

# Differentiated Instruction to Stimulate Multiple Intelligences in Early Childhood Science Learning: A Phenomenological Study in Inclusive Kindergartens

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Received: Februari 18, 2026

Revised: May 4, 2026

Accepted: May 25, 2026

## Abstract

Early childhood science learning in inclusive kindergarten classrooms requires pedagogical practices that are responsive to children's differences in readiness, interests, communication modes, sensory needs, and ways of demonstrating understanding. However, empirical accounts of how teachers translate differentiated instruction into daily science activities while stimulating children's multiple intelligences remain limited. This phenomenological study explored the lived experiences of four kindergarten teachers in implementing differentiated instruction to support early science learning in an inclusive kindergarten. Data were collected through participatory classroom observation, semi-structured interviews, and document analysis of lesson plans, children's learning products, portfolios, and progress notes. The data were analyzed through phenomenological procedures involving repeated reading, horizontalization, meaning-unit coding, clustering of themes, and synthesis of textural and structural descriptions. Five essential themes emerged: responsive planning based on children's interests and needs, multisensory inquiry as process differentiation, flexible representation of learning products, adaptive classroom ecology and peer support, and continuous teacher reflection as real-time pedagogical adjustment. The findings indicate that differentiated science instruction was not implemented as a separate program, but as a dynamic pedagogical stance through which teachers adjusted content, process, product, and learning environment. Multiple intelligences functioned as a practical lens for recognizing children's diverse strengths, while hands-on science activities provided an inclusive space for observation, prediction, classification, questioning, communication, and collaboration. This study contributes to early childhood science education by showing how differentiation, inclusive pedagogy, and multiple-intelligence-oriented learning can be integrated in everyday kindergarten science practices. The findings imply that teacher professional development should move beyond general knowledge of inclusion toward concrete strategies for designing accessible, multisensory, and culturally meaningful science experiences for diverse young learners.

**Keywords:** Differentiated Instruction; Early Childhood Science Learning; Inclusive Kindergarten; Multiple Intelligences; Phenomenology

## INTRODUCTION

Early childhood science learning is crucial for children to learn to think and solve problems from a young age. Santiani, S., Effendi, E., & Salam, S. (2024) say this. We need to teach children in a way that suits each of them because they are all different. This is called teaching, and it is very important. Fitriani, D. (2025) discusses this. There is also something called intelligence, introduced by Howard Gardner. Gardner, H. (2018) says that children learn and understand things in different ways. Therefore, when we teach science to children, we must use appropriate teaching methods. This can include things like observing the world around us, conducting experiments, grouping things, trying to guess what will happen, and telling others what we discover. Harahap, S.A. (2024) says that early childhood science learning is important and we must make it fun and engaging for children. Early childhood science learning should be fun. It

should help children learn and develop. We must use teaching and multiple intelligences to make early science learning beneficial for all children.

Previous studies have addressed differentiated instruction and multiple intelligences separately or within the context of general education. However, there is a lack of research on how these two concepts operate in early childhood science learning, particularly in kindergarten settings that include children with different needs. Existing research focuses on how differentiated instruction works in general or how multiple intelligences are applied to other subjects. Upon closer examination, these studies demonstrate a theoretical basis, but they do not provide in-depth insights into teachers' experiences adapting these strategies to specific science learning environments within inclusive settings. For example, while some studies demonstrate how differentiated instruction influences student engagement across intelligences, they do not detail how this operates in science education for young children. Research on early childhood science education often overlooks the role of differentiated instruction and multiple intelligences in supporting children with different learning needs. These studies do not address how teachers use differentiated instruction and multiple intelligences in science instruction for young children. Studies on teaching and multiple intelligences Don't focus on science education. Early childhood science learning needs teaching and multiple intelligences. Kindergartens use teaching methods and multiple intelligences.

This research is special because it combines a few things: teaching methods that are tailored to individual kids, activities that help children use their different strengths and science education for young children. It does this in a way that includes all kids regardless of their abilities. It uses a method that focuses on understanding peoples experiences. The study looks at what teachersre already doing and also tries to really understand what it is, like for them to teach science to young children. It wants to know how teachers deal with the challenges and opportunities that come up when they try to create a science learning environment that works for each child. So this research helps us understand how to teach science to children in a way that includes everyone by showing how these important elements work together. Pudyaningtyas, A. R., & Hayati, N. (2025)

Multiple intelligences also provide a useful pedagogical lens for recognizing the diversity of children's strengths. Gardner's theory argues that children may demonstrate capacities through linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalistic forms of intelligence (Gardner, 2011). In early childhood education, this theory should not be used to rigidly label children, but to broaden teachers' awareness that children can understand and express scientific ideas in multiple ways. A child may show scientific understanding through drawing, storytelling, movement, building objects, observing living things, asking questions, or collaborating with peers. In this sense, multiple intelligences can support more equitable assessment and participation because children's learning is not reduced to verbal answers or worksheet completion.

Despite the relevance of these frameworks, existing research often examines differentiated instruction, multiple intelligences, inclusive education, and early childhood science learning separately. Studies on inquiry-based science learning commonly emphasize children's science process skills, curiosity, and conceptual understanding, but do not always explain how teachers adapt instruction for diverse learners in inclusive classrooms (Agustini et al., 2024; Ouabich et al., 2024). Studies on differentiated instruction often focus on primary or secondary education and may not capture the sensory, play-based, and relational nature of kindergarten science activities (Hasanah et al., 2022; Tomlinson, 2014). Meanwhile, discussions of multiple intelligences are frequently conceptual and do not sufficiently document teachers' lived experiences in designing inclusive science environments for young children.

This gap is important because inclusive early childhood science learning is shaped by the immediate decisions teachers make during classroom interaction. Teachers must interpret children's responses, adjust materials, simplify or enrich questions, provide alternative modes of expression, organize peer support, and maintain a classroom climate where every child can

participate. These processes are not fully captured by outcome-based research alone. A phenomenological approach is therefore appropriate because it explores the meanings teachers attach to their lived experiences and reveals the essence of their pedagogical actions in real classroom contexts (Moustakas, 1994; Neubauer et al., 2019).

The novelty of this study lies in its integrated focus on differentiated instruction, multiple intelligences, and early childhood science learning within an inclusive kindergarten setting. Rather than treating differentiation as a technical strategy or multiple intelligences as a separate theory, this study examines how teachers experience both as interconnected pedagogical practices in everyday science activities. Accordingly, the purpose of this study is to describe in depth the implementation of differentiated instruction to stimulate multiple intelligences in early childhood science learning in an inclusive kindergarten and to identify the essential phenomenological themes emerging from teachers' lived experiences.

## METHODS

This study employed a qualitative approach using a phenomenological design. Phenomenology was selected because the study aimed to understand the lived experiences of kindergarten teachers as they implemented differentiated instruction in early childhood science learning for diverse learners. The focus was not to measure the effectiveness of an intervention statistically, but to reveal how teachers interpreted, negotiated, and enacted differentiation in inclusive science activities. Following Moustakas (1994), the study sought to describe both the textural dimension of experience, namely what teachers experienced, and the structural dimension, namely how the experience occurred within the classroom context.

The phenomenon examined in this study was the implementation of differentiated instruction to stimulate multiple intelligences during early childhood science learning. Differentiation was understood as teachers' flexible adjustment of content, process, product, and learning environment. Multiple intelligences were used as a pedagogical lens to identify diverse forms of children's engagement and expression, while science learning referred to classroom activities involving observation, exploration, classification, prediction, questioning, simple experimentation, and communication of findings.

### Research Participants

The study was conducted at Kartini 2 Kindergarten, Surakarta, Indonesia, an inclusive early childhood education setting serving children with diverse developmental and learning needs. The research was carried out over five weeks, from 9 February to 13 March 2025. This period enabled the researchers to observe repeated classroom routines, science activities, teacher-child interaction, and teachers' reflective responses during implementation.

Participants were selected through purposive sampling because phenomenological inquiry requires informants who have directly experienced the phenomenon under investigation (Creswell & Poth, 2018). Four kindergarten teachers participated in the study. The inclusion criteria were: actively teaching in an inclusive kindergarten classroom, having experience conducting early childhood science activities, and being willing to participate in interviews and classroom observations. To protect participant confidentiality, the teachers were identified using the codes T1, T2, T3, and T4.

**Table 1.** Participant Profile

Code	Role	Experience Relevant to the Study	Main Data Contribution
T1	Kindergarten teacher	Experience adapting science content to children's interests and readiness	Interview, observation, lesson-plan reflection
T2	Kindergarten teacher	Experience supporting children with varied learning styles and special needs	Interview, observation, portfolio notes
T3	Kindergarten teacher	Experience organizing environmental exploration and science corners	Interview, observation, classroom document review
T4	Kindergarten teacher	Experience facilitating simple experiments and peer interaction	Interview, observation, documentation

## Data Collection

Data were collected through three complementary techniques: participatory observation, semi-structured interviews, and document analysis. Observations were conducted to understand teachers' instructional practices, classroom interactions, use of materials, environmental adaptations, peer-support patterns, and children's ways of engaging with science tasks. Field notes focused on how teachers adjusted activities during science learning rather than on evaluating individual children.

Semi-structured interviews were conducted with each teacher to explore their experiences, assumptions, challenges, and reflections in implementing differentiated science learning. Interview questions addressed how teachers selected science content, adjusted learning processes, provided alternative products, supported children with different needs, and interpreted children's multiple forms of intelligence. Document analysis involved lesson plans, teaching materials, science activity records, children's work samples, portfolios, and progress notes. These documents were used to corroborate interview and observation data.

**Table 2.** Data Collection Matrix

Data Source	Focus of Data	Procedure	Contribution to Analysis
Observation	Teacher actions, child engagement, use of materials, classroom ecology	Repeated classroom observations during science activities	Provided contextual evidence of enacted differentiation
Interview	Teacher experiences, meanings, reflections, and perceived challenges	Semi-structured interviews with T1-T4	Provided phenomenological accounts of lived experience
Document analysis	Lesson plans, portfolios, children's products, progress notes	Review of classroom documents and learning artifacts	Supported triangulation and theme refinement

## Data Analysis

The data were analyzed using phenomenological analysis procedures adapted from Moustakas (1994). First, all interview transcripts, observation notes, and documents were read repeatedly to gain a holistic understanding of the data. Second, horizontalization was conducted by identifying significant statements related to teachers' experiences of differentiation, multiple intelligences, and science learning. Third, meaning units were coded and compared across data sources. Fourth, similar meaning units were clustered into thematic categories. Fifth, textural descriptions were developed to explain what teachers experienced, while structural descriptions were developed to explain how the classroom context shaped those experiences. Finally, an essence statement was synthesized to represent the core meaning of the phenomenon.

Although the study used phenomenological analysis, thematic organization was used to present the findings clearly. This strategy allowed the researchers to describe essential experiential themes while preserving the qualitative richness of teachers' voices. The analysis was iterative; themes were refined through comparison of interview excerpts, observation notes, and documents until coherent patterns emerged.

## Data Analysis

Trustworthiness was strengthened through triangulation, member checking, peer debriefing, and an audit trail. Triangulation was achieved by comparing observation data, interviews, and classroom documents. Member checking was conducted by returning preliminary interpretations to participants to confirm whether the interpretations reflected their experiences. Peer debriefing was used to discuss emerging codes and themes with academic peers in early childhood education. An audit trail was maintained by documenting data collection procedures, coding decisions, and theme development. These strategies were used to enhance credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985; Nowell et al., 2017).

Research ethics were maintained by obtaining institutional permission and participant consent prior to data collection. Participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw. Names of teachers, children, and institutional details that could reveal individual identities were anonymized. The study did not collect sensitive clinical information about children; classroom observations focused on pedagogical practices rather than diagnosing or categorizing learners

## Results

Phenomenological data analysis of teachers' experiences revealed key themes. These themes relate to the implementation of teaching in early childhood science learning in an inclusive kindergarten. The findings are presented in a table. This table provides an overview of the teachers' practices and experiences. Pudyaningtyas, AR, and Hayati, N. (2025).

**Table 3.** Themes analysis data table

Main Theme	Sub-Theme	Supporting Quote/Data (Example)	Researcher's Interpretation
Teaching Flexibility	Science Content Adaptation	"I always try to adjust science materials to children's interests. For example, if they are interested in insects, we can learn about the butterfly life cycle." (T1)	Teachers actively adapt science materials to be relevant to children's interests and developmental levels, ensuring optimal engagement.
	Learning Process Adjustment	"Some children like direct observation, others prefer to draw their observations. I give them choices." (T2)	Teachers provide diverse methods and activities for science exploration, allowing children to choose learning styles that best suit them.
Multisensory Learning Activities	Environmental Exploration	"We often go to the school garden to observe plants and insects. Children can touch, smell, and see directly." (T3)	Science learning involves direct experiences and the use of various senses to enrich children's understanding of scientific concepts.
	Simple Experiments	"Volcano experiments are always a favorite. They can see chemical reactions and ask many questions." (T4)	Teachers facilitate simple experiments that encourage observation, prediction, and questioning, developing early science skills.
Differentiated Learning Products	Representation of Learning Outcomes	"Children can show their understanding through drawings, stories, or even short dramas about what they learned in science." (T1)	Children are given freedom to express their science understanding in various forms, in accordance with their multiple intelligences.
	Science Development Portfolio	"Every child has a portfolio. It shows how they develop in observing, classifying, and communicating about science." (T2)	Assessment is conducted formatively through observation of children's products, reflecting individual progress in science skills.
Adaptive Classroom Environment	Interactive Science Corner	"We have a science corner with various natural materials and simple tools. Children are free to explore anytime." (T3)	The physical classroom environment is designed to support independent and collaborative science exploration, facilitating active learning.
	Peer Support	"Children who understand faster often help their friends. This is good for social interaction and concept understanding." (T4)	Peer interactions are encouraged to support each other in understanding science concepts, creating an inclusive learning community.

Main Theme	Sub-Theme	Supporting Quote/Data (Example)	Researcher's Interpretation
Teacher Pedagogical Responses	Continuous Observation and Assessment	"I always observe how each child interacts with science materials. From there, I know what I need to adjust." (T1)	Teachers conduct continuous observation and assessment to understand individual children's needs and adjust teaching strategies in real-time.
	Individual Guidance	"For children with special needs, I provide more intensive guidance when they do science activities." (T2)	Teachers provide tailored individual support, ensuring that all children, including those with special needs, can actively participate in science learning.

The results show how teachers make science fun for kids by changing the content the way they teach and the place where they learn. For example teacher T1 looks at what the kids interested in and teaches science based on that. Teacher T2 gives the kids options for how they want to learn. Teachers T3 and T4 do things that help the kids use all of their senses and do experiments that help them learn to observe guess what will happen and ask questions. The kids can then show what they learned in ways, which is good because kids are all smart in different ways.

Teachers also make the classroom a fun place to learn science with science areas and help, from other kids. The teachers watch the kids all the time. Help each one so they can learn to do science things like looking, grouping guessing what will happen asking questions and telling people what they saw according to Fitria, T. N. (2026).

## Discussion

This study shows that we can indeed use differentiated instruction to help children learn science in kindergarten. This is important because it helps all children learn despite their differences. Several other studies, such as those by Maufiroh, U., Kuswandi, D., Samawi, A., & Arifin I. (2025) and Fatonah, S. (2019), discuss differentiated instruction and multiple intelligences in general. This study is special because it examines how to use differentiation strategies when children are engaged in science activities. This makes sense because children should be able to explore and try things themselves when they learn science, as stated by Santiani, S., Effendi, E., & Salam S. (2024). Differentiated instruction studies are important because they help us understand how to make science learning fun and engaging for children in kindergarten. Differentiated instruction is a way to ensure that all children can learn and have fun at the same time.

The teaching flexibility demonstrated by the teachers (T1, T2) in adapting science content and processes is central to differentiated instruction. This allows children to engage with science materials according to their interests and readiness levels, which in turn stimulates various multiple intelligences. For example, children with naturalistic intelligence will be highly motivated by environmental observation, while children with spatial intelligence may prefer to draw experiment results. This approach supports Gardner's idea that every child has a unique intelligence profile Gardner, H. (2018). This is further supported by research showing the effectiveness of differentiated learning in stimulating cognitive intelligence in early childhood Mawaddah, K., & Hayyu, H. F. (2026).

Multisensory learning activities, such as environmental exploration and simple experiments (T3, T4), are crucial in early childhood science learning. By involving various senses, children can build a more concrete and in-depth understanding of scientific concepts. This is also a form of process differentiation that allows children with different learning styles to access and process science information effectively. These findings reinforce the argument that science learning should be experiential and interactive Harahap, S. A. (2024). The development of digital

technology for science stories integrated with local wisdom also highlights the importance of engaging children through diverse media Eliza, D., Mulyeni, T., Budayawan, K., Hartati, S., Khairiah, F., & Permana, A. I. (2026)

Differentiated learning products provide opportunities for children to demonstrate their understanding of science in various ways (T1, T2). This not only respects the diversity of multiple intelligences but also allows teachers to conduct more accurate formative assessments of individual children's progress. For example, a child strong in linguistic intelligence can verbally explain their observations, while a child with visual-spatial intelligence can create models or drawings. This contrasts with traditional approaches that often rely on a single form of assessment, which may not be equitable for all children Fitria, T. N. (2026). The application of KSE in differentiated learning also emphasizes the importance of varied assessment methods Zuhro, N. S., Rasmani, U. E. E., Wahyuningsih, S., Fitrianingtyas, A., Nurjanah, N. E., Jumiatmoko, J., & Winarji, B. (2026).

Classrooms designed to help all children learn, with areas for science experiments and places for peers to collaborate, are excellent for children. These classrooms make children feel welcome and eager to learn. They help children learn independently, collaborate with others, and talk to each other, all of which are essential for children learning science and how to get along with others. To ensure everyone feels included, we need classrooms that can transform to meet the needs of all children, so that children with special needs can also participate in science activities. Sudarti, S., Maulani, S., & Ruswandi, A. (2026) conducted several studies that demonstrated the importance of having classrooms like these. Others, such as Hartshorn, C. (2024), also studied how to ensure all children can learn together. They found that we truly need classrooms that can transform to meet the needs of all children.

Teachers are crucial to ensuring children learn well. They observe children constantly, checking their progress. They also help each child individually, a process called tutoring. This means teachers not only teach what they're supposed to teach, but also help children learn in their own way. The researchers who conducted this study only observed what happened for one week. This was beneficial because they could see how teachers helped children when they needed it. Typically, studies like this take longer to see how changes occur over time. Even with just one week, we can see that teachers are crucial in helping children learn.

Others have also studied how teachers help children learn. For example, Pudyaningtyas, A. R., & Hayati, N. (2025), Maufiroh, U., Kuswandi, D., Samawi, A., & Arifin, I. (2025) and Setyoningtyas, N., & Utaminingsih, S. (2026) all found that when teachers help children individually, those children perform better. They are more creative and independent. This is especially true for children. Teachers who help children in their own way make a big difference in how well they learn.

This research shows that teaching science in a way that is tailored to each child in a kindergarten classroom that includes all types of students helps teachers address the reality that all students are different. It also helps children use different types of intelligence and learn basic science skills. This is important for those who create school curricula, train teachers, and decide how to teach children in schools that welcome all children. If teachers consistently use methods that consider how children learn, it can truly help ensure all children have equal opportunities to learn. This is something that researchers such as Prihadi, S., Arif, A., & Nugroho, A. E. J. K. (2026), Sahayu, W., Triyono, S., & Ungu, N. K. (2026) have found.

The findings also strengthen the relevance of UDL principles in early childhood science classrooms. Lohmann et al. (2023) argue that preschool science learning can become more accessible when teachers provide multiple ways of engagement, representation, and expression. The present study illustrates this principle phenomenologically: teachers provided alternative routes for observing phenomena, alternative products for expressing understanding, and environmental supports that allowed repeated exploration. In this way, differentiated instruction and UDL are not contradictory frameworks; rather, they can operate together in inclusive kindergarten practice. UDL supports proactive accessibility, while differentiation

supports responsive adjustment based on children's observed needs.

Multiple intelligences emerged as a useful but carefully interpreted pedagogical lens. The teachers' practices did not diagnose children into fixed intelligence categories. Instead, they recognized that children might engage with science through different strengths: naturalistic engagement during outdoor observation, bodily-kinesthetic engagement during manipulation of materials, spatial engagement through drawing, linguistic engagement through storytelling and questioning, interpersonal engagement through peer collaboration, and logical-mathematical engagement through prediction and classification. This interpretation is important because multiple intelligences should not be reduced to rigid labeling; it is more productively used to expand teachers' repertoire of learning experiences and assessment opportunities (Gardner, [2011](#)).

A key novelty of this study lies in the integration of differentiated instruction, multiple-intelligence-oriented pedagogy, and early childhood science learning in an inclusive setting. Previous studies have often discussed these components separately. This study shows that, in practice, they intersect through teachers' real-time decisions. When teachers allow a child to draw an observation rather than verbally explain it, they are simultaneously differentiating product, recognizing spatial expression, and supporting science communication. When teachers organize peer support in a science corner, they are differentiating environment, stimulating interpersonal intelligence, and creating opportunities for collaborative inquiry. This integrated view represents the main conceptual contribution of the study.

The practical implication is that teacher professional development should not only introduce the terminology of differentiation or inclusion. Teachers need concrete training in designing flexible science activities, preparing multisensory materials, observing children's engagement, documenting progress through portfolios, and providing multiple expression options. Schools also need to support inclusive science learning through accessible spaces, safe exploration materials, collaborative planning time, and reflective supervision. For curriculum developers, the findings suggest that early childhood science learning outcomes should be accompanied by examples of differentiated pathways rather than uniform activity prescriptions.

Several limitations must be acknowledged. First, the study involved only four teachers from one inclusive kindergarten; therefore, the findings should be understood as contextually rich rather than statistically generalizable. Second, the study focused on teachers' lived experiences and classroom practices, not on measuring children's science learning outcomes quantitatively. Third, the study did not compare experiences across different types of inclusive institutions or disability categories, because the ethical focus was on pedagogy rather than child diagnosis. Fourth, the five-week observation period provided sufficient insight into recurring practices but did not capture long-term development across an academic year. Future research may use multi-site designs, longer observations, mixed-method approaches, and child-centered data to examine how differentiated science learning influences children's science process skills, curiosity, communication, and participation over time.

## CONCLUSION

This phenomenological study demonstrates that differentiated instruction can support inclusive early childhood science learning when it is enacted as a flexible, reflective, and child-responsive pedagogy. The experiences of four kindergarten teachers showed that differentiation occurred through responsive planning, multisensory inquiry, flexible learning products, adaptive classroom ecology, peer-mediated support, and continuous pedagogical adjustment. Multiple intelligences functioned as a practical lens for recognizing children's diverse ways of engaging with and expressing science understanding, while science activities provided meaningful opportunities for observation, prediction, classification, questioning, communication, and collaboration. The study contributes to early childhood science education by explaining how inclusive science learning can be designed through the integration of differentiation, multiple

forms of intelligence, and hands-on inquiry. Its practical implication is that teachers and schools need sustained professional support, accessible science materials, portfolio-based assessment practices, and reflective planning systems to ensure that every child can participate meaningfully in science learning. Future research should examine similar practices across wider inclusive early childhood settings and investigate their influence on children's science process skills and participation over time.

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