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Mathematics Learning Area in Taiwanese Preschools: Philosophical Foundations and Educational Goals

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ABSTRACT: In early childhood settings, mathematics learning areas were traditionally centered on the manipulation of concrete materials such as number rods, sorting boxes, and shape boards, with an emphasis on repetitive practice and the development of basic skills. This approach reflected a more structured and technique-oriented pedagogy. In recent years, however, early mathematics education has shifted from skill training toward contextualized and life-based learning, highlighting children's natural use of mathematical concepts in authentic or simulated everyday situations. This article aims to examine the mathematics learning area in Taiwanese preschools, with a particular focus on its educational philosophy and instructional goals. It seeks to illustrate how thoughtfully constructed learning environments can support young children's understanding and application of mathematical concepts, as well as the development of problem-solving and logical thinking skills.

1.INTRODUCTION

In early childhood settings, mathematics learning areas were traditionally centered on the manipulation of concrete materials such as number rods, sorting boxes, and shape boards, with an emphasis on repetitive practice and the development of basic skills. This approach reflected a more structured and technique-oriented pedagogy. In recent years, however, early mathematics education has shifted from skill training toward contextualized and life-based learning, highlighting children's natural use of mathematical concepts in authentic or simulated everyday situations (NAEYC & NCTM, 2010). For example, through activities such as pretend shopping, cooking, construction play, and nature observation, young children spontaneously apply concepts related to number and quantity, classification, measurement, spatial relations, and patterns. In this way, mathematics becomes a tool for understanding the world rather than abstract knowledge detached from daily life (Van de Walle et al., 2019). At the same time, inquiry-oriented curriculum design has gradually replaced traditional approaches based on worksheets and prescribed procedures. This perspective emphasizes children's active role in posing questions, trying out strategies, and testing and revising their ideas through exploration and interaction (Piaget, 1970; Vygotsky, 1978). In this process, children are not merely completing teacher-assigned tasks but become active agents in their own learning, constructing mathematical understanding through dialogue, reflection, and experience. Such a shift supports the development of problem-solving abilities, mathematical thinking, and learning motivation, making mathematics learning more meaningful and holistic (Hiebert et al., 1997). To support early childhood educators in achieving these

objectives, the New Curriculum Guidelines for Preschools systematically articulate competency indicators, learning dimensions, and age-specific benchmarks across six domains: physical movement and health, cognition, language, social development, emotion, and aesthetics. Together, these domains constitute the principal framework guiding contemporary early childhood practice in Taiwan and therefore 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 Guidelines' explicit positioning of both science and mathematics education as integral components of early childhood education, rather than as isolated or advanced subjects (Lin & Shih, 2026; Pan & Pan, 2013). This article aims to examine the *Mathematics Learning Area in Preschool*, with a particular focus on its educational philosophy and instructional goals. It seeks to illustrate how thoughtfully constructed learning environments can support young children's understanding and application of mathematical concepts, as well as the development of problem-solving and logical thinking skills.

2. EDUCATIONAL PHILOSPHY

Early mathematics learning areas in preschools were traditionally centered on the manipulation of concrete materials such as number rods, sorting boxes, and shape boards, with an emphasis on repeated skill practice and conceptual mastery. This approach reflected a more structured and technique-oriented model of instruction. In recent years, however, early childhood mathematics education has gradually shifted toward a more contextualized and life-based orientation, emphasizing the construction of mathematical understanding within authentic and meaningful activity contexts. Rather than working only with abstract materials, children now naturally apply and develop concepts of number, measurement, comparison, and space through everyday experiences such as pretend shopping, cooking activities, block building, and nature exploration (Clements & Sarama, 2020; Leung, 2006; NAEYC & NCTM, 2010). In addition, contemporary curriculum perspectives highlight an inquiry-based learning process that values children's active questioning, experimentation, and verification, rather than simply completing teacher-designed worksheets or directive tasks. This shift not only enhances children's motivation and engagement in learning, but also promotes their thinking skills, problem-solving abilities, and deeper understanding of mathematical meaning (Hedegaard & Chaiklin, 2005; Khomais, 2014; National Research Council, 2007).

3. GOALS

Mathematics education is a critical part of the curriculum for students worldwide. The foundation for understanding mathematical concepts related to number sense begins early in life, and early childhood classrooms can provide the seeds for mathematical skills that will be needed later in life. In recent years, kindergarten curricula in Taiwan have increasingly emphasized children's autonomous exploration. Learning centers, which provide opportunities for free choice and hands-on activities, have gradually become an important instructional approach in early childhood education. Among these, the mathematics center, through the use of concrete manipulative materials, not only guides children in practical operations but also facilitates the development of their cognitive abilities, including classification, shape construction, and spatial reasoning. The mathematics learning area is designed to guide young children in constructing mathematical concepts and problem-solving skills through hands-on activities, exploration, and social interaction within meaningful and authentic contexts. The core learning objectives are as follows: (1) Cultivating logical reasoning and mathematical thinking: Through classification, ordering, pattern recognition, and reasoning activities, children develop an understanding of relationships among objects, such as part-whole and set-correspondence relationships, laying the foundation for subsequent abstract thinking. (2) Enhancing number and operation skills (Number Concept Development). Number concepts: Includes counting, reciting numbers, comparing quantities, composing and decomposing numbers, matching numerals with quantities, and understanding ordinal numbers. Quantity concepts: Involves comparing length

(height, distance, depth), area, volume, weight, capacity, and time measurement. Shape and spatial concepts: Recognizing two-dimensional and three-dimensional geometric shapes, understanding spatial orientations (front-back, left-right, up-down, inside-outside). (3) Building measurement and basic physical concepts: Through manipulative and exploratory activities, children develop preliminary understandings of physical phenomena such as balance, force, and gravity, linking these concepts to quantity, size, and spatial understanding. (4) Developing problem-solving and inquiry skills: Open-ended activities encourage children to pose questions, try multiple strategies, test outcomes, and reflect on their problem-solving processes, fostering inquiry-based thinking. (5) Promoting mathematical representation, language, and communication Skills. Children are guided to express mathematical ideas using verbal language, visual representation, symbols, and bodily actions, enhancing both mathematical vocabulary and communication abilities. (6) Fostering social interaction and cooperative learning. Through shared play and collaborative tasks, children learn turn-taking, sharing, rule-following, and cooperative problem-solving, cultivating teamwork and respect for others (Clements & Sarama, 2020; Ministry of Education, 2021; Linder, Powers-Costello & Stegelin, 2011; Sarama & Clements, 2009; Varol & Farran, 2006). The science learning resource area is presented in Figure 1:

Figure 1: The mathematic learning resource area

4. DISCUSSION

The transformation of mathematics learning areas in early childhood settings reflects a reevaluation of contemporary approaches to learning. The shift from skill-based, manipulative instruction to contextualized, life-based, and inquiry-oriented learning aligns with Piaget's (1970) and Vygotsky's (1978) theories on children as active constructors of knowledge and the importance of social interaction in learning. It also emphasizes the connection between learning and daily life, allowing mathematics to function not as abstract, isolated knowledge but as a tool for understanding the world and solving problems. Through everyday activities such as pretend shopping, cooking, construction play, or nature observation, young children spontaneously apply concepts related to number, classification, measurement, spatial relations, and patterns while simultaneously developing logical thinking and problem-solving skills through interaction. Moreover, inquiry-based learning environments encourage children to pose questions, test strategies, verify hypotheses, and revise ideas, fostering autonomy and critical thinking. This approach resonates with the six-domain framework emphasized in the New Curriculum Guidelines for Preschools (Ministry of Education, 2017), particularly the

cognitive domain's three dimensions: "mathematics in everyday contexts," "natural phenomena," and "cultural artifacts," highlighting the central role of mathematics in supporting children's holistic development. Nonetheless, practical challenges remain. Teachers require not only strong mathematical knowledge but also flexible instructional strategies and the ability to observe and guide children's learning effectively. Learning materials and environmental design must balance safety, manipulability, and engagement to genuinely support children in constructing mathematical understanding through play and exploration. Family and community support is also crucial, as children's experiences outside the classroom significantly influence their mathematical understanding and application. Overall, situating mathematics learning within a life-based, contextualized, and inquiry-oriented framework not only promotes cognitive development but also supports social interaction, problem-solving skills, and intrinsic motivation for learning, carrying substantial educational significance for young children's holistic growth. Future research and practice could further explore how teacher professional development, environmental design, and family engagement can work synergistically to enhance the effectiveness of early childhood mathematics education.

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