ipdae INSTITUTE FOR THE PROFESSIONAL DEVELOPMENT OF ADULT EDUCATORS

Using Visual Representations or Models in Teaching Fractions to ABE Students

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www.floridaipdae.org

Objectives

To improve overall adult student achievement by:

- Understanding what knowledge (**content standards**) and skills (**standards of practice**) students need to master in order to be successful, specifically the ones involving fractions and proportions as outlined in the College and Career Readiness Standards for ABE.
- Exploring the visual approach to teaching fractions which will reinforce students understanding of division.
- Applying the Standard of Mathematical Practice, Model with Mathematics (M.P.4).
- Use resources available from the IPDAE website in helping students understand fractions.

Why do students struggle with fractions?

- Unfamiliar notation
- Vocabulary of fractions
- The number of rules when ordering and solving fractions
- Fractions do not behave like normal numbers
- The dual nature of fractions: 1) Division and 2) Part of a Whole

McLeod and Newmarch (2006). Fractions. *National Research and Development Center for Adult Literacy and Numeracy,* 5.

Why do students have to learn fractions?

- Fractions are integrated into real-world applications of math such as numbers, shapes, data handling, and particularly every sort of measure of weight, length, volume, time, and simple probability.
- Fractions are encountered in various fields of specialization or at home such as solving money problems, sharing a bill, comparing prices, calculating journey times, cooking, interpreting data in pictograms and bar charts, using a ruler, measuring a room, comparing each other's heights, and checking the weight of ingredients.

McLeod and Newmarch (2006). Fractions. *National Research and Development Center for Adult Literacy and Numeracy,* 12.

Model with Mathematics

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. They are able to **identify important quantities** in a practical situation and **map their relationships** using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can **analyze those relationships** mathematically to **draw conclusions**. They routinely **interpret their mathematical results** in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Pimentel, S. (2015). College and Career Readiness Standards for Adult Education. *U.S. Department of Education, Office of Vocational and Adult Education. Washington, D.C.*.

Standards of Mathematical Practice

Model with Mathematics

- Writing an addition equation to describe a situation
- Apply proportional reasoning to plan a school event
- Use proportional reasoning to analyze a problem in the community.
- Use geometry to solve a design problem.
- Use a function to describe the relationship between two quantities in an observation.
- Use approximations to simplify a complicated situation
- Use of tools such as diagrams, two-way tables, graphs, flowcharts and formulas.

Pimentel, S. (2015). College and Career Readiness Standards for Adult Education. *U.S. Department of Education, Office of Vocational and Adult Education. Washington, D.C.*.

What teachers need to keep in mind when teaching fractions?

1. Learners should understand that **one way** of thinking about a fraction is to see it as the result of dividing the top number equally into the number of groups shown by the bottom number.
2. Another way to think about fractions is that the **denominator** is the total number of equal parts (of one whole or one set) and the **numerator** is how many of those equal parts there are.

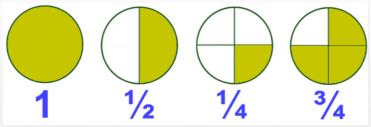
$$\frac{\text{number}}{\text{groups of \_\_\_\_}}$$

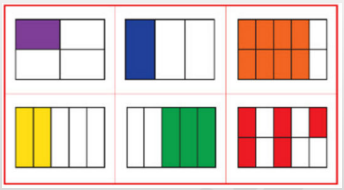
$$\frac{\text{\# of equal parts}}{\text{total \# of equal parts}}$$

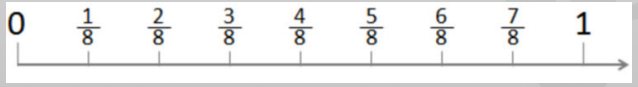
McLeod and Newmarch (2006). Fractions. *National Research and Development Center for Adult Literacy and Numeracy,* 10.

What teachers need to keep in mind when teaching fractions?

3. Learners need to be familiar with multiple representations of fractions, and should always be given more than one representation. These can include: area diagrams using a range of different shapes, number lines, words, symbols, some decimal equivalents and percentages, fractions as a result of division.







McLeod and Newmarch (2006). Fractions. *National Research and Development Center for Adult Literacy and Numeracy,* 10.

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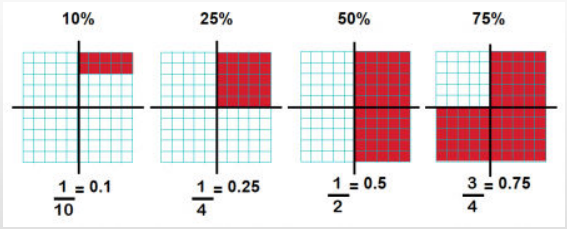
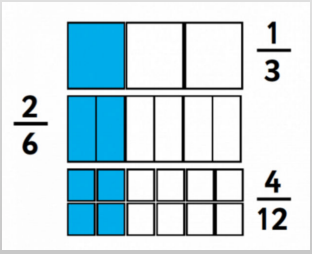
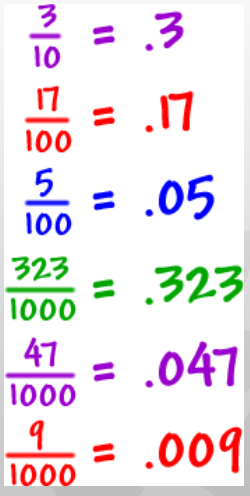


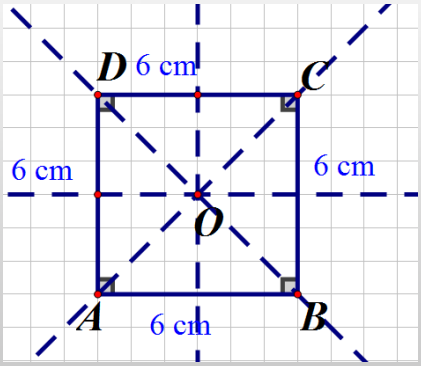


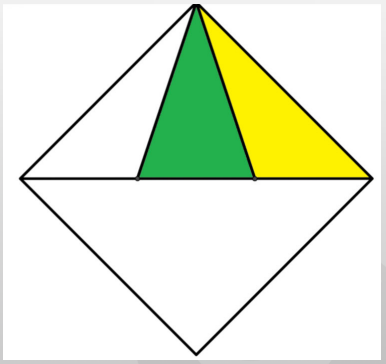


McLeod and Newmarch (2006). Fractions. *National Research and Development Center for Adult Literacy and Numeracy,* 10.

What teachers need to keep in mind when teaching fractions?

4. Visual representations of a particular fraction may be of different sizes, orientation, and partitions or shapes.





McLeod and Newmarch (2006). Fractions. *National Research and Development Center for Adult Literacy and Numeracy,* 10.

Which one is greater?

- Half of a small square
- Quarter of a larger square

Other Teaching Points

5. Compare unit fractions with different denominators (e.g. $\frac{1}{3}, \frac{1}{4}, \frac{1}{5}$).
6. Compare fractions with the same denominator (e.g. $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}$).
7. Encourage strategies for deciding whether a fraction (unit or non-unit) is less than half, equal to half or greater than half.
8. Consider the difference between a unit fraction and a whole unit (e.g. $1 - \frac{1}{4}$ or $1 - \frac{1}{5}$).
9. Show that each fraction can be written in an infinite number of equivalent forms.
10. Show that fractions can be equal to, or bigger than one whole.

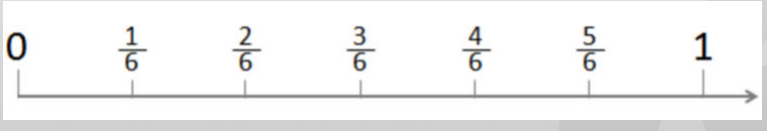
McLeod and Newmarch (2006). Fractions. *National Research and Development Center for Adult Literacy and Numeracy,* 10.

Why do we change the operation to multiplication and flip (or use the reciprocal of) the second fraction when dividing fractions?

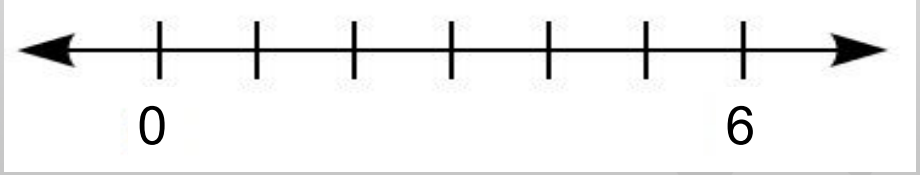
Before demonstrating this answer, please keep in mind two things:

- Math was invented to help make sense of the world, not the other way around.
- There are many valid ways to explain this answer. What you will see is one of more practical ways I explained the method to my students.

$$1 \div 6 = \frac{1}{6}$$



$$6 \div \frac{1}{2} =$$



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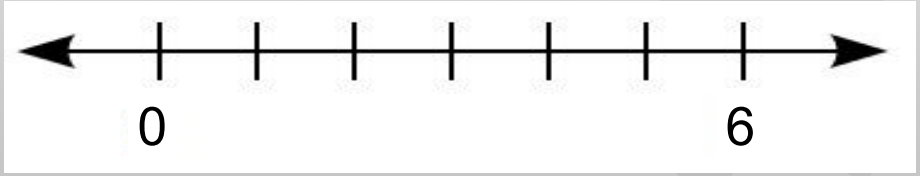
$$6 \div \frac{1}{3} =$$



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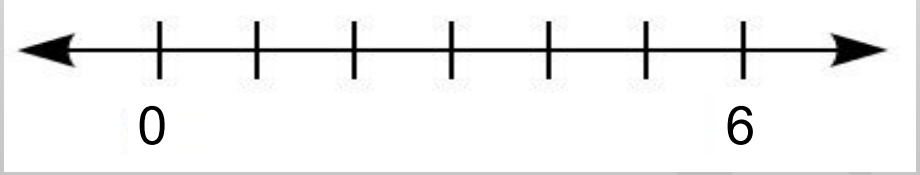
$$6 \div \frac{2}{3} =$$



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Do's and Don'ts

Do

- Find out and start from what learners know
- Be sensitive to the fact that many learners may have previously found work on fractions difficult and frustrating
- Talk about how fractions are used in everyday life
- Encourage learners to estimate with fractions
- Make sure any activities are enjoyable, stimulating and include group work
- Show fractions in a variety of representations
- Encourage learners to talk about fractions
- Support learners in checking their own work
- Give lots of thinking time when you ask questions
- Delay using formal fraction vocabulary until learners are ready
- Use tenths and hundredths and encourage learners to see decimals as another representation of fractions
- Make connections with other maths topics
- Use lots of visual aids

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Do's and Don'ts
Don't
Don't
Introduce formal fraction symbols too early
Teach learners to memorise processes and rules
Teach just halves and quarters, even from the start
Allow learners to compartmentalise fractions or to see them as 'separate' from decimals and percentages
Give endless drills and 'practice'
Tell learners all the answers
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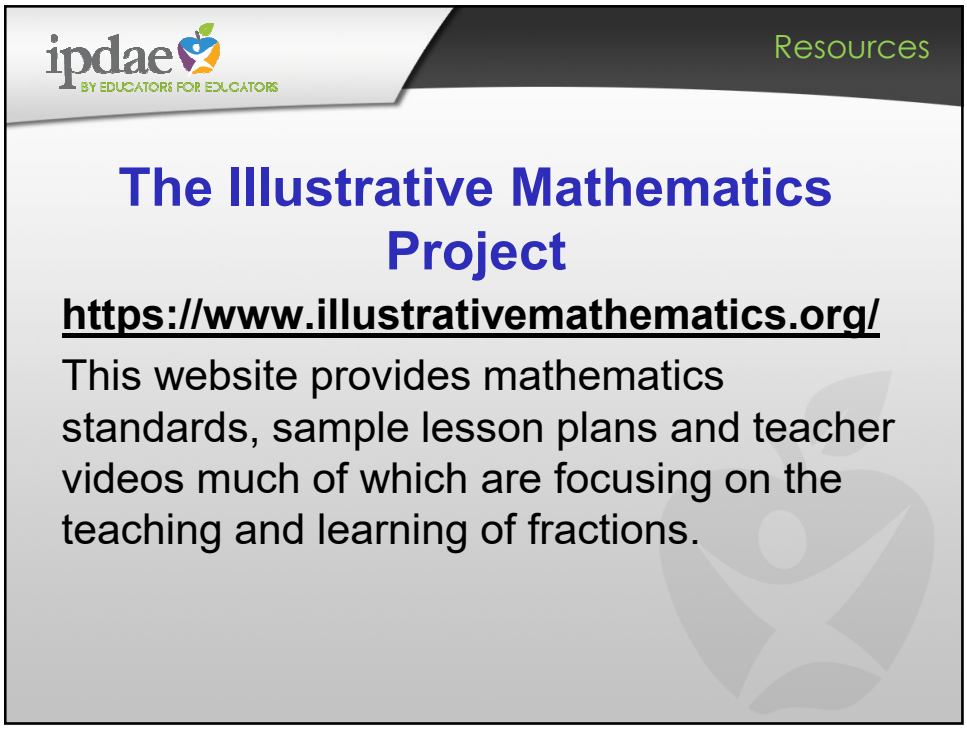
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Resources
The Illustrative Mathematics Project
https://www.illustrativemathematics.org/
This website provides mathematics standards, sample lesson plans and teacher videos much of which are focusing on the teaching and learning of fractions.

Summary

- We increased our understanding what knowledge (**content standards**) and skills (**standards of practice**) students need to master in order to be successful, specifically the ones involving fractions and proportions as outlined in the College and Career Readiness Standards for ABE.
- We explored some visual approaches to teaching fractions that will reinforce students understanding of division.
- We applied the Standard of Mathematical Practice, Model with Mathematics (M.P.4).
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Webinar Evaluation

https://www.surveymonkey.com/r/L9YKXDW

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Thank You!