

Different Ways to Assess Mathematical Thinking

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I have been a teacher for many years and am constantly trying to improve my mathematics instruction. According to Alberta Education's *Program of Studies*, students are expected to gain facility in comparing fractions through the study of various representations and models of fractions. They should be able to solve problems involving equivalent fractions. New visions of mathematics require new assessment tools. Recently, there has been a big emphasis on assessment in our school division.

While I was teaching a unit on fractions to my Grade 5 class, I began to think about different ways to assess their knowledge. After teaching what a fraction represents, equivalent fractions, mixed numbers and the names of the numerals in a fraction, I asked the students to create their own fraction booklet. This replaced my standard unit exam.

I was teaching 10- and 11-year-olds, so I gave them a lot of guidance on what I expected in the booklet. I distributed the following assignment:

Tell Me What You Know About Fractions

Your booklet should include the following the following:

- Vocabulary words, such as numerator, denominator, mixed number and equivalent fraction
- Comparing fractions
- Fraction problems
- Illustrations that show fractions as part of a shape and as part of a set

Be sure to include how whole numbers can be divided into fractions.

Include anything else you have learned or know about fractions. Cut out images from magazines, add humour, use stickers and have fun.

The booklet is due on _____. (And yes, all of the pages in the booklet should be used.)

I made a booklet myself so that the students would have clear expectations about the product. They were given two class blocks of 45 minutes to create their booklets, and then they were assigned as homework.

I set up a four-point rubric for assessment:

My Fraction Book

4: Meets the standard of excellence

- The fractions and illustrations match and are accurate.
- The illustrations enhance understanding of the ideas.
- The booklet includes all of the suggested elements, as well as additional information.
- The explanations and illustrations use appropriate math terminology accurately.
- All problems are stated clearly and solutions are shown. The problems show a high degree of understanding of the concepts taught.
- The booklet is neat and well organized.

3: Exceeds acceptable standard

- The fractions and illustrations match and are accurate.
- A number of fractions are used.
- The booklet includes most of the suggested elements.
- The explanations and illustrations use math terminology accurately.
- All problems are stated clearly and solutions are given. The problems show a good degree of understanding of the concepts taught.
- The booklet is neat and organized.

2: Meets acceptable standard

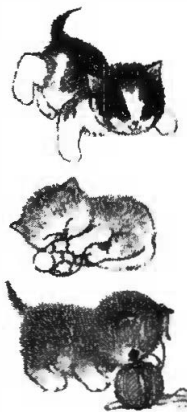
- Fractions and illustrations are generally accurate, although few fractions are used.
- Some fractions are repeated.
- Some of the elements of the assignment are missing.
- The explanations and illustrations use math terminology in a general way.
- Not all problems are clearly stated and no solutions are given.
- The booklet is fairly neat but is poorly organized.

1: Has not yet met the acceptable standard

- The fractions and illustrations may not match.
- No examples of equivalent fractions are given.
- Many of the elements of the assignment are missing.
- The explanations and illustrations do not use math terminology, or the math terminology is used incorrectly.
- There is little or no attempt to include a problem.
- The booklet is messy and no care has been taken to complete the task.

As you can see from the following samples, the students demonstrated their understanding of fractions in creative ways.

I was pleased and amazed with the results that I received, and this project gave me a great deal of insight into the students' thinking. Students were able to represent and describe proper fractions and equivalent fractions, both pictorially and symbolically, and they demonstrated their ability to compare and order fractions. Many of the specific outcomes prescribed in the *Program of Studies* were met. Not only were the fraction books a delight to read but they were a great addition to our portfolios as well.



$\frac{2}{3}$ of the kittens
have a ball

$\frac{1}{3}$ of the kittens
are orange

$\frac{3}{3}$ of the kittens
are cute

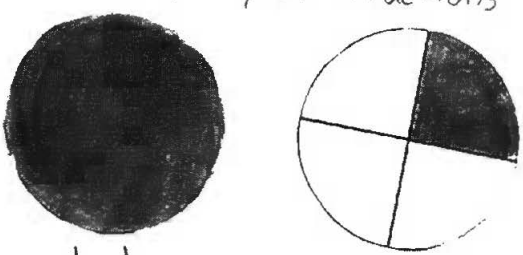


But how come $\frac{1}{10}$ is less than $\frac{1}{8}$ Because 10 is bigger than 8?



Because 10 is divided into more pieces that must be smaller

Mixed numbers are fractions like $3\frac{1}{2}$, $2\frac{5}{10}$ and $6\frac{7}{8}$. They're also called improper fractions



$1\frac{1}{4}$

Mixed numbers are often used in baking, like this: Put the $1\frac{1}{4}$ cup flour in with $3\frac{2}{3}$ tbs. water. Etc. etc. But this isn't cooking class so, on to the next page.

We're almost halfway through this book. Half can be represented as $\frac{1}{2}$ and there are 6 pages in this book. What is $\frac{1}{2}$ of 6? The answer, drumroll please, 3. The next half of this booklet will be dedicated to reviewing what you have already learned about equivalent fractions, mixed numbers, numerators and denominators.

JoAnn Grand Pooley teaches Grade 5 at Graminia Community School in the Parkland School Division. Her interests include science and mathematics curriculum, professional learning communities and authentic assessment.