Project Overview

- EM2 is developing an online diagnostic assessment system designed to uncover student thinking about rational number concepts required to understand advanced mathematics.
- The short and highly-focused assessments target grades 5-7 rational concepts related to fractions, decimals, and operations with fractions and decimals.
- Each EM2 assessment is designed to identify 1-3 misconceptions using the pattern of students' selected responses, but also have students provide constructed responses so that the researchers (and later, teachers) can validate students’ classification.

The Representing Fractions Assessments

A critical attribute of a simple or equivalent representation when partitioning a whole is that the size of each part needs to be an equal size, but not necessarily the same shape.

- CCMMs 4.NF.1. Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

During instruction, students often work with models partitioned into pieces of the same size and shape, leading some students to
- think the pieces must be the same shape
- not consider size

The EM2 representing fractions assessments are designed to identify the students who apply the following misconceptions:

1. **Part to whole, unequal pieces**: views the numerator as the number of pieces shaded and the denominator as the number of total pieces without attending to whether or not the shape is divided into equal size regions or pieces.

2. **Part to whole, equal pieces—does not consider equivalent or partitioned pieces**: Not recognizing the size of a region relative to the whole when (a) the regions are different shapes, but are the same size or (b) one or more partitions distinguishing regions are added or taken away.

Items present a simple or equivalent fraction and the image of a shape with a shaded region and ask students to provide
- selected response: does the shaded part represent the fraction? (yes or no)
- constructed response: explain your answer using words or pictures

**Misconception 1 (M1): Part to whole, unequal pieces**

The M1 assessment includes 7 items designed to elicit M1.

Item example: Is the shaded part 1/4?
In a sample of 283 fifth graders, expert coding (using students’ selected and constructed responses) found that 32% (N=90) have M1 and 84 of these students (93%) responded that this image represented 1/4.

**Misconception 2 (M2): Part to whole, equal pieces—does not consider equivalent or partitioned pieces**

The M2 assessment includes 9 items designed to elicit M2.

Item example: Is the shaded part 1/4?
In a sample of 134 fifth graders, expert coding (using students’ selected and constructed responses) found that 65% (N=86) have M2 and 79 of these students (92%) responded that this image did not represent 1/4.

During the virtual poster session at SREE, the authors will have the assessments, a demonstration of the online assessment system, and examples of students’ constructed responses providing evidence of the misconceptions.

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant 305A110306 to Education Development Center, Inc. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.