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The Rationale for Planning a Science Learning Area in Taiwanese Preschools

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ABSTRACT: The design of learning areas aims to respond to young children's diverse developmental needs. Through carefully planned environments, these areas support children's holistic growth—integrating physical, emotional, social, and cognitive development—through play and exploration. The science exploration area provides natural materials and simple experimental tools to cultivate children's observation skills, curiosity, and inquiry spirit. This article aims to explore the rationale for planning a science learning aera in a preschool. It is hoped that such an exploration will help early childhood teachers understand the principles of science learning design and, in turn, create rich and meaningful science learning environments for young children.

1.INTRODUCTION

The design of learning areas aims to respond to young children's diverse developmental needs. Through carefully planned environments, these areas support children's holistic growth—integrating physical, emotional, social, and cognitive development—through play and exploration. Typical preschool learning areas include the reading area, art and creative area, construction area, dramatic play area, science exploration area, gross motor area, music area, life skills area, and language learning area. The reading area provides age-appropriate picture books and storybooks, encouraging children to read independently and listen to stories in order to develop language skills and cognitive comprehension. The art and creative area is equipped with easels, paints, clay, and other materials to promote creativity, aesthetic sensitivity, and hand–eye coordination. The construction area uses blocks, puzzles, and manipulatives to guide children in developing spatial concepts, problem-solving abilities, and cooperative skills. The dramatic play area sets up real-life props and scenarios—such as a kitchen, a doctor's office, or a shop—to strengthen children's social interaction, language expression, and imagination. The gross motor area is arranged with large-movement equipment to enhance children's physical development, coordination, and confidence in movement. The music area offers a

variety of instruments and sound materials, supporting learning in rhythm, melody, and emotional expression. The life skills area focuses on self-care and daily practices, fostering independence and a sense of responsibility. The language learning area promotes the integrated development of listening, speaking, reading, and writing through stories, dialogue, and a print-rich environment. The science exploration area provides natural materials and simple experimental tools to cultivate children's observation skills, curiosity, and inquiry spirit (Kaur, Shih, Liu, Hsu & Chang, 2024). This article aims to explore the rationale for planning a science learning center in a preschool. It is hoped that such an exploration will help early childhood teachers understand the principles of science learning design and, in turn, create rich and meaningful science learning environments for young children.

2.YOUNG CHILDREN and SCIENCE LEARNING: PERSPECTIVES on LEARNING AREAS

The goal of the learning sciences is to better understand the cognitive and social processes that result in the most effective learning. The science learning area should not be understood merely as a physical space equipped with materials and tools, but rather as a pedagogical environment that supports young children's active construction of knowledge. Drawing on constructivist and sociocultural theories, children are viewed as meaning-makers who learn through interaction with materials, peers, and more knowledgeable others (Piaget, 1952; Vygotsky, 1978; Rennie& McClafferty, 1996; Sawyer, 2014). When children engage with natural objects and simple experimental tools, they practice core science process skills such as observing, classifying, predicting, and inferring (National Research Council). These practices cultivate curiosity and promote an evidence-based mode of thinking from an early age. Furthermore, the design of a science learning aera reflects teachers' beliefs about how children learn. Teachers who conceptualize children as competent and capable explorers tend to create environments that emphasize openness, flexibility, and inquiry-oriented tasks rather than prescriptive, teacher-directed activities (Edwards, Gandini, & Forman, 2011; Lin & Shih, 2025). Such environments allow children to pursue individual interests while also encouraging collaboration and dialogue with peers, which deepens conceptual understanding through social interaction (Rogoff, 2003). At the curricular level, the science learning aera r functions as a hub for integrated learning across developmental domains. For example, when children document their observations, they engage in early literacy practices; when they measure and compare materials, they apply mathematical reasoning; and when they share findings, they develop communication and socio-emotional competencies (NAEYC, 2020). Empirical studies indicate that play-based, inquiry-oriented science environments enhance young children's motivation and conceptual understanding more effectively than didactic approaches (Gelman & Brenneman, 2004; Tu, 2006). Overall, the value of a science learning center lies not in transmitting scientific facts, but in nurturing children's dispositions to inquire, explore, and reason about the world. With intentional design and reflective pedagogy, early childhood teachers can transform science learning areas into key sites for sustaining children's long-term engagement and thinking in science.

3. PLANNING a SCIENCE LEARNING AREA in a PRESCHOOL

Preschool Pathways to Science (PrePS) is a science and mathematics program designed for pre-K children, developed by a team of developmental psychologists in close collaboration with preschool directors, teachers, and other staff. The PrePS approach is grounded in domain-specific theories of development, which posit that different areas of knowledge are organized into separate mental structures, rather than domain-general structures such as concrete operations (Gelman & Brenneman, 2004). In Taiwan, learning areas constitute one of the key curriculum models implemented in preschools. Within preschools that adopt a learning-area–based approach, the development and systematic planning of these areas represent a critical pedagogical consideration for early childhood educators. The focus of this article is on exploring how to develop science learning areas for young children, with particular attention to several considerations that teachers need to take into account (Ministry of Education, 2017).

3.1 Creative Arrangement

Creative arrangement of early childhood learning environments plays a critical role in fostering children's engagement, exploration, and holistic development. The structural organization of classroom spaces into thematic learning areas—such as a science exploration corner—provides opportunities for inquiry-based interactions and authentic engagement with materials. Inquiry-based and design-oriented environments encourage learners to explore concepts physically and cognitively, leading to deeper understanding (Design-based learning, 2025). Activity sequences can be intentionally structured from exploration to hands-on manipulation, discussion, and expression, aligning with constructivist theories that emphasize active meaning-making through social interaction and scaffolding. By using low-cost, attractive materials and integrating creative elements, the learning area becomes a space that young children love to explore and learn in (Piaget, 1952; Shih, 2025a, 2025B, 2025C; Vygotsky, 1978).

3.2 Interactive Exhibits

Building on the "learning by doing" principle emphasized in Interactive Exhibits, the design of the science learning area in early childhood settings should move beyond the mere display of materials and transmission of factual knowledge. Instead, it should be conceptualized as a learning environment that actively supports children's inquiry and social interaction. The materials and activities in the science area should encourage young children to engage in hands-on manipulation, observation, comparison, documentation, and questioning, thereby gradually constructing their understanding of natural phenomena and everyday technologies. This experiential learning process resonates with Dewey's (1938) notion of education as rooted in experience and aligns with the constructivist view that knowledge is formed through action and reflection (Bruner, 1960). Moreover, the science learning area can be regarded as an "interactive exhibit space" within the classroom. When designed to be open-ended, manipulable, problem-oriented, and supportive of dialogue, the science area enables children to function not only as individual explorers but also as collaborative learners who develop scientific thinking through peer interaction, discussion, and joint problem-solving. Such learning processes are consistent with Vygotsky's (1978) sociocultural perspective, which emphasizes that cognitive development is mediated through social interaction and language. Display students' experimental outcomes and work connected to scientific concepts, and include dedicated spaces for hands-on experiments and reading (Ministry of Education, 2017).

3.3 The Science Learning Resource Area

"The science learning resource area provides a variety of scientific tools, materials, and audiovisual resources, supporting children to freely choose activities based on their interests and engage in observation, hands-on manipulation, and inquiry, thereby fostering their exploratory skills and scientific literacy"(Shih & Juan, 2026a, 2026b). The science learning resource area is presented in Figure 1:

Figure 1: The science learning resource area

3.4 Interactivity

In early childhood education, the learning environment is not a neutral backdrop but an active participant in children's learning processes. Drawing on constructivist and sociocultural perspectives, the environment can be understood as a "third teacher" that interacts with children through materials, spatial arrangements, and symbolic representations. An interactive learning environment invites children's exploration, responds to their actions, and supports the co-construction of meaning. Through themed walls and interactive displays, children are attracted to observe and engage, thereby stimulating their curiosity and desire to learn (Jhuo & Chu, 2025; Ministry of Education, 2017).

4. CONCLUSION

Establishing science learning areas is critical for supporting the holistic development of young children, as such environments foster both cognitive and socio-emotional growth (Gelman & Brenneman, 2004; Piaget, 1952). Through creative arrangement, interactive exhibits, diverse scientific resources, and high interactivity, science learning areas encourage children to actively explore, stimulating curiosity, observation, and inquiry skills (Clements & Sarama, 2007). Research indicates that providing children with autonomy in selecting activities enhances engagement and intrinsic motivation, which are key factors in the development of early scientific literacy (Diamond et al., 2007; National Research Council, 2012). For teachers, the deliberate design and organization of these areas constitute a professional practice that operationalizes curricular concepts into tangible learning experiences, effectively supporting inquiry-based learning and hands-on experimentation (Gelman & Brenneman, 2004; Novak, 1988).

Empirical studies in preschool settings have demonstrated that well-designed science areas can increase children's participation in exploratory play, promote reasoning about scientific phenomena, and enhance problem-solving skills (Sarama & Clements, 2009). Overall, the development of science learning areas provides a sustainable, stimulating environment for early

childhood science education, enriching children's learning experiences while laying a foundation for lifelong scientific engagement.

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