instructions. They may also need continuous upskilling to fully integrate project-based instructions. Moreover, future research may build upon the present study by employing mixed methods or experimental research designs to strengthen causal inferences. Experimental studies comparing project-based instruction with traditional approaches could further clarify the mechanisms through which specific instructional features influence scientific skill development.

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