



A Reflective Analysis of the Development of Young Children's Number Concepts

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ABSTRACT: Early childhood is a critical period for the development of number concepts. During this stage, learning is not merely the mechanical memorization of abstract symbols; rather, children gradually construct their understanding of “quantity,” “relationships,” and “operations” through lived experiences, hands-on activities, and social interaction. A solid foundation in number concepts not only influences later mathematical achievement but is also closely related to problem-solving abilities, logical thinking, and the development of self-confidence. This article aims to provide a reflective analysis of the development of young children's number concepts.

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1. INTRODUCTION

The early 21st century is characterised by rapid change. Commentators note how permeating digital technologies engage increasing numbers of children. The extent and rapidity of economic, social, technological, scientific, spiritual and environmental change means that children today grow up facing uncertainties and possibilities on an unprecedented scale. Accordingly, early childhood education should cultivate in children the competencies required to identify, interpret, and resolve problems embedded in everyday life contexts. From a constructivist perspective, such problem-solving capacities emerge through active engagement with authentic situations, while a child-centered curriculum framework positions learners as capable agents who construct knowledge through inquiry, experimentation, and social interaction. Therefore, fostering practical problem-solving literacy is not merely a functional objective, but a foundational component of holistic child development and lifelong learning. Engaging young children in mathematical learning can significantly enhance their capacity to address and resolve problems encountered in everyday life. (Craft, 2010; Shih, 2018). However, for young children to develop strong mathematical understanding, appropriate pedagogical support is essential. Hence, preschool teachers' pedagogical content knowledge (PCK) in mathematics need to be emphasized. The construct of PCK for teaching mathematics in preschool involves three components: (1) noticing mathematical situations in which children engage; (2) interpreting the nature of children's math activity; and (3) enhancing children's mathematical thinking and understanding (Lee, 2017). In fact, children start to develop number sense even well before they start the school. Developing number sense serves as an intermediate tool for learning conventional mathematics taught in schools. This number sense has three key areas: number knowledge, counting and arithmetic operations (Zuhail YIMAZ, 2017). It is crucial for the development of fundamental mathematical ideas in young children. Empirical studies emphasize how play-based learning, cognitive preparedness, and contextual

influences kids' mathematical reasoning. This roadmap provides educators and policymakers with guidance on how to promote successful math comprehension by synthesizing insights from previous studies. The early years are a critical time for developing fundamental mathematical knowledge. In fact, number concepts constitute a foundational cornerstone of early childhood development, laying the groundwork for later mathematical learning and problem-solving abilities. Understanding the developmental sequence of young children's number concepts is akin to possessing a roadmap that enables parents and educators to systematically guide children in exploring the fascinating world of numbers. How, then, do young children's number concepts develop step by step? In essence, this development represents a cognitive progression from the concrete to the abstract. It begins with the perception of quantity, advances to the acquisition of counting skills, and gradually extends to an understanding of basic operations such as addition and subtraction. Each stage builds upon the previous one, forming a coherent and cumulative developmental trajectory. This article aims to examine and reflect upon the development of young children's number concepts (Clements & Sarama, 2020; Juan, Shih & Kao, 2025; Onoshakpokaiye & Eyetan, 2026; Ministry of Education, 2026; NAEYC, & NCTM, 2010; Shih, 2018; Teacher A-Bao, 2026; Ye & Shih, 2021).

2. THE IMPORTANCE of THE DEVELOPMENT of YOUNG CHILDREN'S NUMBER CONCEPTS

The following four aspects are central to young children's number concept development:

2.1 Establishing the Connection Between Quantity and Numerals

In everyday conversation we might talk about something being as 'easy as one-two-three'. But for young children, learning to count isn't so easy. It takes time for children to develop a deep and secure understanding of how numbers work. Fortunately, we have strong research evidence about some of the everyday ways we can help children to enjoy numbers and counting (Julian Grenier, 2026). Young children need to understand the correspondence between quantity and numerical symbols through concrete experiences, such as counting objects, engaging in matching activities, and practicing one-to-one correspondence. Through these experiences, they gradually grasp the concept of cardinality. When children understand that "5" is not merely the final word in a counting sequence but represents the total quantity of five objects, number concepts begin to be internalized meaningfully (Onoshakpokaiye & Eyetan, 2026; Teacher A-Bao, 2026).

2.2 Developing Concepts of Size, Length, and Weight

Experiences of comparison and measurement form an essential foundation for number concepts. Through observation and manipulation, children learn to distinguish relative relationships such as bigger/smaller, longer/shorter, heavier/lighter, taller/shorter, and more/less. These experiences foster logical reasoning skills and lay the groundwork for later understanding of measurement and geometric concepts (Onoshakpokaiye & Eyetan, 2026; Shih, Aslam, Pang & Manditereza, 2025; Teacher A-Bao, 2026).

2.3 Cultivating Classification and Seriation Abilities

Early childhood is widely recognized as a pivotal developmental stage during which children experience rapid growth in cognitive, social, and emotional domains]. At this age, they exhibit a pronounced intrinsic curiosity about the natural world and a strong capacity for learning through exploration. Early childhood children naturally engage in behaviors characteristic of scientific inquiry—they investigate their surroundings, pose questions, and seek understanding through active, hands-on experiences. During this period, their interest in and responsiveness to science-related content tend to increase significantly (Uğraş, Çakır, Zacharis & Kalogiannakis, 2025). For young children, classification and seriation are central to mathematical thinking. By grouping objects according to attributes such as color, shape, size, or function, children learn to identify similarities and differences. This process strengthens abstract thinking and promotes the development of logical organization and pattern recognition skills (Elia et al, 2018; Onoshakpokaiye & Eyetan, 2026; Teacher A-Bao, 2026).

2.4 Emphasizing the Connection Between Emotion and Learning

Academic emotions play a crucial role in mathematics learning, significantly influencing motivation, academic achievement, and career aspirations in mathematics. With the notable increase in research on emotions in recent years (Schoenherr, Schukajlow & Pekrun, 2025). Young children's emotional experiences with mathematics significantly influence their future learning motivation and attitudes. When learning occurs in a joyful and supportive environment, children are more likely to develop a positive mathematical self-concept and confidence. Conversely, early experiences filled with frustration or pressure may lead to mathematics anxiety. Therefore, teachers and parents should create an environment that encourages exploration, allows mistakes, and values learning processes, enabling children to construct number concepts within a safe and respectful context (Lin & Shih, 2026; Onoshakpokaiye & Eyetan, 2026; Teacher A-Bao, 2026).

3. DISCUSSION

Promoting a professional vision of teaching as a key component of teacher expertise is a core challenge in teacher professionalization. Professional teachers must engage in adaptive teaching practices that cater to the diverse needs of their students. Every child is a unique individual (Lin & Shih, 2025). In the course of early childhood mathematical development, the establishment of fundamental mathematical concepts is not only the starting point of academic learning but also a crucial foundation for cognitive development. Before entering formal schooling, children gradually develop an initial sense of number, including the ability to recognize differences in quantity, make magnitude comparisons, and detect increases or decreases in amount. Research indicates that preschool children already possess an intuitive understanding of quantitative relationships and basic counting principles (Gelman & Gallistel, 1978). These intuitive quantitative experiences form the core foundation for subsequent mathematical learning, enabling children to gradually construct abstract mathematical concepts based on concrete experiences. Therefore, the development of number concepts can be regarded as a cognitive transformation process that moves from perceptual experience toward symbolic understanding. From a cognitive developmental perspective, the formation of young children's number concepts involves a gradual progression from concrete operations to abstract thinking. According to Jean Piaget (1952), children in the stage of concrete operations develop an understanding of number conservation and logical relationships through direct manipulation and perceptual experiences. By handling physical objects—such as blocks, picture cards, or everyday materials—children learn to establish correspondences between quantities and numerical symbols. When children are able to connect the quantity of tangible objects with abstract symbols and comprehend their stability and conservation, it indicates that their representational understanding of number has reached a more mature level (Shih, 2026a, 2026b).

In addition, language development plays a critical role in this process. Based on the sociocultural theory proposed by Lev Vygotsky (1978), language and social interaction function as essential mediators of cognitive development. The comprehension and use of number words assist children in grasping ordinal relationships, comparative concepts, and basic operational logic, demonstrating the close interaction between linguistic competence and mathematical cognition. At the level of instructional practice, research widely supports play-based and contextualized learning as effective strategies for promoting early mathematical development. Douglas H. Clements and Julie Sarama (2009) proposed the theory of learning trajectories, emphasizing that systematic hands-on activities and problem-based contexts can guide children in progressively constructing mathematical concepts. Through role-playing activities, constructive tasks, or the integration of everyday life situations, children are able to understand quantitative relationships within natural and meaningful contexts. For example, engaging in counting and exchange activities in a simulated store setting, or learning concepts of equality and comparison while distributing objects, can strengthen mathematical thinking. Meanwhile, when teachers and parents encourage children to articulate their reasoning through questioning and guided

dialogue, their mathematical understanding and reasoning abilities are further deepened (Clements & Sarama, 2020; Lin & Shih, 2026).

From a long-term developmental perspective, early mathematical competence is significantly associated with later academic achievement. Research shows that early mathematics skills are among the strongest predictors of future academic performance (Duncan et al., 2007). A solid foundation in early number concepts not only facilitates the development of later computational skills but also enhances problem-solving and logical reasoning abilities. Therefore, educational policy and curriculum planning should emphasize the quality and equity of early childhood mathematics education and strengthen professional teacher training so that instructional activities can be designed in accordance with children's cognitive developmental characteristics. In conclusion, cultivating number concepts in early childhood is not merely a matter of skill acquisition; rather, it is a foundational undertaking that profoundly influences overall cognitive development and long-term learning trajectories.

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