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Assessment of Science Laboratory Resources in Public High Schools

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Abstract

This study assessed the science laboratory resources in public secondary schools in the CAMAG districts of Bohol Division during School Year 2025–2026. Anchored on Human Capital Theory and Diffusion of Innovation Theory, the study examined the availability, functionality, and extent of utilization of DepEd-provided laboratory resources, as well as the relationship between laboratory utilization and teachers' educational qualifications, years of science teaching experience, and laboratory-related training attendance. An explanatory sequential mixed-methods design was employed, involving 65 science teacher-participants selected through total enumeration. Data were gathered using a researcher-made survey questionnaire and semi-structured interview guide. Quantitative data were analyzed using frequency, percentage, mean, standard deviation, and Spearman correlation, while qualitative data were analyzed through thematic analysis. Findings showed that most laboratory resources were generally available and functional, but physics and STEM chemistry resources were limited, and several resources across integrated science, chemistry, physics, SHS Core, STEM chemistry, and STEM physics were underutilized. Educational attainment had a significant but small positive relationship with laboratory utilization, while years of science teaching experience and laboratory-related training showed strong positive relationships. Low utilization was attributed to inadequate and misaligned laboratory infrastructure, insufficient teacher skills and training, limited time for laboratory activities, and curriculum–laboratory misalignment. The study recommends upgrading laboratory resources, strengthening specialized laboratory training, aligning curriculum requirements with laboratory activities, and providing sufficient time for laboratory work. The study supports SDG 4—Quality Education by promoting improved science learning environments and teacher capacity. Its sustainability impact lies in strengthening educational, institutional, governance, and innovation sustainability through better laboratory management, resource utilization, and science instruction.

Keywords: Assessment, CAMAG Districts, Educational Qualifications, Laboratory Training, Laboratory Utilization, Public High Schools, Science Laboratory Resources

1. Introduction

Science laboratory resources are essential to inquiry-based science education because they enable learners to explore, experiment, observe, and apply scientific concepts through practical activities. In the K–12 curriculum, laboratory instruction supports active and meaningful learning, but its effectiveness depends on the availability, functionality, and actual utilization of laboratory facilities, equipment, materials, and trained teachers. This study focuses on public secondary schools in the CAMAG districts of Bohol Division and examines how DepEd-provided science laboratory resources are available, functional, and utilized in science instruction. It also considers how teachers' educational attainment, teaching experience, and laboratory-related training relate to laboratory utilization.

Science education in the K–12 curriculum emphasizes learners' participation in scientific inquiry through exploration, experimentation, and discovery. Laboratory exposure promotes active, enjoyable, and valuable practical learning (Marasigan & Abas, 2025; Harman et al., 2016; De Feo et al., 2020 & Cabusor & Antonio, 2025), which may contribute to higher learner participation and improved academic achievement (Kevin & Evans, 2024). Students' positive experiences in well-equipped laboratories are also associated with more favorable attitudes toward science (Kumari et al., 2024). The teacher remains central to effective laboratory instruction. Teachers' higher degrees and field specialization may strengthen science laboratory instruction (Mae et al., 2025; Atud et al., 2025), while stronger training proficiency may improve laboratory-related competence (McConnell et al., 2009). However, science laboratory instruction is often constrained by inadequate facilities, insufficient materials and equipment, and lack of proper laboratory training, limiting teachers' opportunities to practice and apply laboratory skills (Rivera & Manalastas, 2025).

The literature consistently affirms that science laboratories serve as spaces where learners can visualize, materialize, observe, and apply scientific concepts, thereby promoting lasting learning (Harman et al., 2016). Laboratories also support critical and creative thinking by enabling students to solve real-world problems through practical tasks (Marasigan & Abas, 2025). Well-equipped and functional laboratories are therefore important because learners may struggle to understand specialized science subjects without access to laboratory activities (Arnejo et al., 2021; Oyelowo, 2023). Hands-on laboratory experiences are also linked to students' motivation, performance, and positive attitudes toward science (Kumari et al., 2024). Despite these benefits, laboratory-based science instruction is affected by recurring challenges. Large class sizes, inadequate equipment (Pareek, 2019; Issah et al., 2023), malfunctioning equipment, limited laboratory space, inadequate utilities (Supriyatman et al., 2024; Marasigan & Abas, 2025), and lack of teacher training (Keskin Geçer and Zengin, 2015) reduce teachers' effectiveness. Some teachers avoid laboratory materials because they lack the skills to use them or fear damaging equipment (Kamba et al., 2019; Duban et al., 2019). Others struggle to use science equipment and teach scientific concepts effectively when laboratory resources are unfamiliar or insufficient (Marasigan & Abas, 2025). Effective utilization of DepEd laboratory resources requires curriculum alignment, teacher training, financial support, safety integration, and continuous professional development (Villaran, 2024). Teachers need sustained professional development and skills training in handling equipment and facilitating experiments (Remigio et al., 2025). Although well-equipped laboratories can support more effective instruction, laboratory facilities alone do not guarantee improved teaching competence unless resources are properly used and safety standards are observed (Doncillo and Justo, 2025).

Philippine studies show disparities in the availability and utilization of science laboratory resources across regions. In Ilocos Norte, basic science laboratory equipment was generally adequate, but many schools lacked sophisticated equipment and chemicals (Cabusor & Antonio (2025). In La Union, some classrooms were converted into laboratories, yet these lacked adequate chemical supplies or had none at all (Nuesca (2025). In Davao del Sur, some schools lacked necessary science laboratories (Caballes et al. (2024). In Lanao del Sur, schools experienced inadequate prescribed laboratories and equipment, limited and outdated chemicals, and insufficient teacher training (Marasigan & Abas (2020). These conditions are supported by the Educational Commission, which reported that half of science teachers had no training in the subjects (EDCOM 2, 2024). Related local studies provide further evidence of uneven compliance with DepEd laboratory standards. Cabusor et al. (2025) examined science laboratory resources stipulated in DepEd Order No. 48, s. 2006 and DepEd Order # 17, s. 2017 among public secondary schools in Ilocos Norte and found that basic laboratory materials were adequate, but chemicals and advanced apparatus were lacking. No apparatus was always utilized during laboratory activities. Caballes et al. (2024) found that selected schools in Davao del Sur complied with some laboratory facility requirements under DepEd Order No. 48. S. 2006 and DepEd Order No.118, s. 2009, but schools varied in their acquisition of laboratory equipment, materials, and quantities across integrated science, biology, chemistry, and physics. Marasigan and Abas (2025) also reported equipment mismatch, shortage of qualified science teachers, lack of training for unfamiliar equipment, and skipped laboratory activities when materials were unavailable. In Bohol Division, there remains limited published evidence on the status and use of DepEd-provided science laboratory resources. No study has specifically examined the availability, functionality, and extent of utilization of these resources in the CAMAG districts of Congressional District 3. This local gap provides the immediate context for the present study.

This study is anchored on Human Capital Theory and Diffusion of Innovation Theory. The Human Capital Theory proposed by Schultz (1961) and Becker (1964) explains that education and training are investments that improve individuals' productivity and performance. As applied to this study, teachers' educational attainment, years of teaching science, and laboratory-related training represent investments in human capital that may strengthen their laboratory skills and improve their use of science laboratory equipment and materials. This is consistent with the view that learning and skill development enhance individuals' capacity to perform productively and efficiently (Wuttaphan, 2017). The study is also grounded in Diffusion of Innovation Theory (Rogers, 2003), which explains how new tools, ideas, and practices are adopted within a social system. Science laboratory resources may be viewed as instructional innovations that support science teaching in public secondary schools. Teachers may differ in their adoption and use of DepEd-provided laboratory resources as innovators, early adopters, early majority, late majority, or laggards, depending on their extent of utilization (Kaminski, 2011). The conceptual basis of the study links the profile of science laboratory resources—availability, functionality, and extent of utilization—with teachers' educational qualifications, including educational attainment, years in teaching science, and laboratory-related training attendance. These elements inform the development of a proposed action plan for improving laboratory management and laboratory instruction. The study is further supported by DepEd Order No. 48 series of 2006, DepEd Order No. 118 series of 2009, and DepEd Order No. 17 series of 2017. DepEd Order No. 48 series of 2006 provides safety measures in science laboratories, including guidelines on hazardous chemical handling, laboratory rules, chemical storage, chemical disposal, and labeling (www.deped.gov.ph). DepEd Order no. 118 series of 2009 prescribes the standard list of science and mathematics equipment, laboratory glassware, and consumables for elementary and secondary science subjects (www.deped.gov.ph). DepEd Order no. 17 series of 2017 provides guidelines for science and mathematics equipment for Grades 4–6 and Grades 11–12, including STEM and non-STEM laboratory resources intended to support the teaching and learning of Science and Mathematics in Basic Education (www.deped.gov.ph).

Although existing studies have examined laboratory resources in several Philippine regions, limited published data evaluate the status of science laboratory resources provided by the Department of Education. More specifically, no study has been conducted in Bohol Division that examines the availability, functionality, and utilization of DepEd-provided science laboratory resources in public secondary schools. This gap is significant because meaningful science learning depends not only on competent teachers but also on adequately equipped, functional, and consistently utilized laboratory facilities. The study therefore assesses the profile of science laboratory resources in public secondary schools in the CAMAG districts of Congressional District 3 of Bohol Division, Philippines. It examines resource availability, functionality, and extent of utilization; describes teachers' educational qualifications in terms of educational attainment, years of teaching science, and laboratory-related training attendance; determines the relationship between laboratory utilization and these teacher-related variables; and explores the reasons for low utilization among teacher-participants. Based on the findings, the study aims to propose an action plan to improve laboratory management, teacher capability, and practical skills in using DepEd-provided laboratory tools and equipment.

Based on the study content, the clearest alignment is with SDG 4 – Quality Education. The study supports this goal by examining how laboratory resources can improve learning environments, strengthen science instruction, and enhance students' learning outcomes. By identifying gaps in resource availability, functionality, utilization, teacher training, and curriculum alignment, the study contributes to efforts to make science education more practical, equitable, and responsive to learner needs. The study also supports the broader aims of educational quality by emphasizing teacher professional development, safe and functional learning environments, and better alignment between laboratory resources and curriculum requirements. These concerns directly relate to improving access to effective science instruction in public secondary schools.

The study contributes primarily to educational sustainability by addressing the long-term quality of science teaching and learning in public secondary schools. Sustainable science education requires laboratory resources that are not only available but also functional, safe, curriculum-aligned, and regularly used in instruction. By assessing these conditions, the study provides evidence that can help teachers, school administrators, and educational supervisors improve laboratory-based learning. The study also contributes to institutional sustainability because its findings may guide schools in verifying laboratory supplies, improving procurement through the Annual Procurement Plan, and strengthening the management of DepEd-provided resources. It supports policy and governance sustainability by using DepEd Order No. 48 series of 2006, DepEd Order No. 118 series of 2009, and DepEd Order No. 17 series of 2017 as legal and operational bases for assessing laboratory standards. In addition, it contributes to technological and innovation sustainability by encouraging more effective use of laboratory tools, equipment, and materials in science instruction. Finally, the study has practical value for science teachers, school administrators, educational program supervisors, and future researchers. It can help science teachers identify professional development needs, assist school leaders in planning laboratory procurement and resource improvement, guide supervisors in designing curriculum reviews and in-service training, and serve as a basis for future studies on the relationship between laboratory resource utilization and teachers' laboratory skills.

2. Material and methods

2.1 Research Design

The study employed an explanatory sequential mixed-methods design. The quantitative phase determined the profile of science laboratory resources in terms of availability, functionality, and extent of utilization, as well as the relationship between laboratory utilization and teachers' educational qualifications, specifically educational attainment, years of teaching science, and laboratory-related training attendance. The qualitative phase followed the quantitative analysis and used semi-structured interviews with low-scoring teacher-participants to explain the underlying reasons for low utilization. The integration of quantitative and qualitative data strengthened the interpretation of findings and provided a more comprehensive basis for improving science laboratory instruction.

2.2 Locale of the Study

The study was conducted in the sub-congressional CAMAG districts of Congressional District 3 of the Division of Bohol, composed of Candijay, Alicia, Mabini, Anda, and Guindulman. These districts were selected because their public secondary schools had DepEd-provided science laboratory facilities and equipment, making them appropriate for assessing laboratory availability, functionality, and utilization. Across the CAMAG districts, the study covered public secondary schools offering regular junior high school, special science programs, and senior high school programs.

2.3 Respondents of the Study

The respondents were teachers handling science subjects in public secondary schools offering regular junior high school, special science, and senior high school programs in the CAMAG districts. The study involved 65 teacher-participants from the five districts: 19 from Candijay, 4 from Alicia, 16 from Mabini, 8 from Anda, and 18 from Guindulman. They provided data on their educational qualifications, the availability and functionality of science laboratory resources in their schools, and the extent to which these resources were utilized in instruction. Teachers with the lowest utilization scores were invited to participate in semi-structured interviews to explain the reasons for low use of laboratory resources.

2.4 Sample and Sampling Procedure

The study used total enumeration, including all teachers handling science subjects in the identified public secondary schools of the CAMAG districts. Only teachers who met the eligibility criteria and voluntarily consented to participate were included. Teachers handling science who declined participation, as well as science-major teachers who were not teaching science subjects, were excluded. For the qualitative phase, teachers with the lowest scores in laboratory resource utilization were selected for follow-up interviews, provided that they agreed to participate.

2.5 Research Instrument

The researcher used a researcher-made survey questionnaire and an interview guide. The questionnaire items were based on DepEd Order No. 48 series of 2006, DepEd Order No. 118 s. of 2009, and DepEd Order No.17 s. of 2017. The first part gathered data on teachers' educational qualifications, including educational attainment, years of teaching science, and laboratory-related training attendance. The second part assessed the availability, functionality, and extent of utilization of science laboratory resources. A 5-point Likert scale was used to assess availability and functionality, with ratings ranging from poor to excellent. Another 5-point Likert scale was used to assess extent of utilization, ranging from very low to very high. The interview guide was designed to explore reasons for low utilization of laboratory resources in science instruction. The instruments underwent content and face validation by three experts in science education, composed of two secondary science master teachers and one district science coordinator. Their recommendations were incorporated into the final instruments. A pilot test was conducted at Alicia Technical Vocational High School, La Hacienda High School, and Candijay National High School to determine reliability using Cronbach's Alpha.

2.6 Data Gathering Procedure

Data gathering began with the preparation of research instruments, ethics clearance, permits, communication letters, validation, pilot testing, and identification of participants. The researcher secured clearance from the Holy Name University-Ethics Regulatory Board and requested permission from the Schools Division Superintendent, Public Schools District Supervisors, and school heads of the participating schools. Consent forms were given to teacher-participants to explain the purpose of the study, the data to be collected, the risks and benefits of participation, and the confidentiality of responses. During implementation, the researcher visited the schools and administered the survey to teachers who signed the consent form. Completed questionnaires were retrieved according to an agreed schedule. After the survey responses were gathered, the researcher identified participants with the lowest utilization scores and contacted them for follow-up interviews. The semi-structured interviews were conducted either face-to-face or through video or audio call, depending on the participants' preferred modality and schedule. After data collection, survey responses were prepared for statistical analysis, while interview responses were prepared for thematic analysis. The findings, conclusions, and recommendations were then derived from the integrated results.

2.7 Data Analysis Techniques

The study used descriptive and inferential statistical methods. Frequency and percentage were used to summarize teachers' educational qualifications, while mean and standard deviation were used to describe the availability, functionality, and extent of utilization of science laboratory resources. Spearman correlation was used to determine the relationship between extent of utilization and teachers' educational attainment, years of teaching science, and laboratory-related training attendance. Statistical analyses were performed using software such as SPSS. Qualitative data from the interviews were analyzed using Thematic Analysis following the six-phase approach of Braun and Clarke (2006). The process involved familiarization with the data, identification of keywords, generation of initial codes, development of themes, conceptualization, and development of a conceptual framework. Thematic analysis was used to identify patterns of meaning, underlying issues, and contextual factors explaining teachers' low utilization of science laboratory resources.

2.8 Ethical Considerations

The study observed ethical procedures before, during, and after data collection. Participants joined voluntarily and were included only after giving consent. Their responses were used solely for research purposes, and their identities were treated with confidentiality. The collected data were handled in accordance with the Data Privacy Act of 2012. Unique identification codes were assigned in place of names on questionnaires and interview transcripts. The master list linking codes to participants was stored separately and securely, accessible only to the researcher. Findings were reported in aggregated and anonymized form to prevent identification of individual respondents. Data were shared only for research, legal, or ethical review purposes when necessary.

3. Results and Discussion

3.1 Profile of Science Laboratory Resources

3.1.1 Availability of Science Laboratory Resources

The results showed that physical facilities, safety and security standards, integrated science, biology, chemistry, SHS core, STEM biology, and STEM physics resources were generally available. However, physics and STEM chemistry resources were only partially available. The findings also showed high variability across schools, particularly in drainage, lighting and ventilation systems, laboratory working tables and stools, laboratory counters, storage rooms, and control rooms. Integrated science resources were generally available but lacked several consumables and instructional materials. Biology resources were also generally available but limited in chemical reagents and instructional charts. Physics resources were partially available, especially in specialized equipment and instructional materials. SHS core, STEM biology, and STEM physics resources were generally available, while STEM chemistry resources were limited in chemical reagents, specialized apparatus, and laboratory equipment. These findings suggest that many schools have existing laboratory spaces, but some function more as classrooms than actual laboratory areas because of inadequate counters, storage rooms, and control rooms. This agrees with Marasigan & Abas (2025), who identified inadequate laboratory facilities, lack of laboratory rooms, and lack of instructional materials as common school issues. The EDCOM II report (2026) likewise noted classroom shortages and deterioration of facilities in the Philippines. Safety-related gaps, particularly in chemical labeling and disposal, were consistent with Oriel et al., (2026), who identified weaknesses in emergency preparedness and hazardous waste management. These conditions are important because laboratory safety requires deliberate planning and regulation in handling hazards during activities (Duban et al., 2019). The insufficiency of chemicals and learning materials also reflected findings from prior studies (Abas and Marasigan, (2020); Cabusor and Antionio (2025); Nuesca (2025); & Caballes et al. (2024). Limited physics apparatus may restrict practical skill development and push instruction toward theory, although laboratory resources help students visualize and understand physics concepts (Alerta et al. (2017). Similarly, the limited availability of chemicals, instructional materials, and advanced apparatus echoed Cabusor et al. (2025), while inadequate laboratory resources may reduce hands-on learning opportunities, as noted by Seid et al.'s study (2022). The use of science laboratory resources supports experiential learning but limited instructional materials may weaken laboratory experiences and students' understanding of abstract concepts (Duban et al. (2019).

3.1.2 Functionality of Science Laboratory Resources

The results showed that physical facilities, safety and security standards, integrated science, biology, chemistry, physics, SHS core, STEM biology, STEM chemistry, and STEM physics resources were generally functional. However, all areas showed wide variation, indicating functionality gaps across schools. Some physical facilities, particularly laboratory counters, control rooms, and storage rooms, had low functionality. Several integrated science consumables and instructional materials, biology reagents and charts, chemistry reagents and specialized apparatus, and physics equipment also showed low functionality. SHS core and STEM laboratory resources were generally functional, but several reagents, consumables, instructional materials, chemistry apparatus, and physics equipment had low functionality. The results indicate that general functionality does not necessarily mean that all resources are ready for effective laboratory instruction. Low functionality in key structures and materials limits the quality of hands-on learning. These findings corroborated Marasigan and Abas' (2025) study, which identified shortages of laboratory rooms and instructional materials in Lanao del Sur. They also aligned with Caballes et al.'s (2024) findings on the insufficiency of prescribed science laboratory resources in Davao del Sur. The poor condition of chemical reagents and apparatus may hinder the conduct of experiments, consistent with Seid et al. (2022), who reported that insufficient laboratory resources limit exposure to hands-on experiences. Overall, low functionality in specific equipment and materials weakens experiential learning opportunities for both teachers and learners.

3.1.3 Extent of Utilization of Science Laboratory Resources

The results showed that physical facilities were generally utilized, although designated spaces such as laboratory counters, control rooms, and storage rooms were seldom used. Safety and security protocols were generally practiced. Integrated science laboratory resources were generally available and functional but poorly utilized. Biology resources were generally utilized, although some available and functional materials were seldom used. Chemistry resources were also seldom utilized, except for basic apparatus such as beakers, graduated cylinders, test tubes, test tube holders, wire gauze, stirring rods, evaporating dishes, Erlenmeyer flasks, and alcohol burners. SHS core, SHS physics, STEM biology, STEM chemistry, and STEM physics resources showed underutilization despite the availability and functionality of some materials and equipment. These results show that availability and functionality do not automatically lead to regular laboratory use. Some basic equipment was underused, while specialized resources were limited, low in functionality, or rarely used. This indicates that laboratory optimization is affected by both resource inadequacy and weak curricular integration. These findings agreed with Cabusor et al. (2025), who found that basic science resources are generally available but that chemicals and advanced laboratory apparatus are lacking, with no apparatus always used during laboratory work.

3.2 Profile of Science Teacher-Participants

3.2.1 Educational Attainment

The results showed that among the 65 teacher-participants, 18 or 27.69% had a bachelor's degree as their highest educational attainment. Most respondents, 45 or 69.23%, pursued master's-level education. Specifically, 23 or 35.38% earned units in a master's degree in science, 2 or 3.07% completed a master's degree in science, 13 or 20% earned units in educational management, and 7 or 10.77% completed a master's degree in educational management. Only 2 or 3.0% completed a doctoral degree. The findings indicate that most science teachers in the CAMAG districts had pursued higher education. This was consistent with Palomar et al. (2025), who reported that 74.24% of teacher educators held at least a master's degree. However, it differed from Aban's (2017) study, which found that only 45.6% of science educators pursued higher education.

3.2.2 Laboratory Training Attendance

The results showed that 41 of the 65 teacher-participants, or 63%, had no laboratory-related training. Twenty-three teachers, or 35.38%, attended one or two laboratory-related trainings, while only one teacher, or 1.53%, attended five or more training sessions. None attended three to four laboratory-related trainings. Most training sessions attended were sponsored by the Department of Education. The findings indicate that many science teachers lacked training in operating or using science laboratory equipment. This conformed to Prudente et al. (2024), who stated that science received only 14 % of the total in-service training or PD program conducted in the Philippines from 2013 to 2023. Aban (2017) also stressed that most training received by science teachers is local training. In addition, the Visayas area received the lowest frequency of training, equivalent to 32 % (PIDS, 2025).

3.2.3 Science Teaching Experience

The results showed that most teacher-participants were early to mid-career science teachers. Seventeen teachers, or 26.15%, had 0–5 years of science teaching experience; 19 or 29.23% had 6–10 years; and 18 or 27.69% had 11–15 years. Only 5 teachers, or 7.69%, had 16–20 years of experience, while 6 or 9.23% had more than 20 years of experience. The findings reveal a relatively young science teaching workforce, with most respondents having 15 years or less of science teaching experience. This aligns with Aban (2017), who emphasized that the majority of science teachers were relatively young, with 77.8 % having less than 5 years of teaching experience.

3.3 Relationship Between Laboratory Utilization and Teacher-Related Variables

3.3.1 Educational Attainment and Laboratory Utilization

The results showed a significant but small positive relationship between educational attainment and the extent of laboratory resource utilization, with $\rho = 0.390$ and $p = 0.003$. Since the p-value was below the 0.05 level of significance, the null hypothesis was rejected. This means that teachers with higher educational qualifications tended to use laboratory resources more, although the relationship was weak. This finding suggests that educational attainment alone is not a strong predictor of laboratory resource use. Higher education may contribute to skill competence, as stated by Atud et al. (2025), but laboratory-competent teachers may still require continuous professional development to improve their skills and respond to changing learning contexts (Supriyatman et al. (2024).

3.3.2 Teaching Experience and Laboratory Utilization

The results showed a significant and strong positive relationship between years of science teaching experience and laboratory utilization, with $\rho = 0.864$ and $p = 0.000$. The null hypothesis was rejected, indicating that more experienced teachers were more likely to utilize science laboratory resources effectively. This finding implies that teaching experience may strengthen confidence and competence in using laboratory resources because experienced teachers are more familiar with instructional strategies, classroom management, and laboratory procedures. However, this finding was in contrast to Atud et al. (2025), who stated that teaching experience has a weak correlation with the teacher's laboratory competence.

3.3.3 Laboratory-Related Training and Laboratory Utilization

The results showed a significant and strong positive relationship between laboratory-related training and the extent of utilization, with $\rho = 0.821$ and $p = 0.000$. The null hypothesis was rejected, showing that teachers who attended more laboratory trainings were more likely to maximize the use of available laboratory resources. This finding indicates that laboratory training is a critical factor in effective laboratory instruction. Training provides teachers with skills, safety knowledge, and practical strategies needed for laboratory work. This data is supported by the study of Demandante & Lagura (2026), which stated that efficient laboratory instruction is grounded on well-trained teachers. Overall, teaching experience and laboratory training were more influential than educational attainment in promoting laboratory resource utilization.

3.4 Factors Affecting Low Utilization of Science Laboratory Resources

3.4.1 Inadequate and Misaligned Laboratory Infrastructure

The qualitative findings showed that low utilization was affected by limited equipment and materials, outdated and non-functional apparatus, incomplete equipment, materials not aligned with competencies, lack of functional laboratory rooms, shared use of laboratories as classrooms, poor ventilation, overcrowding, inadequate space, lack of tables, and disorganized resources. Participants described these issues through statements such as "limited equipment and materials" (P1), "some equipment is outdated and not functioning" (P2), and "no functional laboratory room" (P5). These findings show that the availability, condition, and organization of laboratory facilities directly influence whether teachers can conduct hands-on activities. Inadequate and poorly maintained resources make laboratory work difficult and reduce the frequency of practical instruction. These findings were supported by studies emphasizing that adequate and functional laboratory facilities are essential for effective science instruction because they promote experiential learning and active student engagement (Merriam & Grenier, 2019). Arnejo et al. (2021) and Oyelowo (2023) also emphasized the importance of well-equipped and functional science laboratories.

3.4.2 Insufficient Teacher Skills and Training

The results showed that teachers' limited operational knowledge, lack of training, unfamiliarity with equipment, fear of using laboratory materials, and lack of content background contributed to low laboratory utilization. Participants stated that they were "not knowledgeable on how to operate the equipment" (P10), had "no proper training on how to use equipment even in undergrad" (P11), were afraid to use the equipment, and were not familiar with it (P13). These findings indicate that teacher capacity is central to laboratory resource utilization. When teachers lack confidence or preparation, they tend to avoid laboratory equipment and rely less on practical activities. This aligns with existing literature, which highlights that teacher competence and training are critical factors in the effective use of instructional resources, particularly in laboratory-based teaching (Merriam & Grenier, 2019). Villaran (2024) emphasized that effective use of DepEd laboratory resources requires curriculum alignment, teacher training, financial support, safety integration, and ongoing professional development. Remigio et al. (2025) also stressed the importance of teachers' continuous professional development and skills training in handling equipment and facilitating laboratory work.

3.4.3 Lack of Time for Laboratory Activities

The results showed that time constraints affected laboratory utilization. Participants reported that 45 minutes to one hour was insufficient to prepare, conduct, and clean up laboratory activities. They also noted that setting up equipment was time-consuming, especially without a dedicated laboratory space, and that other school activities competed with instructional time. Participants expressed these concerns through statements such as "1 hour is not enough" (P15), "It takes time to set up the equipment" (P16), and "we only have 45 minutes allotted time per subject" (P17). These findings suggest that even when resources are present, limited class time can discourage teachers from conducting laboratory work. Practical science activities require preparation, implementation, supervision, and clean-up time, making them difficult to integrate into short class periods. This supports prior findings that limited instructional time constrains the implementation of experiential learning strategies, particularly in science education, where laboratory activities require extended periods (Merriam & Grenier, 2019; Remperas & Calzada, 2025).

3.4.4 Curriculum–Laboratory Misalignment

The results showed that low utilization was also influenced by curriculum-related factors. Participants reported that many competencies did not require laboratory work, some lessons focused only on theoretical understanding or equipment identification, and laboratory materials did not always match the required topics. As a result, teachers often relied on lectures, visuals, and videos instead of laboratory activities. Participants stated that "most competencies do not require laboratory work" (P19), "we use video presentations and lectures instead" (P20), and "competencies only require identifying laboratory equipment" (P21). These findings indicate that laboratory utilization depends not only on resources and teacher capability but also on curriculum demands. When competencies do not emphasize hands-on work, teachers are less likely to integrate laboratory activities into instruction. This finding is consistent with literature suggesting that when curriculum requirements do not emphasize practical application, teachers are less likely to integrate laboratory activities into instruction (Merriam & Grenier, 2019). Moreover, according to Villaran (2024), effective use of DepEd laboratory resources requires a combination of curriculum alignment, teacher training, funding support, safety integration, and continuous professional development.

3.5 Overall Results and Discussion

Overall, the study found that science laboratory resources in the CAMAG districts were generally available and functional, but several specialized materials, chemicals, instructional resources, and laboratory spaces remained limited, low in functionality, or underutilized. The results also showed that many teachers pursued higher education but lacked laboratory-related training. Laboratory utilization was significantly related to educational attainment, teaching experience, and laboratory training, with teaching experience and laboratory-related training showing strong positive relationships. The findings indicate that effective use of science laboratory resources is constrained by both structural and pedagogical factors.

Limited facilities, inadequate and misaligned resources, insufficient teacher skills and training, lack of time, and weak curriculum-laboratory alignment collectively reduce opportunities for practical science learning. Addressing these concerns requires improved resource provision, strengthened teacher training, better laboratory management, and stronger integration of laboratory work into the curriculum.

4. Conclusion & Recommendations

The study concluded that although most science laboratory resources in the public secondary schools of the CAMAG districts were generally available and functional, many of them remained underutilized, particularly resources for integrated science, chemistry, physics, SHS-Core, STEM chemistry, and STEM physics. The findings also showed that most science teachers had pursued higher education and were in their early-to-mid teaching careers, but many lacked formal laboratory-related training. Educational attainment had a statistically significant but small positive relationship with laboratory utilization, while years of science teaching experience and laboratory-related training had strong positive relationships with utilization. Overall, inadequate facilities, insufficient teacher training, limited time for laboratory work, and misalignment between curriculum requirements and laboratory activities restricted the optimal use of science laboratory resources.

Based on the findings and conclusions, schools may upgrade laboratory resources, especially physics and STEM chemistry resources, and implement specialized laboratory training focused on underutilized equipment to improve science teachers' laboratory skills. Schools may also align curriculum requirements with laboratory activities and provide sufficient time for laboratory work. Science teachers are encouraged to improve their laboratory skills by attending laboratory-related training and workshops, while Higher Education Institutions may offer short courses relevant to laboratory utilization. The proposed action plan focuses on a training-workshop for science laboratory in-charge personnel and science teachers on laboratory management and practical skills enhancement in the use of DepEd-provided laboratory tools and equipment, since efficient laboratory instruction is anchored on a well-trained teacher (Demandante & Lagura, 2026).

The study was limited to the assessment of science laboratory resources in public secondary schools in the CAMAG districts of Bohol Division during the school year 2025–2026, particularly in terms of availability, functionality, and extent of utilization based on DepEd Order No. 48 s. 2006, DepEd Order No. 118 s. 2009, and DepEd Order No. 17 s. 2017. It also focused only on teachers handling science subjects and on their educational attainment, years of science teaching experience, and laboratory-related training attendance. Since much of the data relied on self-reporting through surveys and interviews, the study recognized the possible risk of response bias, where participants may not have provided entirely objective or accurate information. Future researchers could examine the impact of laboratory usage on students' practical skills.

Compliance with ethical standards

The study was conducted in accordance with institutional ethical standards and was granted ethical clearance by the Holy Name University-Ethics Regulatory Board before data collection. Participation was voluntary, and informed consent was obtained from all teacher-participants after they were informed of the purpose, procedures, benefits, and possible risks of the study. Confidentiality and anonymity were maintained through the use of identification codes, secure storage of data, and reporting of findings in aggregated form in compliance with the Data Privacy Act of 2012. The authors affirm full responsibility for the integrity, accuracy, and originality of the research, declare no conflict of interest, acknowledge the cooperation of the participating schools, administrators, and science teachers, and recognize that copyright ownership and authorship responsibility remain with the authors unless otherwise transferred through publication agreement.

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