



EQUIVALENT FRACTIONS

Subject Matter: Mathematics

Grade Levels: 5-7

Time Allotment: 2-3 hours

Master Teacher: Karen Mapes

Overview

Adding and subtracting fractions with unlike denominators is a major stumbling block for students, and it is made much more difficult if students do not fully understand the concept of equivalent fractions. Students often lack a sense of why they are doing what they are doing, trying instead to memorize a series of steps that don't make sense. Through a series of interactive activities on the Web set up as computer stations, this lesson provides students with the number sense of equivalent fractions. Knowledge is assessed at the end when students are asked to show what they have learned about equivalent fractions by creating their own game.

Learning Objectives

Students will be able to:

- Understand the concept of a fractional part of a whole.
- Understand how equivalent fractions show the same amount of "stuff" in the whole, just divided into different numbers of parts.
- Change fractions into useful equivalent fractions.
- Demonstrate their understanding of equivalent fractions in a performance assessment.

Oregon Standards Available at:

<http://www.ode.state.or.us/cifs>

Mathematics - Calculations and Estimations

- Perform calculations on whole numbers, fractions, decimals and integers using paper and pencil, calculators and/or computers.
- Demonstrate the relationships among whole number, decimal, fraction, percent, exponent and integer operations (including relationships involving ratio and proportion).

National Standards From the National Council of Teachers of Mathematics

(<http://standards.nctm.org/>)

In grades 5-8, the mathematics curriculum should include the study of number systems and number theory so that students can:

- Understand and appreciate the need for numbers beyond the whole numbers.
- Develop and use order relations for whole numbers, fractions, decimals, integers and rational numbers.
- Extend their understanding of whole number operations to fractions, decimals, integers and rational numbers.

Media Components

Video

Check the link at <http://www.opb.org/edmedia/trs/> to find access to the video(s) from unitedstreaming™ referenced in this lesson plan.

- ‘Mathica’s Mathshop: Winter Warm-Up’ (15:00)
 - **Clip:** “Using Tanograms (02:41)”

Web

Note: Some of these Web sites change games frequently, so be sure to check the day of the lesson.

- **Tangram Patterns**
This site has basic information about tangrams, including patterns that students can use to cut out a set of tangrams.
<http://www.tangrams.ca/>
- **Tangram Lesson**
A lesson by Joanne Caniglia that incorporates fractions into tangrams.
<http://explorer.scrtec.org/explorer/explorer-db/rsrc/813447516-81ED7D49.2.PDF>
- **PBS Mathline**
This PBS lesson explores the pieces of a tangram set related to fractions. It also has instructions for students to cut their own tangrams out of a piece of paper by folding, rather than following pre-printed lines. This would be appropriate for more capable students.
<http://www.pbs.org/teachersource/mathline/concepts/asia/activity2.shtm>

- **PBS Cyberchase**
One of the Cyberkids characters challenges students to find 13 ways to shade one-half of a square.
<http://pbskids.org/cyberchase/games/fractions/index.html>
- **Learning Planet**
A game in which students can click on equivalent fractions to beat the clock.
<http://www.learningplanet.com/sam/ff/index.asp>
- **Family Education Network – Fun Brain**
The Fresh-Baked Fraction Game.
<http://www.funbrain.com/fract/index.html>
- **Cool Math 4 Kids**
This site provides colorful explanations of math topics. In “Equivalent Fractions Part 1,” the site describes how to visualize and calculate equivalent fractions.
<http://www.coolmath4kids.com/lessons/fractions4.html>
- **Quia Corporation - Fraction Game**
The Quia Corporation produces Web sites that provide educational support for families and teachers. This site provides a match-the-fraction game in which students identify equivalent fractions.
<http://www.quia.com/mc/351.html>
- **Visual Fractions – Identify Fractions With Lines**
Students translate line graph representations of fractions into equivalent fractions. Other fraction activities can be found at:
<http://www.visualfractions.com/>
<http://www.visualfractions.com/EnterFraction.html>
- **PBS – Melvin’s Make a Match**
In this CYBERCHASE Web game, students help Melvin sort his potion bottles by equivalent fractions.
<http://pbskids.org/cyberchase/games/equivalentfractions/equivalentfractions.html>

Materials

- A tangram set for every 2 students
- A pattern to make tangram sets (if you don’t have access to plastic ones and card stock or construction paper on which to print the pattern)
- At least 7 computers that connect to the Internet – one for each student would be ideal
- A computer that is connected to a projector or television on which to show the video clip
- A copy of the Equivalent Fraction Stations Worksheet for each student (at end of lesson plan)

- Signs to label computer stations (at end of lesson plan)
- Copies of the instructions for the games to put at each station (at end of lesson plan)

Prep for Teachers

Photocopy the following items:

- A copy of the Equivalent Fraction Stations Worksheet for each student
- Signs to label computer stations
- Copies of the instructions for the games to put at each station

Bookmark Web sites on computers that will be used for the stations. Bookmark any tangram sites you want to show the students on your projecting computer.

Familiarize yourself with the video clip. **Cue** the video clip to the beginning.

Introductory Activity

Students will use tangrams to explore the concept of equivalent fractions. Basic information on tangrams can be found on the Web at <http://www.tangrams.ca/>, as well as many other sites. If you don't have tangram puzzles in your classroom, patterns to make tangrams are provided on that site and others. (Card stock works well for creating tangrams, and construction paper works okay. Regular photocopy paper is a little too flimsy.)

Step 1: Introduce tangrams to the students using the video clip, "Using Tanograms" (02:41), from the video, "Mathica's Mathshop: Winter Warm-Up" (15:00). Explain that the Mathmagician is trying to help the Chinese Emperor find spring in his garden. He uses tangrams to do this. Provide students with a **Focus for Media Interaction** by asking them to notice the seven shapes that make up a set of tangrams. **Play** the video clip from the beginning and **pause** at approximately 00:31 when the Mathmagician says, "... Cut the square into seven special pieces." **Pause** and let students note the shapes they will find. Explain that these seven shapes (2 large triangles, 1 medium triangle, 2 small triangles, 1 square and 1 parallelogram) always make up a set of tangrams.

Step 2: Before continuing, provide students with a **Focus for Media Interaction** by asking them to predict what the Mathmagician will do for the Emperor to help him find his spring garden. Ask them to whisper their prediction to a neighbor. **Play** the clip until approximately 01:55 when the Mathmagician says, "... The magic is in your hands and your imagination." Ask students to reflect on their predictions.

Step 3: Give students a set of tangrams and ask them to make a garden-oriented shape out of their tangrams and share with neighbors. This will help students get the urge to play with the tangrams out of their systems.

Step 4: Ask students what the tangram pieces could possibly have to do with equivalent fractions. Using their tangram pieces and a neighbor's, can students demonstrate some equivalent fractions? Joanne Caniglia has written a lesson that incorporates fractions into tangrams at <http://explorer.scrtec.org/explorer/explorer-db/rsrc/813447516-81ED7D49.2.PDF>, and there is a PBS lesson that has the pieces of a tangram set related to fractions at <http://www.pbs.org/teachersource/mathline/concepts/asia/activity2.shtm>. This PBS lesson also has instructions for students to cut their own tangrams out of a piece of paper by folding, rather than following pre-printed lines. This would be appropriate for more capable students.

Step 5: Once students are familiar with the physical concept of equivalent fractions, you can introduce the algorithm (multiply or divide both parts of the fraction by the same number to get an equivalent fraction). Then you are ready for the Fraction Stations on the computer.

Learning Activities

You will need at least seven computers. Each computer will be set up for one of the game stations listed in the following paragraphs. If there are enough computers for each of your students, students can play separately - or they can be divided into small groups to accommodate the computers available. For simplicity, students/groups will rotate through the seven games on different computers rather than sitting at one computer and changing to a new game on that computer. This also ensures that students will spend equal time with each game, not continually play the one they find easiest or most diverting. It also ensures that Web sites will not be overloaded as all students try to access the same ones.

Step 1: Divide the available time into seven periods and have students rotate in a specific direction through the game stations. At each station, provide students with a **Focus for Media Interaction** by placing a goal for that station on a strip of paper on the top of the computer screen (these focus questions/statements are included below and at the end of the lesson plan). Alternatively, these focus questions/statements can be printed out on a student worksheet. Print out a summary of the game and rules for each station.

- **Station 1:** One of the Cyberkids characters challenges students to find 13 ways to shade one-half of a square.
<http://pbskids.org/cyberchase/games/fractions/index.html>

Focus for Media Interaction: Write a sentence that describes how you found all 13 ways to shade in one-half of the square.

- **Station 2:** Learning Planet game in which students can click on equivalent fractions to beat the clock. Each level gives students more fractions for which to find equivalents in the same amount of time.
<http://www.learningplanet.com/sam/ff/index.asp>

Focus for Media Interaction: Play the first game and then write a strategy that can help you succeed at higher levels.

- **Station 3:** The Fresh-Baked Fraction Game: students click on the one fraction out of four that is not equivalent to the others.
<http://www.funbrain.com/fract/index.html>

Focus for Media Interaction: Write your strategy for finding the fraction that is not equivalent.

- **Station 4:** Cool Math 4 Kids is a site that provides colorful explanations of math topics. This is less a game site and more a chance for students to articulate what they know. In “Equivalent Fractions Part 1,” this site describes how to visualize and calculate equivalent fractions. It also provides two chances for students to do it themselves (with expanded games promised for the future).
<http://www.coolmath4kids.com/lessons/fractions4.html>

Focus for Media Interaction: Choose one set of equivalent fractions on the “Try It” page. Write an explanation of why the two fractions are equivalent. Go back to the lesson if you need help explaining it.

- **Station 5:** This site provides a match-the-fraction game in which students identify equivalent fractions.
<http://www.quia.com/mc/351.html>

Focus for Media Interaction: If you were going to play with a partner, write down your strategy for winning with the most matches.

- **Station 6:** Students translate line graph representations of fractions into equivalent fractions.
<http://www.visualfractions.com/EnterFraction.html>

Focus for Media Interaction: Keep a running tally of how many you get right on the first try compared to those that take more than one try. When you are done, turn these tallies into a fraction by placing the number you got right over the number you missed.

- **Station 7:** Melvin’s Make a Match asks students to pair potion bottles labeled by equivalent fractions.
<http://pbskids.org/cyberchase/games/equivalentfractions/equivalentfractions.html>

Focus for Media Interaction: Which potion bottles seem easiest to match? Why?

Culminating Activity

Students will demonstrate an understanding of equivalent fractions by designing a game of their own, either individually or in groups, that involves equivalent fractions. Students will exchange games with other students/groups and play them in the classroom.

Games could include matching equivalent fractions in a number of ways:

- Students could move around the board by drawing a card and moving to the space that has an equivalent fraction.
- Students could roll two dice and create a fraction, then move to an equivalent fraction.
- The matching game could be a bingo format.
- The game could involve timed sessions and the most matches in a given time wins.

Urge students to come up with ideas for game boards that are not copies of commercial games. Games related to other curricular areas could be encouraged – for instance, an Egyptian theme if students are studying Egypt in social studies.

Ground Rules for the Games:

- The game must involve players making equivalent fractions or matching equivalent fractions.
- The game must have clearly written rules so other students will know how to play. The rules should clearly tell players how to start, continue play and win.
- The game must be ready to play by the due date, with all pieces, boards and game cards written out.
- Players must be provided with a way to check their answers to see if they are correct.

Set aside a day in class to play the games.

Cross-Curricular Extensions

Cooking

- It's easy to find recipes for 4-8 servings and then have students increase the size of the recipe to serve their class or their school. The following Web sites have recipes that are scaled for large numbers of people (50-500!), and students can find equivalent fractions to scale these down to family-sized meals:
 - <http://www.angelfire.com/bc/incredible/foodservicelist.html>
 - <http://members.tripod.com/~lotsofinfo/index.html>

Reading

- Read Grandfather Tang's story and use the tangrams to create the shapes of the animals in the story.

Social Studies

- Tangrams have connections to Japan and China. Search on the Web for “tangram” and you will find many sites and activities.

Community Connections

- Students in middle school could take their equivalent fraction games to a fourth- or fifth-grade class for a game day. They could also share what they have learned about the computer games.
- You can invite a person to your class whose job involves working with fractions. For instance:
 - An independent bakery or restaurant planner can share how they take a favorite dish and scale it up to serve to customers.
 - An architect can share how they keep scales in mind when building. Working with scales is working with equivalent fractions.

Summary of Rules for Game Stations

Print out these rules and place a copy at each game station. Game 7 (Fraction Man) is enhanced by sound, but not impossible without it.

Station 1

Cyberkids fraction game: 13 ways to make one-half:

<http://pbskids.org/cyberchase/games/fractions/index.html>

The first four screens explain about fractional parts of a square that can make $\frac{1}{2}$ of the square shaded. Click the arrow on the right side of the screen to continue on to the next page.

The fourth screen is particularly important to pay attention to because it tells you that the same shaded pattern flipped or rotated does not count as a new pattern.

On the fifth screen, click “Play Game.”

The Game

Click on the triangles in the big square. When you think you have a new pattern for shading $\frac{1}{2}$ of the square, click on the “Test for $\frac{1}{2}$ ” button. The correct ones are recorded across the top.

Station 2

Learning Planet game: <http://www.learningplanet.com/sam/ff/index.asp>

In this game, you will try to find equivalent fractions and beat the clock. The levels go up automatically as you answer correctly.

A group of fractions will be displayed on the screen. You must match equivalent fractions.

First click one of the fractions. Next click the equivalent fraction. Continue until all fractions have been matched. The game is over if you allow time to run out.

Station 3

Fresh-Baked Fraction Game – equivalent fractions:

<http://www.funbrain.com/fract/index.html>

The word on the street is that Fraction Jackson is a dog who loves pie (pi?). If you answer 24 problems correctly, you can put your name on Jackson’s list of Master Pie Bakers.

How to Play

- You are shown four fractions.
- Three of the fractions are equivalent. They can all be simplified to the same fraction.
- Click on the fraction that is not equal to the others.
- If you get the answer correct, Jackson gets another piece of pie.

Equivalent fractions are different fractions that name the same amount. For example, these are all equivalent fractions:

$$\frac{1}{3}$$
$$\frac{3}{9}$$
$$\frac{4}{12}$$

Choose a level of difficulty by clicking on the words “Easy,” “Medium,” “Hard” or “Super Brain.” The game will start after you click on your level.

Station 4

"Equivalent Fractions Part 1" from Cool Math 4 Kids:

<http://www.coolmath4kids.com/lessons/fractions4.html>

The first screen shows you how equivalent fractions work. On the left side of the screen, a green triangle says "Try It." Click on that green triangle.

You will see a picture of two equivalent fractions. Answer in your head or tell a partner your answer. Roll the mouse over the rectangle to see if you were right.

Station 5

A match-the-fraction game:

<http://www.quia.com/mc/351.html>

Click on a fraction and then click on the equivalent fraction. If you get it right, stars will appear. When all of the fractions are matched up, you get a star and can start a new game.

Station 6

Use the line graphs to figure out the equivalent fraction:

<http://www.visualfractions.com/EnterFraction.html>

This game will ask you to identify the numerator and denominator that are represented in the line graph. Once you have entered your answer, click "OK." If you missed it the first time, use the hints to keep trying until you get it right. If you are completely stumped, click "Explain" to get some helpful hints. Once you've correctly identified the equivalent fraction, click "New Example" for another problem.

Station 7

Melvin's Make a Match asks students to pair potion bottles labeled by equivalent fractions:

<http://pbskids.org/cyberchase/games/equivalentfractions/equivalentfractions.html>

Melvin will show you a growing number of potion bottles to be placed in pairs according to their fraction labels. Select two bottles that are labeled with equivalent fractions. If you pair all of the potion bottles, it will move on to a more challenging game.

Name: _____

Equivalent Fraction Stations

Start at the station to which you have been assigned and work your way numerically through the stations. Follow the directions provided at each station and complete each section of this worksheet.

Station 1

Write a sentence that describes how you found all 13 ways to shade in one-half of the square.

Station 2

Play the first game and then write a strategy that can help you achieve at higher levels.

Station 3

Write your strategy for finding the fraction that is not equivalent.

Station 4

Choose one set of equivalent fractions on the “Try It” page. Write an explanation of why the two fractions are equivalent. Go back to the lesson if you need help explaining it.

Station 5

If you were going to play with a partner, write down your strategy for winning with the most matches.

Station 6

Keep a running tally of how many you get right on the first try compared to those that take more than one try. When you are done, turn these tallies into a fraction by placing the number you got right over the number you missed.

Station 7

Which potion bottles seem easiest to match? Why?

Computer Station Labels

These labels are identical to what is on the Equivalent Fraction Stations Student Worksheet and may be used instead of the worksheet or in addition to it.

Station 1

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Station 2

Play the first game and then write a strategy that can help you achieve at higher levels.

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