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Teaching Science the Innovative Way: A Synthesis on the Emerging Pedagogies in the Philippines

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Abstract: The current situation of science education in the Philippines is characterized by poor performance levels, lack of interest, and continued use of teacher-centered instructions. Against this background, recent scientific works have investigated some modern teaching techniques that would foster learners' scientific knowledge acquisition and engagement in science lessons. This synthesis paper presents a review of 20 articles published during the period 2020-2025 and available through Scopus database to identify trends shaping modern science education in the Philippines. Based on a thematic conceptual framework for conducting the research, the selected literature was thoroughly analyzed and synthesized to derive broader explanations without drawing statistically-based conclusions. Six interrelated themes were identified during the process: learner-centered instruction, integration of technology into the teaching process, teacher competence and professional development, inquiry- and problem-based learning, cultural relevance, and future-oriented tendencies after pandemic. Results demonstrate that there is a general trend from passive, memorization-oriented instruction to more active approaches, which incorporate use of technological tools and encourage inquiries and collaboration. At the same time, the success of these approaches is contingent upon teacher preparedness and availability of digital materials for all learners.

Keywords*: Cultural Relevance, Inquiry-Based Learning, Learner-Centered Instruction, Science Education, Technology Integration, Component; Formatting; Style; Styling.*

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I. INTRODUCTION

Learning science is vital for national development in that it enhances critical thinking skills among the learners, promotes problem solving abilities and aids scientific decision making. But in the Philippines, a lot of children still have difficulty with science despite all the educational reforms that have taken place. According to a report published in the 2022 Programme for International Student Assessment (PISA), only 23% of Filipino children attained a score of Level 2 or above in the assessment of their science proficiency which is significantly lower than the global average of 76% (Tañedo et al., 2024). This is a clear indication that it's time for us to take stock of the teaching methodologies being used in science education.

In the Philippines, as is the case across the globe, science education was long dominated by teacher-centered pedagogy whereby the focus was mostly on plain recall, heavy content delivery and rigorous examination. This approach may emphasize rote learning rather than scientific understanding, thus hindering the learners' curiosity and creativity. However, emerging teaching strategies emphasize active involvement by the learners, scientific inquiry, and technology among others. As opposed to traditional pedagogies where teaching and learning are centered around teachers' information delivery to students, modern pedagogies involve active involvement by the latter in the discovery of knowledge on their own.

The advent of the Coronavirus Disease 2019 (COVID-19) pandemic accelerated this trend greatly. Schools across the Philippines quickly moved to online and blended learning, requiring teachers to adapt to digital technologies and more flexible learning environments. Although this sudden change was challenging, it also encouraged innovation, as teachers combined traditional strategies with modern tools to ensure continuous and equitable learning for students (Briones, 2023; Colegado, 2025).

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This synthesis integrates recent research in the Philippines on innovative science teaching, addressing the question of how new pedagogical approaches are transforming science education in the Philippines. It highlights six major themes identified in the literature: learner-centered approaches, technology integration, teacher competence and development, inquiry and problem-based learning, cultural and contextual relevance, and post-pandemic and future-oriented trends. Together, these themes showed a clear shift toward a more inclusive, future-ready, and scientifically literate science education in the Philippines.

II. LITERATURE REVIEW

This review summarized recent studies on the new teaching approaches in science education in the Philippines. It showed that learning was more effective when students were active, teachers were well trained, technology was used appropriately, and lessons were connected to students' culture and real-life experiences. Overall, the review explained the challenges and opportunities in building a strong, inclusive, and modern science education system in the Philippines.

- *Learner-Centered Approaches*

Learner-centered methodologies in science education prioritize student interest, engagement, and active participation as essential catalysts for significant learning. Motivated and engaged students dedicate more time, effort, and concentration, resulting in enhanced comprehension and skill acquisition in science (Sadera et al., 2020). In the Philippines, educators are progressively striving to incorporate 21st-century skills to enhance student involvement and scientific literacy, which are vital for national development and innovation (Belisario & Paglinawan, 2025).

Nonetheless, enduring obstacles such as resource scarcity, educational disparity, and socio-cultural influences hinder participation and accomplishment, as seen by the 2018 National Achievement Test results (Oracion, 2021). Research indicates that engagement is multifaceted, comprising behavioral, emotional, and cognitive elements, and is enhanced by experiential learning, positive teacher-student interactions, and interest-based activities (Means & Neisler, 2023).

Research has indicated that grit is essential for maintaining engagement, both directly and indirectly via enhancing student interest, highlighting the necessity for cohesive motivating tactics in learner-centered environments (Alhadabi, 2021; Durak et al., 2024). Moving away from conventional lecture-based teaching, student-centered and active learning methodologies—such as collaborative efforts, interactive dialogues, problem-solving, and experiential tasks—have demonstrated the ability to augment interest, critical thinking, retention, and perseverance in STEM disciplines, while concurrently reducing achievement disparities among underrepresented students (Lugosi & Uribe, 2020). The post-pandemic learning gap in the Philippines, coupled with the requirements of Industry 4.0, amplifies the necessity for learner-centered science education that fosters profound comprehension and practical application (Picardal & Sanchez, 2022). Although evidence endorses active learning, current studies predominantly employ quasi-experimental designs, and there is a notable deficiency in research examining the lived experiences of STEM educators and students in the application of learner-centered methodologies, highlighting a significant area for further exploration (Pacala, 2021).

- *Technology Integration*

The expanding corpus of research on technology-based learning (TBL) provides significant insights into how digital tools might transform education on both local and global levels. The studies below exhibit these twin themes, collectively illustrating the transformative potential of educational technology while emphasizing crucial considerations for equal access and effective integration. A study by Sohail et al. (2019) examines the integration of technology and self-regulation tactics to improve learning outcomes, concentrating on AI-enhanced platforms that promote self-regulated learning. The study offers a scalable paradigm applicable across nations, enhancing comprehension of how technology fosters student autonomy and metacognitive skills vital for 21st-century education. These findings guide the construction of EdTech tools to mitigate issues such as cognitive overload in intricate subjects like programming. In many regions, its focus on individualized instruction and immediate feedback is especially pertinent for areas with restricted access to one-on-one tutoring, aiding in the closure of support gaps for students in technical disciplines.

Chavez's study on improving Flipped Classrooms using Technology-Enhanced Assessments is based in a high school in Davao City, Philippines, highlighting its significant local influence. The research illustrated those inexpensive technologies such as Google Forms and Sheets enhance student performance, engagement, and motivation, while simultaneously increasing teachers' efficiency in monitoring progress—offering a viable model for Philippine schools confronting restricted access to sophisticated assessment systems. This initiative presents a repeatable model for nations facing analogous resource limitations, highlighting the potential of basic digital technologies to facilitate transformation via prompt feedback and tailored learning experiences.

Simultaneously, Baharun and Porter (2019) examine the application of technology in enhancing student learning through a case study focused on video resources for statistics teaching. Globally, it supports the notion that technology helps alleviate learning anxiety and enhance comprehension in difficult subjects, emphasizing the necessity for accessible, high-quality multilingual digital resources. Video-based teaching materials enable flexible learning approaches where there is a shortage of subject-specific teachers, and since the research highlights the need for offline approaches, it means that technology can be used to improve education among poor people who lack adequate access to the internet. The changing environment of education: The impact of technology-enhanced learning on teaching methodologies, evaluation, and

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learning spaces within IB Diploma Program schools as per Kirmani assesses the incorporation of technology post-COVID within international schools across the globe. It globally identifies challenges including the lack of technological resources and opportunities such as artificial intelligence for personalized mathematics education, shaping policies for international education systems. In countries where IB programs operate, the research supports the schools in meeting their infrastructure and training needs, such as choosing low bandwidth options where there is a lack of fast broadband.

These studies underscore the revolutionary potential of technology-based learning on both local and global scales, while highlighting the necessity of addressing obstacles such as the digital divide and ensuring equitable access to quality education. It is collectively determined that technology enhances the delivery and accessibility of information and engagement. This shows how technology evolves beyond traditional means of learning such as textbooks and lecturers.

- *Teacher Competence and Professional Development*

The importance of teacher competency is recognized by many researchers who view it as an important aspect affecting the quality of education at a time when there is a move toward evidence-based practice, sustainable development goals, and global citizenship education among others. According to De Jesus et al., (2023), competency goes beyond the possession of material knowledge but includes teachers' skills of researching, reflective practice, and active participation in school improvement activities. One local perspective on this issue was offered through this research which focused on researching competency among public school teachers in Ilocos Sur, Philippines. The results showed that while teachers had high levels of research knowledge, skills, and positive attitudes toward research, they hardly produced any research. This situation was blamed on structural barriers such as busy teaching schedules, lack of time to research, poor access to research materials, and weak research cultures in educational institutions. It was asserted that professional competence cannot be converted into results without institutional structural assistance entities.

Further highlighting the importance of teacher competence in education reforms, Agujar et al., (2020) explored the role and curricular incorporation of teacher competence in the implementation of sustainable development goal four within Philippine schools. Their findings suggest that higher levels of teacher competence along with appropriate curriculum integration strategies positively predicted the successful execution of quality education initiatives. According to the researchers, teachers are the main agents responsible for translating global policies into classroom practice making their competence a key component in the realization of both national and international educational objectives.

In a meta-analysis of the effects of professional development programs on teacher competence, Kaya et al., (2024) gathered the results of 37 articles addressing teacher training programs as a source of increasing global competency among both pre-service and in-service teachers. They reported a positive correlation between the use of such programs and teacher competence as measured by the quality of knowledge and instructional skills acquired. It was argued that professional development programs have no significant effect on teachers' attitudes because competence acquisition is most effective when carried out continuously and systematically.

It can be concluded from the above-mentioned literature that teacher competence is a complex phenomenon which not only entails pedagogical expertise but also research skills, curricular integration, and professional expertise among others. According to De Jesus et al., (2023), competence does not flourish without institutional support while Agujar et al., (2020) state that competence is necessary in order to achieve reforms in education. At the same time, Kaya et al., (2024) offer evidence from around the world about the importance of professional development programs for promoting teacher competence.

Consequently, literature reveals that improving teacher competence requires a multi-dimensional approach involving individual professional development, institutional support, and coherent policies, thus highlighting teacher development as a key element in education.

- *Inquiry- and Problem-Based Learning*

Ramirez and Francisco (2017) discovered that Grade IV students instructed via inquiry-based learning exhibited markedly superior science achievement and enhanced social skills relative to their peers taught using conventional approaches. Sarsale and Langub (2023) indicated that the incorporation of inquiry- and problem-based learning among Grade 12 science students enhanced learners' interest and engagement, underscoring the significance of student-centered pedagogies in fostering active learning. In support of these findings, Camarao et al., (2024) demonstrated that senior high school The STEM students perceived the inquiry approach to be an effective method in collaborative and reflective learning despite the difficulties encountered when dealing with complex problem solving, emphasizing the importance of adequate scaffolding. The studies show that IBL and PBL enhance students' engagement, learning outcomes, and cognitive skills development at different education levels in the Philippines.

- *Cultural and Contextual Significance in Philippine Education*

Cultural and contextual relevance has emerged as a fundamental subject in modern Philippine education, especially as educational institutions strive to enhance the significance of learning for a varied student population. Recent studies highlight that education based on learners' life experiences, indigenous knowledge, and community contexts enhances engagement, identity development, and learning relevance.

A qualitative study conducted by Tamayo et al. (2025) investigated the ways in which Technical and Livelihood Education (TLE) instructors contextualize their instruction through Philippine culture and history. The authors indicated

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that educators included local languages, community-oriented projects, and indigenous knowledge into their teaching to link education with students' social contexts. It was discovered that these teaching tactics improved student engagement and cultural awareness, enabling learners to relate technical concepts to ordinary experiences. The study revealed problems such as insufficient institutional support and conflicts between standardized curriculum standards and culturally responsive teaching approaches, indicating that contextual relevance necessitates systemic improvements.

Santiago and Rabago (2025) created and verified a contextualized workbook for the Gender and Society course in Philippine higher education institutions. Their findings indicated that including local cultural elements, Filipino social issues, and student-centered activities into instructional materials markedly enhanced students' comprehension and involvement. It was contended that contextualized learning resources connect abstract theories with learners' experiences, allowing students to more effectively recognize the significance of sociological concepts within the Philippine cultural context.

Likewise, Cabiles (2025) concentrated on language instruction by creating a culturally informed module for the course Barayti at Baryasyon ng Wika. It was indicated that including students' authentic linguistic practices and viewpoints within the module improved comprehension of sociolinguistic topics and cultivated favorable attitudes towards linguistic diversity. The author highlighted that culturally pertinent materials enhance both academic success and the maintenance of cultural and language identity among Filipino pupils.

These studies collectively emphasize that cultural and contextual relevance in Philippine education extends beyond the mere incorporation of local examples; it necessitates the reconfiguration of pedagogy, materials, and curriculum to align with learners' cultural identities and lived experiences. According to Tamayo et al. (2025), contextualized pedagogy improves participation but necessitates institutional support for sustainability. Simultaneously, the studies by Santiago and Rabago (2025) and Cabiles (2025) illustrate that culturally relevant teaching materials markedly enhance comprehension, relevance, and identity validation. The literature confirms that culturally and contextually responsive education is essential for enhancing educational quality and inclusivity in the Philippines.

- *Post-Pandemic and Future-Focused Trends in Philippine Education*

The COVID-19 pandemic has transformed the educational framework in the Philippines, necessitating a reevaluation of instructional delivery, teacher training, and long-term educational objectives. Recent study reveals that post-pandemic education is defined by ongoing technological integration, a transition to future-ready competences, and the adoption of foresight-driven pedagogical methods.

A phenomenological study conducted by Alejandro et al., (2024) investigated the evolving dynamics of technology integration in higher education within Central Visayas. The authors discovered that the pandemic expedited the integration of digital resources and altered educators' pedagogical approaches from conventional classroom instruction to blended and hybrid learning models. It was indicated that educators viewed technology not solely as a transient remedy during the crisis, but as an enduring component of post-pandemic education. Nonetheless, they also recognized enduring problems, including inequitable access to digital resources, disparate levels of digital proficiency among educators, and the necessity for institutional support to maintain innovation beyond emergency remote instruction.

Picardal (2025) examined the viewpoints of prospective educators regarding their perceptions of scientific education in the post-pandemic age, specifically among pre-service science teachers in Central Visayas. The research indicated that pre-service teachers seek learning settings that prioritize modern technology, individualized and adaptive instruction, curated learning resources, and the incorporation of sustainability, ethics, and social responsibility within the scientific curriculum. It was contended that these goals signify a progressive outlook influenced by pandemic-related disruptions, indicating that teacher education programs should incorporate future-oriented competences to equip graduates for fluid and unpredictable educational environments.

Caiga et al., (2025) examined the influence of futures thinking and foresight on the innovative pedagogical approaches of pre-service elementary educators in Northwestern Philippines, thereby extending the discourse on future ready. Their research indicated that pre-service teachers exhibiting elevated levels of futures thinking were more inclined to implement new pedagogies, including customized learning, technology-enhanced education, and human-centered teaching methodologies consistent with the principles of Education 5.0. It was highlighted that strategic foresight empowers educators to predict evolving educational needs and develop instruction that is flexible, innovative, and robust.

These studies collectively suggest that post-pandemic education in the Philippines is shifting from crisis-induced technology adoption to a more intentional, forward-looking change. According to Alejandro et al. (2024), the incorporation of technology has emerged as a hallmark of the contemporary educational landscape. The studies by Picardal (2025) and Caiga et al. (2025) illustrate that the preparation of future educators necessitates the integration of foresight, adaptability, and innovation into teacher education. The literature indicates that successful post-pandemic reform must amalgamate technical innovation with futures thinking to guarantee that Philippine education remains attuned to changing societal and global demands.

III. METHODOLOGY

This section served as the roadmap for selecting, analyzing, and integrating twenty related articles on Philippine science education. This section outlines the

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research design, search phase, selection phase, and coding technique.

➢ *Research Design*

This research followed a thematic conceptual research design to explore science education in the Philippines. This integrates findings from multiple studies to develop new interpretations or theories, guided by the principles of thematic analysis. Typically, there were no statistical tools that were used in conceptual synthesis. This is because thematic conceptual synthesis is merely theoretical and interpretative. Conceptual synthesis aims to develop new theoretical frameworks by combining concepts and ideas from different sources.

➢ *Searching Phase*

This approach required a systematic process which began with thorough reading of each article. This was the initial step which extracted the key points, methodologies, and findings. This was used in this research in order to combine, analyze data and identify overall trends and effects from different studies about the emerging trends and pedagogies in science education specifically in the Philippines published between 2020 and 2025.

➢ *Selection Phase*

This focused on generating new insights based on the synthesis of different evidence by critically analyzing twenty Scopus-indexed articles published between 2020 and 2025. Searches were performed across Scopus, ERIC, Google Scholar, and ScienceDirect.

- *Using the Following Keyword Combinations:*

✓ (“inquiry- based” or “constructivist pedagogies”) and (“science education”)
✓ “STEM/ STEAM Approaches” or “interdisciplinary Learning”
✓ (“gamified learning” or “problem-based learning”) and (“science”)
✓ (“contextualized” or “culturally relevant”) and (“science teaching”)
✓ (“Technology- Enhanced Pedagogies”) and (“science education”)

➢ *Coding Technique*

A matrix was constructed to organize the extracted information including columns for each article’s details such as author, year and title, research question, methodology, key findings and identified themes. This was done to facilitate the comparison and contrast of the articles highlighting their similarities and differences in approaches and conclusions.

The data was analyzed with the completed matrix, to identify patterns and discrepancies. Consensus and disagreement among the articles were studied to determine the themes that are most prevalent or less explored. The strengths and weaknesses of each study were also critically examined in identifying possible influence on the findings. The predefined codes were sorted to group themes based on shared concepts and arguments which became the foundation of the synthesis.

IV. SYNTHESIS OF FINDINGS

The reviewed studies showed clear patterns indicating that science education in the Philippines was slowly but steadily changing. These patterns reflected a gradual but meaningful shift toward new teaching approaches, instructional strategies, and learning goals.

In Table 1, it provides an overview of the major common themes identified in the literature review, along with the focus of each theme, supporting studies, and their main findings. These themes showed how different aspects of science education reform support one another rather than functioning independently.

Table 1 Summary of Themes and Supporting Studies in Philippine Science Education.

Common Themes	Study Focus	Supporting Studies	Main Findings
Learner-centered approaches	Student autonomy, collaboration, engagement, interest	Yunzal et al. (2024); Sarsale & Langub (2023); Piamonte & Acledan (2025); Sanchez (2022)	Student-centered approaches increase interest, engagement, grit, and participation in science learning.
Technology integration and digital innovation	Digital platforms, online learning, AI, ICT tools	Colegado (2025); Mangubat (2025); Verdeflor et al. (2025); Briones et al. (2023)	Technology enhances interactivity, innovation, and personalization, but issues of access, readiness, and ethics remain.
Teacher competence and professional development	Pedagogical skills, literacy, efficacy, TPACK	Bustamante (2025); Rubia-Cunanan (2025); Walag et al. (2022); Calo & Vera (2025)	Teacher competence, scientific literacy, and professional development strongly influence student achievement and attitudes.
Inquiry-, problem-, and project-based learning	Scientific inquiry, higher-order thinking, real-world problem solving	Antonio & Prudente (2023); Bagay et al. (2023); Guerrero & Bautista (2023); Dacumos (2023)	Inquiry-, problem-, and project-based strategies improve critical thinking, problem-solving skills, and scientific processes.
Cultural and contextual relevance in science education	Indigenous knowledge, localized teaching, culturally	Magnaye (2025); Tañedo et al. (2024); Laid & Adlaon (2025)	Integrating indigenous and local contexts improves relevance, inclusivity, cultural resilience, and

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	responsive pedagogy		learner engagement.
Post-pandemic and future-oriented trends in Philippine science education	Blended learning, resilience, future readiness	Picardal (2025); Laid & Adlaon (2025)	Post-pandemic practices support flexibility, innovation, resilience, and preparedness for future science education challenges.

One major theme was learner-centered approaches, which focused on students being active in class rather than just listening to the teacher. Studies by Yunzal et al. (2024), Sarsale and Langub (2023), Piamonte and Acledan (2025), and Sanchez (2022) showed that when students worked together, shared ideas, asked questions, and participated in activities, they became more interested and motivated in learning science. This approach helped students understand lessons better and enjoy learning.

Another important theme was inquiry-, problem-, and project-based learning. Studies by Antonio and Prudente (2023), Bagay et al. (2023), Guerrero and Bautista (2023), and Dacumos (2023) explained that students learned science better when they investigated problems, conducted experiments, and worked on real-life projects. Instead of memorizing facts, students learned how to think critically, solve problems, and apply science concepts to real situations.

The theme of technology integration and digital innovation highlighted the use of digital tools such as online platforms, ICT, and artificial intelligence in science education. Studies by Colegado (2025), Mangubat (2025), Verdeflor et al. (2025), and Briones et al. (2023) showed that technology made learning more interactive and engaging. It also allowed personalized learning and flexible study schedules. However, these studies also pointed out challenges like limited internet access, lack of devices, and the need for proper training for teachers and students.

Teacher competence and professional development was another key theme. Studies conducted by Bustamante (2025), Rubia-Cunanan (2025), Walag et al. (2022), and Calo and Vera (2025) emphasized that well-trained and knowledgeable teachers were very important for student success. When teachers had strong teaching skills, good content knowledge, and received continuous training, they were able to deliver lessons more effectively and improve students' performance and attitudes toward science.

Additionally, the theme related to cultural and contextual relevance pointed out that studies by Magnaye (2025), Tañedo et al. (2024), and Laid and Adlaon (2025) proved the positive effects of using local examples and indigenous knowledge in science education. It made lessons more contextualized and relevant in relation to the students' environment and culture.

Finally, one of the themes in Philippine science education researches referred to post-pandemic trends and futuristic approaches in science education. The studies by Picardal (2025) and Laid and Adlaon (2025) discussed blended learning as an effective approach to preparing the educational system for the challenges associated with COVID-19 pandemic.

Hence, blended learning can improve teachers' and students' resilience and help develop sustainable learning strategies. In conclusion, according to the above mentioned literature review and synthesis, science education in the Philippines was moving away from the teacher-oriented and memorization-based approach to teaching science towards the learner-centered, inquiry, technology-enriched, and culturally meaningful approach to science teaching. Further progress in science education will largely depend on strong support provided for teachers, appropriate accessibility to technology resources, and innovative education policies.

V. DISCUSSION

It became evident that science education in the Philippines experienced extensive interconnected transformations related to different aspects of teaching and learning process. In particular, approaches to science teaching, utilization of technology, teacher readiness for innovation, and cultural relevance are no longer viewed separately. All these aspects are closely connected and contribute to the development of comprehensive teaching methodologies that promote more effective acquisition of knowledge. There is clearly seen transition from the traditional approach when lectures played a dominant role to the learner-centered one. Such trend can be depicted in Figure 1.

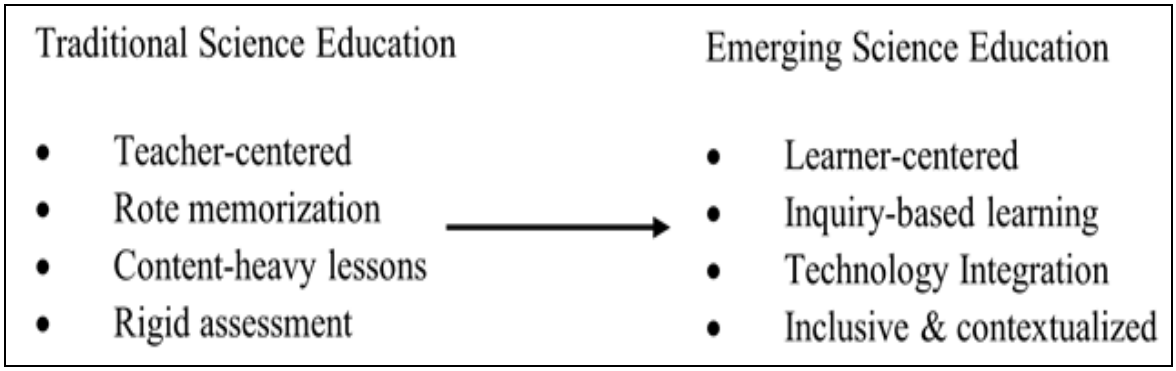

Fig 1 Paradigm Shift in Philippine Science Education.

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Although learner-centered teaching was becoming more common, technology mainly supports learning rather than leads it. Digital tools such as online platforms and interactive materials can make science lessons more interesting and flexible. However, these tools were only effective when teachers know how to use them effectively and when students have equal access. As summarized in Table 2, several factors helped improve science education, such as becoming learner centered, inquiry-based teaching problem and project-based learning, using of digital tools, professional development for teachers, integration of local culture to classroom settings, and blended and flexible learning models. At the same time, many challenges remain, including strict curricula, exam-focused teaching, lack of devices and internet access, heavy teacher workload, and limited localized learning materials.

Table 2 Enablers and Challenges in Implementing Innovative Science Pedagogies

Area	Enablers	Challenges
Pedagogy	Learner-centered and inquiry-, problem-, and project-based learning strategies	Rigid curriculum, exam-oriented practices
Technology	Digital tools, online platforms	Digital divide, limited infrastructure
Teachers	Professional development programs	Insufficient training, heavy workload
Contextualization	Local and indigenous knowledge integration	Lack of localized teaching materials
Post-pandemic readiness	Blended and flexible learning models	Sustainability and access issues

Hence, teacher competence remains one of the most important factors in successful science education. Teachers needed continuous training to help the learning guide inquiry-based activities, use technology properly, and respect students' cultural backgrounds. Without enough training, time, and support, even good teaching strategies may not result in better learning outcomes for students.

Inquiry-based, problem-based, and project-based learning approaches help students use science knowledge in real-life situations. These methods encouraged students to think critically, solve problems, and understand how science works in everyday life. However, their use was often limited by rigid curricula and assessment systems that focused more on exams than understanding. At the same time, making lessons culturally and contextually relevant helps ensure that science education is meaningful and inclusive. When lessons are connected to students' experiences, culture, and community, students become more engaged and interested in learning.

As shown in Figure 2 in the next page, learner-centered approaches, technology integration, teacher competence, inquiry-, problem-, project-based learning, cultural relevance, and readiness for the future were all connected parts of one system, not separate reforms. These connections became especially clear during and after the COVID-19 pandemic, which showed the importance of flexible and resilient education systems that can adapt to change.

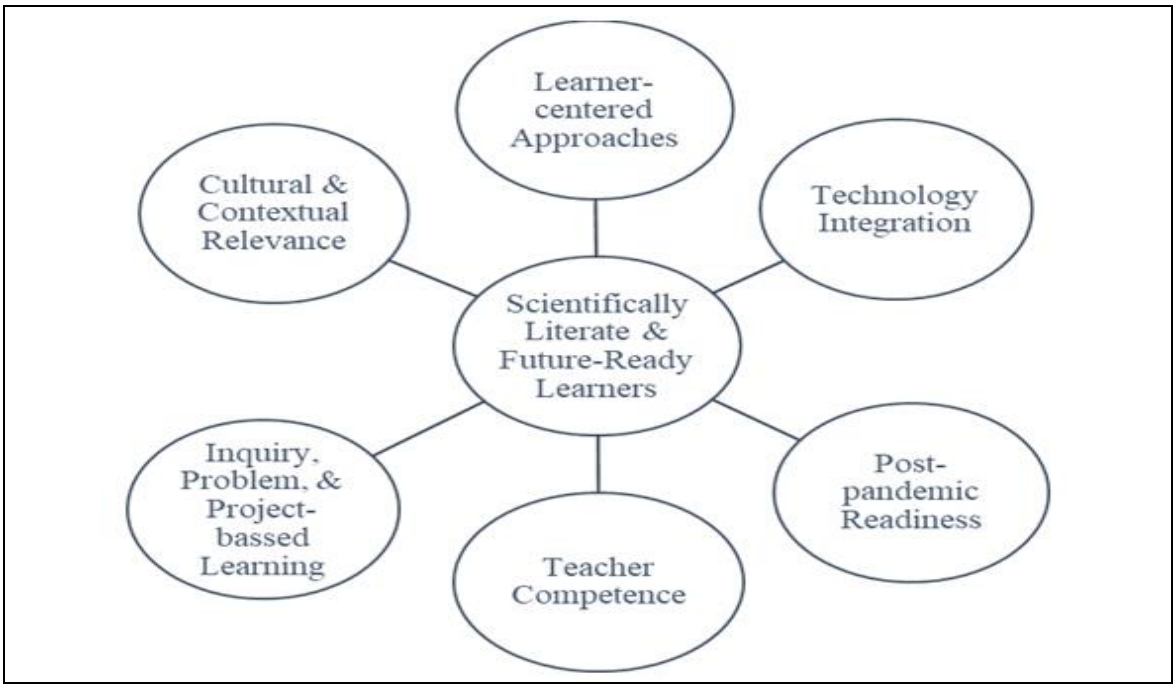

Fig 2 Interconnected Elements of Innovative Science Pedagogy

In summary, science education in the Philippines is moving toward a more integrated and future-ready approach. Real and lasting improvement depends on strong support systems, continuous teacher development, inclusive teaching practices, and fair access to learning resources. This direction is important for developing students who are scientifically literate, adaptable, and socially responsible.

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VI. CONCLUSION

This synthesis paper explores the evolving pedagogical strategies in science education in the Philippines based on the integration of twenty studies indexed in Scopus, which were conducted between 2020 and 2025. Through this review, a significant evolution in the teaching of science was evident, moving from a more conventional, teacher-oriented, and memory-driven approach towards a pedagogy that is more centered around the learner, based on inquiry, facilitated by technology, and culturally responsive. This indicates an increasing appreciation for nurturing scientifically literate, critical thinkers, and adaptive individuals.

Consistently throughout the studies reviewed, learner-centered instruction stood out as one of the essential components of an effective science education program. Active participation on the part of the learners through collaborative learning, inquiry, and experiential activities led to greater knowledge acquisition, motivation, and engagement. The integration of technology and digital innovations also added a positive influence on learning; however, the efficacy was contingent upon equal access to digital materials and the capacity of the teachers to employ the technology effectively.

Inquiry-based, problem-based, and project-based learning approaches supported the development of critical thinking, problem-solving skills, and scientific processes by connecting classroom learning to real-world and community-based contexts. Similarly, culturally and contextually relevant instruction strengthened inclusivity and relevance by linking scientific concepts to students' lived experiences, local knowledge, and indigenous practices. The COVID-19 pandemic served as a catalyst for pedagogical innovation, highlighting the importance of flexibility, resilience, and blended learning models while also exposing persistent challenges related to access, infrastructure, and sustainability. In summary, the synthesis clearly shows that reforms in science education will not be achieved through fragmented interventions. On the contrary, reforms can only be realized through an approach that is systemic and holistic in nature. The integration of teaching methods, technology, teachers' professional development, and relevance to culture must be emphasized to enhance science education. This will prepare Filipino students for scientific literacy and social responsibility in the face of future challenges.

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