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Challenges and Opportunities Encountered by the Teachers in the Implementation of Science Investigatory Projects

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ABSTRACT

This study examined the challenges and opportunities experienced by Grade 6 public elementary school teachers in implementing Science Investigatory Projects (SIPs) in five municipalities of Bohol, Philippines, to inform an evidence-based action plan. Using a convergent parallel mixed-methods design, the study surveyed 50 teachers selected through stratified random sampling and obtained qualitative accounts from 11 purposively selected teachers. A validated, researcher-modified questionnaire and open-ended questions provided data analyzed through descriptive and inferential statistics, multiple regression, and thematic analysis. Teachers reported substantial implementation challenges (overall mean = 3.84), particularly limited resources and laboratory equipment (mean = 4.05), but perceived high opportunities (overall mean = 4.16), led by professional growth (mean = 4.26). Challenge ratings differed significantly by gender ($p = .028$) and educational attainment ($p = .003$), whereas opportunity ratings did not differ significantly across demographic groups. Overall, demographic variables did not significantly predict challenges or opportunities. Qualitative accounts reinforced resource and technical constraints while emphasizing contextualized investigations and practical use of local materials. These findings indicate that teachers recognize the educational value of SIPs despite persistent institutional and instructional barriers. Schools should prioritize laboratory resources, research-focused teacher development, dedicated mentoring time, and community partnerships. As findings reflect self-reported experiences from a limited geographic sample, broader investigation is warranted. The study offers localized evidence for strengthening sustainable inquiry-based education, advancing Sustainable Development Goal (SDG) 4 and supporting innovation and partnerships consistent with SDGs 9 and 17.

Keywords: *Elementary Science Education, Inquiry-Based Learning, Institutional Support, Mixed-Methods Research, Professional Development, Science Investigatory Projects, Sustainable Education*

1. INTRODUCTION

Science Investigatory Projects (SIPs) provide opportunities for elementary learners to develop scientific literacy, critical thinking, problem-solving, and research competencies through inquiry-based and experiential learning. Through systematic observation, experimentation, evidence analysis, and presentation of findings, learners connect scientific concepts with authentic situations. Recent systematic reviews have demonstrated the educational value of inquiry-based science instruction while emphasizing the importance of teacher preparation and effective pedagogical support (Strat et al., 2024; Muhamad Dah et al., 2024). In the Philippines, science education initiatives encourage scientific investigation and innovation. The Department of Education's National Science and Technology Fair guidelines for School Year 2024–2025 provide a platform for learners to apply scientific knowledge to real-world problems (Department of Education [DepEd], 2025). However, the effective implementation of investigatory activities depends on teachers' research competence, instructional planning, available resources, learner readiness, and institutional support. Research indicates that teachers can encounter difficulties translating inquiry-oriented pedagogy into classroom practice, particularly when their professional preparation does not sufficiently integrate instructional knowledge and practical implementation (Canipe, 2025). Professional development and teacher self-efficacy are likewise important considerations in implementing scientific inquiry (Menon et al., 2024; Akuma & Koenen, 2025). Against this background, the present study examines the challenges and opportunities experienced by Grade 6 public elementary school teachers in Dimiao, Lila, Sevilla, Loay, and Loboc, Bohol, during School Year 2025–2026. It explores teachers' demographic characteristics, perceived implementation challenges, opportunities for instructional improvement, and experiences in guiding SIPs. By integrating quantitative and qualitative evidence, the study seeks to provide a localized basis for an action plan to strengthen SIP implementation in rural elementary schools.

Research Problem

Despite the educational value of inquiry-based science learning, effective implementation requires teachers to integrate scientific content knowledge, investigative procedures, learner-centered instructional strategies, and classroom management. Strat et al. (2024) emphasized the importance of preparing teachers to translate inquiry experiences into effective teaching practices, while Canipe (2025) identified difficulties in integrating different dimensions of elementary science instruction. Teachers may also encounter challenges related to limited research preparation, instructional time, laboratory materials, student engagement, and administrative support. These constraints may be particularly relevant to schools operating in resource-limited environments. Mohammed and Luguterah (2024) found that inquiry-based teaching self-efficacy varied according to school and teacher characteristics, while Akuma and Koenen (2025) highlighted the need for appropriately designed professional development to strengthen inquiry-based science education. Nevertheless, SIP implementation offers potential opportunities for contextualized instruction, collaboration, professional development, technological innovation, and stakeholder participation. The central research problem is therefore to determine the levels of challenges encountered and opportunities perceived by Grade 6 teachers, establish whether these differ across demographic and professional characteristics, examine the predictive contribution of those characteristics, and understand how teachers describe their actual experiences. The study specifically addresses the need for localized evidence from Dimiao, Lila, Sevilla, Loay, and Loboc, where teachers' experiences may be shaped by varying school conditions, access to instructional resources, and community contexts. Such evidence can inform an action plan responsive to teachers' professional and institutional needs.

Assumptions of the Study

The study proceeds from the assumption that Grade 6 teachers who have participated in guiding Science Investigatory Projects possess relevant experiences from which implementation challenges and opportunities can be examined. It assumes that differences in professional preparation, teaching experience, and instructional settings may be associated with differences in teachers' perceptions and practices. Existing research provides a basis for investigating these relationships, particularly with respect to teachers' self-efficacy, professional learning, and instructional context (Menon et al., 2024; Mohammed & Luguterah, 2024). The study further assumes that content mastery, research knowledge, instructional planning, resources, learner readiness, and institutional support are relevant dimensions of SIP implementation. Contextualized learning, collaboration, professional growth, technological integration, and external partnerships are likewise treated as potential opportunities that may be experienced differently across schools. These are research assumptions rather than predetermined findings. Finally, the study assumes that combining quantitative measurements with teachers' qualitative accounts can provide complementary perspectives on SIP implementation. The resulting evidence is expected to inform the development of a contextualized action plan for strengthening teacher support, professional competencies, and scientific inquiry practices.

Objectives of the Study

The general objective of this study is to examine the challenges and opportunities experienced by Grade 6 public elementary school teachers in implementing Science Investigatory Projects in Dimiao, Lila, Sevilla, Loay, and Loboc, Bohol, during School Year 2025–2026, as a basis for developing an evidence-based action plan. Specifically, the study aims to describe teachers' demographic and professional profiles in terms of age, gender, highest educational attainment, teaching position, years of teaching experience, and SIP-related training. It seeks to determine the levels of challenges encountered in content mastery and research knowledge, instructional planning and time management, availability of resources and laboratory equipment, student readiness and engagement, and administrative and institutional support. The study also aims to assess perceived opportunities involving contextualization and local resources, collaboration and teamwork, teaching strategies and professional growth, technology and innovative tools, and external stakeholder engagement. It further seeks to determine significant differences in challenges and opportunities when teachers are grouped according to their profiles and examine the extent to which demographic characteristics predict these perceptions. Finally, the study explores teachers' experiences through qualitative inquiry, identifies emerging themes, examines the convergence and divergence of quantitative and qualitative findings, and develops an action plan responsive to the identified challenges and opportunities.

Conceptual and Theoretical Framework

This study is anchored in constructivist learning, experiential learning, Social Cognitive Theory, and a resource-oriented perspective to explain the challenges and opportunities experienced by teachers in implementing Science Investigatory Projects (SIPs). Constructivist and experiential learning emphasize active inquiry, experimentation, reflection, and knowledge construction through teacher-guided investigations (Strat et al., 2024; Muhamad Dah et al., 2024). Social Cognitive Theory highlights teacher self-efficacy and the importance of professional preparation in facilitating scientific inquiry (Menon et al., 2024; Mohammed & Luguterah, 2024). Meanwhile, the resource-oriented perspective emphasizes the role of instructional materials, teacher competencies, professional development, and institutional support in effective implementation (Akuma & Koenen, 2025; Canipe, 2025). Conceptually, teachers' demographic and professional characteristics serve as potential explanatory variables for perceived challenges and opportunities. Challenges include research knowledge, instructional planning, resource availability, learner readiness, and institutional support. Opportunities encompass

contextualized learning, collaboration, professional growth, technology integration, and external partnerships. Quantitative and qualitative findings are integrated to develop an evidence-based action plan for strengthening SIP implementation.

The study primarily supports Sustainable Development Goal (SDG) 4 (Quality Education), particularly teacher development and effective learning environments. It also contributes to SDG 9 (Industry, Innovation and Infrastructure) by promoting scientific inquiry and technology-supported learning, and SDG 17 (Partnerships for the Goals) through school-community collaboration. By addressing instructional barriers and maximizing local resources, the study provides a basis for more sustainable, accessible, and contextually relevant science education (UNESCO, 2024).

2. METHODOLOGY

Research Design

The study utilized a convergent parallel mixed-methods design incorporating descriptive-correlational quantitative analysis and qualitative inquiry. The quantitative component examined teachers' demographic profiles, levels of challenges, perceived opportunities, significant differences, and predictive relationships among variables. The qualitative component explored teachers' experiences, difficulties, coping strategies, and opportunities in guiding SIPs. Quantitative and qualitative data were gathered during the same period, analyzed separately, and subsequently integrated to provide a comprehensive understanding of SIP implementation.

Research Locale or Study Setting

The study was conducted in selected public elementary schools in Dimiao, Lila, Sevilla, Loay, and Loboc, within the Third Congressional District of Bohol under the Department of Education–Bohol Division. These municipalities represent coastal and inland communities with varying geographical, socioeconomic, and educational conditions. The study included high-performing and low-performing schools to capture diverse teaching environments and experiences related to SIP implementation.

Participants or Data Sources

The study identified a target population of 69 Grade 6 public elementary school teachers, from which 50 respondents participated in the quantitative component through stratified random sampling. Teachers were grouped according to municipality, and simple random sampling was applied within each stratum. The respondents comprised 10 teachers from Dimiao, eight from Lila, 11 from Sevilla, 10 from Loay, and 11 from Loboc. Eligible participants were teachers with experience guiding SIPs, and potential replacements from the same strata were identified to address nonresponses. For the qualitative component, 11 teachers were purposively selected based on their SIP mentoring experience, willingness to participate, and minimum teaching experience of eight years. The participants included two teachers each from Dimiao, Lila, Sevilla, and Loay, and three from Loboc. Their responses provided contextual information on the challenges, coping mechanisms, and opportunities encountered in planning, mentoring, and implementing SIPs.

Research Instruments or Materials

The study utilized a researcher-modified questionnaire adapted from Suwono et al. (2022) and Pathoni et al. (2022). It comprised three parts covering teachers' demographic profiles, challenges in Science Investigatory Project (SIP) implementation, and perceived opportunities. A five-point Likert scale measured challenges and opportunities related to research competencies, instructional planning, resources, learner readiness, institutional support, collaboration, and professional development. The questionnaire underwent expert validation

and pilot testing, with Cronbach's alpha of 0.70 or higher considered acceptable for reliability. Qualitative data were collected through open-ended questions examining teachers' experiences, challenges, coping strategies, and opportunities. These questions were reviewed by two Science Education master's degree holders and one Science Coordinator to ensure clarity and relevance.

Data Gathering Procedure

The researcher secured permission from the Schools Division Superintendent of Bohol and the District Supervisors of Dimiao, Lila, Sevilla, Loay, and Loboc before conducting the study. School heads and participating teachers were informed of the research objectives, procedures, and confidentiality measures. Informed consent was obtained, and participants received an orientation before data collection. The validated questionnaires were administered in person or through Google Forms, depending on participants' accessibility and convenience. Qualitative information was collected through written responses to open-ended questions and discussions concerning teachers' SIP implementation experiences. Data collection lasted two weeks, during which reminders and follow-ups were provided to encourage participation. Completed responses were retrieved, reviewed for completeness, and organized for analysis. Incomplete responses were excluded, while inconsistent entries were examined and corrected when necessary. The quantitative responses were encoded and prepared for statistical analysis, while qualitative responses were organized for thematic interpretation.

Data Analysis

Quantitative data were analyzed using descriptive and inferential statistics. Frequency counts and percentages described the respondents' demographic and professional profiles, while weighted means assessed the levels of challenges and perceived opportunities in implementing Science Investigatory Projects (SIPs). Mean scores were interpreted using a five-point scale with the following intervals: 4.21–5.00, 3.41–4.20, 2.61–3.40, 1.81–2.60, and 1.00–1.80, representing progressively lower levels of challenges or opportunities. The Shapiro–Wilk Test determined data normality before inferential analysis. The Independent Samples t-test and One-Way Analysis of Variance (ANOVA) examined differences across demographic groups when normality assumptions were satisfied, while the Mann–Whitney U Test and Kruskal–Wallis H Test served as nonparametric alternatives. Pearson's correlation coefficient or Spearman's rank correlation coefficient examined the relationship between overall challenges and perceived opportunities, depending on data distribution. Multiple regression analysis determined whether demographic characteristics significantly predicted challenges and opportunities. All inferential tests were conducted at a 0.05 significance level. Qualitative responses were analyzed using the six-phase thematic analysis of Braun and Clarke (2022), involving data familiarization, initial coding, theme development, theme review, theme definition and naming, and report preparation. Recurring patterns concerning instructional challenges, coping strategies, institutional support, and perceived opportunities were identified. Participants were assigned identification codes to maintain confidentiality. Finally, quantitative and qualitative findings were integrated to identify convergent, divergent, and complementary insights into SIP implementation.

Ethical Considerations

Ethical principles were observed throughout the study to protect participants' rights, privacy, and welfare. Permission was obtained from the appropriate educational authorities, and informed consent was secured from participating teachers. Participation was voluntary, and respondents could decline or withdraw without penalty. Anonymity was maintained by excluding participants' names from research records and using identification codes when presenting qualitative findings. All collected information was treated confidentially, securely stored, and accessible

only to the researcher. Personal identifiers were removed, and research files were disposed of after the study in accordance with the stated ethical procedures.

3. RESULTS AND DISCUSSION

3.1 Demographic Profile of the Respondents

3.1.1 Age and Gender

The study involved 50 Grade 6 teachers, predominantly aged 31–35 years (24%, n = 12), followed by those aged 41–45 years (20%, n = 10). Teachers aged 36–40 years and those 51 years and above each represented 16%, while respondents aged 26–30 years accounted for 14%. The smallest groups were those aged 46–50 years (6%) and 21–25 years (4%). Most respondents were female (90%, n = 45), while males represented 10% (n = 5). The findings indicate that the respondents represented different career stages, with a predominantly female composition. Professional characteristics may shape teachers' experiences of inquiry-based instruction, although demographic characteristics alone do not establish differences in teaching competence. Preminger et al. (2024) found that elementary teachers varied in their adoption of science instructional practices according to how they interpreted student learning and applied professional development experiences. Thus, the demographic composition provides context for examining teachers' challenges and opportunities without implying that age or gender determines their instructional effectiveness.

3.1.2 Educational Attainment, Teaching Position, and Experience

Most respondents held a master's degree (62%, n = 31), followed by bachelor's degree holders (30%, n = 15) and doctoral degree holders (8%, n = 4). Regarding teaching position, Teacher III accounted for 48% (n = 24), Teacher I for 38% (n = 19), Master Teachers for 8% (n = 4), and Teacher II for 6% (n = 3). In terms of experience, 30% had taught for 6–10 years, 28% for 1–5 years, 20% for at least 21 years, 12% for 11–15 years, and 10% for 16–20 years. These findings indicate that the respondents possessed varied academic qualifications, professional ranks, and teaching experiences. Although many had completed graduate education, advanced qualifications do not necessarily establish competence in supervising scientific investigations. Sager et al. (2025) emphasized the importance of instructional coaching and professional learning communities in strengthening inquiry-based science instruction among elementary teachers. Similarly, Akuma and Koenen (2025) highlighted the need for systematic professional development designed specifically for inquiry-based science teaching.

3.2 Challenges Encountered in Science Investigatory Project Implementation

3.2.1 Availability of Resources and Laboratory Equipment

The respondents rated the challenges encountered in SIP implementation as very challenging, with an overall grand mean of 3.84. Availability of resources and laboratory equipment registered the highest mean of 4.05, interpreted as very challenging. Teachers reported difficulties associated with insufficient scientific instruments, laboratory facilities, research materials, and other resources required to conduct investigations. The findings establish material availability as the most highly rated challenge in SIP implementation. Belisario and Paglinawan (2025) found that instructional-material availability was associated with student engagement in a rural Philippine science education setting. Similarly, Setiyani et al. (2025) identified insufficient institutional resources and support among the interconnected barriers to effective inquiry-based science instruction. These studies reinforce the importance of adequate laboratory materials and accessible instructional resources in supporting elementary scientific investigations.

3.2.2 Student Readiness and Engagement

Student readiness and engagement received a mean score of 3.85, interpreted as very challenging. Teachers experienced difficulties helping learners understand research documentation, scientific concepts, technical writing, and the procedures involved in conducting investigations. Learners also required substantial guidance in completing research activities and developing independence throughout the investigatory process. These results suggest that elementary learners require instructional support appropriate to their developing scientific knowledge and research skills. Petersen (2022) found that effective inquiry teaching involves differentiated scaffolding strategies based on learners' understanding of investigation processes. Likewise, Strata et al. (2024) emphasized the importance of preparing teachers to facilitate conceptual, procedural, and pedagogical dimensions of scientific inquiry. Appropriate scaffolding is therefore relevant to supporting learner participation without replacing students' responsibility for completing their investigations.

3.2.3 Instructional Planning and Time Management

Instructional planning and time management obtained a mean of 3.83, classified as very challenging. Teachers reported difficulties balancing research supervision with regular teaching responsibilities, preparing investigation activities, establishing realistic project schedules, and allocating sufficient time for consultations and experiments. The findings highlight the competing instructional demands associated with supervising SIPs. Setiyani et al. (2025) identified time constraints and difficulty integrating inquiry activities into classroom instruction as significant challenges among science teachers. Polinar et al. (2025) likewise identified workload and inadequate structural support as barriers to research engagement among Philippine public school teachers. These findings suggest that allocating sufficient time for research supervision is an important consideration in improving SIP implementation.

3.2.4 Administrative and Institutional Support

Administrative and institutional support registered a mean of 3.82, interpreted as very challenging. Respondents identified limitations involving financial assistance, project funding, administrative encouragement, and institutional mechanisms for monitoring and sustaining research activities. The findings indicate that organizational support remains an important concern in guiding SIPs. Polinar et al. (2025) emphasized that teachers' research readiness is influenced by the interaction of individual capabilities, institutional support, and professional workload. Sager et al. (2025) likewise demonstrated how collaborative professional learning structures and instructional coaching can support inquiry-based teaching practices. These findings highlight the potential value of institutional mechanisms that provide resources, guidance, and sustained mentoring support.

3.2.5 Content Mastery and Research Knowledge

Content mastery and research knowledge received the lowest challenge mean of 3.63, although it remained within the very challenging category. Teachers reported difficulties simplifying complex scientific concepts, guiding learners in research methodologies, interpreting experimental data, and assisting students in developing evidence-based conclusions. The findings indicate that research-related instructional competence remains a concern even when rated lower than other challenge domains. Toma et al. (2025) emphasized the importance of teachers' self-efficacy in facilitating inquiry-based science instruction and understanding the nature of scientific inquiry. Akuma and Koenen (2025) similarly highlighted the importance of professional development that equips teachers with the knowledge and instructional strategies necessary for inquiry-based science education. These studies support the need for sustained training in research methods, scientific investigation, and inquiry facilitation.

3.3 Opportunities Perceived in Science Investigatory Project Implementation

3.3.1 Enhancement of Teaching Strategies and Professional Growth

The overall mean for perceived opportunities was 4.16, interpreted as high. Enhancement of teaching strategies and professional growth obtained the highest mean of 4.26, classified as very high. Respondents recognized SIP supervision as an opportunity to improve their research-related knowledge, instructional approaches, mentoring practices, and professional competencies. The findings suggest that teachers perceive research supervision as a professional learning opportunity despite its implementation demands. Wilson et al. (2025) demonstrated that sustained inquiry-based professional development can strengthen teachers' instructional practices and promote student-centered learning. Preminger et al. (2024) likewise found that professional learning becomes more meaningful when teachers connect their instructional decisions with students' learning experiences. These findings support the professional-development potential of guiding scientific investigations.

3.3.2 Promotion of Collaboration and Teamwork

Promotion of collaboration and teamwork received a mean score of 4.21, interpreted as very high. Teachers perceived SIP activities as opportunities for learners to exchange ideas, coordinate responsibilities, communicate findings, and accomplish research-related tasks collectively.The results highlight collaboration as a highly perceived benefit of SIP implementation. Chen and Chen (2025), in their systematic review of technology-enhanced collaborative inquiry, reported positive outcomes involving students' scientific knowledge, inquiry processes, and argumentation skills. Sager et al. (2025) also emphasized the role of collaborative learning structures in supporting inquiry-based instruction. These studies suggest that well-organized collaborative investigations can support both learner participation and the instructional processes required for SIP implementation.

3.3.3 Contextualization and Use of Local Resources

Contextualization and use of local resources obtained a mean of 4.16, interpreted as high. Respondents identified opportunities to connect scientific investigations with familiar materials, environmental concerns, local livelihoods, and community conditions. These opportunities allowed teachers to relate science concepts to situations encountered by learners in their immediate surroundings. The findings demonstrate the perceived relevance of localized approaches to scientific inquiry. Banzuelo and Quiñones (2026) reported that contextualization and localization in Philippine science education can strengthen student engagement and conceptual understanding by incorporating community-based problems and local knowledge. Their review also identified inadequate localized resources and teacher preparation as implementation concerns. These findings support the value of locally grounded SIP topics while recognizing the need to ensure appropriate instructional and scientific quality.

3.3.4 Opportunities to Engage External Stakeholders

Opportunities to tap external stakeholders received a mean of 4.10, interpreted as high. Teachers recognized the potential contribution of community members, researchers, professionals, and other external partners in providing guidance, expertise, and additional resources for SIP activities. The findings indicate that teachers perceive external partnerships as a potential source of support for scientific investigations. Yahya et al. (2026) identified scientist–school partnerships as approaches that connect classroom learning with authentic scientific practices and promote collaboration among educational institutions and scientific communities. Their review also identified resource limitations, funding, coordination, and administrative support as

important implementation considerations. These findings support the potential contribution of external partnerships in strengthening SIP implementation.

3.3.5 Utilization of Technology and Innovative Tools

Utilization of technology and innovative tools obtained a mean score of 4.05, interpreted as high. Teachers perceived digital platforms, simulations, research applications, and technology-assisted activities as opportunities to support scientific investigation, improve access to learning resources, and facilitate research-related tasks. The findings suggest that technology is perceived as a useful complement to conventional scientific investigations. Yun and Crippen (2024) found that educational technologies support different stages of inquiry-based elementary science education and provide opportunities for learner engagement. Chen and Chen (2025) similarly documented the potential of technological tools to support collaborative investigation, scientific reasoning, and inquiry processes. These findings support the purposeful integration of appropriate digital tools in SIP implementation.

3.4 Significant Differences According to Demographic Profile

3.4.1 Differences in the Level of Challenges

Significant differences in perceived challenges were identified when respondents were grouped according to gender ($p = .028$) and highest educational attainment ($p = .003$). No significant differences were found according to age ($p = .656$), teaching position ($p = .370$), years of teaching experience ($p = .250$), or SIP-related training attended ($p = .586$). The findings indicate that challenge ratings differed significantly across gender and educational-attainment groups, although the reported statistics do not establish which groups experienced higher challenges. The absence of significant differences across the remaining demographic variables suggests that these characteristics did not distinguish challenge ratings statistically within the sample. Preminger et al. (2024) demonstrated that teachers' adoption of inquiry-oriented practices involves complex interactions between professional learning, instructional decisions, and classroom experiences. Consequently, demographic differences should be interpreted cautiously and should not be treated as direct explanations of instructional competence.

3.4.2 Differences in the Level of Perceived Opportunities

No significant differences were identified in perceived opportunities when respondents were grouped according to gender ($p = .365$), age ($p = .793$), educational attainment ($p = .867$), teaching position ($p = .370$), years of teaching experience ($p = .958$), or SIP-related training attended ($p = .736$). All probability values exceeded the .05 significance level. The findings provide insufficient statistical evidence that perceived opportunities differed across the demographic groups examined. This does not establish that respondents had identical experiences, but indicates that the observed differences were not statistically significant. Sager et al. (2025) highlighted the importance of collaborative learning environments in developing teachers' inquiry-based instructional practices, while Banzuelo and Quiñones (2026) emphasized the contributions of educational context and localized learning resources. These studies provide a broader perspective on opportunities that extend beyond demographic classifications.

3.5 Predictive Relationships Between Demographic Characteristics and SIP Implementation

3.5.1 Demographic Predictors of Challenges

The multiple regression model examining challenges produced $R = .401$, $R^2 = .161$, and an adjusted R^2 of .044. The six demographic variables collectively explained 16.1% of the observed variance before adjustment, but the overall regression model was not statistically significant,

$F(6, 43) = 1.376$, $p = .246$. Among the individual predictors, gender was statistically significant ($B = .677$, $\beta = .322$, $p = .028$), whereas age, educational attainment, teaching position, teaching experience, and training attended were not significant. The findings indicate that the demographic variables did not collectively provide a statistically significant prediction of challenges. Although gender had a significant individual coefficient, this result should be interpreted within the context of the nonsignificant overall model and the unequal gender distribution of the sample. Polinar et al. (2025) emphasized that research-related challenges among public school teachers involve institutional support, professional responsibilities, and individual capabilities. These factors may warrant consideration when examining implementation experiences beyond the demographic variables included in the present analysis.

3.5.2 Demographic Predictors of Perceived Opportunities

The regression model predicting perceived opportunities yielded $R = .338$, $R^2 = .114$, and an adjusted R^2 of −.009. The model accounted for 11.4% of the observed variance before adjustment but was not statistically significant, $F(6, 43) = .926$, $p = .486$. None of the individual demographic predictors reached statistical significance. Teaching position obtained the largest absolute standardized coefficient ($\beta = .385$), but its association was not statistically significant ($p = .113$). The results indicate insufficient evidence that the demographic variables collectively or individually predicted perceived opportunities. The negative adjusted R^2 further suggests that the model provided little explanatory improvement after accounting for its predictors and sample size. Akuma and Koenen (2025) emphasized the importance of systematically designed professional development for improving inquiry-based science instruction, while Sager et al. (2025) highlighted collaborative and organizational support. These findings suggest relevant areas for future investigation rather than establishing additional predictors from the present dataset.

3.6 Qualitative Findings on Challenges and Opportunities

3.6.1 Technical and Content-Related Challenges

The qualitative analysis identified technical and content-related challenges associated with teachers' limited expertise, insufficient research preparation, instructional planning, and time management. Participants described difficulties guiding specialized scientific topics, explaining research procedures, balancing student independence with teacher assistance, and managing consultations alongside regular instructional responsibilities. These experiences provide contextual support for the quantitative findings concerning content mastery, learner readiness, and time management. Petersen (2022) emphasized the importance of differentiated scaffolding in guiding learners through inquiry processes. Toma et al. (2025) likewise highlighted the relevance of teachers' confidence and understanding of scientific inquiry. The qualitative findings suggest that teachers' difficulties involve both research competence and the instructional demands of helping elementary learners complete investigations.

3.6.2 Resource and Institutional Constraints

Resource and institutional constraints emerged as another qualitative theme. Participants described insufficient laboratory materials, limited equipment, inadequate funds, and difficulties obtaining administrative assistance. These constraints affected the conduct of experiments and the availability of resources for research-related activities. These experiences reinforce the quantitative finding that resources and laboratory equipment constituted the highest-rated challenge. Belisario and Paglinawan (2025) identified a relationship between instructional-material availability and science engagement in a rural Philippine school, while Polinar et al. (2025) emphasized institutional support and professional workload as significant

considerations in teachers' research readiness. The qualitative accounts further illustrate how resource limitations and organizational conditions intersect during SIP implementation.

3.6.3 Contextualized Learning and Student Engagement

The qualitative findings identified contextualized learning and student engagement as a major opportunity in SIP implementation. Participants described using familiar materials, local environmental conditions, and community-related issues to make scientific investigations more accessible and meaningful. They perceived these approaches as helpful in strengthening students' understanding, participation, and appreciation of locally available resources. The findings complement the high quantitative rating for contextualization and local resource utilization. Banzuelo and Quiñones (2026) identified contextualized science instruction as an approach that connects scientific learning with local experiences, environmental conditions, and community knowledge. Their findings support the relevance of localized instruction in enhancing the meaningfulness of scientific investigations, particularly when learning activities are aligned with learners' immediate contexts.

3.6.4 Resource Utilization and Practical Application

Resource utilization and practical application emerged as another qualitative opportunity. Participants explained that locally available and household materials enabled learners to undertake hands-on activities despite limited laboratory facilities. They also associated the use of familiar materials and community issues with creativity, problem-solving, and the practical application of scientific concepts. The findings illustrate teachers' perceived opportunities to adapt SIP activities to available resources. Banzuelo and Quiñones (2026) identified community-based problem-solving and locally relevant learning materials as important strategies in contextualized science education. However, contextualization should be accompanied by appropriate scientific procedures and attention to the suitability of materials. The qualitative findings therefore highlight resourcefulness as an instructional opportunity without establishing that locally available materials can replace all specialized laboratory requirements.

3.7 Integration of Quantitative and Qualitative Findings

3.7.1 Convergence of Findings on Challenges

The integration of quantitative and qualitative findings showed the clearest agreement in resource availability and instructional time. Resources and laboratory equipment received the highest challenge mean (M = 4.05), while instructional planning and time management registered a mean of 3.83. Qualitative accounts similarly identified insufficient materials, limited laboratory facilities, inadequate funding, workload, and restricted consultation time as recurring concerns. The convergence indicates that material limitations and time constraints were prominent across both forms of evidence. Setiyani et al. (2025) identified inadequate institutional support, limited preparation, and time constraints as interconnected barriers to inquiry-based science teaching. Polinar et al. (2025) likewise documented the importance of balancing teacher capabilities, institutional support, and workload in developing research readiness. These studies support the interpretation that SIP implementation challenges involve both instructional and organizational conditions.

3.7.2 Complementary and Divergent Findings on Challenges

The quantitative findings identified student readiness (M = 3.85), administrative support (M = 3.82), and content mastery (M = 3.63) as very challenging. However, qualitative accounts placed greater emphasis on teachers' research knowledge and instructional difficulties, while student readiness and institutional support received less detailed attention. The two datasets therefore

differed in the relative prominence of these concerns. This variation demonstrates how structured surveys and open-ended responses capture different dimensions of teachers' experiences. Petersen (2022) highlighted the complexity of scaffolding learners during scientific inquiry, while Akuma and Koenen (2025) emphasized the need for teacher development that addresses inquiry-specific instructional demands. The qualitative evidence provides additional context for understanding the survey ratings, although less frequently discussed themes should not be interpreted as less important solely because they received fewer narrative responses.

3.7.3 Convergence and Complementarity of Findings on Opportunities

The quantitative findings revealed high to very high opportunities in professional growth (M = 4.26), collaboration (M = 4.21), contextualization (M = 4.16), external stakeholder engagement (M = 4.10), and technology utilization (M = 4.05). Qualitative findings reinforced contextualization as a significant opportunity, highlighting the use of local materials, community-based problems, and practical investigations to enhance learner engagement. However, professional growth, collaboration, external partnerships, and technology integration were less prominent in the qualitative responses, indicating differences in emphasis between the two datasets. The findings demonstrate that contextualized learning represents the strongest area of convergence, while other opportunities were primarily supported by quantitative results. Banzuelo and Quiñones (2026) emphasized the value of localized science instruction, while Wilson et al. (2025) highlighted professional development through sustained inquiry-based teaching. Similarly, Chen and Chen (2025) identified the benefits of technology-supported collaborative inquiry. Overall, the integrated findings indicate that SIP implementation offers opportunities for professional growth, collaboration, and contextualized learning despite persistent resource, time, and instructional challenges. These findings provide a basis for an evidence-based action plan emphasizing teacher development, resource provision, institutional support, structured mentoring, and locally relevant scientific investigations.

4. CONCLUSIONS AND RECOMMENDATIONS

The study concludes that Grade 6 teachers in the selected municipalities of Bohol encounter substantial challenges in implementing Science Investigatory Projects (SIPs) despite recognizing meaningful instructional and professional opportunities. Limited resources and laboratory equipment emerged as the primary concern, alongside student readiness, instructional time, institutional support, and research-related competencies. Nevertheless, teachers perceived considerable opportunities for professional growth, collaboration, contextualized learning, technology integration, and stakeholder engagement. The qualitative findings reinforced the importance of technical competence, institutional resources, and locally available materials in facilitating scientific investigations. Significant differences in challenges were identified according to gender and educational attainment, while perceived opportunities showed no significant demographic differences. Collectively, demographic characteristics did not significantly predict either challenges or opportunities. These findings emphasize the importance of strengthening instructional capacity and institutional support while maximizing existing opportunities to improve SIP implementation in the participating elementary schools.

The Department of Education–Bohol Division and school administrators should prioritize improving access to laboratory equipment, instructional materials, and financial support for SIP implementation. Targeted professional development should strengthen teachers' competencies

in research methodology, experimental procedures, data interpretation, and learner mentoring. Schools should establish dedicated consultation periods to address instructional time constraints and provide structured guidance throughout the investigatory process. SIP coordinators and Master Teachers should facilitate peer mentoring, resource sharing, and collaborative instructional planning. Teachers should maximize safe, locally available materials and community-based research topics to promote contextualized scientific investigations. School administrators should also strengthen partnerships with local professionals, community organizations, and educational institutions to expand technical assistance and resource availability. Appropriate digital tools may supplement research supervision and learning activities. The proposed SIP intervention program should be implemented according to institutional capacity and periodically evaluated to determine its effectiveness in addressing identified challenges and sustaining perceived opportunities.

The study was limited to 50 Grade 6 public elementary school teachers from five municipalities in the Third Congressional District of Bohol during School Year 2025–2026. Its cross-sectional mixed-methods design captured teachers' experiences within a specific educational and geographical context, limiting the generalizability of the findings. The quantitative analysis relied on self-reported perceptions, while purposive selection of experienced teachers for the qualitative component restricted the range of perspectives represented. Unequal demographic group sizes and the limited explanatory capacity of the regression models also warrant cautious interpretation. Future studies may involve larger, more diverse samples and additional institutional and contextual variables.

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