

## Abstract

Students' difficulties learning and understanding decimal numbers are well-documented in mathematics education research literature. These difficulties pose a challenge to teachers because of the prominent position decimals occupy in the Common Core State Standards. The purpose of this study was to examine and develop students' thinking about whole number place value, decimal place value, and decimal computations. Four students, who were in the process of finishing fourth grade; were included in the study. Students participated in an initial assessment interview, seven one-hour tutoring sessions, and a post assessment interview. Each instructional session and interview was video recorded, transcribed, and analyzed qualitatively to determine students' development of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Throughout the study, students worked with base-10 manipulatives and place-value mats to visualize key ideas. The manipulatives were used in a manner designed to foster conceptual understanding rather than only procedural fluency. Instruction followed a research-based learning progression for place value and decimals. During instruction, students gained number sense and applied this knowledge to decimal computations. At the conclusion of the study, students demonstrated improved conceptual understanding of decimals and decimal computations. We did find, however, that students needed more time than anticipated to understand whole number place value at the outset of the study. These results demonstrate the importance of spending ample time on each standard about learning decimals in the Common Core and providing students with concrete grounding in visual representations of decimal concepts before moving forward to abstract decimal representations.