

Analysis of Environment Creation's Role in Early Childhood Science Enlightenment: Based on the Observation of Senior-Class Groups in Linyi Municipal Kindergarten

Song Xiangwei, *Romarzila Omar

Faculty of Human Development, Sultan Idris Education University, Malaysia

*Corresponding Author Email: romarzila@fpm.upsi.edu.my

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Abstract

This study takes four senior classes in Linyi City's municipal kindergarten as the research objects, adopts the case study method, and systematically explores the mechanism of environmental creation in early childhood science enlightenment education. Through two-month observations, interviews and document analysis, the study reveals the positive effects of science-oriented environment creation on stimulating children's inquiry interest, fostering their science thinking and improving their cooperative competence. The findings indicate that the openness, operability and dynamism of science-education environments significantly boost young children's initiative and sustainability in science inquiry. Teachers' supportive strategies in environment creation, including open-ended questioning, encouraging discussions and dynamically adjusting teaching materials, serve as critical conditions for the development of children's science thinking. Based on the theories of Piaget, Vygotsky and Dewey, this paper analyzes the educational value of environment creation and puts forward practical suggestions for optimizing science-education environments in kindergartens.

Keywords: Environment Creation, Early Childhood Science Enlightenment, Senior Class Children, Science Education, Case Study

Introduction

Science enlightenment education aims to stimulate children's curiosity and cultivate their preliminary science thinking and inquiry ability through direct perception, personal experience and practical operation. The "guidelines for learning and development of children aged 3-6" and the "guidelines for Kindergarten Education (Trial)" both emphasize that children's development characteristics should be respected and an educational environment that supports active exploration should be created. For 5-6-year-old children in senior classes, science learning mainly depends on specific experience. An open, operational and dynamic environment can provide opportunities for observation, experiment, cooperation and problem solving through spatial layout, material delivery and interactive support (He, 2026).

From the theoretical perspective, Piaget emphasizes that children construct cognition through interaction with the environment; Vygotsky attached importance to adult support and peer interaction; Dewey emphasizes experiential learning in real situations; Malaguzzi (1996) put forward the concept of "environment is the third teacher", which further highlights the educational value of environment. These theories show that science education environment is not only a material space, but also an important resource to promote children's active learning.

However, in practical kindergarten education, numerous problems persist in the creation of science-oriented environments. In some classes, the science corner features rigid settings, single-type materials and infrequent updates; environmental decorations prioritize aesthetics over hands-on operation (Zhao, 2026). Some teachers exert excessive dominance over science activities and overlook the autonomous educational function of the environment (Liu, 2022). Consequently, children participate passively, and their inquiry remains superficial. Meanwhile, environment creation is often disconnected from children's age-related characteristics and interest needs (Jia, 2025), resulting in low utilization rate of science areas and insufficient sustainability of children's inquiry, which hinders the effective implementation of science enlightenment education. Therefore, it is necessary to investigate the relationship among the three in the real situation, and understand the specific process of environmental support for science enlightenment.

This study takes four senior classes of kindergartens directly under the municipal government of Linyi as the object, adopts the method of case study, and through two months' observation, teacher interviews and document analysis, discusses three issues: first, the characteristics of the science environment in terms of spatial layout, material placement and dynamic adjustment; The second is how teachers promote children's inquiry through environment creation, open questioning and interactive support; The third is how the environment supports the development of children's science interest, preliminary science thinking and cooperative ability.

The innovation of this study is to integrate the characteristics of environmental materials, teachers' support behavior and children's inquiry performance, build a multidimensional analysis perspective, and reveal the interactive relationship in the real educational situation. At the level of social science research, the research provides situational evidence for understanding the relationship between the educational environment and children's active learning through micro case analysis, and provides reference for the optimization of the science environment and the improvement of teachers' support strategies.

Literature Review

Theoretical Foundation

Piaget's (1972) cognitive development theory posits that children's cognitive development is a continuous process of interaction between the individual and the environment. The construction of knowledge in young children does not rely on passive indoctrination but stems from operational experiences gained through firsthand manipulation, perception, and exploration, with the environment serving as the core medium for cognitive development. Five to six-year-old children are in a critical transitional period

from the preoperational stage to the concrete operational stage, where a concrete, manipulable, and exploratory environment is essential for their construction of science cognition.

Vygotsky (1978) proposed the core concept of the "zone of proximal development" in his sociocultural theory, arguing that children's learning and development rely on adults' scaffolded support. Environmental setup is not merely the construction of physical spaces but the creation of social learning contexts. By adjusting the environment, providing materials, and offering appropriate guidance, teachers can build learning scaffolds to help children transcend their current cognitive levels and achieve advanced science thinking development.

Dewey (1938/2001) proposed the theory that "education is life," advocating that education originates from and serves life. Early childhood science learning should be grounded in real-life contexts, achieving experiential reconstruction through active inquiry, hands-on operation, and reflective experience. A life-oriented inquiry environment is the prerequisite for effective science learning in young children.

Review of Domestic and Foreign Research

Foreign research generally emphasizes the importance of the life-oriented and open nature of the science environment for young children, as well as the support provided by teachers. Worth (2010) pointed out that science learning for young children should be rooted in familiar life experiences, where science experience is gained through observation, manipulation, and exploration of the surrounding environment. Dogan (2018) noted that in the context of science education, the environment should be natural, conducive to hands-on learning activities, attractive, engaging children actively, rich in visual materials, and provide an open space. Karademir et al (2020) pointed out that children's curiosity and enthusiasm drive them to explore and reason through their own experiences. However, teachers' guidance is needed to transform children's curiosity and activities into a driving force for science inquiry. Therefore, foreign research generally emphasizes providing young children with an open exploration space and abundant opportunities for manipulation based on real-life experiences, and promoting the continuous development of young children's science inquiry through appropriate teacher support.

At the domestic research level, Han (2026) found that the dynamic updating of science regional materials and the adjustment of environments aligned with children's interests are key to sustaining their continuous inquiry. Xia (2025) confirmed through classroom observations that teachers' open-ended questioning approach can effectively deepen the depth of children's science inquiry and cultivate their basic science abilities in observation, comparison, and reasoning. Liu (2023) proposed that modern kindergarten science education requires deep integration of physical environments, psychological environments, and teacher support. Li (2021) verified through empirical research the positive effects of science environment creation on children's inquiry abilities and innovative consciousness.

A review of existing research reveals widespread recognition in academia of the significant value of environmental setup in early childhood science education. However, most studies primarily rely on short-term observations and experiential summaries within single classrooms, lacking systematic empirical research across multiple classes and long-term

cycles. The interactive mechanisms among environmental characteristics, teacher support, and children's exploratory behaviors remain understudied. This study addresses these gaps through two months of continuous tracking observations in four senior classes, providing an in-depth analysis of the educational mechanisms of environmental setup.

Methodology

This study adopts a qualitative case study method and takes Linyi Municipal Kindergarten as the research field. Four senior classes in the kindergarten are selected as the research classes, including 80 children aged 5-6 and 8 teachers in charge. All 8 teachers have over two years of experience in early childhood science education and are familiar with conducting science activities and creating environments. Before the start of the study, all participants signed an informed consent form. To protect the privacy of research subjects, teachers use T1-T8 anonymous encoding during data organization and analysis, and children's related information is also anonymized.

This study lasted for two months and collected data using a combination of observation, semi-structured interviews, and document analysis methods. During the observation phase, researchers entered the kindergarten twice a week, focusing on children's regional activities, science collective activities, and outdoor exploration activities. A total of 20 hours of activity videos were collected, and 38 observation records were completed, with a focus on recording children's operation of science materials, exploration duration, peer interaction, problem posing, and teacher support behavior. During the interview session, one-on-one in-depth semi-structured interviews were conducted with 8 teachers, each lasting 30-60 minutes. After obtaining permission from the interviewees, the interviews were recorded, transcribed, proofread, and anonymized to form the interview text materials. At the same time, collect written materials such as kindergarten science education programs, class environment creation files, teacher teaching reflections, and children's growth files, and cross verify them with observation and interview data to form effective research materials including teacher interview data and observation records, enhancing the completeness and credibility of the data.

In terms of data analysis, this study adopted thematic analysis method and used Atlas.ti software to organize and code observation records, interview texts, video materials, and related documents. Data analysis follows the process of "open coding main axis coding topic extraction". Firstly, the original data is encoded sentence by sentence to extract initial information such as environment creation, teacher support, and child exploration; Secondly, classify and integrate similar codes to form relevant concepts and categories; Finally, through continuous comparison and induction, extract three core themes: environmental characteristics, teacher support, and child exploration, and analyze the interactive relationship between the three. At the same time, through mutual verification of different data sources, the credibility and completeness of research results can be improved.

Result

Through two months of multi-class tracking observation, data coding, and interviews with 8 preschool science teachers, it was found that the openness, operability, and dynamism of the science education environment in kindergarten directly affect the initiative, persistence, and depth of children's science inquiry. Teachers can further activate the

educational value of the environment through scaffolding support, promoting the development of children's science interest, thinking, and collaborative inquiry abilities.

Open Environment: Activating Children's Autonomous Inquiry Interests

Openness is primarily manifested in the accessibility of space, materials, and choices. All four senior classes adopt an open layout for their science areas, with the science corner interconnected with the nature corner, construction area, art and craft area, etc., allowing children to freely access materials according to their inquiry needs. Observations reveal that in a closed environment, children's single inquiry sessions typically last for 3-5 minutes, whereas in an open environment, they generally last for 8-15 minutes, with some children even actively combining materials across different areas for inquiry.

Teacher 1 said: "In the past, the materials in the science area were relatively fixed, so even if the children had ideas, they couldn't go to other areas to get things. After the opening, they will find and combine materials by themselves."

Teacher 2 also mentioned: "After opening up, children will decide how to play on their own, and the teacher doesn't have to constantly tell them what to do next."

Low-structure materials such as magnifying glasses, measuring cups, magnets, seeds, soil, and light and shadow tools are placed in the science area of each class, providing children with a space for free experimentation and trial and error.

Teacher 3 said: "I will reduce the number of toys that are immediately obvious how to play with, and let children guess and try on their own."

Within two months, children initiated over 600 science exploration activities, primarily focusing on topics such as light and shadow, buoyancy and sinking, magnets, and plant growth. This demonstrates that open spaces and materials can effectively stimulate children's interest in independent exploration.

Operational Environment: Assisting Young Children in Building Science Cognition

In the upper grades, children primarily rely on concrete and imagery thinking, and direct operation is a crucial method for them to understand science phenomena. Each class provides children with continuous and rich practical opportunities through natural observation areas, water experiment areas, and physical operation areas. In natural observation activities, children gradually master methods such as continuous observation and comparative observation by observing plants and recording weather. Observations show that over 85% of children can actively discover subtle changes in plant growth, weather, and light and shadow.

Teacher 3 said: "By observing every day, children will notice that today is different from yesterday, and gradually they will find the reasons themselves."

In activities such as floating and sinking, and magnet experiments, young children verify their conjectures through repeated operations and comparisons. For example, by testing materials such as stones, leaves, and plastic bottles, young children gradually come to understand that "heavy objects do not necessarily sink".

Teacher 4 pointed out: "The results that children come to by themselves are easier to remember than those directly told to them by the teacher."

Meanwhile, continuous practice enables young children to gradually develop an exploratory habit of "identifying problems, making conjectures, verifying, and communicating".

Teacher 5 said: "Some children now don't immediately ask the teacher when they encounter problems, but will try on their own several times first."

This indicates that the operational environment not only promotes the acquisition of science knowledge but also helps to form preliminary science inquiry thinking.

Dynamic Environment: Maintaining the Continuity and Dynamic Nature of Young Children's Science Inquiry

This primarily manifests in the continuous adjustment of materials, themes, and the environment. The four classes update materials based on seasonal changes, children's interests, and teaching themes, and promptly respond to questions generated by the children. For example, after children developed an interest in rainbows, the teacher promptly added materials such as triangular prisms and watering cans to guide the children in their continued exploration.

Teacher 6 said: "Once children become familiar with the materials, they may find them boring if they remain the same. Therefore, adjustments should be made based on their recent interests."

Teacher 7 also said: "updating materials is not for the sake of appearance, but to enable children's questions to continue."

Observations revealed that the utilization rate of science corners that were not updated for a long time was less than 20% after two weeks, while the daily average utilization rate of dynamically updated environments remained stable at over 80%.

Teacher 1 further pointed out: "Now we pay more attention to where the children's exploration has progressed, and then decide what materials to add next."

Therefore, dynamism does not simply mean replacing materials; instead, it refers to continuously adjusting the environment in accordance with children's interests and cognitive development, so that science inquiry can advance progressively from the simple to the complex.

Teacher support strategies: Building scaffolds for science thinking development

Teachers primarily provide scaffolds for young children through open-ended questioning, group discussions, and tiered material distribution.

Firstly, teachers guide young children to analyze and verify independently through open-ended questions such as "What did you discover?" and "What other methods are there?", rather than directly giving answers.

Teacher 8 said: "I won't immediately tell the child whether it's right or not. Instead, I'll let him find materials to verify it himself."

Secondly, teachers utilize open spaces to organize group exploration, encouraging young children to share their discoveries, express their conjectures, and discuss different viewpoints.

Teacher 6 believes: "When children have different opinions, we will ask them to do it again instead of directly judging who is right and who is wrong."

Collaborative inquiry not only promotes science thinking but also enhances young children's language expression and collaboration skills.

Finally, teachers provide materials of varying difficulty levels based on the abilities of the young children.

Teacher 5 pointed out: "We cannot expect all children to do the same. Those with weaker abilities can start with simpler experiments, while those with stronger abilities can face greater challenges."

This tiered support embodies individualized teaching and also aids young children in achieving further development based on their existing experiences.

Current practical issues in environmental creation

Based on observations and interviews with 8 teachers, four main issues are identified in the current science environment.

Firstly, some environments exhibit a phenomenon of "emphasizing form over content", with rich wall decorations but insufficient practical materials.

Teacher 6 admitted: "Sometimes we pay more attention to whether the environment looks good or not, but what children really need are things they can touch and try."

Secondly, there is a fragmentation issue in material updates, with a lack of continuity between themes.

Teacher 7 pointed out: "In the past, we would just put whatever we thought of, and although the children found it fresh every time, it was difficult for them to form a complete experience."

Thirdly, there is a deviation in the scale of teacher guidance, with some teachers intervening excessively and others completely laissez-faire.

Teacher 4 said: "True support should be providing a hint when a child needs it, rather than directly telling the answer."

Fourthly, the psychological environment remains relatively weak, with some young children fearing failure and not daring to express themselves and try boldly.

Teacher 1 said: "Science inquiry should inherently allow for failure. If children perceive failure as something wrong, they will be reluctant to keep trying."

Overall, the interviews with 8 teachers and on-site observations mutually corroborate that the science education environment in kindergartens has achieved a certain degree of openness, operability, and dynamism. However, further optimization is still needed in terms of material systematicness, teacher support scale, and psychological environment. The focus should shift from "emphasizing environmental presentation" to "emphasizing children's continuous inquiry", fully leveraging the educational value of the science education environment.

Discussion

Research findings indicate that openness, operability, and dynamism are not independent of each other, but rather collectively constitute the environmental foundation that supports young children's science inquiry. Open spaces, materials, and activity formats provide young children with opportunities for independent choice and exploration. Operational materials offer practical conditions for observation, comparison, experimentation, and verification. A dynamically adjustable environment further enables young children's inquiry activities to continue and deepen. The interaction among these three elements allows young children to gain science experience through direct interaction with materials and the environment. This aligns with Piaget's theory of cognitive development, which suggests that young children's cognitive development does not solely rely on knowledge transfer but is gradually formed through continuous operation and experiential construction. For older preschoolers, transforming abstract science phenomena into observable and operable concrete experiences is more conducive to the development of their science thinking.

However, the environment itself cannot automatically produce educational effects. Teacher support is an important link connecting the environment and children's development. Research has found that through open-ended questioning, peer discussion, material adjustment, and timely guidance, teachers can promote children to gradually move from simple material manipulation to problem discovery, conjecture, verification, and reflection. This is consistent with Vygotsky's "Zone of Proximal Development" theory. The role of teachers is not to directly provide answers, but to provide appropriate scaffolding based on children's existing experiences, helping them complete inquiry tasks that are difficult to accomplish independently. Therefore, the creation of a science environment is not only reflected in the arrangement of material resources and space, but also in teachers' professional judgment of children's interests, experiences, and inquiry levels.

Meanwhile, a life-oriented and dynamic environment aids young children in forming continuous science experiences. Activities such as plant observation, weather recording, and

light and shadow experiments all stem from familiar life situations for young children, enabling the integration of science learning into daily experiences. Teachers can adjust materials in a timely manner based on the immediate interests of young children, which allows for sustained attention and in-depth exploration of their questions, aligning with Dewey's idea that "education is life." However, it is important to note that a dynamic environment does not mean simply and frequently changing materials. Instead, it should establish a continuous chain of activities centered around the existing experiences and exploration interests of young children. If material updates lack thematic relevance, it can easily lead to scattered exploration content among young children. Therefore, environmental adjustments should respond to the interests of young children while also considering educational goals, ensuring that the environment maintains freshness while also providing a certain degree of exploration continuity.

Furthermore, research has found that the supportive role of the science environment depends not only on material conditions but also on the psychological environment. Some young children, even if they have relatively sufficient operational materials, may reduce their attempts due to fear of failure or fear of making mistakes. This indicates that a safe and tolerant psychological atmosphere is an important condition for promoting young children's active exploration. Teachers should accept different conjectures and experimental results from young children, allow them to experience failure, and turn mistakes into opportunities to further ask questions and verify hypotheses. When young children feel that "they can try, express themselves, fail, and try again," the exploration opportunities provided by the material environment can truly be transformed into independent learning behaviors of young children. Therefore, the ideal science education environment should be a comprehensive system where the material environment and psychological environment mutually support each other.

Conclusion and Recommendations

Conclusion

Research Conclusion Based on continuous observation and interviews with four senior classes in kindergartens directly under Linyi City, this study draws the following conclusions:

Firstly, the openness, operability, and dynamism of the science education environment are important foundations for supporting early childhood science enlightenment. Openness promotes independent choice and interest in exploration, operability facilitates the construction of science experience, and dynamism maintains the continuity of exploration.

Secondly, teacher scaffolding is the key to leveraging the educational value of the environment. Open-ended questioning, collaborative discussion, and tiered material presentation can facilitate children's progression from superficial operations to the development of science thinking.

Thirdly, a dynamic interactive relationship is formed among the environment, teachers, and young children. The environment provides conditions for exploration, teachers offer appropriate support, and the interests and exploratory feedback of young children in turn drive environmental adjustments. These three elements together constitute a circular system for science enlightenment.

Fourthly, the current science environment still faces issues such as emphasizing formality over practical operation, fragmented material updates, imbalanced teacher guidance, and insufficient psychological support, which require further optimization.

Recommendations

Firstly, optimize the environmental design to emphasize operability, reduce excessive decoration, and incorporate more low-structure, life-oriented, and operable materials; break down regional barriers to provide conditions for children's cross-regional exploration.

Secondly, establish a dynamic updating mechanism that adjusts materials based on seasons, themes, and children's interests, shifting environmental updates from simply "changing materials" to forming continuous inquiries around problems, and gradually achieving progression from observation to experimentation, and from verification to innovation.

Thirdly, to enhance teachers' scaffolding abilities, they should reduce direct instruction and substitution of operations, and support young children's exploration through open-ended questioning, appropriate prompts, and tiered materials. At the same time, they should organize collaborative discussions and share outcomes.

Fourthly, create a psychological environment that supports trial and error. Respect children's different conjectures and inquiry methods, allow failures and repeated attempts, encourage children to boldly ask questions, express themselves, and innovate, and foster a safe and free atmosphere for science inquiry.

Limitations and Outlook

This study only selected four senior classes from a municipal public kindergarten, with limited sample scope and research period. The universality of the research results still needs further verification. At the same time, this study mainly focuses on the immediate impact of environmental creation on young children's science inquiry behavior, and lacks tracking of its long-term development. Future research can expand the sample scope to include kindergartens in different regions and of different types, and extend the research period to examine the impact of environmental creation on the development of young children's science literacy from a long-term perspective, further improving the theoretical and practical research on the environment for young children's science education.

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