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Research Article

Examining the Relationship Between Science Investigatory Project Learning Experience and Attitudes Toward Science of Grade 11 STEM Students

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ABSTRACT

This study aimed to determine the relationship between science investigatory project learning experience and attitudes toward science of Grade 11 STEM students at San Isidro National High School during the school year 2025-2026. The study employed descriptive-correlational research design and gathered data from 28 Grade 11 STEM students through survey questionnaires. Descriptive statistics revealed that Grade 11 STEM students exhibited a very good level of learning experience, in terms of learning engagement, conceptual understanding and collaboration, after the implementation of science investigatory project. Similarly, they demonstrated very good attitudes toward science, in terms of confidence, enjoyment and utility. Meanwhile, inferential statistics revealed that there was a highly significant relationship found between science investigatory project learning experience and attitudes toward science among Grade 11 STEM students with moderate to strong positive correlations (r values ranging from 0.451 to 0.756, $p<0.05$). This affirmed that science investigatory project learning experiences provide a critical pedagogical approach in fostering positive attitudes toward science. Furthermore, this study encourages teachers to integrate project-based learning, such as SIP, in science teaching. Meanwhile, school administrators may conduct professional development focusing on inquiry-based and project-based teaching strategies. In addition, the proposed action plan must be implemented to improve the learning experience and attitudes toward science through SIP, ensuring sustained improvement in both engagement and scientific disposition.

Keywords: *Attitudes Toward Science, Descriptive-Correlational Study, Learning Experience, Science Investigatory Project, STEM*

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Introduction

Understanding science concepts and processes is significant in analyzing different challenges in the community. Knowledge derived by science informs societal behaviors and policies; technologies discovered via science can result in better lifestyles for mankind (Belk, et al., 2025). These significance of science would be appreciated by the learners as they develop positive attitudes toward science, which would lead to their strong interest in pursuing scientific careers.

As cited by Mao et al. (2021), in recent years, the decline of students' favorable attitude toward science has become a matter of considerable societal concern and debate in some regions across the world. In the Philippine education system, fostering a positive attitude toward science among students remains a pressing concern. Despite the implementation of the K-12 curriculum and various educational reforms, students' engagement and interest in science subjects have not met desired levels. These concerns lead to poor academic performance of students in science. In the recent Program for International Student Assessment (PISA) 2022, students from the Philippines are still among the least proficient in the world in math, reading, and science (Acido and Caballes, 2024). Moreover, the country is ranked low in the Trends in International Mathematics and Science Study (TIMSS) (Ignacio et al., 2022).

These challenges regarding the students' academic performance and attitudes toward science suggest that improving curriculum content alone is insufficient; rather there is a need to examine the students' learning experience in science class. According to Mellona and Ancheta (2025), there is a significant relationship between the utilization of authentic tasks in science class and the students' learning experience. This informs that exposing the students to authentic tasks could lead to an increase in their learning experience in science.

Specifically, project-based learning and inquiry-based learning creates authentic tasks where learners explore real-world challenges fostering critical thinking, collaboration and deeper understanding. As stated by Doly (2024), these approaches provide formidable framework for educational transformation, equipping learners' academic excellence and navigating the complexities essential in the 21st-century environment.

These approaches are depicted in the context of conducting science investigatory projects (SIP). This strategy encourages students to apply their theoretical knowledge to real-world problems, making science more relevant and engaging. Moreover, through SIP, learners are immersed in authentic tasks where they identify problems, formulate hypothesis, design and conduct experiments, and communicate their findings. According to the study of Mellona and Santos (2025), exposing students to environmental project-based instructions such as SIP could result in an increase in their science process skills. This suggests that this strategy strengthen not only the academic performance of the learners but also the skills needed to explore and deepen their understanding of the world. Moreover, Cabarieto (2026) confirms that active engagement in SIP contributes to the academic success of the learners, highlighting the value of participatory and inquiry-based learning in science education.

Despite the growing emphasis of science investigatory project, there is a limited number of studies that directly examine the relationship of the learning experience of students in this strategy and the attitudes toward science, particularly within the Philippine senior high school context. While studies affirm the effectiveness of SIP in the cognitive and process skills of the learners, studies about its influence on the affective domain of learning are limited, specifically attitudes toward science in terms of confidence, enjoyment and utility.

Moreover, grade 11 STEM students are at a critical stage in their academic and career development, where attitudes toward science significantly influence their future educational and professional pathways. Their grade level also represents the transitional phase where students move from foundational knowledge to more specialized and application-oriented learning.

In line with the given premises above, the researchers wanted to determine the relationship between the grade 11 STEM students'

learning experience and their attitudes toward science.

Statement of the Problem

This study focused on determining the relationship between science investigatory project learning experience and attitudes toward science of Grade 11 STEM students. Specifically, this study sought to answer the following questions:

1. How may the students' science investigatory project learning experience be described in terms of:
   1.1 learning engagement;
   1.2 conceptual understanding; and
   1.3 collaboration?
2. How may the students' attitudes toward science be described in terms of:
   2.1 confidence;
   2.2 enjoyment; and
   2.3 utility?
3. Is there a significant relationship between students' science investigatory project learning experience and attitudes toward science?
4. What program of activities can be crafted based on the results of the study?

Hypothesis

The hypothesis below was tested in the study:

1. There is no significant relationship between students' science investigatory project learning experience and attitudes toward science.

Methodology

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

Research Design

This study employed descriptive correlational research design. The collection of data was done through survey questionnaires, where students' science investigatory project learning experience and attitudes toward science were obtained and measured. Consequently, the relationship between students' science investigatory project learning experience and attitudes toward science were assessed.

Sampling Procedure

The respondents of the study include the Grade 11 STEM students at San Isidro National High School during the Second Semester, School Year 2025-2026. The study utilized total enumeration sampling, wherein Grade 11 STEM students in a section handled by the researcher were included as the respondents of the study. This group was selected as the participant-respondents since they have direct exposure to the implementation of Science Investigatory Project. With this, the entire class was considered as the sample to completely represent the students within this specific learning context.

However, since this study was limited to a single class section with relatively small sample size, the findings may not be fully generalizable to the entire population of Grade 11 STEM students in the Division of Pampanga. In addition, there is a possibility of researcher and response bias as students may have felt influenced in providing their responses. These limitations were acknowledged in interpreting the results and drawing conclusions of the study.

Table 1. Respondents of the Study

Section	Number of Students
STEM 11	28

Research Instrument

The researchers utilized a five-point scale survey questionnaire to determine the science investigatory project learning experience and attitudes toward science among Grade 11 STEM students. The survey questionnaire intended for student-respondents is composed of three parts. Part I focuses on the demographic profile of the respondents. Meanwhile, Part II of the questionnaire deals with students' learning experience in science investigatory project, which is adapted from Mellona and Santos (2025) titled Evaluating the Relationship between Students' Learning Experience and Science Process Skills through Environmental Project-Based Instruction. On the other hand,

Part III of the questionnaire deals with the students' attitudes toward science, 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.

Moreover, the research instrument underwent content validity through expert validation. This was reviewed by three science experts to ensure the clarity and alignment of the items to the purpose of the study. The suggestions and revisions gave by the validators were integrated to ensure the validity and accuracy of the research instrument.

Furthermore, reliability test was established through Cronbach Alpha, computed through Statistical Package for Social Science (SPSS). The research instrument obtained an overall Cronbach's alpha of 0.969, indicating a good reliability. As cited by Otibar et al. (2023), Cronbach alpha values of 0.7 or higher align with the generally accepted standard for reliability.

Data Analysis

The researchers utilized descriptive statistics, such as mean, to describe the Grade 11 STEM students learning experience in science investigatory project in terms of learning engagement, conceptual understanding and collaboration. Moreover, this was also used to describe their attitudes toward science in terms of confidence, enjoyment and utility.

Consequently, although the data gathered use five-point Likert-scale responses for both variables, composite scores were computed for each variable through summing responses across multiple items leading them to be treated as interval scale. In line with this, inferential statistics such as Pearson correlation was utilized to determine the relationship between science investigatory project learning experience and attitudes toward science of Grade 11 STEM students. Moreover, the researchers utilized the correlation coefficient and strength of relationship outlined by Ahmad et al. (2019) to determine the strength of correlation between variables, 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 science investigatory project learning experience and attitudes toward science of Grade 11 STEM students.

Science Investigatory Project Learning Experience

Learning experience influences the academic performance and future career success of the students. This was measured by the researchers in the context of Science Investigatory Project in terms of learning engagement, conceptual understanding and collaboration. The overall assessment of the Grade 11 STEM students' science investigatory project learning experience was summarized in table 3.

Table 3. Science Investigatory Project Learning Experience

SIP Learning Experience	Weighted Mean	Verbal Interpretation
Learning Engagement	3.69	Very Good
Conceptual Understanding	3.71	Very Good

SIP Learning Experience	Weighted Mean	Verbal Interpretation
Collaboration	4.29	Excellent
Overall Mean	3.90	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 summary of results for the science investigatory project learning experience of Grade 11 STEM students with an overall mean of 3.90 which possess a verbal interpretation of "Very Good". It can be noted that collaboration obtained the highest mean of 4.29 and a verbal interpretation of "Excellent". Meanwhile, learning engagement received the lowest mean of 3.69 and a verbal interpretation of "Very Good", indicating that behind the result received, students were actively involved in the learning process.

This affirmed that science investigatory project provided a better learning experience to the students. This also indicates that the implementation of SIP fosters essential skills among learners such as teamwork, inquiry and active participation.

This is aligned with the results of the study of Mellona and Ancheta (2025), confirmed that utilization of authentic task, such as science investigatory project, in science class provides students higher learning experience. Zhang and Ma (2023) also indicated that science investigatory project significantly improved students' learning outcomes and positively contributed to academic achievement, affective attitudes, and thinking skills, especially academic achievement. Similarly, Hero and Lindfors (2019) stated that the implementation of investigatory project provided better learning experiences in relation to conflicts and unusual situations, while becoming aware of and claiming their collaborative agency and internalizing phases of an investigation and innovation process.

Attitudes Toward Science

Attitudes toward science influences the confidence of the students in dealing with science-related tasks, engagement in science activities and their interest in pursuing science-related careers. The overall assessment of the Grade 11 STEM students' attitudes toward science in terms of confidence, enjoyment and utility was summarized in table 4.

Table 4. Attitudes Toward Science

Attitudes Toward Science	Weighted Mean	Verbal Interpretation
Confidence	3.09	Good
Enjoyment	4.11	Very Good
Utility	4.16	Very Good
Overall Mean	3.79	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 summary of results for the attitudes toward science of Grade 11 STEM students with an overall mean of 3.79 and a verbal interpretation of "Very Good". It can be gleaned from the results that utility obtained the highest mean of 4.16 and a verbal interpretation of "Very Good".

Meanwhile, confidence obtained the lowest mean of 3.09 and a verbal interpretation of "Good". It is important to note that confidence in science develops gradually and is influenced by prior experiences, task difficulty, and exposure to complex scientific processes. The relative lower confidence level may be attributed to the rigorous nature of conducting science investigatory project such as independent experimentation, experimental failures or data analysis anxiety. These may cause the students to

feel less confident even when they find the work useful and enjoyable. This is anchored in self-efficacy theory, as cited by Honicke et al. (2023), which highlights that the learning experience of the students influences their confidence and behavior in conducting academic tasks. This implies that students encountered difficulties in conducting SIP may develop lower confidence despite recognizing its usefulness. Nevertheless, with continued exposure to supportive and student-centered learning environments, students' confidence is likely to increase alongside their competence in science.

In general, the results implied that Grade 11 STEM students demonstrate positive attitudes toward science. These results also indicates that SIP foster not only the cognitive aspects but also the affective engagement of the students, which are both significant for long-term success in STEM education.

This is aligned with the study of Chistyakov et al. (2023), mentioned that project-based learning can make students more participated in the classroom. In the context of science investigatory project, this strategy provides higher attitudes towards science by fostering curiosity and increasing motivation toward learning. Furthermore, Ganajová et al. (2025) confirmed that after exposing students to this strategy, they perceived science subjects as less difficult and showed greater interest in their study. They were also more aware of the significance of science subjects and their importance for daily life.

The Relationship Between Science Investigatory Project Learning Experience and Attitudes Toward Science

Table 5 summarized the results of the correlational analysis performed to determine the significant relationship between the Grade 11 STEM students' science investigatory project learning experience and their attitudes toward science.

Table 5. Results of the Correlational Analysis Between Science Investigatory Project Learning Experience and Attitudes Toward Science

Science Investigatory Project Learning Experience	Attitudes Toward Science		
	Confidence	Enjoyment	Utility
Learning Engagement	0.718* (S) (<0.001)	0.708* (S) (<0.001)	0.452* (M) (0.016)
Conceptual Understanding	0.756* (S) (<0.001)	0.690* (M) (<0.001)	0.501* (M) 0.007
Collaboration	0.451* (M) 0.016	0.615* (M) (<0.001)	0.543* (M) (0.003)

Legend:
* = significant ($p \leq 0.05$)
Numbers in the upper entry are correlation values (r-values)
Number enclosed in parenthesis are probability values (p-values)
Strength of Correlation:
±1 [Perfect (P)]; $\pm 0.7 < r < \pm 1$ [Strong (S)]; $\pm 0.3 < r < \pm 0.7$ [Moderate (M)]; $0 < r < \pm 0.3$ [Weak (W)]; 0 [Zero (Z)]

The results revealed that highly significant relationship was found between the science investigatory project learning experience and the attitudes toward science among Grade 11 STEM students. This significant relationship is manifested by the computed values that ranged from <0.001 to 0.016, which are less than 0.05 significance level. Moreover, correlation values ranged from 0.451 to 0.756 indicates moderate to strong positive correlation.

The strongest positive correlation was observed between conceptual understanding and confidence (r=0.756, strong), suggesting that the knowledge acquired by the students through science investigatory project provide them with greater confidence in dealing with science activities and problem-solving situations. Meanwhile, collaboration and confidence obtained the lowest positive correlation (r=0.451, moderate), this may indicate that

although collaboration in science investigation project contribute to enhancing students' confidence, its influence may vary depending on group dynamics and individual participation. The collaboration remains a pivotal aspect of the learning process which provide opportunities for peer support, and social interaction among students – building gradually the students' confidence in science.

The results highlight the importance of integrating structured science investigatory projects in the science class, as they significantly contribute to the cognitive and affective learning outcomes.

These results are supported by Mao et al. (2021), stated that context-based teaching approaches, such as inquiry-based learning and project-based learning, have significant positive impact on students' overall attitudes toward science. Similarly, Senina and Manguilimotan (2025) emphasized that engagement, consistent involvement in project-based learning is significantly related to more positive attitudes and heightened interest in science. Moreover, Taghap and Addani (2024) confirmed that the teachers' effort in developing teaching strategies, such as SIP, provide ample opportunities for the development of both affective and cognitive aspects of attitude. This affirmed that science investigatory project learning experiences provide a critical pedagogical approach in fostering positive attitudes toward science. This also highlighted the importance of providing students meaningful and relevant opportunities to connect science to society (Adarlo et al., 2022).

Proposed Program of Activities

The results of the study revealed that there is a highly significant relationship between science investigatory project learning experience and attitudes toward science among Grade 11 STEM students.

Moreover, the assessments of SIP learning experience yielded a verbal interpretation of "Very Good". Similarly, the assessments of attitudes towards science also resulted in a verbal interpretation of "Very Good".

Hence, as presented on table 6, the researchers proposed an action plan to improve students learning experience and attitude toward science through SIP.

Table 6. Proposed Program of Activities

Objectives	Action	Timeline	Person Involved	Expected Output
To increase learning engagement during SIP activities	Utilize differentiated strategies such as problem-based learning tasks and integration of technology	Before Implementation of SIP	Science Teacher, ICT Coordinator, Students	Increased student participation, Sustained interest in tasks
To improve conceptual understanding through deeper inquiry	Integrate concept mapping and inquiry-based discussions before and during SIP implementation	Before Implementation of SIP	Science Teacher, Students	Strengthened grasp of scientific concepts
To strengthen effective collaboration and individual accountability	Assign clear roles within groups and conduct regular group monitoring	During Group Formation and Project Execution	Science Teacher, Students	Balanced group participation
To enhance students' confidence in performing scientific tasks	Implement scaffolded activities such as guided research planning,	Throughout SIP implementation	Science Teacher, Students	Improved students' self-efficacy

Objectives	Action	Timeline	Person Involved	Expected Output
	step-by-step experimentation and reflective journaling.			
To sustain and enhance science enjoyment and utility	Connect SIP topics to rea-life applications and contemporary community issues.	Before and End of SIP implementation	School Administrator Community Stakeholders, Science Teacher, Students	Increased appreciation of science relevance and sustained positive attitudes toward science

Conclusion

Grade 11 STEM students exhibited a very good level learning experience, in terms of learning engagement, conceptual understanding and collaboration, after the implementation of science investigatory project. Similarly, they demonstrated very good attitudes toward science, in terms of confidence, enjoyment and utility. Moreover, there was a highly significant relationship found between science investigatory project learning experience and attitudes toward science among Grade 11 STEM students.

Recommendation

This study suggested that teachers may integrate project-based learning, such as investigatory project to enhance students' learning experience and attitudes toward science. School administrator may institutionalize SIP-related enrichment activities to provide students the opportunity to showcase their work and further strengthen their appreciation to the application and relevance of science. They may also conduct professional development focusing on inquiry-based and project-based teaching strategies. Furthermore, the proposed action plan must be implemented to improve the learning experience and attitudes toward science through SIP, ensuring sustained improvement in both engagement and scientific disposition.

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