Modeling students' fraction arithmetic strategies using inverse planning

Anna Rafferty
Carleton College, Northfield, Minnesota, United States

Rachel Jansen
University of California, Berkeley, Berkeley, California, United States

Tom Griffiths
University of California, Berkeley, Berkeley, California, United States

Abstract

Fraction arithmetic is a challenging topic for students. Past work has found that many errors can be accounted for by a limited number of malrules, reflecting both execution errors and incorrect strategies (Braithwaite, Pyke, and Siegler 2017). We develop an inverse planning model for fraction arithmetic that computes students' affinity for particular malrules based on their problem solutions. Inverse planning models people's choices when solving problems, and has been used to model data from solving algebraic equations and playing educational games. The output of the fraction arithmetic inverse planning model gives a more detailed assessment of a student's knowledge than the number of problems she answers correctly, and does not require human interpretation of students' solutions. Applying the model to the two datasets in Braithwaite et al. (2017) and inferring tendencies to use two specific malrules shows that its output is consistent with manual annotations of students' strategies.