WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

The Relationship between Engagement in Science Laboratory Activities and Scientific Skills Development among Grade 10 Learners

Guia S. Azur [a], Khim Beverly Gonzales [b], Keithneth A. Mendoza [c]*

[a] *Tanauan Institute Incorporated, Tanauan City, Batangas 4232 Philippines*
[b] *Tanauan Institute Incorporated, Tanauan City, Batangas 4232 Philippines*
[c] *Tanauan Institute Incorporated, Tanauan City, Batangas 4232 Philippines*

A B S T R A C T

This study investigated the relationship between engagement in science laboratory activities and scientific skills development among grade 10 learners. Laboratory activities are essential in science education as they provide hands-on experiences that bridge theoretical knowledge with practical application, fostering critical thinking, problem-solving, creativity, collaboration, communication, and technical proficiency. The study, which involved 238 Grade 10 student-respondents, assessed their level of engagement in laboratory activities and evaluated their scientific skills across five domains: cognitive skills, practical and technical skills, attitude and ethical development, collaboration and communication, and creativity and innovation. Findings revealed that students recognized the importance of laboratory activities in enhancing their scientific understanding and skills, demonstrating abilities in critical thinking, technical proficiency, scientific behavior, teamwork, and creative problem-solving. They emphasized the need for clear instructions, proper laboratory orientation, and continuous learning through inquiry and research. Results showed a highly significant relationship between students' engagement in laboratory activities and the development of their scientific skills. Based on these findings, the study recommends strategies to further improve student engagement in laboratory tasks to strengthen their scientific competencies.

Keywords: *scientific skills, laboratory activities, critical thinking, behavior*

Introduction

Laboratory activities play a vital role in the learning process, providing students with hands-on experiences that enhance their understanding of scientific concepts. According to the Department of Education (DepEd) (2024), science education in the Philippines is designed to develop students' critical thinking, problem-solving, and inquiry skills through experiential learning. With the implementation of the Matatag Curriculum, the emphasis on practical applications and active learning aligns with the needs of 21st-century learners, who must be equipped with scientific literacy and skills necessary for innovation and global competitiveness. Laboratory activities serve as a crucial platform for students to explore, experiment, and apply scientific principles in real-world contexts.

In science education, laboratory activities bridge the gap between theoretical knowledge and practical application. The science curriculum fosters scientific inquiry, experimentation, and investigation, allowing students to observe natural phenomena, formulate hypotheses, and test their ideas using scientific methods. Engaging in laboratory tasks enhances process skills, such as measuring, analyzing data, and drawing conclusions—fundamental abilities required in various scientific fields (Vijayatheepan, 2023).

In addition to these, laboratory experiences promote other key scientific skills: creativity and innovation, as students design and modify experiments; collaboration and communication, as they work in teams and share findings; and ethical responsibility, as they follow procedures with integrity and safety. Technical proficiency in using scientific tools and equipment is also essential, enabling learners to carry out accurate investigations. These comprehensive skills are crucial for learners to thrive in science-related careers and contribute to solving real-world problems.

However, despite the importance of laboratory activities, many Grade 10 learners face challenges that hinder their full engagement. Factors such as limited laboratory resources, lack of teacher guidance, time constraints, and students' motivation may affect their participation and learning outcomes. If students do not actively engage in laboratory work, their scientific skills—such as critical thinking, problem-solving, experimentation, creativity, and collaborative learning—may not be fully developed. This raises concerns about whether current science laboratory activities are effectively fostering the necessary competencies among learners (Pareek, 2019).

Shaby et al. (2023) highlighted that laboratory activities are important in helping students develop scientific skills through hands-on experiences. Their study showed that without proper guidance, students struggled to cooperate and fully understand the scientific concepts during lab tasks. This finding supports the idea that well-structured laboratory activities are essential because they not only help students apply their knowledge but also improve their

communication, collaboration, and problem-solving skills. Properly planned laboratory activities lead to better learning outcomes and a deeper understanding of science among students.

According to Nugroho et al. (2016), the study developed a tool to measure students' scientific literacy in four areas: science as knowledge (Category A), science as thinking (Category B), science as investigation (Category C), and the connection between science, technology, and society (Category D). The study tested the tool with 9th-grade students in Kudus, checking its accuracy and reliability. The reliability score improved from 0.59 to 0.74 over time. The tool was also checked for difficulty, with 13% of items being easy, 67% medium, and 20% difficult. The results showed that students' scientific literacy was still low, with scores below 50% in all areas. Overall, the tool was found to be valid and effective in measuring students' scientific literacy.

This study investigated the engagement of grade 10 learners in science laboratory activities and their relation with the development of their scientific skills in terms of cognitive skills, practical and technical skills, attitude and ethical development, collaboration and communication, and creativity and innovation.

This study aims to examine the level of engagement of Grade 10 learners in science laboratory activities and how it relates to the development of their scientific skills. Understanding these relationships is crucial for improving science education practices and ensuring that laboratory experiences effectively support student learning.

The findings of this study will be beneficial to educators, school administrators, and curriculum developers in refining instructional strategies and policies. Furthermore, it will help students enhance their learning experiences by identifying factors that influence their engagement and skill development in the science laboratory.

Research Method

The study will utilize a descriptive research design. The choice of the method was appropriate to know the design to examine the relationship between among of Grade 10 learners in science laboratory activities and the development of their scientific skills, S.Y 2024-2025. The study will involve Grade 10 students from selected secondary schools. A random sampling technique will be employed to ensure representation from different sections or science tracks. The respondents of this study consisted of two hundred thirty-eight (238) students in Grade 10 of Bernardo Lirio National High School. The respondents are distributed using the sampling method. Grade 10 has fourteen (14) sections, and the researchers will only choose eighteen (18) students in each section. The respondents were given questions that they filled in with their answers based on their perspectives and opinions.

Results and Discussion

This chapter presents the analysis and interpretation of the data about the problems addressed in this study.

Table 1

Laboratory Experiment in Science 10

Experiment	**Completed**	**Percentage**
Volcano Experiment	184	77.31%
Chemical Reaction Experiment	144	60.50%
Simple Circuit	169	71.01%
Photosynthesis Experiment	40	16.81%
Force and Motion Experiment	102	42.86%
Water Evaporation	125	52.52%
Magnetism Experiment	169	71.01%
Density Experiment	119	50.00%

Table 1.1 shows that the Volcano Experiment had the highest number of students who completed it, with 184 students or 77.31%. In contrast, the Photosynthesis Experiment had the lowest number completed, with only 40 students or 16.81%. The popularity of the Volcano Experiment may be attributed to its engaging, visual, and interactive nature, which makes scientific concepts more tangible and exciting for learners.

Table 2

Level of Engagement of grade 10 learners in Science Laboratory Activities

As a student, I...	**Weighted Mean**	**Interpretation**
1. Feel excited about the science topics covered in laboratory activities.	3.38	Very High
2. actively participate in hands-on activities during science laboratory sessions.	3.39	Very High
3. Excited to try new experiments in the lab.	3.54	Very High
4. Collaborate with my classmate during laboratory activities.	3.57	Very High
5. Feel confident about completing the lab task on my own.	2.96	High
6. Ask questions to understand the lab work better.	3.38	Very High
7. Do you understand the science concepts after doing the lab experiment?	3.04	High
8. Enjoy solving problems during science lab activities	2.91	High
9. Feel motivated to perform laboratory experiments because of their real-world applications	3.17	High
10. recommend laboratory activities to my classmates based on my experiences.	3.23	High
Composite Mean	**3.26**	**High**

Legend: 4.00-3.25 Always/Very High, 3.24-2.50 Most of the time/High, 2.49-1.75 Sometimes/Moderate, 1.74-1.00 Never/Low

In Table 2, the respondents answered that "I collaborate with my classmate during laboratory activities" with a mean of 3.57, Very High, which means students always work together in the lab. On the other hand, the lowest mean score of 2.91 is High for the statement "I enjoy solving problems during science lab activities," which means students enjoy it most of the time. This means that students who collaborate are better able to exchange ideas, communicate more effectively, and gain knowledge from one another. Working as a team during lab exercises fosters collaboration and group debates, which develop critical science abilities.

Table 3

Level of scientific skills of grade 10 learners in terms of Cognitive Skills

As a student, I…,	**Weighted Mean**	**Interpretation**
1. can enhance my attention to detail and accurate data collection.	3.04	High
2. Can analyze and evaluate experimental results.	2.92	High
3. can find solutions when experiments do not go as expected	2.71	High
4. Can understand cause-and-effect relationships in experiments.	3.04	High
5. I am confident in identifying patterns and trends in scientific experiments**.**	2.78	High
6. can understand difficult scientific ideas.	2.50	High
7. Use the scientific method in the experiment.	3.00	High
8. I can make predictions based on facts and evidence.	2.76	High
9. Confidently understand complex scientific theories.	2.57	High
10. can apply scientific concepts to solve real-life problems.	2.92	High
Composite Mean	**2.82**	**High**

Legend: 4.00-3.25 Always/Very High, 3.24-2.50 Most of the time/High, 2.49-1.75 Sometimes/Moderate, 1.74-1.00 Never/Low

In Table 3, the respondents answered that "I can enhance my attention to detail and accurate data collection" and "I can understand cause and effect relationship and experiment," highest weighted mean of 3.04, with a verbal interpretation of High.

On the other hand, the student answered with the lowest weighted mean of 2.50 for the statement "Can understand difficult scientific ideas" with a verbal interpretation of High. This means that students sometimes find it challenging to understand difficult scientific ideas, even though they try to understand

them most of the time during lab activities. This means science lab activities often help students collect data carefully and understand how one thing can cause another in experiments. However, students still find it a bit hard to understand complex scientific ideas, even though they try most of the time.

Table 4

Level of scientific skills of grade 10 learners in terms of Practical and Technical Skills

As a student, I…,	**Weighted Mean**	**Interpretation**
1. I can do experiments on my own.	2.53	High
2. I am comfortable using scientific tools in the lab.	2.70	High
3. Know how to stay safe while working in a lab.	3.23	High
4. I am good at following experimental steps and making changes when needed.	3.19	High
5. can measure, record, and analyze results accurately.	2.93	High
6. I am skilled in setting up experiments and ensuring they are properly conducted.	2.88	High
7. Troubleshoot problems or challenges that arise during experiments.	2.68	High
8. I am confident in using laboratory equipment correctly and safely.	3.00	High
Composite Mean	**2.89**	**High**

Legend: 4.00-3.25 Always/Very High, 3.24-2.50 Most of the time/High, 2.49-1.75 Sometimes/Moderate, 1.74-1.00 Never/Low

In Table 4, the respondents answered that most of the time "I know how to stay safe while working in a lab" with a highest weighted mean of 3.23, which means that students usually know how to keep themselves safe while doing activities in the science lab. On the other hand, the student answered with the lowest weighted mean of 2.53 for the statement "I can do experiments on my own" with a verbal interpretation of High, which means that students can usually do experiments by themselves, but they may still need some help or guidance at times. This means that students usually know how to stay safe when doing science lab activities. They can mostly do experiments on their own, but sometimes they still need a little help or support.

Table 5

Level of scientific skills of grade 10 learners in terms of Attitude and Ethical Development

As a student, I…,	**Weighted Mean**	**Interpretation**
1. Respect and properly handle living organisms or specimens used in experiments.	3.36	Very High
2. Develop my patience and perseverance in laboratory activities.	3.30	Very High
3. I am responsible for maintaining an organized and clean workplace.	3.34	Very High
4. accidentally spill a chemical or break lab equipment.	2.02	Moderate
5. Consider an ethical dilemma in a scientific experiment.	2.92	High
6. Follow laboratory safety rules.	3.49	Very High
7. Ask permission before using laboratory equipment.	3.56	Very High
8. Handle frustration when an experiment does not go as planned.	3.03	High
9. Report my classmate breaking a safety rule in the lab.	2.90	High
Composite Mean	**3.10**	**High**

Legend: 4.00-3.25 Always/Very High, 3.24-2.50 Most of the time/High, 2.49-1.75 Sometimes/Moderate, 1.74-1.00 Never/Low

In Table 5, the respondents answered that "I ask permission before using laboratory equipment" with the highest weighted mean of 3.56, with a verbal interpretation of Very High. This means that students always ask for permission before using any equipment in the science lab. On the other hand, students answered with the lowest weighted mean of 2.02 for the statement "I accidentally spill a chemical or break lab equipment," with a verbal interpretation of Moderate. This means that students accidentally spill chemicals or break lab equipment, but it doesn't happen very often. This means students always ask for permission before using equipment in the science lab. Although most of the time, they accidentally spill chemicals or break equipment.

Table 6

Level of scientific skills of grade 10 learners in terms of Collaboration and Communication

As a student, I…,	**Weighted Mean**	**Interpretation**
1. Ensure that all group members contribute equally during our lab activities.	3.51	Very High
2. Face challenges when working with a team in the lab.	3.36	Very High
3. Handle disagreements with group members regarding lab procedures.	3.15	High
4. Provide constructive feedback to a group member who made a mistake.	2.87	High
5. Ensure that the written lab reports are clear and understandable to others	3.36	Very High
6. Make sure that I listen and understand my group members' ideas.	3.48	Very High
7. Improve my communication skills when presenting lab results.	3.38	Very High
8. Discuss and analyze results with my classmates.	3.31	Very High
9. Explain observations and results to my classmates.	3.27	Very High
10. Contribute to group discussion and decision-making during laboratory activities.	3.38	Very High
Composite Mean	**3.31**	**Very High**

Legend: 4.00-3.25 Always/Very High, 3.24-2.50 Most of the time/High, 2.49-1.75 Sometimes/Moderate, 1.74-1.00 Never/Low

In Table 6, the respondents answered that "I ensure that all group members contribute equally during our lab activities," with the highest weighted mean of 3.51, with a verbal interpretation of Very High. This means that students always make sure everyone in their group does their part during lab activities. On the other hand, the student answered with the lowest weighted mean of 2.87 for the statement "I provide constructive feedback to a group member who made a mistake," with a verbal interpretation of High, which means that students sometimes provide helpful feedback to a group member who makes a mistake.

Table 7

Level of scientific skills of grade 10 learners in terms of Creativity and Innovation

As a student, I…,	**Weighted Mean**	**Interpretation**
1. Create a unique hypothesis for an experiment.	2.84	High
2. Discover something unexpected while experimenting.	3.01	High
3. Could design my experiment.	2.56	High
4. Come up with new ways to improve an experiment.	2.82	High
5. Can use technology in laboratory activities.	2.94	High
6. Think of different solutions when facing challenges in the lab.	2.84	High
7. Ask a "what if" question during scientific investigation.	3.12	High
8. Use an alternative method to complete an experiment.	2.71	High
9. Encourage being more innovative in other areas of learning.	3.02	High
Composite Mean	**2.87**	**High**

Legend: 4.00-3.25 Always/Very High, 3.24-2.50 Most of the time/High, 2.49-1.75 Sometimes/Moderate, 1.74-1.00 Never/Low

In Table 7, the respondents answered that "I ask 'what if' question during scientific investigation, with a highest weighted mean of 3.12, with a verbal interpretation of High. This means that most of the time, students ask " what if" questions when doing scientific investigations. On the other hand, the student answered with the lowest weighted mean of 2.56 for the statement "I could design my experiment" with a verbal interpretation of High, which means that most of the time, students can design their experiments, but they may still need help or practice.

Table 8

The significant relationship between the level of engagement in laboratory activities in science 10 and the Scientific Skills of Grade 10 learners.

Level of Scientific Skills	Pearson R		Decision
	r-values	p-values	
Cognitive Skills	0.4716	<0.00001	Reject Ho
Practical and Technical Skills	0.4119	<0.00001	Reject Ho
Attitude and Ethical Development	0.4451	0.00154	Reject Ho
Collaboration and Communication	0.4409	0.00238	Reject Ho
Creativity and Innovation	0.5134	0.00004	Reject Ho

Table 8, shows that there is a significant positive relationship between Grade 10 learners' engagement in science lab activities and all areas of their scientific skills. This means that the more involved students are in lab work, the better they develop skills like thinking, doing experiments, acting ethically, communicating, and being creative.

Abulibdeh et al. (2020) showed that students learn science better when they often do hands-on experiments. In their study, students who did regular laboratory activities got higher scores than those who only learned through traditional lectures. The results of Abulibdeh et al.'s study support the idea that schools should give students more chances to do experiments and provide complete lab tools to make science learning more effective and enjoyable.

This connects well with what is shown in Table 8 of this research, where students agreed that they could do better in science if they were more often involved in actual scientific activities. Doing experiments helps students understand lessons more clearly, think more deeply, and build important science skills.

Summary of Findings

The salient findings of the study are summarized as follows:

1. Out of 622 students, there are 238 students have participated in answering the questionnaires from Grade 10.

2. The data gathered as student-respondents perceived the performance of Grade 10 students with their scientific skills in terms level of engagement in science laboratory activities. The respondents have shown the level of their scientific skills in various terms through the significance of the ability to use critical thinking, proficiency in class, scientific behavior, individual and group performance, and with their creative mindset.

3. The students perceived the importance of laboratory activities, detailed instruction, and proper orientation in using the laboratory together with its equipment. It also realized the importance of constant learning through asking and researching information.

4. There is a highly significant relationship between students and teachers on how to efficiently improve the scientific skills of students in hands-on activities and regular laboratory activities.

Conclusion

The following are the conclusions drawn by the researchers based on the findings of the study that there is a significant relationship between the level of engagement in laboratory activities in science 10 and the Scientific Skills of Grade 10 learners.

Recommendations

In light of the findings and conclusion of the study, the following recommendations are offered:

1. For Science Teachers. Design and implement laboratory activities that require students to formulate hypotheses, analyze data, and draw conclusions in order to enhance learners' critical thinking and reasoning abilities.

2. For School Administrators. Ensure that science laboratories are well-supplied and properly maintained with functional tools and materials, and provide regular opportunities for students to develop their skills in using laboratory equipment and conducting experiments.

3. For Curriculum Planners. Integrate ethical considerations and responsible scientific conduct into laboratory instructions and assessments to help students practice safety, honesty, and accountability during experiments.

4. For Future Researchers. Investigate how different group dynamics, sizes, or leadership roles during laboratory work influence students' communication, teamwork, and overall participation in collaborative tasks.

5. For Future Researchers. Explore the effects of student-designed experiments on developing original thinking, innovation, and problem-solving skills in science education.

Acknowledgements

The researchers wish to express their most profound and heartfelt gratitude to the following people who offered their wholehearted and sympathetic support and who allotted their valuable resources toward the completion of this piece of work. Behind the fulfillment of this work, the researchers would like to extend their deepest gratitude to certain valuable persons for their help and support in the completion of this study. Recognition and heartfelt thanks are hereby extended to the following:

Dr. Nelson "Sonny" Perez Collantes, Chairman Emeritus of Tanauan, and **Hon. Ma. Theresa "Maitet" Collantes,** Congresswoman of the 3rd District of Batangas, for the scholarship given to the researchers;

Ms. Guia S. Azur, our research teacher, for her brilliant ideas and substantial knowledge, for her constructive criticisms, which serve as a foundation and challenge for the success of our profession;

Mrs. Armaine Amor Madera, Mrs. Madonna Malabuyoc, and Ms. Bel Patrice T. Tisuela, the validators, for their valuable suggestions and comments;

Mr. Mark Andrew Rimas, our statistician, for his dedication to helping in fulfilling our research;

Ms. Christine Joy Manguiat, our grammarian, for her invaluable assistance as the grammarian for this research;

Dr. Nelia Mananguit, dean of studies, for his understanding and consideration in working on this thesis;

The **Administrators** and **Teachers** at Tanauan Institute Inc. for their wholehearted cooperation and support;

Above all, to the **Almighty God** for being good and gracious to them throughout the completion of this research.

References

Abulibdeh, E. (2019). *Science practical work and its impact on students' science achievement*. Journal of Technology and Science Education, 9(3), 312–326. https://www.jotse.org/index.php/jotse/article/view/888/467

Nugroho, S. E., Ibrahim, M., Rahayu, S., & Suryani, N. (2016). Development of a scientific literacy measurement tool for junior high school students. *Journal of Physics: Conference Series, 739*(1), 012036. https://doi.org/10.1088/1742-6596/739/1/012036

Pareek, R. B. (2019). *An assessment of availability and utilization of laboratory facilities for teaching science at secondary level.* https://eric.ed.gov/?id=EJ1209309

Shaby, N., Assaraf, O. B., & Koch, N. P. (2023). *Students' interactions during laboratory group activity in a science museum.* International Journal of Science and Mathematics Education, 22(4), 703–720. https://doi.org/10.1007/s10763-023-10404-8

Vijayatheepan, Rajaratnam. (2023). Science Education for All -A Critical Analysis