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Assessing Science Laboratory Conditions and Utilization in Public Science High Schools in the Division of Olongapo City Towards the Development of Laboratory Intervention Program (Slip)

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Abstract

This study evaluates the condition and utilization of science laboratories in public secondary schools implementing the Special Science Curriculum Program (SSCP) in a Region III division, using a convergent mixed-methods approach involving 255 students, 14 teachers, and key informants. Findings indicate that laboratories are generally adequate for basic instruction but face limitations in advanced equipment, ventilation, access, and maintenance, with disparities linked to school infrastructure. While teachers and students share similar perceptions of laboratory conditions and use, qualitative insights reveal system-wide challenges in safety, accessibility, and resource quality, alongside a strong recognition of laboratories' educational value. The study concludes that although laboratories moderately support SSCP goals, significant gaps remain, prompting the development of a revised, data-driven Science Laboratory Intervention Plan (SLIP) focused on safety, resource enhancement, improved access, capacity building, and sustainable monitoring for scalable application in similar school contexts.

Keywords: Science Education, laboratory utilization and condition, convergent mixed methods, Philippines.

Introduction

Access to functional and well-utilized science laboratory facilities is fundamental to the delivery of quality science education, particularly in schools implementing special science curricular and enrichment programs. Laboratories serve as critical learning environments where theoretical concepts are translated into concrete experiences, enabling learners to develop scientific reasoning, inquiry skills, and problem-solving abilities essential for academic success and lifelong learning (Hofstein & Mamlok-Naaman, 2007; Pareek, 2019). Empirical studies consistently show that students who engage in laboratory-based instruction demonstrate higher levels of conceptual understanding, motivation, and retention of scientific knowledge than those primarily exposed to lecture-centered

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approaches (Olufunke, 2012; Chengere et al., 2021). Conversely, inadequate or poorly maintained laboratory facilities often lead to an overreliance on theoretical instruction, which limits experiential learning and reduces student engagement in science subjects (Mosissa, 2017; Hafni et al., 2020).

At the national level, the urgency of strengthening science education infrastructure has been strongly emphasized in the Year 1 report of the Second Congressional Commission on Education (EDCOM II), which identified persistent deficiencies in the availability, condition, and utilization of science laboratories in Philippine public secondary schools (EDCOM II, 2024). The report highlighted that many schools either lack adequately equipped laboratories or possess facilities that are underutilized due to insufficient materials, limited maintenance, and inadequate instructional support, conditions that directly affect the quality of inquiry-based science instruction. These systemic limitations were linked to weak learner performance in science and the country's continuing struggle to develop scientifically literate and innovation-ready graduates, as reflected in international assessments such as PISA and TIMSS (Ali et al., 2022). The EDCOM II findings situate laboratory inadequacy as a structural and policy-level concern, reinforcing the need for evidence-based school-level and division-level interventions.

The condition and availability of science laboratories are closely connected to school-level budget planning and resource allocation mechanisms, particularly the Maintenance and Other Operating Expenses (MOOE). In public secondary schools, funding for laboratories is not earmarked as a fixed percentage of the annual budget; instead, the MOOE is released as a consolidated amount covering both Junior High School and Senior High School operations, with allocations determined through institutional planning based on overall operational priorities. As clarified by school administrative offices, laboratory development competes with other essential expenditures such as utilities, instructional materials, repairs, and general school operations, underscoring the complexity of prioritizing laboratory needs within limited financial resources. This budgetary context highlights that laboratory inadequacy is not solely a matter of neglect but is also shaped by planning constraints and competing institutional demands, thereby underscoring the need for systematic assessment to guide strategic, data-informed investment decisions.

Beyond instructional purposes, science laboratories are central to the effective implementation of Science Intervention Programs (SIPs), which are designed to address learning gaps, enhance scientific competencies, and provide enrichment opportunities for learners. Studies indicate that intervention programs anchored in hands-on laboratory experiences are more effective in improving students' conceptual understanding and scientific skills than those relying solely on remedial classroom instruction (Bernardo et al., 2023; Marsini, 2023). Laboratories enable project-based learning, experimentation, and investigative activities that foster creativity, curiosity, and scientific confidence, positioning them as vital spaces for nurturing student innovativeness and research-oriented thinking.

The role of science laboratories also extends to the country's broader innovation and competitiveness agenda, particularly when viewed through the lens of the Global Innovation Index (GII). Global data consistently show that countries with strong innovation performance invest heavily in STEM education infrastructure, including school laboratories that cultivate experimentation, critical thinking, and applied problem-solving skills from the basic education level (Huang & Zhao, 2021). Weak laboratory ecosystems at the secondary school level constrain the development of future scientists, engineers, and innovators, ultimately affecting national productivity, technological advancement, and sustainable development (Bibri, 2021; González & López, 2023). Strengthening school laboratories, therefore, aligns local educational improvement initiatives with global innovation priorities.

Within the local context of Olongapo City, these challenges are particularly pronounced. As a rapidly developing urban center, the city expects its schools to prepare learners to participate in a knowledge-driven, technologically advanced society. However, disparities in laboratory access, condition, and utilization continue to limit the consistent delivery of practical and inquiry-based science instruction, particularly in schools implementing special

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science curricular programs (Liu, 2016; Monta & Perdio, 2025). These constraints affect both teaching effectiveness and student learning experiences, reinforcing the need for localized empirical assessment to inform targeted improvement efforts.

In view of these concerns, this study focuses on assessing the condition and utilization of science laboratory facilities in schools implementing special science curricular programs in the Schools Division of Olongapo City. By examining laboratory resources, patterns of use, and contextual constraints related to planning and funding, the study aims to generate empirical evidence to inform the development of effective Science Intervention Programs and guide strategic decision-making. Ultimately, strengthening science laboratories is envisioned not only as a means of improving classroom instruction but also as a pathway toward fostering scientific literacy, student innovativeness, and long-term educational and national development.

Review of Relevant Theory, Studies, and Literature

The review of related theories and literature provides a critical foundation for understanding the condition and utilization of science laboratories in SSCP-implementing schools. Grounded in Constructivist Theory, Situated Cognition Theory, and the Resource-Based View (RBV), the literature emphasizes that effective science learning is achieved through active engagement, authentic contexts, and the strategic use of resources. These perspectives frame laboratories as essential environments where learners construct knowledge through experience, interaction, and practical application.

Constructivist Theory highlights the value of hands-on and inquiry-based learning, where students actively engage in experimentation to build deeper understanding. Situated Cognition Theory reinforces that learning is shaped by context and social interaction, positioning laboratories as authentic settings where students participate in real scientific practices. The RBV perspective further explains that laboratory facilities, equipment, and maintenance systems function as strategic resources that directly influence the quality of instruction and student outcomes.

Empirical studies consistently show that well-equipped, accessible, and properly maintained laboratories improve students' academic achievement, critical thinking, and scientific skills. Laboratories help bridge theory and practice by making abstract concepts more concrete. However, research also identifies persistent issues such as inadequate resources, outdated equipment, limited space, poor ventilation, and insufficient safety provisions, all of which constrain effective laboratory instruction and limit experiential learning opportunities.

The literature identifies key dimensions that determine laboratory effectiveness, including availability of resources, physical condition, and maintenance practices. Adequate equipment, materials, and utilities support continuous experimentation, while safe and well-designed environments enable productive learning. Regular inspection, sanitation, and proper storage of materials are essential to ensure sustainability and safe laboratory operations over time.

In terms of utilization, studies emphasize that laboratories are most effective when they are used regularly, aligned with curriculum goals, and supported by meaningful instructional activities. The frequency of use, relevance to learning objectives, and the design of laboratory tasks, such as hands-on experiments, collaboration, and inquiry-based investigations, play a crucial role in shaping student learning. Limited access, poor scheduling, and weak alignment with instruction often result in underutilization of laboratory facilities.

Teacher competence and administrative support are also critical factors influencing laboratory use. Teachers who are well-trained in conducting experiments and integrating laboratory work into instruction are more likely to maximize laboratory potential. At the same time, administrative support through funding, policy, and maintenance ensures that laboratories remain functional and accessible.

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Despite strong evidence supporting laboratory-based learning, significant gaps remain, particularly in public secondary schools. These include resource shortages, inadequate infrastructure, inconsistent maintenance, and limited access. Such challenges weaken inquiry-based instruction and contribute to lower levels of student engagement and achievement in science.

Overall, the review synthesizes key theories, findings, and gaps, situating the study within the broader academic discourse. It highlights the need for systematic assessment of laboratory conditions and utilization, and provides a basis for developing a data-driven and context-responsive Science Laboratory Intervention Plan to improve the quality and effectiveness of science education.

Methods of the Study

This study employed a systematic methodology to assess the accessibility, sufficiency, and utilization of science laboratories in SSCP-implementing schools in Olongapo City. It outlines the research design, participants, instruments, data collection procedures, and analytical techniques used to ensure a comprehensive and reliable evaluation. The approach was designed to generate both statistical evidence and contextual insights to support practical recommendations for improving laboratory conditions and use.

A convergent mixed methods design was adopted, allowing quantitative and qualitative data to be collected simultaneously, analyzed separately, and integrated during interpretation. The quantitative component used a descriptive-comparative design to examine laboratory conditions and utilization across school profiles, student population, and faculty qualifications. Data were gathered through structured questionnaires and analyzed using descriptive statistics and inferential tests to identify patterns and differences. The qualitative component followed a descriptive phenomenological approach, using semi-structured interviews to explore participants' lived experiences. The integration of both data types strengthened the validity of findings through convergence and deeper contextual understanding.

The study involved key stakeholders from two public secondary schools implementing the SSCP, including students, science teachers, laboratory custodians, and school heads. Stratified random sampling was used in the quantitative phase to ensure proportional representation, with sample size determined using Slovin's formula. For the qualitative phase, purposive sampling was used to select participants with relevant experience in laboratory use and management. Sampling continued until data saturation was reached, ensuring depth and credibility of insights.

The primary research instruments included a researcher-developed questionnaire and semi-structured interview guides. The survey instrument was divided into sections covering school profile, laboratory condition, and laboratory utilization. Laboratory conditions were assessed in terms of available resources, physical environment, and maintenance practices, while utilization was assessed in terms of frequency of use, relevance to the curriculum, and types of laboratory activities conducted. Responses were measured using a four-point Likert scale. The interview guide complemented the survey by exploring participants' perceptions, challenges, and experiences, providing richer explanations of quantitative findings.

Instrument validity was established through expert review, ensuring alignment with research objectives and clarity of items. Minor revisions were made based on feedback. Reliability was confirmed through pilot testing, with Cronbach's alpha coefficients indicating high internal consistency across all subscales. Some items were removed to improve coherence and measurement accuracy, resulting in a refined and reliable final instrument.

Data collection was conducted with proper authorization and ethical clearance. Surveys were administered in an organized manner, while interviews were conducted in conducive settings and recorded with consent. Quantitative

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data were encoded and analyzed using statistical software, employing descriptive measures and nonparametric tests due to non-normal data distribution. Qualitative data were analyzed through thematic analysis, involving coding, categorization, and theme development. Member checking was conducted to ensure the credibility and accuracy of interpretations.

Integration of findings occurred during the interpretation phase, where quantitative results were compared with qualitative themes to identify convergence and provide deeper explanations. This process enabled a comprehensive understanding of laboratory conditions and utilization, forming the basis for the proposed Science Laboratory Intervention Plan.

Ethical standards were strictly observed throughout the study. Informed consent was obtained from all participants, with parental consent secured for student respondents. Participation was voluntary, and confidentiality was maintained through anonymization and secure data handling. The study complied with institutional ethical guidelines and the Data Privacy Act of 2012, ensuring the protection of participants' rights, privacy, and well-being.

Results and Discussion

This section presents and discusses the quantitative findings on the condition and utilization of science laboratories in SSCP-implementing public secondary schools. It interprets the results through statistical analysis, supported by relevant theories and recent literature, to provide a comprehensive understanding of the study's outcomes.

Figure 1 illustrates the distribution of Grade 10 students across eight science-oriented sections from two schools, with four sections each from School 1 and School 2, serving as the basis for participant selection. Data collection was conducted over four weeks, beginning with coordination with school authorities and distribution of consent forms to students and guardians. The research instrument was administered during regular class hours by trained data collectors to ensure consistency. All procedures were carried out within the science classrooms to maintain a controlled and familiar environment.

Figure 1

Number of Students per School

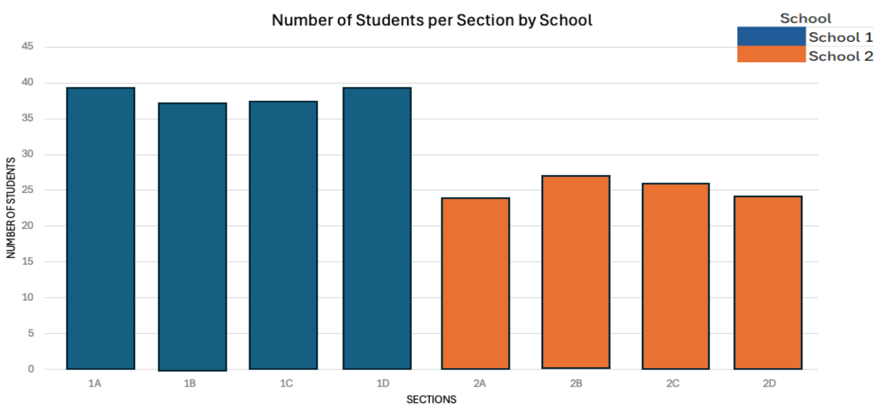

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Figure 1 displays the number of students per section across two schools. For School 1, all four sections (Section 1A, Section 1B, Section 1C, and Section 1D) maintained consistently high enrollment, with each section having 38 or 39 students. This resulted in an average class size of 38.5 students, which is considered Very High based on class size indicators. In contrast, the four sections from School 2 (Section 2A, Section 2B, Section 2C, and Section 2D) had smaller class sizes, ranging from 24 to 27 students, with an average of 25.25 students per section, which falls within the Moderate category.

Across all eight sections, the mean number of students per section was 31.88, with a standard deviation of 6.76, indicating noticeable variation between the two schools. The visual representation highlights the stark contrast in class sizes, with School 1 consistently having larger class sizes than School 2. The data suggest that science laboratory activities at School 1 are conducted with relatively larger groups of students, potentially placing pressure on resources and individualized supervision. In contrast, School 2's smaller class sizes may provide better opportunities for more focused instruction and hands-on engagement. The notable difference in student population per section may influence how effectively laboratories are utilized in each context.

According to Darling-Hammond et al. (2019), class size is a critical determinant of instructional quality and student outcomes in science education. Smaller class sizes often allow for more active participation, better classroom management, and enhanced teacher-student interaction, especially in laboratory settings. Similarly, Lee and Burkam (2003) emphasized that student engagement in science is significantly improved when class sizes are more manageable, particularly during practical activities.

The data highlights the importance of contextualizing laboratory planning based on the student population. Schools with larger class sizes, such as School 1, may require enhanced science laboratory resources, rotational schedules, or additional facilitators to ensure equitable learning experiences. On the other hand, schools like School 2 with moderate class sizes are better positioned to integrate student-centered, inquiry-based activities that support science process skills. Overall, understanding enrollment patterns enables school leaders and science educators to strategically align laboratory utilization with student needs, optimizing science teaching and learning outcomes.

Table 1

Number of Functional Science Laboratories Available

School	Type of Science Laboratory	Number of Laboratories
School 1	Chemistry Lab	1
	Biology Lab	1
	Physics Lab	1
	Earth and Space Lab	1
	Total	4
School 2	Chemistry Lab	1
	Biology Lab	1
	Physics Lab	1
	Total	**3**

Table 1 presents the number of functional science laboratories available in two participating schools. School 1 was equipped with a complete set of four laboratories: Chemistry, Biology, Physics, and Earth and Space Science. In contrast, School 2 had only three laboratories and lacked a dedicated Earth and Space Science facility.

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Both schools have one laboratory, each for Chemistry, Biology, and Physics. School 1 had four laboratories, while School 2 had three. This discrepancy highlights a variation in facility provision between the two institutions. The availability of a full suite of laboratories at School 1 suggests greater capacity for specialized science instruction. The presence of an Earth and Space Science Lab may provide opportunities to conduct domain-specific experiments and implement interdisciplinary science programs. Meanwhile, School 2's absence of this laboratory limits the extent to which Earth and Space concepts can be taught through experiential learning, potentially affecting curriculum delivery in this domain.

According to Hofstein and Lunetta (2003), science laboratory experiences are essential for developing students' scientific understanding, particularly when aligned with specific content areas such as chemistry or earth sciences. Furthermore, Osborne (2010) emphasized that the absence of specialized laboratory facilities often leads to a reliance on theoretical instruction, thereby reducing opportunities for inquiry-based learning and skill development.

The presence or absence of specific laboratories directly impacts the implementation of the science curriculum. School 1 is well-positioned to offer a comprehensive laboratory-based science experience, aligning with the goals of science education reforms that emphasize hands-on, student-centered learning. Conversely, School 2 may need to consider alternative strategies such as mobile labs, shared facilities, or simulations to ensure equitable access to practical experiences, particularly in Earth and Space Science. Ensuring that all science domains are supported by appropriate laboratory infrastructure is vital for promoting well-rounded scientific literacy among students.

Figure 2

Faculty Qualifications in School 1 and School 2

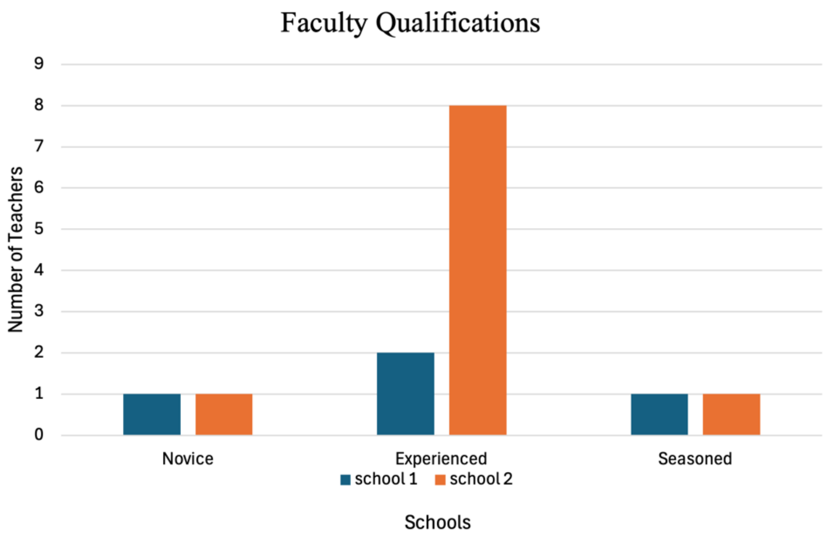

Figure 2 shows the distribution of faculty members by teaching experience in science subjects across two schools: School 1 and School 2. Faculty members were categorized into three levels of teaching experience: Novice (0–3 years), Experienced (4–10 years), and Seasoned (more than 10 years). As illustrated in Figure 2, both schools had one novice and one seasoned teacher. However, a notable difference was observed in the experienced category, where School 2 had eight teachers, while School 1 had only two.

This distribution suggests that both schools have a balanced mix of teaching experience, with School 2 showing a higher concentration of faculty in the mid-career or experienced range. This could imply a stable workforce capable of bridging foundational pedagogical practices and newer instructional innovations. On the other hand, School 1, having fewer experienced teachers, may reflect transitions in staffing or a younger teaching workforce in general, especially in a science-focused institution.

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Consistent with constructivist and inquiry-based learning perspectives discussed in the literature, teaching experience plays an important role in the effective implementation of science instruction, particularly in laboratory-based and problem-solving–oriented activities. Prior studies reviewed in this research emphasize that teachers' instructional behaviors, pedagogical decision-making, and ability to facilitate inquiry-based learning improve as they gain classroom experience, enabling more effective integration of laboratory activities into science teaching (Rott, 2020; Hafni et al., 2020). The presence of experienced and seasoned teachers, therefore, supports the sustained use of inquiry-oriented and laboratory-integrated instruction, which is essential for meaningful science learning.

The impact on science education is significant. A well-distributed teaching force in terms of experience allows schools to implement mentorship programs, promote collaborative planning, and maintain continuous cultural improvement. The experienced teachers at School 2, for instance, may help foster peer coaching and ensure consistency in laboratory practices. Meanwhile, the equal representation of seasoned and novice teachers across both schools indicates the need for targeted professional development and succession planning to maintain quality instruction in laboratory-based science education.

Table 2 presents the summary of the laboratory conditions of SSCP-implementing schools as perceived by teachers and students. The table consolidates the results on available resources, physical condition of the laboratories, and maintenance of facilities and equipment to provide an overall assessment of laboratory condition from both respondent groups.

Table 2

Summary of Laboratory Condition

No.	Indicators	Teachers			Students		
		Mean	**SD**	**VI**	**Mean**	**SD**	**VI**
1	Available Resources	2.99	0.51	A	2.99	0.51	A
2	Physical Condition of the Laboratories	2.99	0.43	A	3.27	0.52	VMA
3	Maintenance Of Facilities and Equipment	3.27	0.47	VMA	3.21	0.56	A
	Overall	**3.39**	**0.49**	**VMA**	**3.20**	**0.54**	**A**

Note: Verbal Interpretation: 3.26–4.00 – Very Much Available (VMA); 2.51–3.25 – Available (A); 1.76–2.50 – Slightly Available (SA); and 1.00–1.75 – Not Available (NA)

Table 2 presents a summary of the laboratory conditions of SSCP-implementing schools as perceived by teachers and students, in terms of available resources, the physical condition of the laboratories, and the maintenance of facilities and equipment. Results indicate that teachers rated the overall laboratory condition as *Very Much Available* (M = 3.39, SD = 0.49), while students rated it as *Available* (M = 3.20, SD = 0.54). Across indicators, both groups generally perceived the laboratory condition as adequate, although mean scores and verbal interpretations differed between teachers and students.

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In terms of available resources, both teachers and students reported identical mean ratings (M = 2.99, SD = 0.51), corresponding to the verbal interpretation *Available*. This suggests a shared perception that laboratory resources are generally present but may not be fully sufficient or optimal. Regarding the physical condition of the laboratories, teachers rated this indicator as *Available* (M = 2.99, SD = 0.43), whereas students rated it as *Very Much Available* (M = 3.27, SD = 0.52), indicating that students viewed the laboratories' physical environment more favorably than teachers. Conversely, for the maintenance of facilities and equipment, teachers gave a higher rating of *Very Much Available* (M = 3.27, SD = 0.47) than students' *Available* rating (M = 3.21, SD = 0.56), reflecting a divergence in perceptions regarding the adequacy of maintenance practices.

The differences in the summary ratings of laboratory conditions reflect how teachers and students engage with laboratory environments in distinct ways. Teachers gave higher ratings for overall laboratory conditions and maintenance practices, which may be attributed to their familiarity with institutional processes such as scheduled cleaning, equipment inspections, and coordination with laboratory custodians. For example, teachers are often informed when laboratories undergo general cleaning, safety checks, or preparation for major activities, which leads them to perceive maintenance systems as well-established. Students, on the other hand, reported higher ratings of the physical condition of laboratories, as their assessments are shaped by immediate, visible features such as the cleanliness of workstations, the availability of space for movement, and the presence of safety equipment during laboratory sessions. However, students also encounter more direct limitations during experiments, such as sharing limited equipment, experiencing water shortages, or using outdated tools, which may explain why their overall evaluation of laboratory conditions remained at the Available level rather than Very Much Available.

Meanwhile, several students affirmed the generally positive laboratory condition, noting that *"the science laboratory is in good condition, with clean workstations, well-maintained equipment, and a safe and organized environment"* and that *"cleanliness is well-maintained, ensuring a hygienic space for experiments"*. These statements converge with the students' higher rating of the physical condition of laboratories. However, despite acceptable mean ratings for available resources, participants also expressed concerns that qualify these findings. Some students explicitly noted limitations, stating that *"the only difficulties I have encountered is equipment shortages… lack of equipment, shortages, or outdated equipment"* and *"some essential tools and resources are outdated or missing"*. Similarly, issues related to maintenance and facilities were highlighted through remarks such as *"there is water shortage inside the lab"* and *"the laboratory is sometimes clean since some researchers leave used equipment without cleaning them"*. These qualitative accounts explain why students' overall and maintenance ratings remained at the Available level rather than Very Much Available, indicating convergence with the quantitative results while adding depth to the identified constraints.

The findings align with the study's theoretical and empirical foundations, particularly the constructivist and situated learning perspectives, which emphasize the importance of well-maintained, adequately resourced learning environments for effective hands-on science instruction (Hofstein & Mamlok-Naaman, 2007). Consistent with the study's review of related literature, adequate laboratory conditions support inquiry-based learning, while deficiencies in equipment, ventilation, and maintenance can limit the quality of laboratory experiences (Cetin & Eymur, 2018; Elesio, 2023). Moreover, the results reflect the national context described in the study, wherein public secondary schools often report a moderate level of laboratory facility adequacy due to competing budgetary priorities and limitations in Maintenance and Other Operating Expenses (MOOE), as highlighted in the EDCOM II report (EDCOM II, 2024). The observed differences between teachers' and students' perceptions further support earlier findings in this study that teachers tend to provide more favorable assessments of laboratory conditions, possibly due to greater familiarity with institutional constraints and resource management.

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The implications of these findings suggest that while science laboratories in SSCP-implementing schools are generally functional and supportive of instruction, targeted improvements are necessary to elevate laboratory conditions from *Available* to *Very Much Available*, particularly from the students' perspective. Priority areas include upgrading and standardizing laboratory equipment, improving maintenance systems for utilities such as water and ventilation, and strengthening protocols for cleanliness and shared laboratory use.

These results underscore the need for a structured Science Laboratory Intervention Program (SLIP) that focuses on resource enhancement, preventive maintenance, and equitable access to laboratory facilities. Addressing these gaps is essential to sustaining effective hands-on science learning and ensuring that laboratory environments consistently support the development of students' scientific skills and competencies.

Table 3 presents a summary of utilization findings for SSCP-implementing school laboratories, based on three lower-order constructs: frequency of use, relevance of use, and laboratory activities conducted, as perceived by teachers and students. This table synthesizes the preceding utilization indicators to provide an overall assessment of how science laboratories are employed to support instruction, learning relevance, and experiential activities under the Special Science Curriculum Program.

Table 3

Summary of Utilization Findings

No.	**Lower-Order Constructs**	**Teachers**			**Students**		
		Mean	**SD**	**VI**	**Mean**	**SD**	**VI**
1	Frequency of Use	3.17	0.58	A	3.23	0.54	A
2	Relevance of Use	3.00	0.62	A	3.37	0.49	VMA
3	Laboratory Activities Conducted	3.66	0.29	VMA	3.58	0.45	VMA
	Overall	**3.32**	**0.56**	**VMA**	**3.12**	**0.62**	**3.12**

Note: Verbal Interpretation: 3.26–4.00 – Very Much Available (VMA); 2.51–3.25 – Available (A); 1.76–2.50 – Slightly Available (SA); and 1.00–1.75 – Not Available (NA)

Table 3 shows that teachers rated the overall utilization of science laboratories as *Very Much Available* (M = 3.32, SD = 0.56), whereas students rated it as *Available* (M = 3.12, SD = 0.62). These findings suggest that laboratories are generally used across instructional dimensions, although teachers and students differ in their perceptions of the extent of use.

In terms of specific constructs, both teachers and students rated frequency of use as *Available* (Teachers: M=3.17, SD=0.58; Students: M=3.23, SD=0.54), indicating that laboratories are regularly used but not consistently maximized across all contexts. For relevance of use, teachers again reported an *Available* rating (M=3.00, SD=0.62), while students rated this construct as *Very Much Available* (M=3.37, SD=0.49), reflecting stronger student perceptions of instructional alignment and learning value. Both groups rated laboratory activities conducted as *Very Much Available* (Teachers: M=3.66, SD=0.29; Students: M=3.58, SD=0.45), highlighting strong implementation of hands-on, collaborative, and safety-oriented activities.

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The differences in the summary utilization ratings reflect how teachers and students experience laboratory use across instructional contexts. Teachers reported higher overall utilization due to their involvement in planning laboratory schedules, organizing safety-oriented and innovative activities, and coordinating laboratory use for curricular and extracurricular purposes. From the teachers' perspective, utilization extends beyond class-time experiments to include preparation, supervision, and facilitation of laboratory-based tasks, which may contribute to their more favorable overall assessment. Students, in contrast, rated relevance of use more highly, as laboratory activities are experienced as directly reinforcing classroom lessons, clarifying concepts, and enhancing engagement during hands-on sessions. However, students rated overall utilization slightly lower, likely due to limited access beyond scheduled class periods and participation being restricted to specific activities or groups.

The quantitative results align with the qualitative interview findings, highlighting both the strengths and limitations of laboratory utilization. Students consistently described laboratory activities as meaningful and engaging, stating that *"performing hands-on experiments has strengthened my understanding of scientific principles, making abstract ideas more concrete"* and that *"the experiments we conducted helped me understand the lessons better than just reading or watching videos."* These statements strongly support the very high ratings for laboratory activities conducted. However, convergence also reveals constraints related to frequency and access, as some participants shared that *"one of the most prominent concerns is the time access… it is not opened or difficult to access beyond hours"* and that *"we were not able to conduct some experiments because the materials and equipment were lacking."* These qualitative insights explain why students rated the frequency of use and overall utilization only as Available, despite the high quality of activities when laboratories were accessible.

The summarized utilization findings are consistent with the related literature reviewed in this study, which emphasizes that hands-on, well-structured laboratory activities significantly enhance students' understanding, engagement, and scientific skills, particularly when learners are actively involved in experimentation and collaborative tasks (Chengere et al., 2021; Ali et al., 2022). At the same time, recent studies highlight that effective laboratory utilization is strongly influenced by access, scheduling, and availability of materials, noting that limited laboratory hours and insufficient equipment often constrain the regular conduct of practical activities in public secondary schools (Marasigan & Abas, 2025; Macayana & Mangarin, 2024).

Moreover, national-level findings underscore that the underutilization of science laboratories is frequently linked to systemic issues such as resource limitations, competing instructional demands, and operational constraints, rather than to the absence of pedagogically sound laboratory activities (EDCOM II, 2024). These findings suggest that while SSCP-implementing schools demonstrate a strong capacity to deliver meaningful and engaging laboratory activities, structural factors related to access and resource sufficiency continue to limit the consistent and equitable use.

The implications of these findings suggest that SSCP-implementing schools possess a strong capacity to deliver meaningful laboratory activities but must address structural factors that limit the consistent and equitable use. Enhancing laboratory access policies, expanding supervision for extended use, and ensuring adequate materials across all science subjects may improve frequency and overall utilization. These results provide a strong empirical basis for the proposed Science Laboratory Intervention Program (SLIP), emphasizing the need to balance high-quality laboratory activities with improved access and resource optimization to maximize the impact of science laboratories on student learning.

Table 4 presents the results of the Mann–Whitney U Test conducted to determine whether a significant difference exists between teachers' and students' perceptions regarding the condition of SSCP-implementing school laboratories. The nonparametric test was employed to compare the two independent groups with respect to their assessments of laboratory resources, physical condition, and the maintenance of facilities and equipment.

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Table 4

Mann–Whitney U Results on the Difference in the Perception of the Condition of SSCP-Implementing School Laboratories Between Teachers and Students

Group	Mean Rank	Sum of Ranks	Mann–Whitney U	Asymp. Sig. (2-tailed)
Students	136.26	34,746.50	1463.50	0.256
Teachers	112.04	1,568.50		

Table 4 shows that the Mann–Whitney U Test yielded a U value of 1463.50 with an asymptotic significance (2-tailed) of 0.256, which is greater than the 0.05 level of significance. This indicates that no statistically significant difference exists between teachers' and students' perceptions regarding the condition of SSCP-implementing school laboratories.

In terms of group comparison, students obtained a higher mean rank (MR=136.26) than teachers (MR=112.04), suggesting that students tended to provide slightly more favorable ratings of the laboratory condition. However, the difference in mean ranks was not statistically significant, implying that both teachers and students share similar views on the adequacy of available resources, the physical laboratory environment, and the maintenance of facilities and equipment.

The quantitative findings align with the qualitative interview responses, in which both teachers and students described the laboratories as functional and generally conducive to learning. Participants noted that laboratories were *"clean and organized"* and *"supportive of hands-on activities,"* while also identifying shared concerns such as *"equipment shortages," "ventilation problems,"* and *"the need for renovation in some areas."* These shared experiences help explain the absence of a significant difference between the two groups, as both encounter similar laboratory conditions in practice.

Although no statistically significant difference was found, the pattern of higher student mean ranks may be explained by differences in how laboratory conditions are experienced. Students typically evaluate laboratory conditions based on immediate and visible factors such as cleanliness, space for movement, and the availability of materials during scheduled activities. Teachers, on the other hand, consider broader operational concerns, including the sustainability of resources, the frequency of maintenance, and the suitability of facilities for repeated use across multiple classes. Despite these differing perspectives, the absence of statistical significance suggests that both groups recognize a comparable level of laboratory adequacy, indicating shared experiences of both strengths and constraints within the same institutional context.

The findings are consistent with related literature reviewed in this study, which reports that when laboratory resources, physical conditions, and maintenance practices are uniformly experienced by users, differences in stakeholder perceptions tend to be minimal. Recent studies indicate that both teachers and students often acknowledge that laboratories are generally functional while also identifying common challenges, such as limited equipment, environmental discomfort, and maintenance constraints, that affect daily laboratory use (Marasigan & Abas, 2025; Macayana & Mangarin, 2024). In addition, national-level findings indicate that systemic limitations in laboratory infrastructure often shape similar perceptions among stakeholder groups, particularly in public secondary schools, where resource constraints affect all users (EDCOM II, 2024).

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The implications of these findings suggest that initiatives to improve science laboratory conditions should focus on system-wide enhancements rather than stakeholder-specific interventions. Since both teachers and students perceive laboratory conditions similarly, the proposed Science Laboratory Intervention Program (SLIP) should prioritize infrastructure upgrading, equipment acquisition, and improved maintenance practices to elevate laboratory conditions for all users and strengthen the delivery of science instruction.

Table 5 presents the results of the Mann–Whitney U Test conducted to determine whether a significant difference exists between teachers' and students' perceptions regarding the utilization of SSCP-implementing school laboratories. The nonparametric test was employed to compare the two independent groups with respect to their assessments of laboratory frequency of use, relevance of use, and laboratory activities conducted.

Table 5

Mann–Whitney U Results on the Difference in the Perception of the Utilization of SSCP-Implementing School Laboratories Between Teachers and Students

Group	Mean Rank	Sum of Ranks	Mann–Whitney U	Asymp. Sig. (2-tailed)
Students	136.31	34,759.00	1451.00	0.238
Teachers	111.14	1,556.00		

Table 5 shows that the Mann–Whitney U Test yielded a U value of 1451.00 with an asymptotic significance (2-tailed) of 0.238, which is greater than the 0.05 level of significance. This indicates that no statistically significant difference exists between teachers' and students' perceptions regarding the utilization of SSCP-implementing school laboratories.

In terms of group comparison, students obtained a higher mean rank (MR=136.31) than teachers (MR=111.14), indicating that students tended to rate laboratory utilization slightly more favorably. However, the observed difference in mean ranks was not statistically significant, suggesting that both groups generally share similar views regarding how frequently and effectively science laboratories are utilized for instructional purposes.

Although the difference in perceptions was not statistically significant, the higher mean ranks among students may be attributed to differences in experience and access. Students often evaluate laboratory utilization based on scheduled class-time activities and direct engagement in experiments, which may create a perception of regular and effective use. Teachers, in contrast, consider utilization in relation to broader instructional planning, laboratory availability across multiple classes, and scheduling and resource-sharing constraints. Despite these differing evaluative lenses, the lack of statistical significance suggests that both groups face comparable opportunities and constraints in laboratory use within the same school context.

The quantitative results align with the qualitative interview findings, in which both teachers and students emphasized that laboratories are regularly used and meaningful for science learning. Participants commonly reported that *"hands-on experiments help us understand lessons better"* and that *"laboratories are used to reinforce what we learn in class."* At the same time, shared constraints were identified, including *"limited access beyond class hours," "scheduling conflicts,"* and *"equipment availability issues,"* which may have tempered perceptions of utilization for both groups. These shared experiences help explain the absence of a statistically significant difference in utilization perceptions.

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The findings are consistent with the related literature reviewed in this study, which indicates that science laboratories are often perceived as effective instructional spaces during scheduled class activities but are simultaneously constrained by access limitations, shared facilities, and equipment availability. Recent studies report that hands-on and collaborative laboratory activities enhance learning when laboratories are accessible, while limited scheduling, insufficient materials, and operational constraints reduce the frequency and breadth of laboratory use (Ali et al., 2022; Chengere et al., 2021; Marasigan & Abas, 2025; Macayana & Mangarin, 2024). In addition, national-level findings highlight that utilization challenges in public secondary schools are systemic and commonly experienced by both teachers and students, leading to similar perceptions across stakeholder groups (EDCOM II, 2024).

The implications of these findings indicate that efforts to improve laboratory utilization should focus on enhancing institutional systems rather than targeting specific stakeholder groups. Strengthening scheduling mechanisms, improving access policies, and ensuring adequate resources may increase the effectiveness and consistency of laboratory utilization. These results further support the relevance of the proposed Science Laboratory Intervention Program (SLIP) for addressing systemic factors influencing laboratory use across SSCP-implementing schools. The qualitative findings collectively portray the science laboratory as a fundamentally valuable and generally functional learning environment that supports science instruction, yet one that requires targeted improvements to maximize its potential.

Many participants described the laboratories as clean, organized, and conducive to learning, emphasizing the maintenance of safety measures and functional equipment. Positive expressions such as “highly equipped and clean” reflect satisfaction with the overall environment and indicate that laboratories provide a stable foundation for instructional activities. However, these affirmations were frequently accompanied by concerns regarding ventilation, environmental comfort, aging infrastructure, and inconsistent maintenance. Statements such as “not up to quality” and “not that clean” suggest that while laboratories meet operational standards, variations in upkeep and modernization influence the quality of the user experience.

Across responses, the most consistent and compelling theme is that the laboratory serves as a catalyst for experiential learning and conceptual understanding. Students emphasized that hands-on experiments significantly enhanced their comprehension of scientific concepts, often describing laboratory activities as more engaging and meaningful than purely theoretical instruction. In vivo expressions such as “hands-on learning makes it easier,” “experience is the best teacher,” and “it significantly improved my understanding on a whole new level” underscore the transformative impact of practical engagement. Experiments in chemistry, physics, and biological dissection were frequently cited as powerful learning moments that deepened critical thinking, strengthened analytical skills, and fostered sustained interest in science. These accounts position the laboratory as an essential instructional space that bridges theory and practice, promoting active knowledge construction and scientific inquiry.

At the same time, the qualitative data reveal persistent barriers that constrain optimal laboratory utilization. Participants reported equipment shortages, outdated materials, limited access due to scheduling conflicts, and occasional gaps in safety knowledge or supervision. Statements such as “equipment shortage is my issue,” “we also must bring our own materials sometimes,” and “all the materials in the science laboratory are outdated” illustrate resource-related challenges that restrict the scope of experimentation. Although many students acknowledged adequate safety guidance, some responses indicated knowledge gaps and insufficient protective resources, pointing to the need for enhanced safety training and the consistent provision of equipment. Overall, the synthesis suggests that while the science laboratory effectively supports experiential learning and conceptual growth, its full educational potential is moderated by structural, resource, and operational limitations that warrant strategic institutional attention.

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Table 6 presents the combined quantitative and qualitative findings, demonstrating a general pattern of convergence accompanied by contextual elaboration. The survey results show that laboratories in SSCP-implementing schools are typically rated between Available and Very Much Available for resources, physical condition, and maintenance.

Table 6

Convergence of Quantitative and Qualitative Findings on the Condition and Utilization of SSCP-Implementing School Laboratories

Area of Investigation	Quantitative Findings	Qualitative Themes	Convergence Analysis	Meta-Inference
Available Resources (Table 6)	Teachers: Available (M=2.99) Students: Available (M=3.13)	"Overall Laboratory Condition as Generally Adequate but Requiring Targeted Improvements"; in vivo: "HIGHLY EQUIPPED AND CLEAN"	Convergence with nuance	Laboratories possess foundational resources sufficient for routine instruction; however, sustainability and modernization remain concerns.
Physical Condition (Table 7)	Teachers: Available (M=2.99) Students: Very Much Available (M=3.27)	Cleanliness and safety acknowledged; concerns on ventilation and comfort; in vivo: "NOT UP TO QUALITY"	Partial Convergence	Physical environment is generally conducive, but environmental comfort and space constraints affect prolonged instructional use.
Maintenance of Facilities (Table 8)	Teachers: Very Much Available (M=3.27) Students: Available (M=3.21)	Safety awareness present but some knowledge gaps; in vivo: "I HOLD THE HOT ERLENMEYER BY MY HAND"	Complementary	Maintenance systems exist, yet visibility and student awareness of safety processes need strengthening.
Laboratory Functionality in Teaching	Quantitative: Generally Available across indicators	Theme: "Science Laboratory as a Catalyst for Experiential Learning Amid Structural	Strong Convergence	Laboratories effectively enhance experiential learning, though constrained by

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		Constraints”*;* in vivo: “WE UTILIZE WHAT WE HAVE”		equipment and infrastructure limitations.
Effectiveness in Enhancing Understanding	High availability ratings supporting instructional use	Theme: “Laboratory as a Foundational Support for Scientific Understanding”*;* in vivo: “HANDS-ON LEARNING MAKES IT EASIER”	Strong Convergence	Hands-on laboratory activities significantly improve conceptual understanding and critical thinking.
Barriers to Access and Experimentation	Slightly lower ratings in technology & resource sufficiency	Theme: “Barriers to Laboratory Access and Experimentation”*;* in vivo: “EQUIPMENT SHORTAGE IS MY ISSUE”	Convergent Expansion	Quantitative adequacy ratings are moderated by qualitative accounts of scheduling conflicts and equipment shortages.
Obsolescence of Tools	Generally rated Available	Theme: “Perceived Adequacy Versus Deficiency”*;* in vivo: “ALL THE MATERIALS… ARE OUTDATED”	Divergence (Perceptual Gap)	While survey data suggest adequacy, interviews reveal strong perceptions of obsolescence, indicating experiential disparities.

The integration of quantitative and qualitative findings reveals a pattern of overall convergence with contextual expansion. Survey data indicate that SSCP-implementing school laboratories are generally Available to Very Much Available across dimensions of resources, physical condition, and maintenance.

These findings align with qualitative themes describing laboratories as “highly equipped and clean” and effective in supporting experiential learning. However, qualitative findings deepen the interpretation by revealing environmental discomfort, outdated tools, equipment shortages, and scheduling conflicts that are not fully captured by mean ratings. This suggests that while laboratories meet minimum operational standards, experiential quality varies depending on context, frequency of use, and role (teacher vs. student).

Strong convergence is observed in experiential learning, where both data strands affirm that hands-on activities significantly enhance conceptual understanding (“hands-on learning makes it easier”). This reinforces the laboratory’s role as a catalyst for inquiry-based instruction. Meanwhile, divergence emerges in perceptions of resource modernization. While quantitative ratings classify resources as available, qualitative responses strongly express concerns about outdated equipment, revealing a perceptual and experiential gap.

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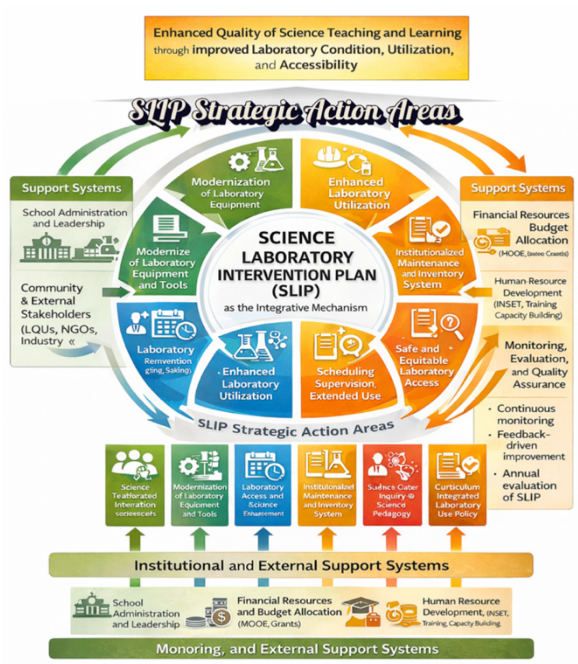
The convergent parallel analysis indicates that SSCP-implementing school laboratories are functionally adequate and pedagogically valuable, particularly in fostering experiential and conceptual learning. However, their full instructional potential is moderated by: Equipment Modernization Gaps, Environmental Comfort Issues, Scheduling Constraints, and Uneven Resource Sustainability.

Thus, while structural foundations are in place, strategic upgrades, improved access systems, and enhanced safety visibility are necessary to optimize laboratory utilization and ensure equitable, high-quality science learning experiences.

Figure 3 presents the revised Science Laboratory Intervention Plan (SLIP), developed based on the study's quantitative and qualitative findings. The intervention plan adopts a Problem–Evidence–Strategy–Outcome structure to ensure that each proposed action is directly traceable to identified issues, supported by empirical evidence from Chapter IV, and aligned with realistic and achievable outcomes within SSCP-implementing schools. This revised SLIP responds to the panel's recommendation for a data-driven, context-sensitive, and framework-aligned intervention plan that reflects actual laboratory conditions, utilization constraints, and institutional capacities observed in the study.

Figure 3

Proposed Science Laboratory Intervention Plan (SLIP)



The Science Laboratory Intervention Plan (SLIP) is presented as an integrative framework that illustrates how multiple interrelated strategic action areas collectively contribute to enhanced quality of science teaching and learning through improved laboratory conditions, utilization, and accessibility, as shown in the uppermost outcome of the figure. This framing reflects the study's central finding that science laboratory effectiveness is shaped not by isolated factors but by the interaction of instructional, infrastructural, organizational, and support systems.

At the core of the framework is the Science Laboratory Intervention Plan (SLIP), which serves as the integrative mechanism linking laboratory conditions, utilization practices, and access policies to institutional and external support systems. This positioning is empirically justified by the study's convergent findings, which show that while

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laboratory conditions and utilization were generally rated as *Available*, persistent challenges in equipment adequacy, maintenance, scheduling, and safety limited optimal instructional use. The central placement of SLIP emphasizes that coordinated planning is necessary to translate existing resources into improved learning outcomes.

Figure 3 identifies multiple SLIP Strategic Action Areas; each grounded in the study's quantitative and qualitative results. Modernization of Laboratory Equipment and Tools is included in response to findings that laboratories lacked sufficient modern instruments, technological tools, and updated materials. Qualitative accounts of *"outdated tools"* and limited equipment availability support this action area and align with the Resource-Based View (RBV) Theory, which underscores the importance of strategic resource enhancement for institutional effectiveness.

Laboratory Renovation (e.g., ventilation, space, and safety improvements) directly addresses students' reported experiences of *"very hot"* laboratory environments and inadequate ventilation. This action area is further supported by findings that physical condition indicators did not consistently achieve the highest ratings, highlighting the need to improve laboratory comfort and safety to sustain engagement. Enhanced Laboratory Utilization appears as both a strategic focus and an outcome-oriented process. Quantitative results indicated that utilization was only *Available*, particularly for extended access and independent use. This justifies interventions aimed at maximizing instructional time, relevance, and the frequency of laboratory engagement, consistent with Constructivist Learning Theory, which emphasizes learning through active, repeated hands-on experiences.

Moreover, Scheduling, Supervision, and Extended Use are included to address qualitative findings related to overlapping schedules, limited laboratory access beyond class hours, and students' expressed need for guidance. This component ensures that laboratory use is not only frequent but also safe, equitable, and pedagogically meaningful, supporting Situated Learning Theory, which emphasizes learning in authentic, well-supported contexts. Institutionalized Maintenance and Inventory System reflects recurring concerns about inconsistent maintenance practices, water shortages, and undocumented equipment management. The inclusion of this action area underscores the importance of sustainability and operational continuity, ensuring that improvements in laboratory conditions are maintained over time.

Meanwhile, safe and equitable laboratory access addresses both safety concerns and access inequities identified in the study. Students' apprehension about conducting experiments and the limited availability of laboratories for all learners justify policies and procedures that ensure safe participation and equitable access across sections and ability levels. Science-Oriented Inquiry-Based Pedagogy emphasizes the instructional dimension of laboratory use. Findings showed that laboratory activities were most effective when guided, relevant, and aligned with classroom instruction. This action area aligns with Constructivist and Inquiry-Based Learning Theories, reinforcing the need for pedagogical approaches that integrate experimentation, reflection, and guided discovery.

Curriculum-Integrated Laboratory Use Policy ensures alignment between laboratory activities and curricular goals. The study revealed that relevance of use was rated highly when experiments directly supported lesson objectives, justifying formal policies that embed laboratory work within curriculum planning rather than treating it as an optional supplement.

The lower and side sections of the figure emphasize Institutional and External Support Systems, recognizing that SLIP implementation depends on enabling structures.

School Administration and Leadership are highlighted as key drivers of policy implementation, scheduling decisions, and resource prioritization. This inclusion is supported by findings showing that differences in laboratory conditions and utilization were significant when analyzed by school profile.

Financial Resources and Budget Allocation (e.g., MOOE, grants) are explicitly included to address constraints related to equipment procurement, renovation, and maintenance. Without financial backing, the strategic action areas cannot be sustained. Human Resource Development (INSET, training, capacity building) responds to qualitative findings that students value guidance and supervision during laboratory activities. Teacher training ensures that instructional practices align with inquiry-based, safety-oriented laboratory practices. Community and External Stakeholders (LGUs, NGOs, industry) are incorporated to expand support beyond the school, consistent with best practices in educational resource mobilization and sustainability.

Meanwhile, the inclusion of Monitoring, Evaluation, and Quality Assurance, with mechanisms such as continuous monitoring, feedback-driven improvement, and annual evaluation of SLIP, reflects the study's conclusion that laboratory improvement must be iterative. This component operationalizes the feedback loop necessary for sustained quality enhancement, ensuring that interventions remain responsive to emerging needs.

To ensure institutional adoption and sustainability, the Science Laboratory Intervention Plan (SLIP) shall be disseminated and operationalized through established school and division-level mechanisms. The SLIP will be formally presented to school heads, science teachers, and laboratory custodians during In-Service Training (INSET) and school-based Learning Action Cell (LAC) sessions to ensure shared understanding of its components, objectives, and implementation roles.

Following dissemination, the SLIP shall be integrated into the School Improvement Plan (SIP) and the Annual Implementation Plan (AIP), thereby embedding the proposed strategies within the existing planning, budgeting, and monitoring structures of SSCP-implementing schools. Adoption will be facilitated by designating responsible units, including school administrators for policy alignment, science teachers for instructional implementation, and laboratory custodians for maintenance and safety compliance. Continuous monitoring and feedback mechanisms, coordinated by the school and the Schools Division Office, will support iterative refinement of the SLIP, ensuring that the intervention remains responsive to contextual constraints and aligned with instructional priorities.

Overall, the SLIP framework synthesizes Constructivist Learning Theory, Situated Learning Theory, and the Resource-Based View, translating them into actionable strategies grounded in empirical findings. The circular and interconnected design of the figure reinforces the idea that improving science laboratories is a systemic and ongoing process, not a one-time intervention.

Conclusion, Limitations, and Recommendations

This study examined the condition and utilization of science laboratories in SSCP-implementing public secondary schools, including differences in perceptions between teachers and students, as well as their lived experiences. Findings revealed clear differences in school profiles, particularly in student population, number of laboratory facilities, and availability of specialized laboratories. School 1 had a larger student population and more complete laboratory facilities, including an Earth and Space Science laboratory, while School 2 had fewer resources, which influenced both laboratory condition and utilization.

In terms of laboratory conditions, both teachers and students generally rated laboratories as available, indicating adequacy for basic instructional needs. However, limitations were identified in advanced equipment, ventilation, lighting, and documentation of maintenance practices. Despite these concerns, no significant difference was found between teachers' and students' perceptions, suggesting a shared understanding of existing conditions. Significant differences emerged when analyzed by school profile, with better-equipped schools receiving more favorable ratings.

Laboratory utilization was also rated as available, with regular use for curriculum-aligned experiments. Laboratory activities such as safety instruction, demonstrations, hands-on experiments, and collaborative work were highly

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evident and contributed positively to students' learning. However, access beyond regular class hours and opportunities for extended or research-based activities were limited. In laboratory conditions, no significant difference was found between teachers' and students' perceptions, although differences were observed across schools depending on available facilities.

Qualitative findings reinforced the importance of science laboratories as essential learning environments that enhance conceptual understanding through hands-on experiences. At the same time, participants identified persistent challenges, including limited equipment, ventilation issues, scheduling constraints, and inconsistent maintenance. These findings served as the basis for proposing a Science Laboratory Intervention Plan (SLIP) to improve resources, infrastructure, access, and sustainability.

The study concludes that SSCP-implementing schools vary significantly in terms of infrastructure, resources, and capacity to support effective laboratory instruction. Schools with more specialized laboratories and better facilities are better positioned to provide high-quality science education. While existing laboratories are generally adequate, they are not fully optimized, as gaps remain in advanced equipment, environmental conditions, and systematic maintenance practices.

The absence of significant differences between teachers' and students' perceptions indicates a shared and consistent experience regarding both laboratory conditions and utilization. However, differences based on school profile highlight that institutional capacity is a more influential factor than respondent role. Laboratories are regularly used and aligned with instructional goals, but limited access and extended use prevent the full realization of their educational potential.

Laboratory activities are effectively implemented and support experiential learning, demonstrating that teachers can maximize available resources despite constraints. Nevertheless, recurring issues such as outdated equipment, ventilation concerns, scheduling limitations, and maintenance gaps persist. These challenges underscore the need for a structured and data-driven intervention. The proposed Science Laboratory Intervention Plan (SLIP) provides a practical, context-sensitive approach to addressing these issues and improving the conditions and utilization of science laboratories.

Based on the findings and conclusions, it is recommended that students be actively involved in laboratory safety orientations, supervised extended use, and feedback mechanisms to improve engagement and safety. Science teachers should continue to strengthen their competencies in laboratory instruction, safety management, and innovative experimental design through continuous professional development.

School heads and administrators are encouraged to prioritize improvements in laboratory infrastructure, ventilation, maintenance systems, and access policies, and to support the institutionalization of the SLIP. Laboratory custodians should implement regular, well-documented maintenance procedures and ensure consistent adherence to safety standards and the availability of utilities.

Curriculum planners and science supervisors should enhance the alignment of laboratory activities with curriculum goals and improve scheduling to maximize laboratory use. The Schools Division Office should provide differentiated support based on school needs, recognizing disparities in resources and infrastructure. Policymakers are urged to strengthen standards related to laboratory safety, maintenance, and environmental conditions.

Finally, future researchers are encouraged to conduct longitudinal or experimental studies to examine the long-term impact of improved laboratory conditions and utilization on student outcomes. Further research may also explore variables such as funding, class size, and teacher workload to deepen understanding of factors influencing effective science laboratory use.

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