



Examining Science Education Principles in Taiwan's *Early Childhood Education and Care Curriculum Framework*

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ARTICLE INFO	ABSTRACT
Published Online: 31 January 2026	Taiwan's early childhood science education goals extend beyond a purely knowledge-oriented approach, emphasizing the integrated development of inquiry abilities, cognitive skills, and social competencies. For teachers, effective curriculum design should begin with children's lived experiences, creating inquiry-based learning contexts that are hands-on, dialogic, and collaborative. For young children, science is not merely the pursuit of correct answers but a continuous process of questioning, reasoning, and jointly constructing understanding with others. This article examines the principles underlying science education in Taiwan's Early Childhood Education and Care Curriculum Framework, with the aim of informing and supporting preschool teachers' practices in science teaching.
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1. INTRODUCTION

Early childhood science education is not merely the transmission of factual knowledge; rather, it is an inquiry-driven process that nurtures children's natural curiosity and supports their cognitive development (Shaw, Blake & Cliatt, 1992; Eshach, 2011; Shih, 2025a, 2025d; Shih, Juan & LaBad, 2026). This perspective aligns with constructivist theories of learning, which emphasize that children actively construct knowledge through exploration, experimentation, and reflection (Piaget, 1952; Vygotsky, 1978). By engaging in hands-on activities and guided inquiry, young learners develop critical thinking skills, problem-solving strategies, and a foundational understanding of scientific concepts that extend beyond rote memorization. Moreover, inquiry-based science learning encourages collaboration and communication, as children share

observations, ask questions, and negotiate explanations with peers and teachers. This social dimension of learning not only

enhances cognitive development but also fosters essential socio-emotional skills such as empathy, perspective-taking, and self-confidence (Shih, 2025b, 2025c). Practically, early childhood educators can support this process by designing rich, stimulating learning environments that incorporate natural materials, simple experimental tools, and opportunities for meaningful interaction.

According to Taiwan's *Early Childhood Education and Care Curriculum Framework*, the goals of science learning for young children emphasize three key dimensions: developing the habit of active exploration, cultivating systematic thinking abilities, and fostering communication and collaboration in problem-solving. These goals reflect not merely a focus on knowledge acquisition, but also a child-centered,

constructivist view of learning. First, the “habit of active exploration” highlights children’s agency in learning. Young children are not passive recipients of knowledge; rather, they construct understanding through observing, manipulating materials, and asking questions in authentic contexts. This perspective resonates with Piaget’s theory of cognitive constructivism and Dewey’s experiential learning, both of which emphasize that learning emerges from children’s interactions with their environment. Second, “systematic thinking ability” suggests that early childhood science is not a collection of fragmented activities, but a process of guiding children to develop basic scientific process skills such as observing, comparing, classifying, inferring, and making simple causal judgments. Through continuous and spiral curriculum design, children can gradually form logical thinking and causal concepts, laying the foundation for more abstract scientific learning in later stages. Third, “enjoyment of communication and collaborative problem-solving” underscores the social nature of scientific learning. Through small-group discussions, cooperative experiments, and interactive roles, children learn not only to express their ideas but also to listen, negotiate, and co-construct meaning with others. This aligns with Vygotsky’s sociocultural theory, which posits that learning occurs through social interaction and that language and dialogue function as key mediational tools in cognitive development (Ministry of Education, 2017; Shih, 2025a, 2025b).

In sum, Taiwan’s early childhood science goals go beyond a knowledge-oriented approach and move toward the integrated development of inquiry abilities, thinking skills, and social competencies. For teachers, curriculum design should begin with children’s lived experiences and create inquiry-based contexts that are hands-on, dialogic, and collaborative. For children, science becomes not merely the search for correct answers, but a process of continuously questioning, thinking, and jointly making sense of the world with others (Ministry of Education, 2017). This article aims to examine the principles of science education in Taiwan’s *Early Childhood Education and Care Curriculum Framework*, with the hope that such an exploration will contribute to and support preschool teachers’ science teaching practices.

2. COGNITION DOMAIN in EARLY CHILDHOOD EDUCATION and CARE CURRICULUM FRAMEWORK

The Cognition domain in the ECEC Curriculum Framework refers to the development of children’s abilities to process information, think critically, and solve problems. It emphasizes supporting children in actively exploring, observing, and interpreting the world around them, allowing them to construct knowledge and concepts through meaningful experiences (Ministry of Education, 2017). Key components include:

2.1 Information Gathering and Observation

Children develop the capacity to notice and attend to information from their environment through multiple senses—sight, hearing, touch, taste, and smell. They are encouraged to explore objects, people, and events, forming the foundation for further understanding (Ministry of Education, 2017).

2.2 Information Processing and Organization

Children learn to organize and classify information, make connections between new stimuli and prior knowledge, and recognize patterns or relationships. This supports the development of logical thinking, categorization, and reasoning skills (Ministry of Education, 2017).

2.3 Problem Solving and Application

Children are guided to apply their knowledge to solve real-life problems, make decisions, and test hypotheses. This includes evaluating alternatives, reflecting on outcomes, and adjusting strategies based on experience (Ministry of Education, 2017).

2.4 Integration of Prior Knowledge and Interests

The framework highlights that children’s existing knowledge and personal interests are starting points for learning. Cognition develops through a continuous cycle of connecting new experiences with previous understanding, fostering conceptual growth (Ministry of Education, 2017).

2.5 Collaboration and Communication

Cognition is not only an individual process; it is enhanced through social interaction. Children are encouraged to share ideas, discuss solutions with peers and adults, and co-construct understanding through dialogue (Ministry of Education, 2017).

Overall, the cognition domain aims to cultivate children’s active engagement with their environment, systematic information processing, and critical thinking. It supports the development of independent problem-solving skills while promoting collaboration and communication, which are essential for lifelong learning (Ministry of Education, 2017).

3. THREE CORE COGNITIVE ABILITIES in the COGNITION DOMAIN: GATHERING INFORMATION, ORGANIZING INFORMATION, and PROBLEM SOLVING

The cognitive domain includes three core cognitive abilities: “gathering information,” “organizing information,” and “problem solving.” One of the three core cognitive abilities in the cognition domain is information collection. Information collection refers to obtaining data through the use of the senses, measurement tools, and recording activities. It is not random or aimless exploration; rather, it involves systematic and organized awareness, observation, and measurement of information, followed by documentation of the collected data. When collecting information, young children utilize not only their eyes for observation but also their ears for hearing, nose for smelling, hands or skin for touch, and tongue for tasting. In addition to sensory perception, measurement tools allow children to gather information that cannot be directly perceived through the senses. Children then record the collected information using images and symbolic representations. Images may include photographs, videos, drawings, or step diagrams, while symbols encompass not only text and numbers but also self-created symbols or approximations of writing. The manner in which children record information evolves with age, progressing from images to self-created symbols and approximations of writing, and eventually to text and numerical symbols (Ministry of Education, 2017).

“Organizing information” refers to the step-by-step process of structuring and arranging the various kinds of information that have previously been collected. After children gather different types of information, they can use strategies such as grouping, classifying, comparing, identifying relationships, sequencing and patterning,

synthesizing and analyzing, or using charts and diagrams to organize the information into meaningful structures. For example, children may be asked to classify information based on features such as color, sound, smell, size, weight, or shape provided by others, or to categorize and name information according to features they discover themselves. They can also compare similarities and differences among these features and identify the relationships and patterns between them, or use synthesis, analysis, and visual representations (e.g., graphs or tables) to organize quantitative information they have collected. Through the process of organizing information, children come to understand rules, sequences, and categories among objects, as well as causal relationships and part-whole relationships among pieces of information (Ministry of Education, 2017).

Children develop their cognitive abilities through frequent engagement with three learning dimensions: “mathematics in the living environment,” “natural phenomena,” and “cultural artifacts.” Mathematics includes quantity, counting, numbers, shapes, and spatial orientation. However, mathematics does not exist in isolation; it becomes meaningful only when applied to objects and situations in the living environment. The living environment encompasses both natural phenomena and cultural artifacts. Therefore, “mathematics in the living environment” refers to the mathematics embedded in natural phenomena and cultural artifacts, through which children come to understand the world around them. For example, plants and animals, weather, temperature, stones, sand, and light and shadow are all considered “natural phenomena.” In contrast, cultural artifacts include any objects, tools, equipment, and buildings created by humans to meet the needs of daily life, such as clothing, means of transportation, museum collections, and historical monuments. The scope of everyday objects ranges from the clothes children wear, the items they use, and the tools, equipment, and buildings they frequently encounter in daily life, to objects, facilities, and buildings used in other regions or in ancient times (Ministry of Education, 2017).

Integrating the three core cognitive abilities—“gathering information,” “organizing information,” and “problem solving”—with the three learning dimensions of “mathematics

in the living environment,” “natural phenomena,” and “cultural artifacts,” the curriculum goals for the cognitive domain are as follows (Ministry of Education, 2017):

C-1-1 Gather mathematical information from the living environment

C-1-2 Gather information about natural phenomena

C-1-3 Gather information about cultural artifacts

C-2-1 Organize mathematical information from the living environment

C-2-2 Organize relationships among information about natural phenomena

C-2-3 Organize relationships among information about cultural artifacts

C-3-1 Collaborate with others to solve problems in the living environment

3.CONCLUSION

To support early childhood educators in accomplishing the aforementioned objectives, the New Curriculum Guidelines for Preschools systematically articulate competency indicators, learning dimensions, and age-specific benchmarks across the domains of physical movement and health, cognition, language, social development, emotion, and aesthetics. These provisions constitute the principal framework guiding contemporary early childhood practice in Taiwan and, as such, warrant careful and critical engagement. Within the cognitive domain, three interrelated dimensions are delineated: “mathematics in everyday contexts,” “natural phenomena,” and “cultural artifacts.” This structuring reflects the New Curriculum Guidelines for Preschools’ explicit positioning of both science and mathematics education as integral components of early childhood education (Pan & Pan, 2013). This article examines the principles of science education embedded in Taiwan’s *Early Childhood Education and Care Curriculum Framework*, with particular focus on the Cognition domain and its three core cognitive abilities: gathering information, organizing information, and problem solving. The analysis indicates that early childhood science learning in Taiwan is not conceived as the mere transmission of isolated facts; rather, it is framed as a developmental process in which children actively construct understanding

through inquiry, systematic thinking, and social interaction. This curricular approach aligns with constructivist and sociocultural perspectives, emphasizing that children develop scientific concepts through interactions with their environment and the use of language as a mediational tool (Piaget, 1952; Vygotsky, 1978). The Framework integrates these cognitive abilities with learning dimensions in the living environment, natural phenomena, and cultural artifacts, providing a coherent, experience-based model for early scientific learning. Previous studies have shown that young children’s engagement in hands-on exploration and teacher-guided dialogue can enhance their explanatory language and scientific reasoning skills (Maltese & Tai, 2010; Sandoval & Reiser, 2004). Furthermore, the emphasis on social learning and collaborative interaction reflects the role of language and guided participation in knowledge construction, as highlighted in sociocultural theory. Pedagogically, the Framework positions teachers not as mere transmitters of knowledge but as designers of inquiry-rich environments and facilitators of dialogue. This shift in teacher role is consistent with constructivist instructional theory and supports children in developing not only foundational scientific process skills but also language, reasoning, and social competencies through observing, documenting, comparing patterns, and collaborating with peers (Bruner, 1996; Edwards, Gandini, & Forman, 2011; Kaur, Shih, Liu, Hsu & Chang, 2024; Shih, Aslam, Pang, PC-I & Manditereza, 2025; Shih & Juan, 2026; Vygotsky, 1978).

Overall, Taiwan’s early childhood science curriculum embodies a holistic vision of learning that integrates inquiry, cognition, and social interaction. Its emphasis on lived experience, systematic thinking, and collaborative problem solving provides a strong foundation for nurturing young children as curious, reflective, and socially engaged learners. Future research should investigate how these curriculum principles are enacted in diverse classroom contexts and examine their impact on children’s scientific thinking, participation, and identity as learners. More importantly, teachers should recognize that creativity is not an innate, immutable characteristic, but rather a malleable set of abilities and skills that can be cultivated across both general and

specific domains through pedagogical practices aligned with the holistic development of young learners (Hui et al, 2015).

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