

Unit 12 Research



The development of young children's number sense and understanding of the base ten system is essential for the acquisition of more complex number skills in later years. Once children have developed a basic sense of numbers up to ten, they need to develop a strong "sense of ten" as a foundation for both place value and mental calculations. Students need many instructional experiences to develop their understanding of numerical systems including how numbers are written. Research indicates that students' experience using physical models to represent tens and ones can be effective in dealing with place value issues early in the curriculum. The materials should help them think about how to combine quantities and eventually how this process connects with written procedure. Children, therefore, often need extra help in understanding the base ten organization underlying number names and in seeing quantities organized into hundreds, tens, and ones. Conceptual supports, such as manipulatives, show the magnitude of the quantities and connect them to the number names and written numerals, and have been found to help children acquire insight into the base ten number system. That insight is important to learning and understanding numerals and also to developing strategies for solving math problems.⁽¹⁾ However, "merely having manipulatives available does not ensure that students will think about how to group the quantities and express them symbolically", states The National Council of Teachers of Mathematics. Rather, students must construct meaning for themselves by using manipulatives to represent groups of tens in classroom discussions and in authentic, cooperative activities.⁽²⁾

Research findings suggest that in two-digit numeral representations, children's understanding of the ones place develops before knowledge of the tens place. These findings directly relate to mathematics contexts, with implications for early childhood mathematics instruction. Arthur J. Baroody at the University of Illinois argues that exposure to foundational place value concepts (e.g., exposure to multiunit meanings, working with two-digit numbers) should be introduced much earlier than

first grade, and can begin as soon as children begin working with two-digit numbers. Baroody's rationale for early exposure rests on the assertion that young children have the ability to make basic connections and establish foundational understanding for later mathematics. He suggests, "By introducing multiunit meanings concretely as soon as children begin using two-digit numbers in school and discussing them throughout the primary grades, children may develop a more secure basis for understanding multiunit concepts."⁽³⁾

Students need opportunities to practice the fundamentally important "exchange principle", e.g., ten ones is the same as one group of ten and explore the concept of leftovers.⁽⁴⁾ In Starfall Math, children learn that the meaning of a digit in a written number is determined by its placement within the number. Activities are designed to provide opportunities to create and count groups of 10 with connect cubes, providing students with a physical representation of how two-digit numbers are created, and emphasizes the place value concepts of groups of ten and leftover ones.

(1) Kilpatrick, J., Swafford, J., and Findell, B. (2015) *Adding It Up: Helping Children Learn Mathematics*, Center for Education, Division of Behavioral and Social Sciences and Education, National Research Council. National Academy Press; Washington, DC.

(2) *Principles and Standards for School Mathematics* (2000). National Council of Teachers of Mathematics [NCTM].

(3) Baroody, A. (1990). How and when should place value concepts and skills be taught? *Journal for Research in Mathematics Education*, 21(4), 281-286.

(4) Copley, J. V. (2000). *The young child and mathematics*. Washington, DC: NAEYC.

Unit 12 Frequently Asked Questions

The Starfall Math Curriculum includes place value concepts from day one. Why is so much emphasis placed on this concept?

It is absolutely essential that children develop a solid understanding of the base ten numeration system and place value concepts. Starfall introduces place value through real-life experiences every day during the Gathering Routine in which the children chart the number of days they have been in school then group them by ones, tens, and one hundred. This daily exposure to place value helps children understand that our base ten number system only includes the numbers 0 through 9. Being introduced to the concept of regrouping from an early age helps children develop the concepts they will later need to successfully learn to regroup in addition and subtraction.

In which other types of lessons do children use their knowledge of place value?

Children use their individual ten-frames and manipulatives to construct number representations above 9. When the concept of teens is introduced, the children learn them by understanding the value of each number's placement. The children construct meaning for themselves by using manipulatives to represent groups of tens in classroom discussions and in authentic cooperative activities.