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Making Science Meaningful: A Phenomenological Inquiry into Teachers' Pedagogical Practices in a Philippine Private Montessori School

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ABSTRACT

Science education becomes meaningful when learners are provided opportunities to connect scientific concepts with observation, experimentation, inquiry, everyday experiences, and authentic problems. Within Montessori-oriented learning environments, science pedagogy may further emphasize learner independence, concrete experiences, exploration, purposeful activity, and teacher facilitation. This qualitative descriptive phenomenological study explored teachers' lived experiences of implementing pedagogical practices that made science meaningful in a Philippine private Montessori school. Specifically, it examined how teachers translated abstract scientific concepts into understandable learning experiences, facilitated inquiry and hands-on activities, connected science with learners' everyday lives, responded to differences in learners' abilities and interests, and reflected on challenges encountered in science instruction. Participants consisted of purposively selected teachers with direct experience teaching science or facilitating science-related learning activities. Data were generated through semi-structured, in-depth interviews and analyzed using Colaizzi's descriptive phenomenological method. The inquiry was theoretically informed by constructivist learning, experiential learning, inquiry-based science education, and Montessori principles while allowing meanings and themes to emerge from participants' narratives. The study conceptualized meaningful science pedagogy as a dynamic interaction among scientific content, learner experience, pedagogical facilitation, and teacher reflection. The findings offer implications for learner-centered science teaching, professional development, experiential instruction, and the contextualization of science within private Montessori-oriented educational environments.

Keywords: experiential learning, inquiry-based learning, Montessori education, phenomenology, science education, science pedagogy, teacher experiences

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1. Introduction

Science education is fundamental to developing learners who can observe phenomena, ask meaningful questions, evaluate evidence, solve problems, and make informed decisions. Effective science instruction therefore extends beyond memorizing scientific terminology, principles, and processes. It involves helping learners understand how scientific knowledge explains phenomena encountered in everyday life.

Science, however, contains concepts that can be difficult for learners because many scientific processes cannot be directly observed or easily connected with prior experience. Teachers consequently occupy a critical position in transforming abstract scientific ideas into meaningful learning experiences.

Constructivist perspectives emphasize that learners actively construct knowledge by connecting new information with prior understanding and experience (Vygotsky, 1978). Science teaching from this perspective requires more than information transmission. Teachers facilitate experiences through which learners investigate, question, manipulate materials, discuss observations, interpret evidence, and reconstruct existing understandings.

Experiential learning similarly provides a relevant perspective. Kolb (1984) proposed that learning develops through the transformation of experience involving concrete experience, reflective observation, abstract conceptualization, and active experimentation. Science provides considerable opportunities for such learning through experimentation, observation, demonstrations, field experiences, model construction, and practical problem-solving.

Inquiry-based science education further emphasizes learners' participation in processes associated with scientific investigation. Rather than receiving predetermined explanations exclusively from teachers, learners can formulate questions, investigate phenomena, gather evidence, interpret findings, and communicate explanations. Such practices potentially make science meaningful because students experience science as a process of inquiry rather than merely a collection of facts.

These principles have particular relevance within Montessori-oriented education. Montessori pedagogy traditionally emphasizes purposeful activity, concrete learning experiences, learner independence, carefully prepared learning environments, observation, and teachers' facilitative roles (Lillard, 2017). While implementation can vary among schools using the Montessori designation, these principles provide a potentially rich context for examining how teachers make science accessible and meaningful. Kolb (1984) argued that experience becomes educationally meaningful when learners reflect upon and transform it into understanding. Consequently, hands-on science should involve not merely manipulating materials but predicting, observing, explaining, questioning, and reflecting.

Understanding science pedagogy within such settings requires attention to teachers' actual experiences. Teachers continuously make decisions regarding when to explain, demonstrate, question, provide materials, allow exploration, intervene, differentiate activities, and connect concepts with learners' experiences.

Quantitative studies can determine relationships between teaching strategies and achievement, but they provide less insight into what teachers experience while attempting to make science meaningful, how they interpret learners' responses, why they modify instruction, and what professional meanings they derive from these experiences.

This study therefore employed a phenomenological approach to examine science teaching through the lived experiences of teachers in a Philippine private Montessori school.

Research Objectives

The study aimed to explore teachers' lived experiences of implementing pedagogical practices that made science meaningful within a Philippine private Montessori school. Specifically, it sought to describe teachers' experiences of teaching science within a Montessori-oriented learning environment; identify the pedagogical practices they employed to make abstract scientific concepts understandable; examine their use of experiments, demonstrations, observations, inquiry, and other experiential activities in science instruction; explore how they connected scientific concepts with learners' everyday experiences and environments; determine how they encouraged curiosity, questioning, exploration, and learner independence; describe how they responded to differences in learners' prior knowledge, interests, abilities, and learning needs; identify the challenges they encountered in implementing meaningful and experiential science instruction; examine how they adapted their pedagogical practices in response to learners' reactions and classroom circumstances; and explore the professional meanings and insights they derived from their experiences of teaching science.

Theoretical and Conceptual Foundations

The study was anchored in Constructivist Learning Theory, Experiential Learning Theory, Inquiry-Based Science Education, and Montessori educational principles. Constructivism conceptualizes learners as active participants in knowledge construction rather than passive recipients of information. Drawing from Vygotsky (1978), meaningful science learning was understood as developing through interaction, prior knowledge, guided participation, and appropriately scaffolded experiences. This perspective was particularly relevant because scientific understanding often requires learners to reconcile previous beliefs with evidence emerging from observation and investigation. Complementing constructivism, Kolb's (1984) Experiential Learning Theory conceptualizes learning as a cycle of Concrete Experience → Reflective Observation → Abstract Conceptualization → Active Experimentation. Science instruction provides opportunities for this process when learners observe phenomena, conduct activities, reflect on outcomes, develop explanations, and test emerging understanding. The study was also informed by inquiry-based science education, which emphasizes questioning, evidence gathering, investigation, interpretation, and explanation as important components of scientific learning. Montessori educational principles provided an additional contextual lens through their emphasis on concrete experiences, purposeful activity, learner independence, observation, and prepared learning environments (Lillard, 2017). These frameworks served as sensitizing concepts rather than predetermined themes. Conceptually, meaningful science teaching was viewed as an iterative interaction represented by Scientific Concept ↔ Learning Experience ↔ Learner Response ↔ Teacher Reflection ↔ Pedagogical Adaptation. Teachers translated scientific content into learning experiences, observed how learners responded, reflected on the quality of understanding and participation, and subsequently maintained, modified, scaffolded, or redesigned their pedagogical

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approaches. Meaningful science learning was therefore understood as a dynamic and relational process created through the interaction of scientific knowledge, learner experience, pedagogical facilitation, and reflective teaching.

Research Gap

Existing research has extensively examined inquiry-based learning, constructivist science teaching, experiments, student achievement, and science engagement. However, three gaps justified the present investigation.

First, many studies have examined science pedagogy quantitatively by measuring learning outcomes or comparing instructional strategies. Such designs provide valuable evidence but may not fully explain teachers' lived experiences of making scientific concepts meaningful.

Second, pedagogical approaches are frequently examined separately, although teachers may combine explanation, demonstration, inquiry, experimentation, questioning, contextualization, and differentiation within the same lesson.

Third, relatively limited phenomenological scholarship has examined teachers' experiences of science pedagogy specifically within a Philippine private Montessori-oriented school context.

The study therefore moved beyond asking which strategy was most effective and instead examined how teachers experienced the process of transforming scientific content into meaningful learning experiences.

Methodology

The study employed a qualitative descriptive phenomenological design to explore teachers' lived experiences of implementing pedagogical practices in science within a Philippine private Montessori school. Phenomenology was appropriate because the inquiry sought to understand how teachers experienced, interpreted, and assigned meaning to their science-teaching practices rather than measure predetermined variables or test causal relationships.

Participants consisted of teachers with direct experience teaching science or facilitating science-related learning experiences within the selected school. Purposive criterion sampling was employed to identify information-rich participants. Participants had sufficient teaching experience to reflect meaningfully on science pedagogy, had facilitated practical or inquiry-oriented science activities, and voluntarily consented to participate. Sample adequacy was guided by information power and thematic sufficiency rather than adherence to a rigid numerical target.

Data were generated through semi-structured, in-depth interviews. Interviews lasted approximately 45–60 minutes and were audio-recorded with participants' informed consent before being transcribed verbatim. Participants were encouraged to describe specific teaching experiences rather than provide generalized statements about preferred strategies. Questions explored experiences of teaching difficult scientific concepts, experiments and demonstrations, inquiry, learner questioning, contextualization, differentiated instruction, Montessori-oriented practices, classroom challenges, and pedagogical adaptation.

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Interview prompts included questions such as: *"Can you describe a science lesson that became particularly meaningful to your learners?"; "How did you make difficult or abstract concepts understandable?"; "What happened when students were allowed to investigate or experiment?"; "How did you respond when learners held misconceptions?"; "How did you connect science with students' everyday experiences?"; and "What did your experiences teach you about effective science teaching?"*

Data were analyzed using Colaizzi's descriptive phenomenological method. The researcher repeatedly read the transcripts, extracted significant statements related to science pedagogy, formulated meanings, clustered related meanings into themes, developed an exhaustive description of the phenomenon, and synthesized its fundamental structure. Where feasible, participants were invited to reflect on the synthesized interpretations. The analytical process followed: Familiarization → Significant Statements → Formulated Meanings → Theme Clusters → Exhaustive Description → Fundamental Structure → Participant Reflection.

Researcher reflexivity was maintained through a reflexive journal documenting assumptions, analytical decisions, and potential biases. Bracketing was practiced throughout data collection and analysis to ensure that participants' accounts remained central to interpretation.

Trustworthiness was addressed through credibility, transferability, dependability, and confirmability. Credibility was strengthened through in-depth interviews, probing, prolonged engagement with transcripts, and peer examination. Thick description supported transferability, an audit trail strengthened dependability, and reflexive documentation and explicit links between evidence and interpretation supported confirmability.

Ethical clearance and institutional authorization were secured before data collection. Participation was voluntary and based on informed consent. Codes such as ST01, ST02, and ST03 replaced participants' names. Identifying information involving learners, colleagues, administrators, or other individuals was removed or generalized. Interview recordings and transcripts were securely stored, and participants retained the right to decline questions or withdraw without penalty.

Results and Discussion

The phenomenological analysis generated seven interconnected themes that captured teachers' experiences of making science meaningful within a private Montessori-oriented learning environment. These were: (1) Seeing Science Come Alive: Learning Through Concrete Experience; (2) Questions Before Answers: Curiosity as the Beginning of Science; (3) From Everyday Life to Scientific Meaning: Making the Familiar Explainable; (4) Guide, Then Step Aside: Balancing Teacher Support and Learner Independence; (5) Different Learners, Different Pathways: Adapting Science Pedagogy; (6) Creating Science from What Is Available: Resourcefulness in Practice; and (7) Teaching, Watching, Rethinking: Science Teachers as Reflective Practitioners. Collectively, these themes revealed that meaningful science teaching was experienced not as the delivery of scientific information but as a continuing process of translating abstract ideas into experiences that learners could observe, question, investigate, connect with their lives, and eventually understand.

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Theme 1. Seeing Science Come Alive: Learning Through Concrete Experience

Participants described hands-on activities, experiments, demonstrations, and direct observations as particularly meaningful aspects of science instruction. Teachers observed that concepts that initially appeared abstract became more understandable when learners were allowed to see scientific processes occur or manipulate materials themselves.

One participant described how experimentation changed learners' understanding:

ST01: "There are concepts that are difficult for the children when I only explain them. But when they actually perform the experiment and see what happens, they understand better. Sometimes they suddenly say, 'Oh, that is why it happens.' That moment tells me that the activity helped them connect the explanation with what they actually saw."

Another teacher emphasized how practical experiences generated curiosity:

ST04: "When I bring materials for an experiment, you can already see their excitement. They want to touch the materials and know what will happen. After the experiment, they have more questions because they have actually observed the result instead of simply reading about it."

A third participant explained that concrete experience also helped learners remember scientific ideas:

ST07: "They remember the lesson longer when they experience it. Sometimes, weeks later, I ask about the concept and they refer back to the experiment we did. The activity becomes something they can connect with the scientific explanation."

The participants' experiences suggested that science became more meaningful when learners encountered scientific concepts through concrete phenomena. Instead of merely receiving information, learners generated understanding from observations and experiences.

This finding strongly reflects Kolb's (1984) Experiential Learning Theory, which proposes that concrete experience can serve as the foundation for reflection, conceptualization, and further experimentation. However, the narratives also indicated that hands-on activities alone were insufficient. Teachers needed to encourage learners to interpret what they observed and connect the outcome with scientific principles. The finding is also consistent with Dewey's (1938) argument that educational experiences become meaningful when learners actively interact with their environment and subsequently reflect upon those experiences.

The process emerging from the participants' narratives may therefore be represented as:

Experience → Observation → Reflection → Explanation → Understanding

The findings consequently distinguished between merely doing science activities and learning science through activities. Meaningful pedagogy required teachers to connect concrete experience with conceptual explanation.

Theme 2. Questions Before Answers: Curiosity as the Beginning of Science

Participants also emphasized the importance of learner questioning. Teachers described curiosity as an indication that students were beginning to engage more deeply with scientific phenomena.

One participant explained:

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ST02: "Sometimes during an experiment, the children ask questions that are not even in my lesson plan. They ask why something changed or what would happen if we used another material. I like those questions because they show that the learners are thinking beyond what I have explained."
Another participant described deliberately withholding immediate answers:
ST06: "When they ask me why something happened, I do not always give the answer immediately. Sometimes I ask them, 'What do you think happened?' or 'How can we find out?' If I give the answer right away, the discussion ends. If I return the question to them, they start giving different explanations."
Another teacher highlighted how curiosity could generate further investigation:
ST09: "There are times when one question leads to another activity. The students become interested in testing whether their idea is correct. For me, that is when science becomes exciting because they are no longer waiting for me to give everything."
The narratives positioned curiosity as the beginning of scientific inquiry. Teachers interpreted learner-generated questions not as interruptions but as evidence of emerging scientific thinking.
Inquiry-based science education similarly emphasizes questioning, evidence, investigation, and explanation as essential components of scientific learning. The National Research Council (2000) emphasized that inquiry involves learners in asking scientifically oriented questions, gathering evidence, developing explanations, and communicating their reasoning.
The findings also suggested an important transformation in the teacher's role. Rather than functioning exclusively as the person who possessed correct answers, teachers became facilitators who encouraged learners to investigate possibilities.
The pedagogical movement was therefore:
Question → Prediction → Investigation → Evidence → Explanation
The finding demonstrated that meaningful science pedagogy sometimes required teachers to resist the temptation to provide immediate answers. A productive question could have greater educational value than a quickly supplied explanation because it encouraged learners to reason scientifically.

Theme 3. From Everyday Life to Scientific Meaning: Making the Familiar Explainable

Teachers repeatedly described connecting science lessons with learners' everyday experiences. Familiar phenomena provided accessible entry points for understanding scientific concepts.
One participant shared:
ST03: "When we discuss evaporation, I do not start only with the definition. I ask them what happens to wet clothes when they are placed under the sun. They already know that the clothes become dry, so from that experience we begin talking about what happens to the water."
Another participant explained:
ST08: "Science becomes easier when they can relate it to something they see at home. If we talk about plants, food, water, electricity, or weather, I ask them first about their own observations. They become more interested because they realize that the lesson is something they experience every day."
A third teacher described how contextualization changed students' perception of science:
ST11: "Some learners think science is only about difficult words in the book. When we connect it with

what happens around them, they realize that science is everywhere. Then the lesson does not feel as difficult."

The participants' accounts demonstrated the importance of contextualization as a bridge between prior experience and scientific explanation. Everyday phenomena gave learners something familiar from which more abstract scientific concepts could be developed.

This interpretation corresponds with constructivist perspectives emphasizing that learners interpret new information through existing knowledge and experiences (Vygotsky, 1978). Contextualized instruction can therefore help teachers identify what learners already understand and progressively introduce more formal scientific explanations.

The teachers' experiences suggested a movement from:

Familiar Experience → Scientific Question → Conceptual Explanation → New Understanding

The finding revealed that science became meaningful when learners recognized its explanatory power in their own lives. Effective contextualization transformed the perception that:

"Science is something in my textbook"

into:

"Science explains what happens around me."

Theme 4. Guide, Then Step Aside: Balancing Teacher Support and Learner Independence

Another prominent theme concerned teachers' efforts to balance instructional guidance with learner autonomy. Within the Montessori-oriented environment, participants described providing initial support and subsequently allowing learners greater independence.

One participant explained:

ST05: "I usually explain the basic instructions and safety reminders first, but I do not want to control every step. Once they understand what they need to do, I allow them to explore. Sometimes they discover something I did not expect them to notice."

Another teacher described knowing when intervention was necessary:

ST09: "There are students who can continue after one demonstration, while others still need guidance. I observe first. If I see that they are struggling and becoming frustrated, that is when I step in. But if they are solving the problem on their own, I allow them to continue."

A third participant emphasized independence:

ST02: "If we always tell them exactly what to do, they become dependent on the teacher. I want them to learn how to think and decide. Of course, we guide them, but eventually they should be able to work without waiting for every instruction."

The narratives revealed a delicate balance between scaffolding and autonomy. Teachers did not interpret learner-centered instruction as the complete withdrawal of teacher guidance. Instead, they adjusted the amount of assistance according to learners' emerging competence.

This finding reflects Vygotsky's (1978) emphasis on guided learning and also resonates with Montessori principles concerning independence, purposeful activity, and the teacher's role as an observer and facilitator (Lillard, 2017).

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The pedagogical progression can be represented as:
Teacher Guidance → Supported Exploration → Developing Competence → Reduced Assistance → Learner Independence
Importantly, teachers appeared to regard observation as a pedagogical act. Knowing when not to intervene was sometimes as important as knowing when to provide assistance.

Theme 5. Different Learners, Different Pathways: Adapting Science Pedagogy

Participants recognized that learners did not understand scientific concepts at the same pace or through identical instructional approaches. Differences in prior knowledge, confidence, interests, language, and learning preferences required teachers to modify their pedagogy.
One participant explained:
ST07: "Some learners understand when I explain verbally, but others need to see something before they understand. There are also learners who need to perform the activity themselves. That is why I cannot depend on only one way of teaching."
Another participant described providing additional scaffolding:
ST10: "When I notice that a learner is still confused, I try another example or use a simpler material. Sometimes I pair the learner with someone who already understands. I learned that repeating the same explanation in the same way does not always solve the problem."
Another teacher added:
ST03: "There are fast learners who immediately want another challenge, while some still need time with the first activity. I have to find a way to support those who need help without stopping those who are ready to move forward."
The theme illustrated the importance of adaptive and differentiated science pedagogy. Participants did not interpret differences in learning exclusively as deficiencies among students. Instead, learner variation prompted teachers to reconsider representations, examples, materials, grouping, pacing, and levels of support.
The finding complements constructivist and scaffolded approaches to learning, which emphasize building instruction from learners' existing understanding and providing appropriate assistance.
A particularly important professional shift emerged from the narratives. The central question moved from:
"Did I teach the lesson?"
toward:
"How did different learners experience and understand the lesson?"
This shift positions successful teaching not simply as curriculum delivery but as responsiveness to evidence of learner understanding.

Theme 6. Creating Science from What Is Available: Resourcefulness in Practice

Teachers also described resource availability as influencing how they implemented science activities. Although some lessons ideally required specialized materials or equipment, participants reported finding

alternative ways to make scientific phenomena observable.
One participant stated:
ST04: “There are experiments we want to do, but sometimes we do not have all the materials or equipment. We have to think of alternatives because I do not want the lesson to remain only in the textbook.”
Another participant explained:
ST11: “I use materials that are available at home or around the school whenever possible. Bottles, containers, plants, water, recycled materials—many simple things can be used to demonstrate scientific concepts if you plan the activity carefully.”
Another teacher emphasized that improvisation itself could make science relatable:
ST06: “Sometimes using ordinary materials is actually helpful because students realize that they can explore science even outside school. They do not always need expensive laboratory equipment to become curious.”
The findings positioned teacher resourcefulness as pedagogical adaptation. Participants attempted to preserve experiential science learning despite material limitations by using household objects, recycled materials, locally accessible resources, models, demonstrations, and alternative activities.
This practice aligned with experiential and contextualized perspectives because familiar materials can bring scientific investigation closer to learners’ everyday environments.
Nevertheless, an important distinction emerged. Resourcefulness should not be interpreted as evidence that adequate science facilities are unnecessary. Improvised materials may effectively demonstrate certain phenomena, but specialized equipment remains essential for particular competencies, precise measurements, safety requirements, and more advanced investigations.
Thus: Resourcefulness extended pedagogical possibilities, but it did not eliminate the importance of adequate educational resources.

Theme 7. Teaching, Watching, Rethinking: Science Teachers as Reflective Practitioners

The final theme concerned teachers’ willingness to modify instruction when lessons did not generate the understanding they expected. Participants described reflection as an integral part of their teaching practice.
One participant shared:
ST06: “There are lessons that look very good when I prepare them, but when I teach them, the students do not understand as I expected. Instead of blaming them, I ask myself what I need to change.”
Another teacher described responding during the lesson:
ST12: “If I see confused faces, I know I cannot just continue because it is in the lesson plan. Sometimes I stop, use another example, demonstrate again, or ask them what part is confusing.”
Another participant discussed reflection after instruction:
ST08: “After the lesson, I think about which part worked and which did not. Sometimes I realize that I explained too much and did not give them enough time to explore. I use that realization when I teach the topic again.”
Interpretation

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This theme portrayed meaningful science teaching as an iterative and reflective process. Teachers observed learners' questions, misconceptions, expressions, participation, and performance and treated these responses as evidence about the effectiveness of their instruction.

The process emerging from the narratives can be represented as:

Teach → Observe → Interpret → Reflect → Adapt → Re-teach

This finding resonates with Schön's (1983) concept of the reflective practitioner, particularly reflection-in-action and reflection-on-action. Teachers sometimes adjusted instruction while teaching and, at other times, reflected afterward to improve subsequent lessons.

Significantly, participants did not automatically interpret unsuccessful learning as learner failure. They also examined their own pedagogical choices.

This represents an important feature of professional practice: when learners struggled, reflective teachers reconsidered not only the learner but also the teaching.

7.1 Essence of the Lived Experience: Making the Invisible Visible and the Abstract Meaningful

Across the seven themes, the essence of teachers' lived experiences was captured by their continuous effort to make scientific ideas visible, experienceable, understandable, and personally meaningful to learners.

The findings demonstrated that no single pedagogical strategy accomplished this purpose. Meaningful science learning emerged through the interaction of concrete experience, curiosity, inquiry, contextualization, scaffolding, learner autonomy, differentiation, resourcefulness, and teacher reflection.

The phenomenon may be synthesized as:

Experience → Curiosity → Inquiry → Explanation → Application → Meaning

First, concrete experiences allowed learners to encounter scientific phenomena directly. These experiences stimulated curiosity and questions. Questions subsequently created opportunities for inquiry, investigation, and evidence-based explanation. Scientific explanations became more meaningful when connected with learners' everyday experiences, while teacher guidance enabled learners to progress toward greater independence. Differences among learners required pedagogical adaptation, and resource limitations encouraged teachers to develop creative alternatives. Throughout this process, reflection enabled teachers to evaluate whether their approaches were actually producing understanding.

The findings also revealed the fluidity of the science teacher's role. At different moments, participants became explainers, demonstrators, questioners, observers, facilitators, scaffolders, resource developers, and reflective practitioners. Effective science pedagogy therefore did not involve choosing between teacher-directed and learner-centered instruction as absolute opposites. Rather, teachers moved between these roles according to learners' needs and the demands of the scientific concept.

This experience reflected broader constructivist and experiential perspectives. Kolb (1984) emphasized the transformation of experience into learning, while Vygotsky (1978) highlighted the importance of interaction and guided participation. Montessori-oriented principles further emphasized concrete experiences, observation, independence, and purposeful activity (Lillard, 2017). Inquiry-based science education complemented these perspectives by positioning questions, evidence, investigation, and explanation at the center of scientific meaning-making.

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The essence of the phenomenon was therefore not simply making science entertaining. Enjoyment could encourage participation, but meaningful science pedagogy required something deeper: learners needed opportunities to connect what they observed with what they thought, what they questioned with what they investigated, and what they learned in school with what they experienced in life.
Ultimately, making science meaningful involved transforming the learner's experience from:
"The teacher told me this is true"
toward:
"I observed it, questioned it, investigated it, and now I understand why it happens."
This transformation captured the central meaning of the teachers' experiences: science became meaningful when learners were enabled to move from receiving scientific information toward actively constructing scientific understanding.

8. Implications for Science Education

The findings may provide several implications for science pedagogy. First, science instruction should provide sustained opportunities for hands-on and minds-on experiences, ensuring that experimentation is accompanied by questioning, explanation, and reflection. Second, teachers should cultivate classrooms in which learner questions are treated as resources for inquiry rather than interruptions to instruction. Third, contextualization should connect scientific concepts with learners' everyday environments and experiences. Fourth, Montessori-oriented science pedagogy should maintain an appropriate balance between learner autonomy and instructional scaffolding. Fifth, professional development should strengthen teachers' capacity for differentiation, inquiry facilitation, questioning, formative assessment, and reflective adaptation. Finally, schools should provide appropriate materials, equipment, spaces, and professional support so that teacher creativity complements rather than substitutes for adequate science-learning resources.

Conclusion

This phenomenological inquiry examined science pedagogy through teachers' lived experiences within a Philippine private Montessori school. It conceptualized meaningful science teaching as a process through which teachers transformed abstract scientific content into experiences that learners could observe, investigate, question, interpret, and connect with everyday life.
The study emphasized that meaningful science pedagogy cannot be reduced to experimentation alone. Effective teaching required teachers to connect concrete experiences with conceptual understanding, encourage curiosity, scaffold inquiry, support learner independence, differentiate instruction, contextualize scientific ideas, and continuously reflect on learner responses.
Within a Montessori-oriented environment, the teacher's role was therefore neither completely directive nor completely passive. Teachers created and facilitated conditions within which learners could increasingly assume responsibility for exploration and meaning-making.
Ultimately, making science meaningful involved helping learners move from knowing scientific

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information toward seeing science as a way of understanding the world around them.

Limitations and Future Research

As a qualitative phenomenological investigation conducted within a particular private-school context, the study did not seek statistical generalization. Findings represented teachers' interpretations of their pedagogical experiences and were influenced by the educational context in which those experiences occurred.

Because the study centered teachers' perspectives, future research could investigate students' lived experiences of Montessori-oriented science instruction. Comparative qualitative studies could also examine science pedagogy across Montessori and conventional private or public schools. Classroom observations, learner artifacts, and reflective journals could be integrated with interviews to provide additional perspectives on how meaningful science learning develops in practice.

utional policies, and applicable data-privacy requirements.

References

Bybee, R. W. (2015). *The BSCS 5E instructional model: Creating teachable moments*. National Science Teachers Association Press.

Colaizzi, P. F. (1978). Psychological research as the phenomenologist views it. In R. S. Valle & M. King (Eds.), *Existential-phenomenological alternatives for psychology* (pp. 48–71). Oxford University Press.

Dewey, J. (1938). *Experience and education*. Macmillan.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning. *Educational Psychologist, 42*(2), 99–107.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Lillard, A. S. (2017). *Montessori: The science behind the genius* (3rd ed.). Oxford University Press.

National Research Council. (2000). *Inquiry and the National Science Education Standards: A guide for teaching and learning*. National Academies Press.

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