

From Integers to Fractions: Developing a Coherent Understanding of Proportional Magnitude

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Abstract

Children display an early sensitivity to implicit proportions (e.g., 1 of 5 apples vs 3 of 4 apples) but have considerable difficulty in learning the explicit, symbolic proportions denoted by fractions (e.g., $1/5$ vs $3/4$). Theoretically, reducing the gap between representations of implicit vs explicit proportions would improve understanding of fractions, but little is known about how the representations develop and interact with one another. To address this, we asked 163 third to fifth graders to estimate the position of proportionally-equivalent integers and fractions on number lines (e.g., 3 on 0-8 number line vs $3/8$ on 0-1 number line). We found that, with increasing age, children were more accurate and linear in representing both integers and fractions. More importantly, childrens estimates of implicit and explicit proportions became more coherent, such that a child's estimates of fractions on a 0-1 number-line was a linear function of the same child's estimates of equivalent integers. This representational coherence independently predicted childrens fraction proficiency in other tasks, suggesting that building a coherent understanding of proportions is an educationally-important goal.