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Bridging the gap: fraction understanding is central to mathematics achievement in students from three different continents.

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Summary: Numerical understanding and arithmetic skills are easier to acquire for whole numbers than fractions. The integrated theory of numerical development posits that, in addition to these differences, whole numbers and fractions also have important commonalities. In both, students need to learn how to interpret number symbols in terms of the magnitudes to which they refer, and this magnitude understanding is central to general mathematical competence. We investigated relations among fraction magnitude understanding, arithmetic and general mathematical abilities in countries differing in educational practices: U.S., China and Belgium. Despite country-specific differences in absolute level of fraction knowledge, 6th and 8th graders' fraction magnitude understanding was positively related to their general mathematical achievement in all countries, and this relation remained significant after controlling for fraction arithmetic knowledge in almost all combinations of country and age group. These findings suggest that instructional interventions should target learners' interpretation of fractions as magnitudes, e.g., by practicing translating fractions into positions on number lines.

Classification: F43 C33 C43 C63

Keywords: fractions; magnitude representations; arithmetic; integrated theory of numerical development; cultural differences

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