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Academic Article

Science Teaching Strategies and Teacher Motivation in Philippine Elementary Schools: A Narrative Literature Review

Dionel Posion[1,*]
[1]*Villa Aurora Elementary School, Department of Education- Division of Leyte, Philippines*
*Email: dionelposion2022@gmail.com

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Abstract. This narrative literature review synthesizes evidence on science teaching strategies and motivation in Philippine elementary schools. Guided by Constructivism and Self-Determination Theory, the review examined how contextual conditions and instructional practices shape teachers' motivation and science teaching. A broad and purposive search of Philippine E-Journals, Google Scholar, ERIC, and Scopus identified literature published from 2016 to 2026. Following abstract and title screening and full-text assessment, 32 studies were retained for thematic narrative synthesis. The findings indicate four major instructional approaches: experiential, technology-integrated, differentiated, and inquiry-based teaching. These teaching strategies were associated with meaningful learning, learner engagement, scientific thinking, and conceptual understanding, although their reported contributions varied according to teacher implementation conditions, competence, contextual relevance, and instructional resources. Teacher motivation was associated with a supportive teaching environment, instructional technology, learner success, and professional growth, with autonomy, competence, relatedness, and institutional support emerging as important contextual considerations. The literature suggests that effective science teaching depends not only on selection of teaching strategies but also on teachers' skills and the condition supporting instructional implementation. The review identifies gaps in context-sensitive, longitudinal, and comparative research and recommends further empirical investigation across diverse Philippines elementary school settings.

Keywords: Science teaching strategies; teacher motivation, thematic analysis; literature review; Philippine basic science education

INTRODUCTION

Science education at elementary level is important for fostering learners' foundational understanding, critical thinking, and curiosity about the real world. In Philippine education, enhancing science teaching has been a priority of the basic education reform, which stresses scientific literacy and inquiry-based learning from elementary grades. Despite these initiatives, obstacles and challenges remain, including varying preparedness and motivation, as well as limited instructional resources.

Effective elementary science education requires more than the delivery of scientific knowledge; it also depends on teachers' ability to use appropriate teaching strategies that sustain learners' interest and meaningful learning in science. Teachers play a key role in making learning experiences engaging through inquiry-based approaches, adequate resourcing, and teacher competence (Basher

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et al., 2026). However, the effective implementation of these instructions practices is influenced by professional competence and the availability of instructional strategies. Thus, the relationship between science teaching strategies and teachers' motivation is essential to understanding the factors that contribute to effective basic science education. Effective science teaching shape learners' interest, self-efficacy, learning quality, and scientific literacy (Syofyan et al., 2025).

Globally, elementary science teaching emphasizes basic scientific literacy, critical thinking, curiosity-building, and inquiry-based learning. Guided by frameworks such as those from UNESCO and assessments like the Program for International Student Assessment (PISA), teachers focus on real issues and aim to provide accessible, inclusive science education for all learners. In Jordan, low PISA performance stems from motivation and teaching gaps, highlighting the need to improve and study elementary science teaching (AlAli and Wardat, 2024). Moreover, in Australia, PISA's framework for global competencies struggle to capture context-specific science learning, underscoring the need to study how science is taught in elementary schools across local settings (Chandir and Blackmore, 2024).

In this context, understanding elementary science requires examining both the instructional strategies teachers use and the factors that influence their teaching motivation to deliver meaningful and effective science instruction. Teacher motivation is another key factor influencing how learners engage in and participate in science activities, as it affects achievement, persistence, and attention. Moreover, teachers employ strategies such as contextualized instruction, hands-on activities and experiments, and inquiry-based learning. In the Philippines, teachers and schools often face challenges such as a large class size, limited materials, constrained government education budgets, and limited ability to innovate and adapt instructional strategies (Cayabas and Sumeg-ang, 2023; Frianeza et al., 2024). Elementary science teachers face obstacles such as complex content and scarce resources, but can improve instruction through hands-on, practical, and targeted training (Garcia et al., 2025).

However, the literature remains fragmented, leaving limited synthesis of how instructional strategies and teachers' motivation interact in Philippine basic science education, particularly across different local contexts and resource conditions. This literature review examines studies on science teaching in Philippine elementary schools, focusing on teachers' instructional strategies and motivation. By synthesizing relevant studies, this review aims to identify effective practices, gaps in the current literature, and common challenges in science teaching. Finally, it seeks to deepen understanding of how teachers' motivation can strengthen science teaching by more effectively engaging learners through teaching strategies and theories.

OBJECTIVE OF THE REVIEW

This narrative literature review aimed to synthesize literature on science teaching strategies and teachers' motivation in Philippine elementary schools. Specifically, it examined the science teaching strategies reported in the literature, identifies factors associated with teachers' teaching motivation, synthesized patterns across the reviewed literature, and identifies research gaps and limitations in the existing evidence.

THEORETICAL FRAMEWORK

This narrative literature review draws on Self-Determination Theory and Constructivism, which provide complementary explanations of the relationships between teachers' instructional strategies and motivation in science teaching. Self-Determination Theory posits that motivation is influenced by the satisfaction of three of the basic psychological needs: autonomy, competence and relatedness. In science instruction, these needs are reflected in teachers' confidence in implementing instructional strategies, their professional independence, and supportive relationships within the school conditions. When these psychological needs are satisfied, teachers are more likely to demonstrate sustained motivation and commitment to effective science instruction (Geduld, 2023). Thus, SDT explains the motivational conditions that encourage teachers to sustain and adopt and sustain meaningful science teaching practices.

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Constructivism complements this perspective by emphasizing active knowledge construction through meaningful experiences, interaction, and inquiry with the learning environment. In teaching science, it supports learner-centered instruction, including experiential, culturally responsive, inquiry-based, and differentiated approaches that promote critical thinking and conceptual understanding (Shah, 2019). Teachers act as facilitators who design learning experiences that connect basic scientific concepts with learners' real-world contexts and prior knowledge.

Viewed together, these theories suggest that teacher motivation provides an important foundation for implementing science teaching approaches and strategies. At the same time, positive instructional experiences may reinforce teachers' perceived motivation, competence, and autonomy. This theoretical integration highlights the interconnected roles of instructional practice and motivation in promoting effective basic science education in elementary schools.

METHODOLOGY

Research Design

This study used a narrative literature review to synthesize and interpret existing research on teacher motivation and science teaching in Philippine elementary schools. The researcher selected a narrative review design because the available literature spans diverse research designs, instructional contexts, participants, and topics that are not readily amenable to statistical aggregation. Therefore, this approach allowed the researcher to integrate findings across the literature while accounting for differences in methodology, context, and reported outcomes.

The study primarily considered literature published from 2016 to 2026 concerning teacher motivation, instructional practices, and science teaching strategies in Philippine elementary schools. The review also considered relevant international literature to provide contextual and theoretical support for interpreting the findings.

The literature review used thematic narrative synthesis to identify recurring themes, areas of divergence and convergence, and gaps in existing studies. It examined teacher motivation, instructional resources, professional development, learner engagement, and contextual factors influencing science instruction.

Because the research was designed as a narrative literature review, the synthesis emphasizes reported associations and patterns in the literature rather than assuming causal relationships not established in the original studies reviewed. The study considered differences in sample characteristics, research design, available resources, and educational setting when interpreting the findings.

Sources of Data

The literature drew scholarly sources obtained from research repositories and databases, including Philippine E-Journals, Google Scholar, Scopus, and ERIC. The sources reviewed included peer-reviewed journal articles and relevant academic dissertations and theses. The study focused on science teaching strategies, teacher motivation, instructional approaches, and basic science education in the Philippines. The study included international literature when it provided relevant contextual or theoretical evidence that strengthened the interpretation of the Philippine studies. The search covered publications from 2016 to 2026 to capture relatively recent evidence while maintaining sufficient studies to support a meaningful narrative synthesis.

Search Strategy

The researcher conducted a broad literature search across identified academic research repositories and databases. Search terms were developed around the key concepts of the literature review and included "science teaching strategies", "teachers' motivation," Philippine basic science teaching", and "elementary science teaching". The search strategy was purposive rather than systematic or protocol-driven because the study used a narrative literature review design and aimed to identify studies relevant to teacher motivation and understanding of science teaching strategies in Philippine elementary schools.

The researcher initially screened retrieved records by title and abstract, then examined the full text of potentially relevant literature. The review excluded irrelevant, duplicate, opinion-based, and

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non-elementary studies on science teaching and motivation. The researcher retained studies that provided relevant empirical evidence on teacher motivation and science teaching strategies in Philippine elementary settings.

Data Inclusions

The researcher considered literature eligible for inclusion: (1) were published between 2016 and 2026; (2) addressed science teaching, teacher motivation, instructional strategies, and related topics; and (3) demonstrated direct relevance to elementary science teaching. The review prioritized literature addressing Philippine educational contexts, particularly peer-reviewed journal articles, academic dissertations, and theses. Included studies had to provide sufficient substantive evidence for one or more areas of the review, including teacher motivation, science instructional strategies, contextual support, instructional resources, and learner engagement. The inclusion coding and screening were conducted by a single reviewer without independent peer debriefing or dual coding.

Only 32 studies that met the inclusion criteria and were individually listed in Table 1 constitute the evidence base for the final narrative synthesis. In contrast, all other references cited in this manuscript were used solely for conceptual definition, background context, and theoretical framing, and did not contribute findings to the synthesis.

The review included international literature when it provided contextual or theoretical evidence useful for interpreting Philippine studies. The study excluded opinion-based studies, duplicate records, non-academic publications, studies unrelated to the study focus, studies involving non-elementary populations, and studies lacking sufficient information for meaningful interpretation. The studies retained for synthesis are shown in Table 1.

Table 1. Studies included in the final narrative synthesis (N=32).

No.	Full citation	Context	Study Design	Thematic lenses/Key findings
1	Angcaway (2025)	Grade 6 pupils, Dangguinan ES	Evaluation study	e-SIM and ICT based intervention improved performance, engagement, and teaching effectiveness.
2	Aquino (2019)	Grades 4-6	Experimental Design	Interactive multimedia presentations improved learners' science performance, learning outcomes and engagement.
3	Arioder et al. (2020)	Elementary Science learners	Experimental	5E intervention on environmental concepts slime mold improved understanding and engagement.
4	Balbin and Odiem (2023)	Grade 4 science learners	Comparative intervention	Explainer videos improved pupils' science performance and test scores.
5	Balbuena (2023)	Grade 3 pupils	Effect study	Mother-tongue instruction improved pupil's academic performance and comprehension but needs supplementation.
6	Bansiong et al. (2025)	Elementary science textbooks	Content analysis	Text was mostly gender-fair, images less so, and audio-visual aided learning.
7	Basod (2025)	Grade 6 pupils, Madatag ES	Intervention study	The intervention improved pupil's performance and understanding.
8	Bug-os et al. (2021)	Elementary science teachers	Curriculum analysis	Low physics confidence weakens science teachers' motivation and self-efficacy.
9	Canuto et al. (2024)	Primary science teachers and pupils	Relationship study	Teaching competencies and teachers performance related to pupils' academic achievement, though other factors also affect learning.
10	Daguio and Bernardo (2019)	K-12 science teachers, Santo Tomas District	Quantitative method	Teachers implemented prescribed approaches but faced training, resource, and learner-related challenges.
11	Daloos and Paderna (2023)	Grade 2 pupils	Comparative intervention	Collaboration and metacognitive learning improved conceptual learning.
12	Dela Ciete et al. (2025)	Elementary science teachers	Developmental evaluation	The gender sensitivity manual improved inclusivity and teaching support.

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No.	Full citation	Context	Study Design	Thematic lenses/Key findings
13	De Los Reyes and Bagona (2022)	Multilingual science classrooms	Classroom based study	Supports and improved communication in multilingual classrooms.
14	Fabillar et al. (2024)	Grade 4 pupils	Impact study	Comics improved literacy and conceptual understanding and enhanced engagement and instructional creativity.
15	Fajardo (2019)	Pre-service elementary teachers	Conceptual paper	Cultural awareness improves relevance.
16	Falculan (2025)	Elementary science teachers	Relationship study	Scaffolding supports cognitive and affective growth and strong link to instructional leadership.
17	Garcia et al. (2025)	Elementary science teachers	Descriptive Phenomenology	Teachers adapt using experiential and creative strategies.
18	Gutierez and Han (2025)	Elementary science learners	Exploratory Study	Emotional support and epistemic empathy sustain elementary learners' inquiry engagement.
19	Lasconia (2025)	Elementary science teachers	Descriptive-correlational	Teachers reported confidence and positive outcome expectations for culturally responsive teaching and engagement.
20	Lituañas and Dela Cruz (2025)	Grade 6 science learners	Developmental intervention	Developed and evaluated contextualized SIM, with localized materials improving understanding.
21	Pacala (2023)	Philippine K-12 science education	Documentary design	Spiral progression was generally beneficial but required improvements in implementation and learning outcomes.
22	Pawilen (2021)	Philippine elementary science curriculum	Conceptual paper	Local knowledge enhances engagement
23	Pelaez et al. (2025)	Prospective elementary teachers	Convergent parallel design	Weak NOS understanding among teachers in training
24	Prado and Sabas (2023)	Special science elementary schools	Descriptive-correlational	Instructional leadership linked to performance improvement
25	Quidmas and De Guzman (2026)	Key stage 2 science teachers	Descriptive-correlational	Inquiry-based strategies correlate with achievement. Instructional strategies positively linked to student performance.
26	Sedigo et al. (2025)	Grade 5 science learners	Relationship study	Collaboration improves learner engagement, participation, and science performance skills.
27	Sebastian (2024)	Grade IV science teachers and learners, Zambales	Descriptive survey design	Literacy strategies were used to support learner outcomes.
28	Sena et al. (2023)	Grade 5 science learners	Developmental intervention	Developed and evaluated a game-based multimedia tool; interactive systems increased engagement over traditional systems.
29	Sumardani (2021)	Philippine science education	Exploratory design	Discussed Philippine curricula strengths, weaknesses, and language barriers.
30	Tabamo (2023)	Philippine science education literature	Literature review	Traditional methods limit inquiry skills.
31	Tandas et al. (2017)	Elementary science teachers	Training intervention	Training improved teaching skills and science proficiency.
32	Vega and Orleans (2025)	Science teachers in remote Philippine areas	Descriptive survey design	Teachers perceived LAC implementation as strengthening knowledge, skills, and attitudes.

Selection Process

The study-selection process followed four stages: identification, screening, eligibility and assessment, and inclusion, as summarized in Table 2. During the initial identification stage, the researcher identified 1,920 titles and abstracts from peer-reviewed journals, preprints, theses and dissertations, research reports, and other academic publications in selected databases using established search terms. During initial screening, the researcher excluded 1,755 records that did not meet the preliminary eligibility criteria, being off-topic or lacking Philippine elementary science focus, including ineligible peer-reviewed and foreign articles, ineligible preprints, theses, and dissertations. Theses and dissertations were excluded from the final synthesis. This screening reduced the records to 165 peer-reviewed and preprint studies for full-text evaluation.

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During the full-text eligibility assessment stage, the researcher evaluated the remaining 165 studies against the established inclusion and exclusion criteria, including relevance to science teaching strategies, teacher motivation, elementary education, and the Philippine context, as well as related international evidence that supported local findings. The researcher excluded 133 peer-reviewed and preprint studies because they did not meet the eligibility criteria, were not sufficiently relevant to the literature review objectives, or did not provide enough information for thematic analysis. The remaining 32 studies comprising peer-reviewed articles met the inclusion criteria and were retained for thematic narrative synthesis and analysis. As shown in Table 2, full-text assessment and sequential screening reduced the initial 1,920 records to 32 eligible peer-reviewed studies.

Table 2. Article search, screening, and selection process**.**

Selection Stage	No. of records
Titles and abstracts identified and screened.	1920
Records excluded after initial screening.	1755
Articles assessed through full-text review.	165
Articles excluded after full-text assessment.	133
Article included in the final narrative synthesis.	32

Data Gathering Procedure

After eligibility screening, the researcher read the 32 selected studies multiple times. The researcher identified and organized relevant findings, key concepts, methodological characteristics, and conclusions according to their relationships to the literature review objectives.

Data gathering involved identifying information on the study context and participants, science teaching strategy examined, teacher motivation-related factors, reported learner and teacher outcomes, professional development and teacher competence, cultural, contextual, and linguistic considerations, and limitations or research gaps identified by the original authors. The researcher coded relevant findings according to recurring conceptual patterns. The researcher grouped related codes into broader categories and compared them across the literature. This process enabled the researcher to identify patterns that appeared consistently across studies while also recognizing findings that differed by educational context, research design, available resources, or participants.

The synthesis was iterative. The researcher identified initial themes, reviewed them against the selected literature, and refined them as needed to ensure the resulting categories accurately represented the studies. Relevant international literature provided contextual and theoretical support where appropriate, while Philippine studies remained the primary contextual primary focus.

Data Analysis

The selected studies were analyzed using thematic narrative analysis, involving systematic coding, thematic organization, comparison, and interpretative synthesis. Related findings were grouped into themes related to teacher motivation, professional competence, science teaching strategies, instructional resources, contextual conditions, and learner engagement. Self-Determination Theory and Constructivism guided interpretation of the teacher-related factors and instructional practices, respectively. These associations allowed the synthesis to identify consistent findings, variations, gaps in the literature, but not causal relationships.

Methodological Scope and Limitations

As a narrative literature review, this study provides a contextual synthesis rather than a statistical aggregated or exhaustive estimate of instructional effects. The purposive search may have excluded relevant literature, and differences in samples, designs, educational contexts, and measures limit direct comparison across findings. The researcher considered these limitations when interpreting the findings, emphasizing recurring themes and contextualized findings rather than

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causal generalization. The study also highlights the need for further empirical research using rigorous and longitudinal designs, larger samples, and direct investigations of the relationship between teachers' science teaching practices and motivation.

RESULTS AND DISCUSSION

STRATEGIES IN TEACHING SCIENCE

Figure 1 presents the framework of science teaching strategies through Constructivist Theory. As shown in the figure, the literature shows that technology-integrated, inquiry-based, differentiated, and experiential teaching enhance elementary science instruction through scientific thinking, conceptual understanding, active knowledge construction, and learner engagement. Nonetheless, their effectiveness depends on teacher competence, sustained institutional support, adequate resources, effective instructional integration, and contextual relevance, underscoring the need for research on their implementation across elementary schools.

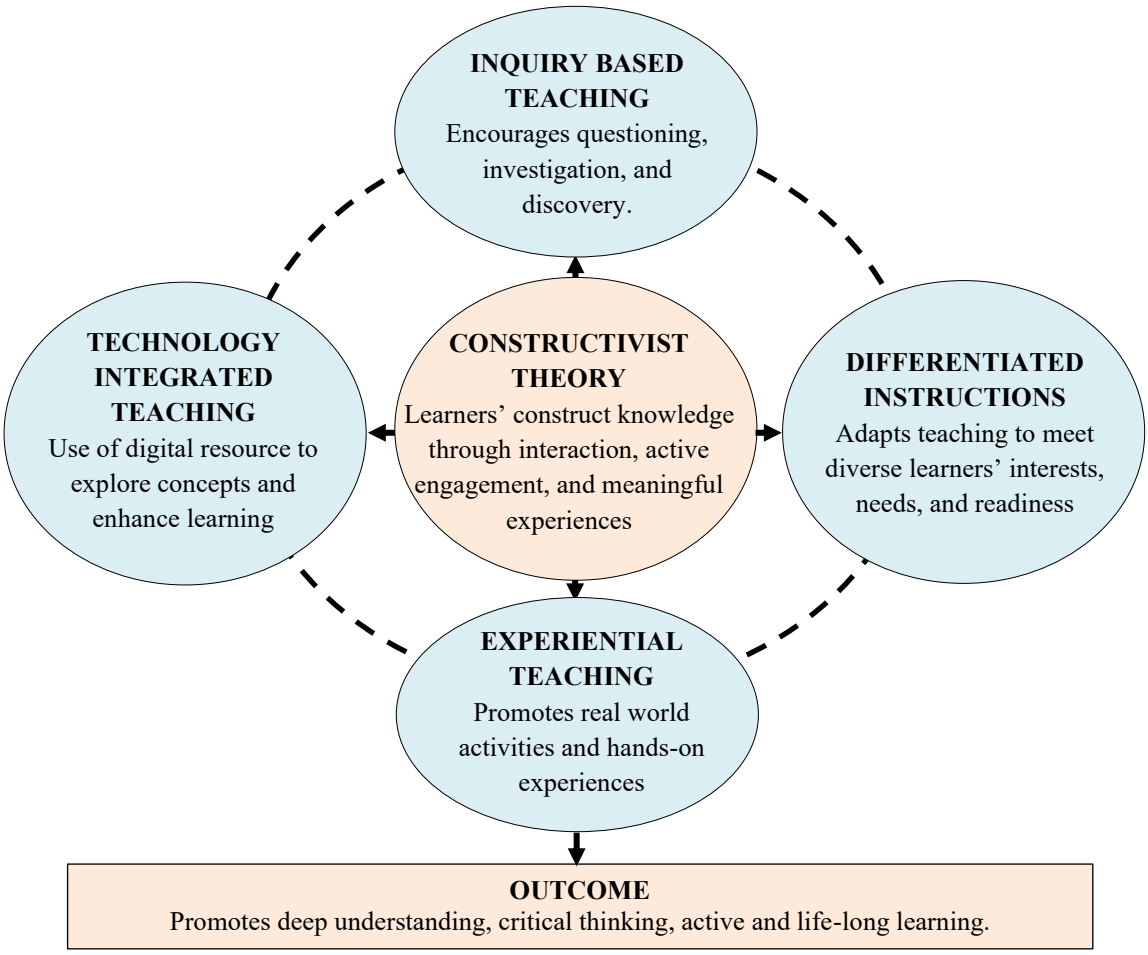

Figure 1. Framework of Science Teaching Strategies Through Constructivist Theory.

Technology-Integrated Teaching

The reviewed literature indicates a consistent but qualified pattern: technology-integrated science teaching may support learner engagement, learning outcomes, participation, and comprehension, although these benefits vary depending on how technology is integrated into science instruction. Angcaway (2025), Balbin and Odiem (2023), and Basod (2025) reported favorable outcomes associated with audio-visual resources, including explainer videos and instructional materials. In contrast, Memiş et al. (2023) emphasized the importance of teachers' technological knowledge and capacity to integrate digital tools meaningfully. Across these studies, technology is most useful when aligned with classroom context, instructional purposes, and learner

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needs, rather than treated as a teaching strategy in itself. From a constructivist perspective, this pattern suggests that digital tools may strengthen science learning when they facilitate exploration, knowledge construction, inquiry, interaction, and connections between learners' prior experiences and new science concepts. At the same time, Self-Determination Theory (SDT) helps explain the teacher dimension of technology integration: appropriate professional support and digital resources may strengthen teachers' sense of autonomy and competence, whereas technological constraints, inadequate training, and limited resources may restrict these motivational conditions. Thus, the findings suggest that technology's instructional value emerges from the interaction of digital resources, contextual support, teacher capacity, and pedagogical practice.

Despite these common patterns, important gaps and differences remain across the reviewed literature. Much of the evidence comes from short-term, localized interventions, and relatively small samples, with greater attention to learner outcomes than to teachers' sustained instructional use. Consequently, evidence remains limited on how technological competence, contextual conditions, resource availability, teachers' motivational needs, and professional training jointly shape the sustained implementation of technology-integrated science teaching in Philippine elementary school settings. The literature provides insufficient comparative evidence across diverse elementary school contexts, particularly settings where teacher preparation, infrastructure, and access to digital resources vary substantially. These limitations suggest that technology integration should not be understood solely in terms of the availability of digital tools; rather, its potential depends on teachers' motivation and capacity to transform those tools into contextually responsive, meaningful, and learner-centered science experiences. Further research is needed to examine how teacher competence, contextual conditions, motivation, and institutional support interact to sustain effective technology-integrated basic science teaching across diverse Philippine elementary schools.

Inquiry-Based Teaching

The reviewed studies consistently present inquiry-based teaching as a multidimensional approach that supports scientific thinking, active participation, reflection, conceptual understanding, and collaboration. Across the literature, responsive inquiry, the 5E model, collaborative-metacognitive strategies, and scaffolding emphasize learner-centered knowledge construction, though they differ in their evidence base and mechanisms. Arioder et al. (2020) linked the 5E model to improved conceptual understanding, while Daloos and Paderna (2023) reported similar gains following a metacognitive approach. Falculan (2025) emphasized teachers' use of scaffolding in science teaching, whereas Gutierez and Han (2025) highlighted emotional responsiveness during learners' scientific sense-making. These findings suggest that effective inquiry-based teaching involves complementary metacognitive, affective, social, and cognitive support rather than a single instructional approach. Self-Determination Theory (SDT) suggests that supportive inquiry environments may strengthen autonomy, competence, and relatedness through appropriate challenge, collaboration, and meaningful participation. At the same time, Constructivism Theory explains this pattern by emphasizing active knowledge construction through interaction, reflection, prior knowledge, and experience.

Evidence varies in outcome measures, participants, research designs, and settings, limiting direct generalization and comparison despite the common patterns. The reviewed literature emphasizes classroom processes or learner outcomes, while fewer studies examine the conditions that sustain inquiry-based teaching. From an SDT perspective, teachers' continued use of inquiry-based instruction may be influenced by their sense of autonomy, competence, and relatedness particularly when inquiry requires responsive classroom management, planning, and scaffolding. Thus, the reviewed studies support inquiry-based teaching as promising approaches but do not suggest that all inquiry approaches operate similarly across contexts. Further research using more diverse and larger samples, stronger comparative designs, and longer implementation periods is needed to examine how metacognitive, collaborative, cognitive, motivational, and emotional supports interact, and how teachers' contextual support and competence influence the sustained implementation of inquiry-based science teaching in diverse elementary settings.

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Differentiated Instruction

The reviewed studies consistently show that differentiated, culturally responsive instruction can make elementary science learning more relevant, meaningful, and inclusive by connecting scientific concepts to learners' experiences, language, and cultural backgrounds. De Los Reyes and Bagona (2022) and Balbuena (2023) emphasized differentiated instruction, mother-tongue use, and translanguaging use in supporting communication and comprehension, while Fajardo (2019) and Pawilen (2021) highlighted the value of community and indigenous-based knowledge in connecting science with learners' local experiences. Similarly, scenario-based and contextualized approaches reported by Pawilen (2021) and Lasconia (2025) suggest that linking science concepts to real-life scenarios can strengthen learner engagement and relevance. Although the studies differ in context and instructional approach, they all find that adapting contexts, content, language, and learning experiences to learners' backgrounds supports more responsive science instruction. These findings align with constructivism, which explains learning as the active construction of knowledge through connections with prior knowledge and meaningful experiences. At the same time, Self-Determination Theory further suggests that differentiated and culturally responsive practices may strengthen learners' relatedness, competence, and autonomy by allowing them to participate meaningfully and see themselves within the learning process.

Despite these converging findings, the literature also reveals important research gaps and limitations. Yunani et al. (2024) emphasized that effective differentiated instruction depends not only on teaching strategies but also on teachers' capacity and preparedness to adapt instruction. Moreover, much of the reviewed research relies on quasi-experimental, pretest-posttest designs, and context-specific or relatively small samples, limiting the generalizability of the findings across diverse elementary school contexts. Evidence is also limited on how sustained professional support, teacher preparedness, and contextual differences shape the long-term implementation of differentiated and culturally responsive science instruction. Thus, while existing studies offer consistent learner-responsive and contextualized approaches, further research should use more diverse and larger samples, integrated measures of teacher capacity, longitudinal designs, and measures of learning outcomes and learner motivation. The findings suggest that differentiated science instruction is most effective when it combines meaningful learner experiences with teachers' capacity to provide motivating, supportive, and culturally responsive learning environments.

Experiential Teaching

The reviewed studies collectively suggest that experiential, adaptive, and innovative teaching strategies can strengthen science learning when they are purposefully aligned with classroom contexts and learners' needs. Tabamo (2023) highlighted the limitations of continued reliance on traditional methods, while Sebastian (2024), Sena et al. (2023), Susiloningsih et al. (2023), and Mapandala (2024) reported positive contributions of experiential, science-based, multimedia, adaptive, and literacy-based approaches to learner achievement, engagement, curiosity, motivation, and understanding. Although the literature differs in reported outcomes and strategies, a common pattern is that learners benefit when instruction provides opportunities for meaningful experiences, active participation, and varied ways of applying and applying knowledge. At the same time, Canuto et al. (2024) show that teacher competencies and external conditions also shape learner engagement, suggesting that teaching strategies do not operate independently of teacher- and classroom-related factors. From a constructivist perspective, these findings indicate that learning is strengthened when learners actively connect new scientific concepts with real-life experiences and prior knowledge. Self-Determination Theory further explains these findings, suggesting that adaptive, engaging learning environments can support autonomy, competence, and relatedness, fostering stronger participation and motivation.

Despite these converging findings show that a clear gap remains in the literature. Existing studies have largely examined immediate learner outcomes and individual instructional strategies, with less attention to how multiple approaches work together. Less attention has also been given to how teacher competence, learner characteristics, classroom conditions, and motivational outcomes, such as autonomy and engagement, shape their effectiveness within the same framework. This

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research gap matters in elementary science, where learners' contextual and developmental differences may shape how they experience instructional approaches. Future research should therefore use more longitudinal and diverse designs to examine how teacher capacity, contextual conditions, and teaching practices interact to shape both motivational and learning outcomes, using more longitudinal and diverse designs. Such research can build on existing evidence by determining not only whether innovative teaching strategies are effective, but also under what conditions, for whom, and through which motivational and learning processes they work best.

MOTIVATION IN TEACHING SCIENCE

Multiple factors shape teacher motivation to teach science in elementary schools, including instructional technology, professional growth, learner success, and teacher support, all which may strengthen engagement, competence, confidence, and meaningful instructional practices. Sustained teachers' motivation depends on adequate instructional and technological resources, institutional support, contextual responsiveness, and opportunities to develop autonomy, competence, relatedness, underscoring the need for future research on how these conditions interact across diverse, resource-constrained and diverse elementary school settings. These relationships are illustrated in Figure 2.

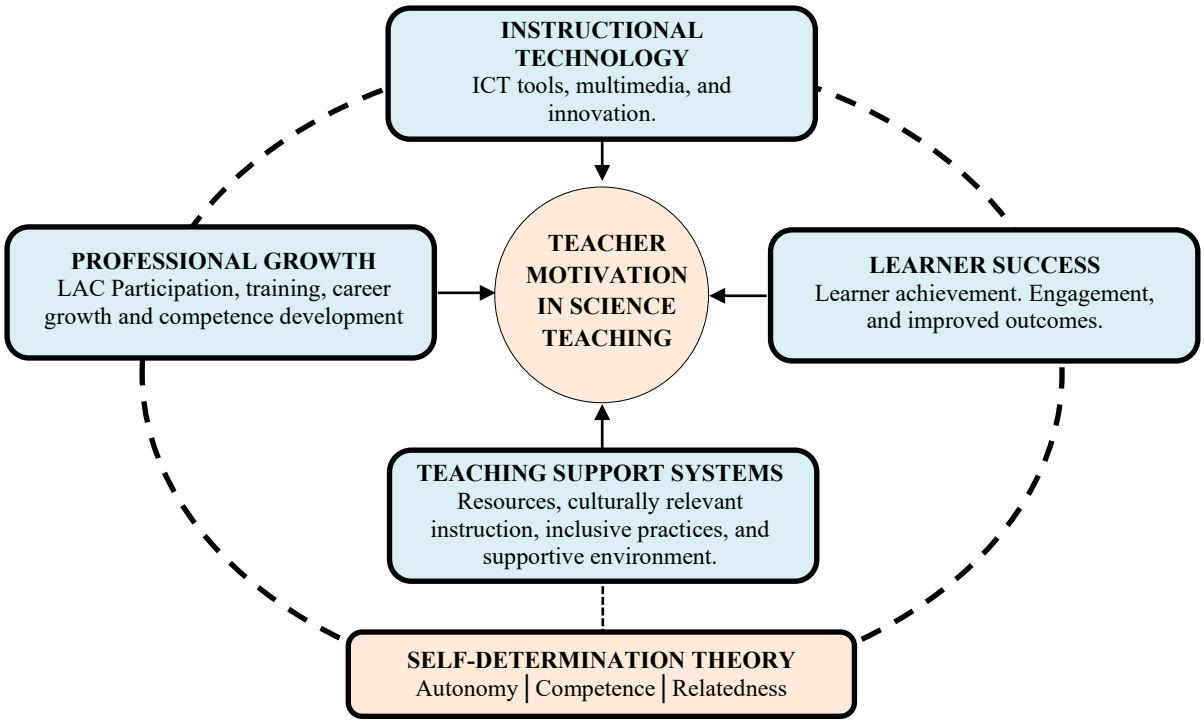

Figure 2. Framework of Teacher Motivation Factors in Teaching Elementary Science Anchored in SDT.

Instructional Technology

Studies suggest that multimedia and ICT-based instructional resources may support teachers' motivation in science teaching by encouraging more engaging teaching practices, expanding instructional possibilities, and strengthening perceived competence. Angcaway (2025), Basod (2025), Balbin and Odiem (2023), Fabillar et al. (2024), and Sena et al. (2023) reported positive contributions of video-based learning, electronic instructional materials, science comics, audio-visual resources, and gamification to science instruction and learner outcomes, which may encourage teachers to develop greater confidence, adopt innovative practices, and strengthen teaching motivation in science instruction. However, these studies differ in focus: some examined teachers' instructional practices and technology use, others primarily measured learner achievement and engagement rather than teacher motivation directly, and therefore did not provide direct

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evidence of increased motivation. Altin et al. (2025), who directly investigated teacher motivation, found that teachers stay motivated by developing digital competence. Thus, positive learner outcomes should not automatically be interpreted as evidence of increased teacher motivation to teach science. Instead, the studies suggest that technology's motivational value may depend on teachers' confidence, technological competence, institutional support, and resource availability. This distinction highlights a gap in how technological readiness, contextual support, professional development, and resource availability influence elementary science teachers' sustained motivation, particularly in resource-constrained classrooms.

Self-Determination Theory and Constructivism can further explain the findings. From a constructivist perspective, multimedia and technology resources can facilitate collaborative, active, meaningful, and learner-centered science experiences by providing varied opportunities for knowledge construction and exploration. Self-Determination Theory complements this perspective by explaining how technology may strengthen teachers' motivation when it supports their relatedness, autonomy, and competence. Flexible digital resources may increase teachers' autonomy, interactive technology-supported activities may promote meaningful teacher-learner engagement, and successful technology integration may strengthen teachers' sense of competence. Nevertheless, access to technology alone does not guarantee motivation; limited resources, insufficient institutional support, inadequate training, and increased workload may reduce its motivational value. Overall, the literature indicates that the relationship between teacher motivation and instructional technology is conditional rather than automatic, highlighting the need for more research on the contextual conditions and mechanisms through which technology can sustain teachers' innovative practices and motivation in basic science teaching.

Professional Growth

Across the literature, professional growth and competence development through Learning Action Cell (LAC) participation, professional training, and instructional leadership were reported in connection with more effective science teaching and greater instructional confidence (Tandas et al., 2017; Prado and Sabas, 2023; Falculan, 2025; Vega and Orleans, 2025). However, these studies did not directly measure teachers' motivation, so they provide indirect support for the motivation link. Direct evidence is more limited: Kang et al. (2026) reported a positive relationship between science teaching motivation and professional growth. In contrast, inadequate training and gaps in basic scientific content knowledge were associated with reduced confidence (Bug-os et al., 2021; Pelaez et al., 2025). Reduced motivation was reported only where it was directly measured. Similarly, Duha and Kaur (2023) and Canuto et al. (2024) reported that strengthening teachers' professional and pedagogical competence may be associated with greater instructional confidence, effectiveness, and commitment to continuous improvement. However, differences in samples and design, largely small, survey-based, or scale-limited, limit causal claims. Targeted professional development therefore appears promising, but its sustained effects on teachers' motivation to teach science remain insufficiently established.

From a Self-Determination Theory perspective, competence development may support teachers' motivation when paired with opportunities for professional growth and autonomy-supportive conditions. Professional learning, career development, and instructional support may strengthen motivation to teach science by enabling teachers to feel more confident, engaged, and capable in their instructional practices. Nevertheless, the reviewed studies provide limited longitudinal evidence showing whether improvements in professional competence translate into sustained teaching motivation. Future research should examine how professional development, autonomy, institutional support, and competence interact to shape teachers' motivation to teach science, particularly across resource-constrained and diverse elementary science settings. This gap is important because understanding these conditions may help distinguish short-term gains in instructional confidence from sustained professional growth and motivation.

Learner Success

The reviewed studies provide limited direct evidence that teachers' motivation to science is positively associated with learner success, engagement, and professional competence, particularly

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in instructional effectiveness, content knowledge, and instructional mastery. Across the studies, positive learning outcomes, Learning Action Cell (LAC) participation, effective instructional strategies, and professional training were associated with more effective science teaching and greater instructional skills (Tandas et al., 2017; Falculan, 2025; Vega and Orleans, 2025). However, these studies did not directly measure teacher motivation, so they provide only indirect support for a motivation link. Bug-os et al. (2021) and Pelaez et al. (2025) further indicated gaps in understanding of scientific concepts may undermine teachers' confidence. Effects on motivation were inferred rather than directly tested, highlighting subject-matter mastery as an important condition for effective science teaching. Mahler et al. (2018) showed that teachers' teaching motivation has a significant relationship with learners' success. However, the reviewed literature does not provide direct longitudinal evidence for this cycle. The findings also suggest a potentially reciprocal relationship between learner success and teacher motivation: motivated teachers may be more likely to employ effective strategies and prepare instruction thoroughly, which promote learner achievement and engagement, while positive learning experiences may, in turn, reinforce teachers' motivation and self-efficacy (Balbin and Odiem, 2023; Pelaez et al., 2025). The synthesis suggests that competence-based, sustained, and targeted professional development appears promising for instructional practices, but its long-term effects on teachers' motivation remain insufficiently established.

The literature offers limited explanation of the broader factors that sustain and shape teachers' motivation in science teaching. Reviewed studies relied on non-experimental or cross-sectional designs and context-specific samples, which limit conclusions about causality and the long-term sustainability of motivational gains. From a Self-Determination Theory perspective, the literature strongly emphasizes competence as a key component of motivation while giving comparatively less attention to relatedness and autonomy. This imbalance suggests that professional competence alone cannot fully explain teachers' motivation; collegial relationships, organizational support, learner interaction, and teachers' sense of instructional autonomy may also influence motivation. Future research should therefore examine how competence interacts with relatedness, learners' success, autonomy, and organizational support over time. More robust longitudinal evidence is needed to determine whether targeted professional development and improved professional competence can sustain teachers' motivation and improve science teaching over time.

Teaching Support Systems

The literature indicates that supportive, culturally responsive, and inclusive teaching environments may support teachers' motivation to teach science by building instructional competence, confidence, and meaningful engagement. Across the literature, teaching support systems, translanguaging, indigenous knowledge, mother-tongue instruction, inclusive instructional materials, and culturally relevant knowledge were associated with more meaningful instructional experiences and improved learner participation (De Los Reyes and Bagona, 2022; Balbuena, 2023; Fajardo, 2019; Pawilen, 2021; Lasconia, 2025; Bansiong et al., 2025; Dela Ciete et al., 2025). Meanwhile, Ning (2026) reported that teaching support shaped teaching performance alongside teachers' motivation. However, with the exception of Ning (2026), the other studies did not directly measure teachers' motivation, they only provide indirect support for a teaching motivation link. De Los Reyes and Bagona (2022) and Balbuena (2023) emphasized the value of mother-tongue and translanguaging instruction in facilitating learner participation, while Fajardo (2019), Pawilen (2021), and Lasconia (2025) highlighted the importance of teacher confidence, indigenous knowledge, and relevant content in promoting culturally responsive instruction. However, Sumardani (2021) and Garcia et al. (2025) indicated that contextual constraints, language barriers, and curriculum limitations may reduce the effectiveness of supportive teaching strategies, requiring teachers to employ experiential and creative approaches. The literature findings suggest that meaningful resources, supportive school environments, instructional relevance, and learner-responsive practices may strengthen teachers' engagement and competence, although evidence directly linking these conditions to sustained teachers' teaching motivation remains comparatively limited.

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From the perspective of Self-Determination Theory, supportive and culturally responsive environments may strengthen teachers' needs for relatedness and competence by connecting instruction to learners' experiences, enabling them to use appropriate strategies, and helping them develop meaningful relationships within the school and classroom community. Nevertheless, the reviewed studies provide limited evidence regarding the sustainability of motivational effects, contextual differences, causality, and teachers' readiness to implement culturally inclusive and responsive practices. Rather than assuming that supportive environments automatically increase science teaching motivation, the findings suggest that their motivational influence may depend on how instructional resources, teachers' competence, school support, contextual readiness, and cultural responsiveness interact. A key gap therefore concerns how these factors interact over time to improve science instruction and teachers' motivation. Future mixed-methods studies could provide stronger evidence on the contextual conditions and mechanisms through which culturally supportive and inclusive teaching environments contribute to lasting motivational and instructional outcomes.

CONCLUSION AND IMPLICATIONS

Conclusion

The literature suggests that inquiry-based, experiential, technology-integrated, and differentiated approaches contribute to effective basic science teaching by fostering conceptual understanding, learner engagement, and scientific thinking. However, their effectiveness depends on teachers' competencies and contextual support, including appropriate integration of strategies and access to adequate resources.

Teachers' motivation is also influenced by opportunities for professional growth, supportive school environments, access to instructional technology, and learner achievement. These factors may strengthen teachers' autonomy, confidence, and commitment to instruction. Overall, effective elementary science instruction requires supportive conditions and sound pedagogical practices that sustain teaching quality and teachers' motivation.

Implications and Recommendations

The findings highlight the importance of developing teachers' adaptive, pedagogical, and technological competencies through continuous professional development. Education stakeholders and school leaders should provide adequate teaching resources, promote supportive instructional environments, and encourage culturally responsive and learner-centered science teaching practices.

At the policy level, educational institutions should prioritize equitable access to instructional technologies, institutional support mechanisms, and sustained teacher development to address teachers' professional needs. These initiatives may contribute to sustained teachers' motivation and improved science instruction.

Future research should employ more diverse and larger samples, longitudinal designs, and mixed-methods designs to examine how instructional strategies, institutional support, professional competence, and teachers' motivation interact across different elementary school contexts.

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