Instructor's Manual

Module 15: Fractions and Measurement

What Students Should Gain from this Module

At the end of this module, students should be able to:

- Explain what a fraction is
- Determine which of two fractions is the largest
- Identify parts of a tape measure
- Read a tape measure to 1/16"
- Measure length using a tape measure

Recommended Timing for this Module 4 hours

Required Equipment and Materials

- An LCD projector and a Windows computer or laptop. The computer should have high speed internet access, a recent version of PowerPoint, an updated Internet browser, and speakers
- Cords for connecting the LCD projector to the computer
- A wireless presenter which allows you to move around the room while controlling the PowerPoint presentation
- A screen visible to all in the room

- One fun-size candy bar for each student
- One regular size (1.55 oz) Hershey's bar per group plus a few extra. Most groups will be four students, with at least one group of two. See the activity instructions in the Introduction part of the lesson for more information.
- Two sets of fraction strips per student. The strips should be separated from one another. For example, each set of fraction strips should consist of sixteen 1/16ths separated from one another, not a single row of connected 1/16ths.
- One copy of the *Enlarged Number Line*, with two lines on each 8.5 x 11" sheet. The number line only extends from 0 to 1 with unlabeled lines for 1/2, fourths, eighths, and sixteenths. Laminating the sheets will help preserve them. Make two or more copies of the *Enlarged Number Line* if you plan to have teams compete in correctly placing their fractions on the number line
- A role of painter's tape. If the sheets of the *Enlarged Number Line* are not laminated use removable scotch tape instead.
- At least two 3 x 5" index cards per student, each with a fraction written on one side. The fraction should be written with a wide-tip marker so all students will be able to read it. Fractions should be halves, fourths, eighths, or sixteenths, and include 1/1 and equivalent fractions (e.g. 1/2, 2/4, 4/8, & 8/16)
- A tape measure for each pair of students
- A ruler for each student
- The *Fractions and Measurement* PowerPoint file
- A copy of the *Fractions and Measurement* handout for each student and instructor

Set Up

- Set up the computer and projector.
- On a wall that is easily visible by all students, tape the eight sheets that make up the *Enlarged Number Line* so that it forms a large number line.
- Label objects in or near the classroom that students can measure with a tape measure. Objects could include door frames, window frames, white boards, floor tiles, tables, the width of a room, etc. Each object should be far enough apart from the others that pairs of students can measure the object without interfering with other students. If possible, label enough objects so that only one pair of students needs to be at an object at a time (e.g. 24 objects for 12 pairs of students). Each label should include the name of the object and indicate whether students are to measure height, width, distance from another object, etc.
- Create an answer key for the objects to be measured by students.

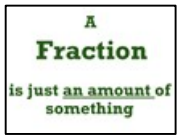
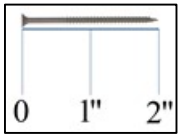
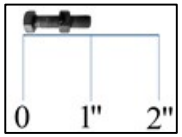
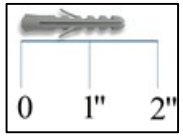
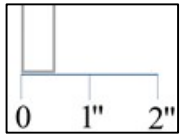
Optional Materials

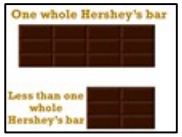
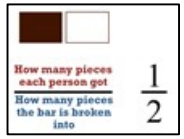
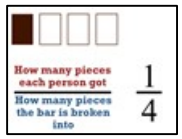
At Math-Aids.com http://www.math-aids.com you can create and print a wide variety of practice problem sets (and answer keys) for students who want or need additional practice. You can also create problem sets that offer a higher degree of challenge for students who want an additional challenge. Be sure to confirm that your use of the Math-Aids resources complies with its usage guidelines.

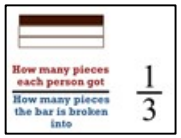
Note to the Instructor

Some of the slides for this module require you to "Click" or press enter on the keyboard to reveal additional information on the slide. Especially where there is a lot of information on a slide, this will help you guide students' attention to the information you are addressing. In other cases, it engages students by giving them a chance to think through their own answer or strategy for solving a problem before the answer is revealed on the slide.

Time	Activity	Materials	What to Do
15	**Introduction**	**Fun-size candy bars** **Regular (1.55 oz.) Hershey's bars**	**Organize students into groups** - mostly groups of four, with at least one group of two and, if necessary, a group of three*. **Give each group** one fun-size candy bar/group member. Have each group split the candy evenly. **Ask** how many fun-size candy bars each person got? **Give each group** a regular sized Hershey's bar and have them split it evenly. **Ask** each group how many regular sized bars each person in their group got. (Most will probably express the amount as a fraction (e.g. 1/2, 1/4, or 1/3). If some groups need help, use a group who stated their amount correctly as an example – e.g. How many pieces did each person in your group get? and What is the total number of pieces in your group? Write their answers to those questions on the board, as a fraction. ***Note: Only organize a group of three if necessary to accommodate an odd number of students in the class. In this activity, a group of three would work with thirds, which are not typically used in construction. If a group of three is necessary, tell students that thirds are not typically used in construction and are only used in this first part of the lesson to help students understand what a fraction is. If it is possible to avoid a group of three, delete the slides in this presentation that refer to thirds.***

30	**Understanding Fractions**	**Handout:** *Fractions and Measurement*	**Pass out** the *Fractions and Measurement* handout
			**Say** that no one got a whole bar, each got a *fraction* of a bar. **CLICK** **Say** that a fraction is just an amount of something.
			**Say** that, in construction, they will be measuring amounts all the time: length, weight, perimeter, area, volume, etc. **CLICK** **Review** the objective.
			**Say** that whole numbers work well if the thing being measured is equal to a whole number. Like this drywall screw, which is exactly two inches long. **Point out** the symbol for inches.
			Or this bolt, which is exactly one inch long
			But what if you had to measure the length of this screw anchor? **Point out** that it is longer than one inch but shorter than two inches.
			Or the thickness of this piece of drywall? **Point out** that it is less than one inch.

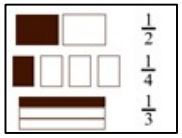
			**Say** that fractions allow us to measure things that are not exactly whole numbers. Like a piece of dry wall that is less than an inch thick or a piece of a Hershey's bar that is less than one whole Hershey's bar.
			**Ask -** if you have to split a Hershey's bar with other people and you like chocolate and are hungry, what are you going to want to know about the pieces of the Hershey's bar? – (e.g., How much am I going to get? How much will others get? What fraction of the whole piece will I get?).
			**Say** that they be interested in two numbers: 1. How many equal pieces will the chocolate bar be broken into? **CLICK** 2. How many of those pieces will I get?
			**Ask** the group with two students how many pieces their regular Hershey's bar was broken into. **CLICK** **Ask** the group how many of those pieces each person received. **CLICK** **Say** that each person in this group got one half of a regular Hershey's bar.
			**Ask** a group with four students how many pieces their regular Hershey's bar was broken into. **CLICK** **Ask** the group how many of those pieces each person received. **CLICK** **Say** that each person in this group got one fourth of a regular Hershey's bar.



Ask the group with three students (if there is one) how many pieces their regular Hershey's bar was broken into. **CLICK**

Ask the group how many of those pieces each person received. **CLICK**

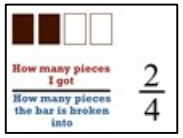
Say that each person in this group got one third of a regular Hershey's bar.



Note: Delete the 1/3 example if you don't have a group of three students.

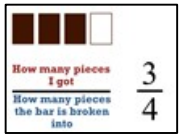
Say that these amounts are fractions of a whole regular Hershey's bar.

Say that a fraction is just an amount. Like, 1, 2, 3, 15, etc. it is a single amount, but the amount is written with two numbers so you can understand how much the amount is.

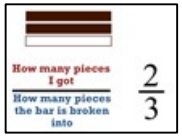


Ask how much of a regular Hershey's bar you would have if you could get two members from a group of four to give you their pieces. **CLICK**

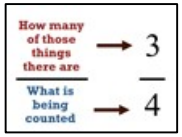
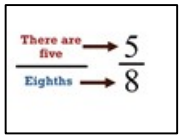
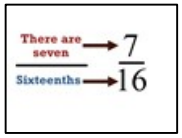
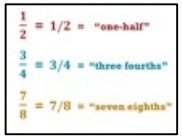
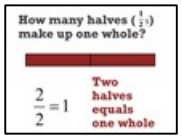
Say that the bar would still be broken into 4 pieces and you would have 2 of them so you would have 2/4ths.

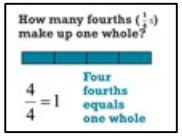
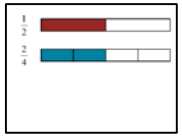


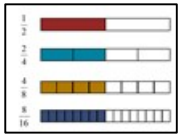
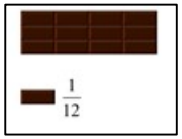
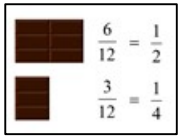
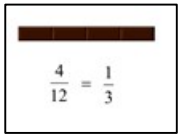
Ask how much of a regular Hershey's bar you would have if you could get three members from a group of four to give you their pieces. CLICK

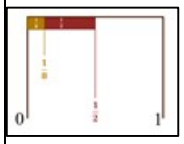
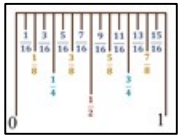


(*If there is a group of three students*) Ask how much of a regular Hershey's bar you would have if you could get two members from a group of three to give you their pieces. **CLICK**

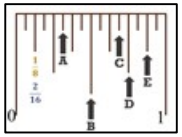
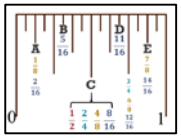
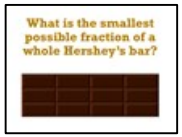
			**Say** that another way to think about fractions is that the bottom number tells you what is being counted. **CLICK** and the top number tells you how many of those things there are. In this example, the things begin counted are fourths and there are three of them, so 3/4ths.
			**Ask** what is being counted and how many of them there are. **CLICK**
			**Ask** what is being counted and how many of them there are. **CLICK**
			**Point out** that there are many ways to state the same fraction. Like this example. Or **CLICK** Or **CLICK**
			**Have students** work in pairs and use their fraction strips to figure out how many halves make up one whole and write their answer on their handout.
			**Point out** the two halves and how the top and bottom numbers relate to the picture (e.g. halves are being counted and there are two of them). **Have students correct their answers** (if necessary) on their handout.

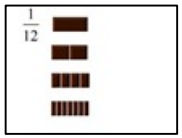
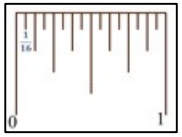
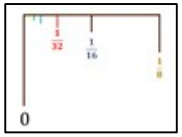
			**Have students** work in pairs and use their fraction strips to figure out how many fourths make up one whole and write their answer on their handout.
			**Point out** the four fourths and how the top and bottom numbers relate to the picture (e.g. fourths are being counted and there are four of them). **Have students correct their answers** (if necessary) on their handout. **Ask** students to predict how many eighths would make up one whole and how many sixteenths would make up one whole. **Have students** use their fraction strips to verify or confirm their predictions if necessary.
			**Have students** work in pairs and use their fraction strips to determine whether they would rather have: 1/2 or 2/4.
			**Point out** that 1/2 and 2/4 are the same amount.
			**Have students** use their fraction strips to determine how many eighths would be the same amount as 1/2 and how many sixteenths would be the same amount as 1/2.

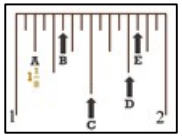
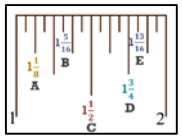
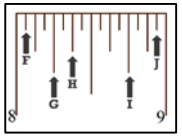
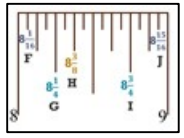
			**Have students correct their answers** (if necessary) on their handout. **Point out** that even though the numbers in each fraction are the different, these are all the same amount and any fraction can be written many different ways.
			**Ask** how many small, individual pieces make up a regular Hershey's bar when you take it out of the package (12). **Ask** how you would write and say one of those pieces. **CLICK** **Point out** the 1/12 and how there are 12 of them in a regular Hershey's bar. **Have students write**, on their handout, how many 12ths would equal 1/2, 1/4, and 1/3* of a Hershey's bar. ***Skip the 1/3 if you did not have a group of three for the Hershey's bar activity.***
			**Point out** how 6/12ths is the same amount as 1/2. **CLICK** **Point out** how 3/12ths is the same amount as 1/4. **Have students correct their answers** (if necessary) on their handout.
			**Point out** how 4/12ths is the same amount as 1/3. **Have students correct their answers** (if necessary) on their handout.

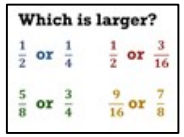
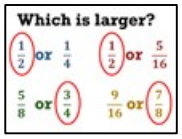
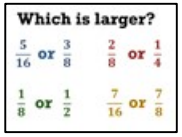
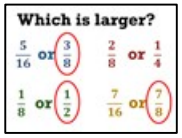
20	**Creating a Number Line**	**Handout:** *Fractions and Measurement*   	**Refer students** to the Blank Number Line in their handout. **Have students** work in pairs to use their fraction strips to mark where all of the halves, fourths, eighths, sixteenths would go on the number line. **Say** to draw a long, vertical line to mark where the 1/2 would go, slightly shorter lines to mark the 1/4s, etc. (as in the answer key on the next slide), and label each half, fourth, eighth, and sixteenth. **Demonstrate**, using this slide or a sketch you draw on the board, how to draw different the lines of different lengths for each fractions. **Point out** that the 1/8 fraction strip is placed over the 1/2 in the slide. **Have students** check each other's work and ask questions if they have any. **Check in** with pairs as they work to answer questions and ensure that all are on the right track. It is critical that students construct an accurate number line. **Have students correct their answers** (if necessary) on their number line.

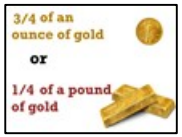
20	**Locating Fractions on a Number Line**		**Have students** put away their handout and notes**.** **Pass out** 3 – 4" of removable scotch tape or painter's tape and at least two of the 3 x 5" index cards (with fractions written on them) to each student. In quick succession, have each student place her first fraction where it would go on the number line (using the painter's tape). Equivalent fractions should go under one another. **Have students** review the fractions and correct any that are not in the right location. **Point out** equivalent fractions. If necessary, go back to the earlier slide which used fractions and pictures of amounts to show how 1/2, 2/4, 4/8, and 8/16 are equivalent. **Remove the index cards and repeat the activity**, having students place their second fraction on the number line. ***Note: It is critical that students are able to accurately locate fractions on a number line. If students are having difficulty correctly locating fractions, review the number line using the following slide as a guide. You could then have students trade index cards and, again, practice placing their fractions on the Enlarged Blank Number Line.*** ***Optional Activity.*** *If time and classroom space allow, you could organize the class into two or more teams, each with its own set of fraction cards and Enlarged Blank Number Line. Give each team a stack of cards (one per team member) but tell them not to look at the cards until you tell them to start. Give teams 30 seconds or so to place their cards on their number line. Each member of the team must place one card but teammates can help each other correct*

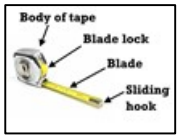
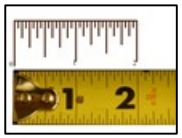
			their fractions if any are misplaced. At the end of the 30 seconds, each team could check the other's number line and identify and correct any misplaced index cards. Teams could earn one point for each correctly-placed index card on their own number line + one point for any of the other team's cards they corrected. Points could also be deducted for misplaced cards.
20	**Understanding Fractions Continued**	  	**Point out** how 1/8 is the same as 2/16. **Have students write**, on their handout, what fractions A – E are, writing them as many different ways as possible using halves, quarters, eighths, and sixteenths. **Point out** the correct answers, especially where there are equivalent fractions. **Have students correct their answers**, if necessary, on their handout. **Ask** students what the smallest possible fraction of a regular Hershey's bar would be.

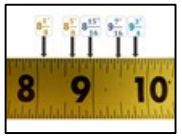
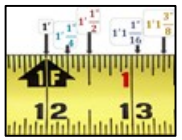
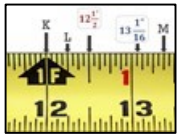
			**Point out** that the smallest piece the bar is divided into when unwrapped is 1/12. **Ask** whether it is possible to divide the 1/12 piece into two. **CLICK** **Ask** whether it would be possible to divide those two pieces into smaller pieces. **CLICK** **Ask** whether it would be possible to divide those pieces into smaller pieces, **CLICK** **Ask** whether it would be possible to divide those pieces into smaller pieces. **Point out** that each smaller piece represents a smaller fraction of the whole Hershey's bar.
			**Ask students** if there is a fraction smaller than 1/16.
			**Say** that this is what the number line would look like if you zoomed in on it. **Ask** students if they know what fraction the red line would be. **CLICK** **Ask** if there is a fraction smaller than 1/32. **CLICK** **Point out** that there can always be a smaller fraction.

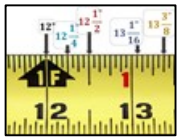
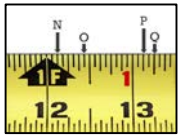
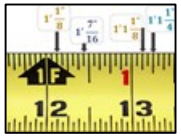
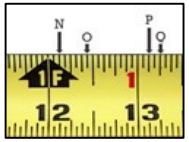
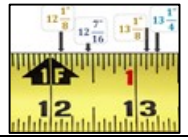
			**Say** that, until now, all of the fractions you have been working with have been less than 1, but there are fractions between every whole number. **Point out** that this number line goes from 1 to 2 and **A** is 1 1/8. **Have students write**, on their handout, what fractions A – E are
			**Have students correct their answers** (if necessary) on their handout.
			**Have students write**, on their handout, what fractions F – J are.
			Have students correct their answers (if necessary) on their handout. ***Note: If students need more practice locating fractions larger than one, and if time allows, you could do one or both of the following:***
			1. *Have students practice creating fractions larger than one with their fraction strips* 2. *Cover the 0 and 1 on the Enlarged Number Line with other consecutive numbers (e.g. 1 & 2; 23 & 24. etc.) and give students new index cards, labeling them with mixed numbers (e.g. 1 5/8; 23 1/4) and have students practice locating those fractions on the number line.*

20	**Determining Which Fraction is Largest**		**Review** the objective
			**Say** to imagine that their fraction strips are Hershey's bars. **Ask**, if you like chocolate and are hungry, would you rather have 1/2 of a Hershey's bar or 1/4? **Ask** why (because it's larger.) **CLICK** **Have students** use their fraction strips to determine which of the other sets of fractions is larger.
			**Have students correct their answers** (if necessary) on their handout.
			**Have students** use their fraction strips to determine which of the other sets of fractions is larger.
			**Have students correct their answers** (if necessary) on their handout. **Point out** that 2/8 and 1/4 are the same amount.

			Have students work with a partner and circle the larger of the two fractions in each pair on the page titled *Comparing Fraction Amounts Practice 1* in the *Fractions and Measurement* handout. As they do, check in with students to answer questions and help any who are struggling. **Review the answers**, answer questions, and review content students are struggling with. ***Note: The Fractions and Measurement handout includes additional pages of practice comparing fractions. It will be most effective to spread the practice over multiple weeks. For example, as part of this lesson, students could complete Comparing Fraction Amounts Practice 1. Students could then complete the additional practice pages in subsequent weeks.***
40	**Using a Tape Measure**		**Ask** students which is the larger amount, 1/4 or 3/4. **CLICK** **Ask** students which amount they would rather have. **Point out** that, by themselves, fractions do not have any meaning - you always have to know what units you are talking about, an ounce or a pound. A quart or a gallon. **Say** that, in construction, two of the most common units are inches and feet. **Ask** what tool is most often used to measure inches and feet.
			**Review** the objective.

		Handout: *Fractions and Measurement*	**Review** the *Measuring Your Success* pages in the handout, using the image in this slide to review the parts of a tape measure.
			
			**Point out** how a tape measure is just a number line like the ones you have been working with.
			**Point out** the 1 1/2” mark and the importance of including the units in the measurement. **Point out** how some of the sliding hook covers part of the first inch. **Have students write**, on their handout, what the lengths of objects A – E would be if measured from zero.
			**Have students correct their answers** (if necessary) on their handout. ***Note: The boxes are only meant to help separate the fractions from one another.***

			**Have students write**, on their handout, what the lengths of objects F – J would be if measured from zero.
			**Have students correct their answers** (if necessary) on their handout.
			**Point out** that, in addition to inches, a tape measure displays feet and, often, measurements will be in a combination of feet, inches, and fractions of an inch. **Show** how to read a tape measure that shows both feet + inches, and total inches. **Point out** that 12 inches = 1 foot. **Point out** the 1’ 1/2” and the 1’ 1 1/6” marks and explain how a measurement consisting of feet, inches, and fractions of an inch are written. **Have students write**, on their handout, what the lengths of objects K – M would be, in feet & inches, if measured from zero.
			**Have students correct their answers** (if necessary) on their handout.
			**Show** how to read this tape measure in inches alone. **Point out** the 12 1/2” and the 13 1/6” marks

			Have students write, on their handout, what the lengths of objects K – M would be, in inches alone, if measured from zero.
			**Have students correct their answers** (if necessary) on their handout.
			**Have students write**, on their handout, what the lengths of objects N – Q would be, in feet & inches, if measured from zero.
			**Have students correct their answers** (if necessary) on their handout.
			**Have students write**, on their handout, what the lengths of objects N – Q would be, in inches alone, if measured from zero.
			**Have students correct their answers** (if necessary) on their handout.
15	**Practice Reading a Tape Measure**	**Handout:** *Fractions and Measurement*	**Have students form groups** of 3 or 4. **Say** to remember that, in class or on the job, they will need to work as a team, which means supporting and encouraging one another. It is not enough for the group to get the right answers. Instead, they should take responsibility for

			helping one another until each member of the group has mastered the process and feels confident in her ability to solve the problems on her own. **Say** that they should remember the goal(s) they set for themselves, what they pledged to do to "Commit to Grit" in the *Being Gritty* handout at the beginning of the course, and the importance of maintaining a growth mindset if they have difficulty or get frustrated. **Say** that you can provide additional problem sets for students who want additional practice or additional challenge. See the information about Math-Aids under Optional Materials above. **Have students** work through the pages titled *Measurement Practice 1* in the *Fractions and Measurement* handout. As they do, check in with groups to answer questions and ensure that no individual(s) in the group is being left behind. **Review the answers**, answer questions, and review content students are struggling with. ***Note: if students are still having difficulty accurately reading a tape measure at the end of this lesson, complete one or two more of the Measurement Practice pages together, as a class, inviting individual students to share their answer for one of the measurements and asking the rest of the class to confirm or correct the answer given.*** ***The Fractions and Measurement handout includes additional pages of practice measuring lines and reading a tape measure. It will be most effective to spread the practice over multiple weeks. For example, as part of this lesson, students***

			could practice with the first two to three practice pages. Each subsequent week, students could complete one or two of the additional practice pages.
45	**Measuring with a Tape Measure**	**Handout:** *Fractions and Measurement*	**Show** students how to use a tape measure to measure the length of an object. **Review** the instructions in the *Hands On Measurement Practice* page in the Fractions and Measurement handout. **Point out** the objects they are to measure. Each object should be labeled with its name and what aspect students are to measure (e.g. height, width, distance from one object or part of an object to another.) **Say** how they should move from one object to another (e.g. in sequence when you give them a signal or randomly) and how much time they have. **Have** students start measuring. **Review** the answers when all students have finished. **Have students correct their answers** (if necessary) on their handout.
10	**Planning to Apply their Learning**		**Have students reflect** on the learning from this module and note in their journal what they have learned that will be useful to them on the job, what they want to remember, tips, etc., and when they have demonstrated grit or a growth mindset.