Evaluating the comprehension of fractions in 6th to 10th grade using a graduated number line test

Maxime Cauté
CEA, Inserm, Université Paris-Saclay, Gif/Yvette, France

Cassandra Potier-Watkins
CEA, Inserm, Université Paris-Saclay, Gif/Yvette, France

Chenxi He
CEA, Inserm, Université Paris-Saclay, Gif/Yvette, France

Stanislas Dehaene
CEA, Inserm, Université Paris-Saclay, Gif/Yvette, France

Abstract

How can we know whether a child really understands a fraction and how they understand it? We argue that number-to-line tasks are a great probe, as children need to think about magnitude and have many opportunities for error. We tested 26,000 pupils from 6th to 10th grades and analyzed their errors. In 6th grade, 80% of the responses were wrong; 45% were still so in 10th grade. We observed seven error patterns. In particular, younger and lower-performing children mostly confused fractions with decimals; older and higher-performing children rather placed the inverse of the target fraction. All grades also confused the roles of the numerator and the denominator. We propose that children use two strategies: they either convert the target fraction into a decimal or partition the line into units to count. We discuss theoretical (strategy choice vs. strategy execution) and pedagogical (identify and remediate misunderstandings) implications.

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