ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

Empowering Learners: Teachers' Management Education Strategies for Developing Literate, Numerate and Independent Science Learners

June D. Cantoria[1,2]
[1] *Assistant Professor, Liceo De San Jacinto Foundation Incorporated;*
[2] *Head Teacher III, San Jacinto National High School, San Jacinto District, Masbate, Philippines*
june.cantoria@deped.gov.ph

Date Submitted:
February 21, 2026

Date Accepted:
April 17, 2026

Date Published:
July 3, 2026

DOI:
10.5281/zenodo.21184687

ABSTRACT

This study determined the management education strategies utilized by science teachers and their relationship to the development of literate, numerate, and independent Science learners in the public elementary and junior high schools of San Jacinto District, Masbate, for School Year 2025-2026. A quantitative descriptive-correlational research design was employed. Complete enumeration was used among 40 Science teachers, while 26 school heads and department heads served as secondary respondents for triangulation. Data were gathered using an expert-validated questionnaire and analyzed using mean, standard deviation, and Pearson product-moment correlation. Findings showed that teacher-rated management strategies were practiced at Sometimes to Often levels: mentoring and coaching (M = 3.38), collaborative lesson planning (M = 3.56), and use of learner performance data (M = 4.03). School head-rated peer observation and feedback (M = 3.87) and classroom management and instructional support (M = 3.98) were both rated Often. Learner development in scientific literacy (M = 3.48), numeracy (M = 3.40), and independence (M = 3.53) was Moderate, indicating that learners were functional but not yet highly proficient. Correlation analysis showed moderate positive relationships between teacher-rated strategies and learner development domains (r = 0.61 to 0.74), while school head-rated strategies produced low negative correlations (r = -0.18 to -0.25). The study concludes that learner empowerment in science is more strongly associated with teacher-led, collaborative, and data-informed practices than with compliance-oriented supervision. Project STRIDE is proposed to institutionalize structured mentoring, collaborative planning, science numeracy integration, reflective peer observation, and learner independence activities.

Keywords: *instructional mentoring, learner independence, management education strategies, Project STRIDE, Science literacy, Science numeracy*

INTRODUCTION

Quality basic education remains a central concern in global and national development. Sustainable Development Goal 4 emphasizes inclusive, equitable, and quality education and the promotion of lifelong learning opportunities for all (United Nations, 2015). In Science education, this goal requires learners to develop not only content knowledge but also the ability to read and communicate scientific information, interpret quantitative data, and pursue learning independently. These competencies are especially important in the 21st century, where learners are expected to think critically, solve problems, and apply scientific reasoning in real-life contexts.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

In the Philippine setting, school leadership and instructional support are anchored in Republic Act No. 9155 or the Governance of Basic Education Act of 2001, which emphasizes effective school management in improving instructional delivery (Official Gazette of the Republic of the Philippines [OGRP], 2001). Republic Act No. 10533 or the Enhanced Basic Education Act of 2013 likewise strengthens the mandate to develop lifelong learning skills through a responsive basic education curriculum (OGRP, 2013). These policies highlight the importance of school-based professional development, mentoring, classroom supervision, and collaborative planning in improving the quality of teaching and learning.

Despite policy reforms, Science learning in the Philippines continues to face serious challenges. The country performed poorly in the 2022 Programme for International Student Assessment, where only a limited proportion of Filipino learners reached basic Science proficiency (OECD, 2023). The Department of Education also recognizes the need to improve foundational skills and 21st-century competencies through the Basic Education Development Plan 2030 (Department of Education, 2022). These national concerns are reflected in rural districts such as San Jacinto, Masbate, where School Assessment Management System data for School Year 2025-2026 recorded an overall mean percentage score of 56.20% in science, below the ideal 75% benchmark.

Teachers are the most immediate drivers of learning quality inside the classroom. However, the effectiveness of Science instruction depends not only on individual teacher competence but also on the management education strategies through which teachers are mentored, coached, observed, supported, and guided by learner data. Strategies such as mentoring and coaching, collaborative lesson planning, use of learner performance data, peer observation and feedback, and classroom management and instructional support may help teachers improve their practice and respond to learner needs.

This study addressed the need for localized quantitative evidence on the management education strategies of science teachers in San Jacinto District and their relationship with learners' development in science literacy, numeracy, and independence. Specifically, it assessed the extent to which Science teachers utilized key management education strategies, determined the level of learner development, tested the relationships between strategies and learner outcomes, and proposed a management education intervention based on the findings.

Literature Review

Instructional Leadership and Management Education Strategies

Instructional leadership theory explains that educational improvement depends on how leaders define learning goals, manage the instructional program, and promote a positive learning climate (Hallinger & Murphy, 1986). Recent scholarship extends this view by recognizing that leadership is not limited to school heads; teachers also perform instructional leadership when they mentor peers, lead collaborative planning, analyze learner data, and share effective classroom practices. Yusuf et al. (2025) reported that research on instructional leadership has shifted toward distributed and context-sensitive leadership structures, with teacher capacity-building and professional learning communities serving as important mechanisms for improving student achievement.

Management education strategies are therefore understood in this study as professional practices that guide, support, and develop Science teachers within their schools. These include mentoring and coaching, collaborative lesson planning, use of learner performance data, peer observation and feedback, and classroom management and instructional support. Mydin (2024) found that the dimensions of professional learning communities were positively related to teacher performance, while Walindato et al. (2025) identified digital leadership, quality management, digital literacy integration, and collaborative-reflective learning as key themes in innovative teacher development.

Philippine studies similarly show that instructional management and teacher collaboration matter for professional growth. Cantilan and Baguio (2025) found a significant positive relationship between instructional management practices and professional development among teachers. Manoos-Pacia (2025) reported that master teachers' instructional leadership competence was linked to learners' literacy, numeracy, and general academic performance. These findings support the present study's focus on teacher-level management strategies as measurable contributors to science learner development.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

Science Literacy, Numeracy, and Learner Independence

Scientific literacy is a major goal of science education because it enables learners to understand scientific texts, explain phenomena, evaluate claims, and communicate evidence-based ideas. Hanson (2022) described scientific literacy as involving knowledge of science content, understanding of scientific methods, and application of science to everyday life. Nalle et al. (2025) likewise emphasized that scientific and numerical literacy prepare learners for the demands of the 21st century by helping them interpret scientific and quantitative information.

Science numeracy refers to the ability to use quantitative reasoning in science contexts. It includes interpreting graphs, recognizing data patterns, measuring accurately, applying formulas, and evaluating evidence. Aripin et al. (2025) found that problem-based learning supports Science literacy and 21st-century skills, while Cebrero (2025) reported that constructivist, inquiry-based, and problem-oriented approaches improve Science achievement. These studies indicate that learner numeracy develops when teachers provide contextualized and problem-solving-oriented Science instruction.

Learner independence is also a critical outcome of quality Science teaching. It refers to the learner's ability to complete tasks with limited teacher supervision, initiate inquiry, manage time, self-correct, seek supplementary materials, and apply concepts in unfamiliar contexts. The Education Endowment Foundation (2025) reported that metacognition and self-regulation produce strong gains in learning, while Stanton (2021) emphasized that learners who monitor and evaluate their own thinking tend to perform better in science. These ideas show that independent Science learning must be deliberately developed through teacher guidance and instructional scaffolding.

Professional Learning, Mentoring, and Data-Driven Science Instruction

The literature consistently connects teacher professional development with improvements in classroom practice and learner engagement. Kurteshi and Rrustemi (2025) found that continuous professional development improves teaching practices when it is structured, sustainable, and meaningful. Mather and Visone (2024) showed that peer observation can improve teacher self-efficacy, while Sibanda and Amin (2021) reported that mentorship contributed to professional and conceptual development among Mathematics, Science, and Technology teachers. These studies support the importance of structured mentoring and peer observation in science teacher development.

The use of learner performance data is another essential management education strategy. Sandoval-Rios (2025) found that data literacy training strengthens teacher decision-making, especially when connected with collaborative learning and practical classroom application. Marzano Research (2022) also showed that data literacy training helped teachers use formative data to improve instruction. In Science classrooms, data use becomes meaningful only when quiz results, performance tasks, and learner portfolios are translated into targeted instructional responses.

In the Philippine context, Learning Action Cells provide an institutional mechanism for teacher collaboration and professional learning. Prudente et al. (2022) documented the value of science teachers' communities of practice, while Vega and Orleans (2025) found that LAC sessions can support Science teachers' professional development in remote regions when they are focused, relevant, and tied to instructional needs. These findings are directly relevant to San Jacinto District, where the present study identified a need to shift from informal consultation and compliance-based observation to structured coaching, reflective dialogue, and data-driven collaborative planning.

Theoretical and Conceptual Anchors of the Study

This study was anchored on three complementary perspectives. Vygotsky's Sociocultural Theory explains that learning develops through guided participation and interaction with more knowledgeable others (Vygotsky, 1978). Applied to this study, Science teachers develop professionally when they participate in mentoring, coaching, peer observation, and collaborative planning. Shulman's Pedagogical Content Knowledge framework explains that effective teaching requires the ability to transform subject matter into teachable forms suited to learners' needs (Shulman, 1986, 1987). In Science education, this involves making scientific concepts understandable, measurable, and applicable.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

Hallinger and Murphy's Instructional Leadership Theory further supports the study by linking instructional management behaviors with learner outcomes (Hallinger & Murphy, 1986). Together, these theories suggest that management education strategies help teachers improve pedagogical content knowledge and instructional responsiveness, which in turn support the development of literate, numerate, and independent Science learners. The conceptual framework follows the Input-Process-Output model, where management education strategies and learner development domains are examined through quantitative correlational analysis to produce Project STRIDE as the proposed intervention.

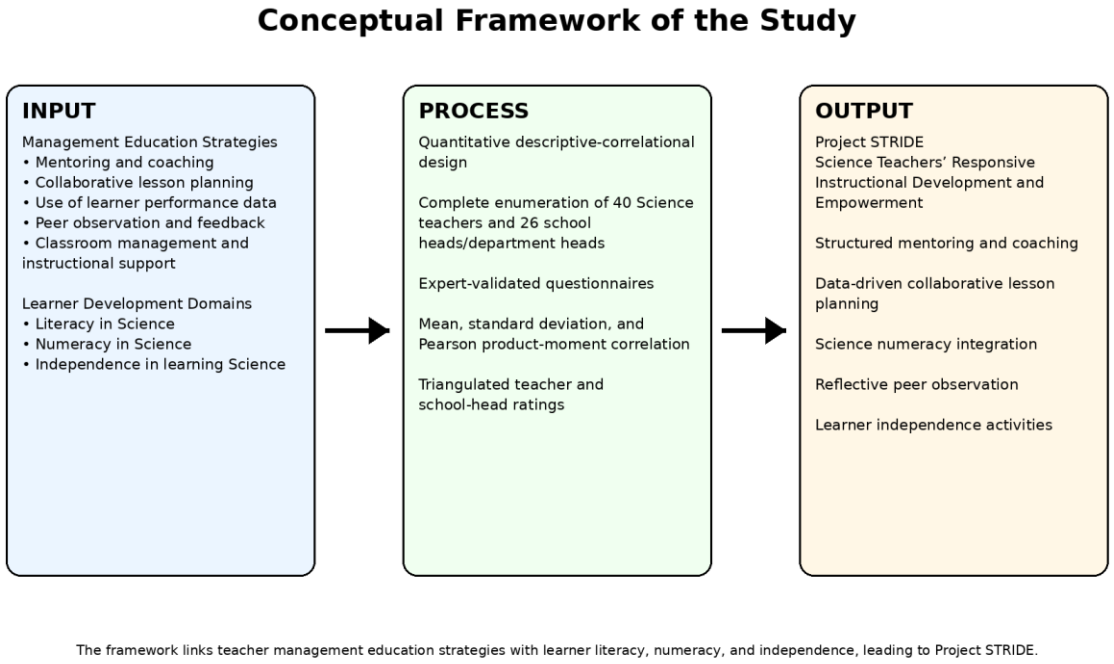

Figure 1. *Conceptual Framework of the Study*

METHODS

Research Design

The study employed a quantitative descriptive-correlational research design. The descriptive component was used to determine the extent of management education strategies and the level of learner development in science literacy, numeracy, and independence. The correlational component was used to determine the relationship between science teachers' management education strategies and learner development outcomes. The design was appropriate because the study measured existing practices and outcomes without manipulating variables (Creswell & Creswell, 2018; Fraenkel et al., 2023).

Research Locale

The study was conducted in San Jacinto District, Schools Division of Masbate Province, Bicol Region. San Jacinto is a fourth-class coastal municipality in Masbate composed of 21 barangays. Its rural and geographically dispersed setting provides a relevant context for examining Science teacher support systems, instructional management strategies, and learner development outcomes in public elementary and junior high schools.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

Participants and Sampling Technique

Complete enumeration was used for the Science teacher respondents. The respondents consisted of 40 Science teachers handling Grades 3 to 10 Science subjects in public elementary and junior high schools of San Jacinto District during School Year 2025-2026. In adherence to triangulation, 26 school heads and department heads served as secondary respondents. The Science teachers rated their management education strategies and learner development outcomes, while school heads and department heads provided ratings for peer observation and classroom management-related dimensions.

Table 1. *Summary of Respondents and Role in the Study*

Respondent group	Number	Sampling technique	Role in the study
Science teachers	40	Complete enumeration	Rated teacher-led management education strategies and learners' development in science literacy, numeracy, and independence
School heads/department heads	26	Triangulation respondents	Rated peer observation and feedback as well as classroom management and instructional support
Total	66	Combined respondent groups	Supported triangulated assessment of management education strategies and learner outcomes

Research Instrument

The study used a triangulated, expert-validated questionnaire. The Management Education Strategies Questionnaire assessed mentoring and coaching, collaborative lesson planning, use of learner performance data, peer observation and feedback, and classroom management and instructional support. The Learner Outcomes Rating Scale assessed literacy in science, numeracy in science, and independence in learning Science. The instruments used rating scales interpreted from Never to Always for strategies and from Very Low to Very High for learner outcomes. Reliability checking was conducted in the appendices, and instrument development was guided by established principles of validity and internal consistency (Taber, 2018).

Data Gathering Procedure

The researcher secured permission from concerned school authorities before data collection. The questionnaires were administered to all Science teacher respondents and to the school heads or department heads serving as secondary raters. Completed instruments were checked, encoded, and organized according to the study variables. The results were used to answer the research questions and to provide the empirical basis for Project STRIDE.

Data Analysis

Mean and standard deviation were used to determine the extent of management education strategies and the level of learner development. Pearson product-moment correlation was used to determine the relationships between management education strategies and learner development in science literacy, numeracy, and independence. Correlation values were interpreted according to the strength and direction of relationship. Statistical analysis was aligned with the quantitative descriptive-correlational nature of the study (Field, 2018; Hair et al., 2019).

Ethical Consideration

The study observed voluntary participation, confidentiality, respect for respondents, and responsible handling of data. Respondents were informed of the purpose of the study and that their responses would be used for academic research. Data were reported in aggregate form, and no individual respondent was identified in the presentation of results. The final journal submission may include the specific institutional or school approval reference number when required by the journal.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

RESULTS AND DISCUSSION

Management Education Strategies Utilized by Science Teachers

The results show that the management education strategies were practiced at varying levels. Among teacher-rated dimensions, use of learner performance data obtained the highest mean (M = 4.03, Often), followed by collaborative lesson planning (M = 3.56, Sometimes) and mentoring and coaching (M = 3.38, Sometimes). This indicates that Science teachers were more consistent in collecting and analyzing learner data than in engaging in structured mentoring or collaborative planning. The lowest indicators in these dimensions reveal that one-on-one mentoring, structured coaching during LAC sessions, and collaborative preparation of laboratory equipment were not yet strongly institutionalized.

School head-rated peer observation and feedback (M = 3.87, Often) and classroom management and instructional support (M = 3.98, Often) were rated higher. These results suggest that observable classroom management behaviors and willingness to receive feedback were present. However, the lower-ranked items indicate weakness in reflective post-observation dialogue, adjustment of lesson pacing, and immediate correction of misconceptions. This supports the argument that observation and classroom order alone do not automatically produce learner empowerment unless paired with instructional mentoring and adaptive teaching.

Table 2. *Summary of Management Education Strategies*

Strategy dimension	Respondent source	Mean	Interpretation	Key implication
Mentoring and coaching	Science teachers	3.38	Sometimes	Informal peer advice was present, but structured coaching during LAC sessions was weak.
Collaborative lesson planning	Science teachers	3.56	Sometimes	Assessment alignment was strong, but laboratory and hands-on collaboration were limited.
Use of learner performance data	Science teachers	4.03	Often	Teachers analyzed scores, but systematic tracking of struggling learners remained weak.
Peer observation and feedback	School heads/department heads	3.87	Often	Teachers accepted feedback, but post-observation reflection needed strengthening.
Classroom management and instructional support	School heads/department heads	3.98	Often	Classroom monitoring was evident, but adaptive pacing and misconception correction were weaker.

Level of Learners' Development in Science

The learners' development in science was consistently rated Moderate across the three outcome domains. Literacy in Science obtained a mean of 3.48, numeracy in science obtained the lowest mean of 3.40, and independence in learning Science obtained a mean of 3.53. These results indicate that learners were able to participate in discussions, use measuring tools, and complete assigned tasks with some independence, but they had difficulty translating visual scientific information, applying mathematical formulas in science problems, and seeking supplementary reading materials independently.

The moderate results suggest a systemic pedagogical gap. Learners were functional in basic Science tasks but had not yet reached a high level of scientific literacy, numeracy, or independence. This mirrors the national concern on science learning and the local San Jacinto District performance data. Since learner outcomes were moderate in all three domains, improvement efforts should not focus only on content delivery but also on literacy integration, Science numeracy, inquiry-based tasks, and learner self-regulation.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

Table 3. *Summary of Learners' Development in Science*

Learner development domain	Mean	Interpretation	Highest-rated indicator	Lowest-rated indicator
Literacy in Science	3.48	Moderate	Participating actively and sensibly in science discussions (M = 3.93)	Translating visual scientific information into written or spoken words (M = 3.25)
Numeracy in Science	3.40	Moderate	Using measuring tools accurately and recognizing patterns in data (both M = 3.73)	Applying mathematical formulas to solve Science word problems (M = 3.18)
Independence in learning Science	3.53	Moderate	Completing Science performance tasks with minimal supervision (M = 3.65)	Seeking supplementary reading materials independently (M = 3.43)

Relationship Between Management Education Strategies and Learner Development

Teacher-rated strategies produced moderate positive correlations with learner development outcomes. Mentoring and coaching were moderately related to literacy (r = 0.66), numeracy (r = 0.74), and independence (r = 0.66). Collaborative lesson planning was also moderately related to literacy (r = 0.72), numeracy (r = 0.73), and independence (r = 0.61). Use of learner performance data showed moderate positive relationships with literacy (r = 0.73), numeracy (r = 0.72), and independence (r = 0.63). These findings support the rejection of the first null hypothesis and show that teacher-led, collaborative, and evidence-based strategies are positively associated with learner empowerment in science.

In contrast, school head-rated peer observation and feedback and classroom management and instructional support produced low negative correlations with all learner development domains. Peer observation and feedback correlated negatively with literacy (r = -0.22), numeracy (r = -0.24), and independence (r = -0.18), while classroom management and instructional support correlated negatively with literacy (r = -0.21), numeracy (r = -0.25), and independence (r = -0.21). These findings indicate that the current supervisory model, when implemented mainly as observation and compliance monitoring, does not positively contribute to learner outcomes. The second null hypothesis was therefore accepted for school head-rated strategies.

Table 4. *Correlation Between Management Education Strategies and Learner Development*

Management education strategy	Literacy r	Numeracy r	Independence r	Interpretation
Mentoring and coaching	0.66	0.74	0.66	Moderate positive correlations across all domains
Collaborative lesson planning	0.72	0.73	0.61	Moderate positive correlations across all domains
Use of learner performance data	0.73	0.72	0.63	Moderate positive correlations across all domains
Peer observation and feedback	-0.22	-0.24	-0.18	Low negative correlations across all domains
Classroom management and instructional support	-0.21	-0.25	-0.21	Low negative correlations across all domains

Proposed Project STRIDE

The findings point to a professional practice system that is data-rich but coaching-poor. Teachers frequently analyzed performance results, but these results were not yet consistently transformed into structured coaching, differentiated intervention, and collaborative lesson redesign. Project STRIDE, or Science Teachers' Responsive Instructional Development and Empowerment, is therefore proposed as a district-level management education intervention embedded in Learning Action Cell sessions. The program aims to strengthen mentoring and coaching, collaborative lesson planning, Science numeracy integration, reflective peer observation, learner independence, and continuous monitoring.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 7 (July 2026)

Table 5. *Proposed Project STRIDE Program Matrix*

Program component	Objective	Participants	Mode/Frequency	Expected result
Structured mentoring and coaching sessions	Formalize peer mentoring through scheduled one-on-one coaching focused on instructional challenges.	Science teachers	Pair-based mentor-mentee coaching, demonstration teaching, and coaching conferences during LAC sessions; monthly	Improved teaching confidence, coaching portfolio, and stronger classroom management practices
Data-driven collaborative lesson planning workshops	Use learner performance data as basis for lesson design and literacy-numeracy integration.	Science teachers and department heads	Grade-level planning using a data-to-lesson protocol; quarterly	Enhanced lesson plans, contextualized materials, and collaborative teaching outputs
Science numeracy integration training	Strengthen numeracy skills in science instruction and develop learners' analytical skills.	Science teachers, Grades 3-10 priority	INSET workshops, hands-on computation tasks, and demonstration activities; twice per school year	Numeracy-integrated Science activities and improved computation/data-analysis skills
Reflective peer observation cycle	Transform observation into a reflective professional learning cycle with pre- and post-observation discussions.	Science teachers, school heads, and department heads	Peer classroom observation, reflection conferences, and observation journals; quarterly	Observation reports, reflective journals, and improved instructional delivery
Learner independence development initiative	Equip teachers with inquiry-based and metacognitive strategies that develop learner autonomy.	Science teachers and school heads	PLC sessions on self-directed inquiry tasks, investigatory projects, and research-based activities; monthly	Increased learner participation, independent learning outputs, and student Science portfolios
Program monitoring and evaluation	Assess the effectiveness of Project STRIDE and ensure continuous improvement.	District supervisor, school heads, and department heads	Classroom observations, surveys, feedback, progress meetings, and year-end review; quarterly/year-end	Monitoring reports, evaluation results, and sustainability recommendations

CONCLUSION

The study concludes that management education strategies among science teachers in San Jacinto District were present but unevenly institutionalized. Use of learner performance data was the most practiced strategy, while mentoring and coaching and collaborative lesson planning remained at the Sometimes level. This means that teachers were already collecting and analyzing learner data, but the professional structures needed to translate that data into targeted instruction were not yet fully developed.

Learners' development in science literacy, numeracy, and independence was consistently Moderate. This indicates that learners were functional in classroom participation, measurement, task completion, and basic scientific activities, but they were not yet highly proficient in interpreting scientific visuals, applying formulas to science problems, using data for reasoning, and pursuing supplementary learning independently. The moderate pattern across all learner domains suggests a systemic instructional concern rather than an isolated weakness.

The relationship findings show that teacher-led strategies are more closely connected with learner outcomes than school head-rated compliance-oriented supervisory practices. Mentoring and coaching, collaborative lesson planning, and use of learner performance data produced moderate positive correlations with

literacy, numeracy, and independence, while peer observation and classroom management support produced low negative correlations. The study therefore contributes evidence that learner empowerment in Science depends on structured instructional mentoring, collaborative planning, and responsive use of data, not merely on classroom monitoring or observation compliance.

Recommendation

School heads and department heads may strengthen classroom supervision by emphasizing reflective dialogue after observation, demonstration teaching, coaching conferences, and collegial feedback. Observation should move beyond compliance and become a professional learning process that helps teachers improve pacing, address misconceptions, and differentiate instruction according to learner needs. Administrators may also provide support for laboratory preparation, instructional materials, and Science numeracy activities.

Science teachers may maximize Learning Action Cell sessions as venues for structured mentoring, collaborative planning, analysis of learner performance data, and sharing of effective strategies. They are encouraged to translate assessment results into concrete intervention plans for struggling learners and to integrate more activities involving mathematical problem-solving, interpretation of graphs and data, independent reading, inquiry, and performance-based Science tasks.

District supervisors may implement Project STRIDE as a district-wide capability-building intervention focused on mentoring systems, data-driven collaborative planning, Science numeracy integration, reflective peer observation, and learner independence. Regular monitoring, technical assistance, and inter-school sharing of best practices may help sustain the program and ensure that management education strategies produce measurable improvements in science literacy, numeracy, and independent learning.

Future researchers may replicate the study in other districts, include learner respondents and standardized learner assessment data, or use mixed-method designs to capture deeper teacher and learner experiences. Future studies may also evaluate the effectiveness of Project STRIDE after implementation to determine whether structured management education strategies can improve Science achievement and learner independence over time.

References

Aldea, K. Q., & Dayawon, M. A. (2025). Rural science education during and beyond COVID-19: Teachers' strategies and prospects from a Philippine perspective. International Journal of Education Research and Evaluation, 14(4), 2846-2856. https://doi.org/10.11591/ijere.v14i4.30446

Aripin, N., Mufit, F., Lufri, Andromeda, & Festiyed. (2025). The role of problem-based learning in developing science literacy and 21st-century skills in high school students: A meta-analysis. Formatif: Jurnal Ilmiah Pendidikan MIPA, 15(1), 269-284. http://dx.doi.org/10.30998/formatif.v15i1.27799

Cantilan, J. L. F., & Baguio, J. B. (2025). Instructional management practices and professional development of teachers in public secondary schools. EPRA International Journal of Multidisciplinary Research, 11(8). https://doi.org/10.36713/epra23772

Cebrero, J. D. (2025). 21st century skills and science achievement among secondary school students. ERIC, EJ1478563. https://files.eric.ed.gov/fulltext/EJ1478563.pdf

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approach (5th ed.). SAGE Publications.

Department of Education. (2022). Basic Education Development Plan 2030. DepEd. https://www.deped.gov.ph/wp-content/uploads/2022/05/DO_s2022_024.pdf

Education Endowment Foundation. (2025). Metacognition and self-regulation. EEF. https://educationendowmentfoundation.org.uk/education-evidence/teaching-learning-toolkit/metacognition-and-self-regulation

Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed.). SAGE Publications.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2023). How to design and evaluate research in education (11th ed.). McGraw-Hill Education.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage Learning.

Hallinger, P., & Murphy, J. (1986). Instructional leadership in effective schools. ERIC. https://files.eric.ed.gov/fulltext/ED309535.pdf

Hanson, C. R. (2022). Developing scientific literacy to promote 21st-century skills [Master's thesis, Bethel University]. https://spark.bethel.edu/etd/1862

Kurteshi, V., & Rrustemi, J. (2025). Exploring the impact of continuous professional development on teacher performance: Insights from students and teachers. EduPIJ, 16, e2025228. https://doi.org/10.22521/edupij.2025.16.228

Manoos-Pacia, L. M. (2025). Master teachers' instructional leadership competence and learners' achievements in numeracy and literacy. Philippine E-Journals. https://ejournals.ph/article.php?id=32336

Marzano Research. (2022). Data use solutions: Building teacher capacity and efficacy. Marzano Research. https://marzanoresearch.com/wp-content/uploads/2025/02/Data-Use-Solutions_Building-Teacher-Capacity-and-Efficacy.pdf

Mather, B. R., & Visone, J. D. (2024). Peer observation to improve teacher self-efficacy. Journal of Educational Research and Practice, 14(1), 1-22. https://doi.org/10.5590/JERAP.2024.14.1.01

Mydin, A. A. (2024). Professional learning communities and their impact on teacher performance. Teaching and Teacher Education, 148, 104715. https://doi.org/10.1016/j.tate.2024.104715

Nalle, C., Ilma, A. Z., Saryanto, & Rejokirono. (2025). The role of numerical and scientific literacy in preparing students for the challenges of the 21st century: A systematic review and bibliometrics analysis. Learning Gate, 9(3), 2199-2210. https://doi.org/10.55214/25768484.v9i3.5769

OECD. (2023). PISA 2022 results (Volume I and II) - Country notes: Philippines. OECD Publishing. https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/philippines_a0882a2d-en.html

Official Gazette of the Republic of the Philippines. (2001). Republic Act No. 9155: Governance of Basic Education Act of 2001. https://www.officialgazette.gov.ph/2001/08/11/republic-act-no-9155/

Official Gazette of the Republic of the Philippines. (2013). Republic Act No. 10533: An Act enhancing the Philippine education system. https://www.officialgazette.gov.ph/2013/05/15/republic-act-no-10533/

Prudente, M., et al. (2022). Structure, activities and teacher development in the Philippine science teachers' community of practice. International Journal of Learning, Teaching and Educational Research, 21(6). https://doi.org/10.26803/ijlter.21.6.5

Sandoval-Rios, F. (2025). Role of data literacy training for decision-making in teaching practice: A systematic review. Frontiers in Education, 10. https://doi.org/10.3389/feduc.2025.1485821

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4-14. https://doi.org/10.3102/0013189X015002004

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1-22. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Sibanda, D., & Amin, N. (2021). The link between a mentorship programme for mathematics, science, and technology in-service teachers and professional development. SAGE Open. https://doi.org/10.1177/2158244020988732

Stanton, J. D. (2021). Fostering metacognition to support student learning and performance. CBE-Life Sciences Education, 20(2). https://doi.org/10.1187/cbe.20-12-0289

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. Research in Science Education, 48(6), 1273-1296. https://doi.org/10.1007/s11165-016-9602-2

United Nations. (2015). Sustainable Development Goal 4 (SDG 4). Department of Economic and Social Affairs. https://sdgs.un.org/goals/goal4

Vega, M. G. A., & Orleans, A. V. (2025). Learning action cell as an in-house professional development training. EduLearn, 19(4), 1814-1828. https://doi.org/10.11591/edulearn.v19i4.22853

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.

Walindato, E., et al. (2025). Innovative management for teacher professional development in the digital age: A meta-synthesis. PIJED. https://ejournal.ppsdp.org/index.php/pijed/article/view/857

Yusuf, F., et al. (2025). Mapping the knowledge domain: A bibliometric review of instructional leadership and student achievement in secondary schools. Elicit Publisher Journal of Educational Sciences. https://journal.elicitpublisher.com/index.php/ejes/article/view/6