YALE NATIONAL INITIATIVE
to strengthen teaching in public schools®

Curriculum Units by Fellows of the National Initiative
2023 Volume III: Transitions in the Conception of Number: From Whole Numbers to Rational Numbers to Algebra

Teaching Elementary Fractions Using Fractions Strips

Curriculum Unit 23.03.01, published September 2023
by Jessica Mason

Introduction

"In the end, we will conserve only what we love, we will love only what we understand, and we will understand only what we are taught." - Baba Dioum, a Senegalese forestry engineer. This quote was shared during one of the lectures this summer. The quote spoke to me regarding teaching math because I hated mathematics, and I did not conserve all that I learned. However, as time went on, I was able to get extra help and it helped me understand some basic math skills because of what was taught to me once I had a teacher who took the time to work with me. How many times has a child thought that 1\4 was bigger than ½? I am sure most students who have not had any explicit teaching on fractions thought so. I was one of those students who thought that ¼ was larger than ½ because 4 is bigger than 2. I did not fully understand until someone broke it down to me about sharing objects.

Fractions can be a huge challenge, maybe even a painful experience for students, especially struggling learners. I know from experience that students do not learn what they do not understand. I believe that fractions do not make sense to students because they lack basic math skills such as addition, subtraction, multiplication and division. Students struggled with skip counting and using mental math. I remember hating fractions as well. Fractions were introduced in the third grade when I was a kid. For most of that year, I did not have a teacher. My introduction to fractions was not a good start. I only had a teacher for half the year in fourth grade and an uncertified teacher in fifth grade. I remember finally learning about fractions in summer school during the fifth-grade year. I struggled with math throughout my school years. I learned through procedural methods, so it did not stick. How can I make fractions understandable and maybe even painless for students?

School Demographic

I teach at Anna R. Langford Community Academy. It is a Chicago Public Elementary school located on the south side of Chicago in the Englewood neighborhood. This area is considered one of the poorest neighborhoods in Chicago and violence is the norm there. Students are already at a disadvantage when they enter my classroom. The data from my school shows that students are one to two grade levels behind based on the school-wide assessment. The pandemic did play a role in this data; however, before the pandemic students were still struggling with math. Not quite 200 students attend the school. Over half of the teachers have a master's degree or higher. The student population is predominantly African American and there is a small percentage of Hispanic students. Langford Community Academy is a Title 1 school and qualifies for federally funded educational programs. Ninety-nine percent (99) of our students live below the poverty level.

About 1 student in every eight receives special education service. We have had several students transfer into the school who do not speak English. The English Language Learner population is increasing at a rapid rate. We currently only have one English Learner Program Teacher. Students in the lower grades are exposed to basic mathematic skills such as adding and subtracting using many different strategies and multiplication using arrays. However, when we move on to geometry, specifically, dealing with partitioning shapes, we start to see a decrease in excitement and engagement. This is when fractions are introduced. Fractions can be hard because there are so many components to fractions. So, what do our students need? They need to be taught basic mathematical skills through conceptual teaching. This method emphasizes teaching concepts. According to research from the National Center for Education Statistics, students are entering algebra courses struggling with precursor mathematics skills such as fractions. Students cannot be successful in algebra without understanding fractions. Fractions are also important because we use them in everyday activities such as measurement during cooking, counting money, and solving equations, just to list a few things. This unit will start with teaching fractions using fraction strips.

Rationale

According to the book "*Computation of Fractions*," students entering algebra often struggle with precursor mathematics skills such as fractions arithmetic. Students must accurately compute fractions when solving and graphing equations, interpreting decimals, and working with ratios, and using ratios and proportions. Proficiency in math depends on the continuous development and blending of intricate combinations of various critical component skills. Gaps in any of these component skills will cause students to struggle in many aspects of their math education.[1] Proficiency with fractions is an important foundation for learning Algebra, and other advanced mathematics. According to the National Council of Teachers of Mathematics "Fractions are a student's first introduction to abstraction in mathematics and, as such provide the best introduction to algebra in the elementary and middle school years. Time and emphasis are necessary for students to develop the links among fractions, decimals, and percents and solve problems involving their use. [2]

According to the National Council of Teachers of Mathematics, the goal of mathematics education is to raise the level of mathematical proficiency of all students and to eliminate differences in levels of mathematical proficiency among students in different social, cultural, and ethnic groups. States and national professional

organizations have developed standards for mathematics proficiency and assessments intended to measure the degree to which students attain such proficiency. Various programs have been developed to attract and retain more effective teachers of mathematics.[3]

This unit is geared toward helping students to understand what fractions are. There is a learning gap that I am trying to close when it comes to students learning fractions. According to the National Center for Education Statistics, the percentage of students in the state of Illinois who performed at or about the National Assessment of Educational Progress (NAEP) Proficient level was only 27% in 2022. This was smaller than in earlier years. In the year 2000, 33%, and in 2019 31%. There are many factors that have negatively affected our students. The pandemic and poverty have been among the largest factors. Here are further statistics specifically about the student population I service. In the year 2022, African American Students in the state of Illinois had an average score that was 32 percentage points lower than white students. In the year 2022, Hispanic students had an average score that was 23 percentage points lower than white students. My goal is to bridge the gap between these students. I plan to do this by setting the foundations of teaching fractions. I want to encourage students, help make them mathematically competent, and help them thrive in math. I believe that if I teach fractions well then as the students move on to the next grade level, they will be successful.

For many years teachers have started teaching fractions by introducing students to equal parts by sharing a pizza. Yes, students get excited because pizza is one of their favorite foods to eat. However, can students divide their pizza into equal shares beyond sharing more than six slices? Teachers all over have started their introduction to fractions by teaching students that fractions are part of a whole. Sometimes students do not fully understand that. If they do not fully understand that how can they divide pieces into halves, thirds, and fourths (quarters)? Students who only work with, for example, circles divided into even-sized pieces, may develop limited strategies, such as counting the number of pieces rather than assessing the relationship of the part(s) to the whole.

Some of the motivating questions for this unit are, what are some best practices for teaching fractions that will spark students' excitement and engagement? Can we identify some practices that will teach all types of learners to master the foundation of fractions? Also, I hope this unit will help students with math disabilities. The challenges that students with math disabilities encounter during their mathematic instruction are sustained and well documented: Difficulties experience in math begin early and continue throughout their education and are magnified as students progress toward secondary- level math courses. The Concrete, Pictorial, Abstract approach (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of math in pupils. Often referred to as the concrete, representational, abstract framework, CPA was developed by American psychologist Jerome Bruner. “With the CPA framework, every abstract concept is first introduced using physical interactive concrete materials.” The C stands for Concrete, and this is the stage when we provide students with manipulatives to give them a chance to be hands-on. CPA approach brings concepts to life by allowing students to experience and handle physical concrete objects. The P stands for Pictorial. During this stage students will have a chance to create and draw a model or a representation of the concrete things that they have been learning. And then the A is for Abstract. Abstract is the “symbolic” stage, where students use abstract symbols to model problems. [4]

Content Objective

Fractions have always represented a considerable challenge for students, even in the middle grades. Results of NAEP testing have consistently shown that students have a very weak understanding of fraction concepts (Werne &Kouba, 2000) This lack of understanding is then translated into many difficulties with fraction computation, decimal and percent concepts, the use of fractions in measurement, and ratio and proportion concepts. One reason for the weak performance is that students have limited exposure to fractions. They are introduced at the end of second grade, where according to the Common Core State Standards students will partition shapes and move on to learning about equal shares. In third grade, students learn to develop an understanding of fractions by the following standards. They learn that a fraction *1/b* is the quantity formed by 1 part when a whole is partitioned into b equal parts and that a fraction *a/b* is the quantity formed by *a* parts of sizes *1/b.* They move on to understand a fraction as a number on the number line and to represent fractions on a number line diagram. In the last third-grade fraction standard the student is asked to explain the equivalence of fractions in special cases and to compare fractions by reasoning about their size. In Van De Walle's book *Elementary and Middle School Mathematics: Teaching Developmentally* he found that "Few, if any programs provide students with adequate time or experiences to help them with this complex area of the curriculum". He states that "We must explore a conceptual development of fraction concepts that help students at any level construct a firm foundation, preparing themes for the skills that are later built on these ideas."[5]

He further states that "When teaching fractions, there are several ways to help students make connections for deeper understanding:"

1. Connect the informal knowledge that students bring to fraction instruction by relating new concepts, procedures, and symbols to real-world contexts and situations outside of school that are meaningful to students, and then build on them.

2. Connect the different models used in instruction so students learn to seamlessly progress from one to another and back again, gradually coming to appreciate their similarities and differences.

3. Connect the models used in instruction to the words articulated (new vocabulary, math talk), actions modeled (movements, gestures), and symbols manipulated (of the form a/b). Students who experience a variety of ways to think, talk, and act about fractions, and who are expected to move back and forth between them, develop more flexibility in their fraction understanding.[6] In the Van De Walle book, he states that we should start teaching fractions by developing concepts. What should students learn about fractions? What are the big ideas? The things that I will teach in second grade are as follows. These concepts are adopted from Van De Walle's big ideas in his book.

1. Fractional parts are equal shares or equal-sized portions of a whole or unit. A unit can be an object or a collection of things. More abstractly, the unit is counted as 1. On the number line, the distance from 0 to 1 is the unit.
2. Fractional parts have special names that tell how many parts of that size are needed to make the whole. For example, thirds require three parts to make a whole.
3. The more fractional parts used to make a whole, the smaller the parts. For example, eighths are smaller than fifths. The denominator of a fraction indicates by what number the whole has been divided to produce the type of part under consideration.

4. Thus, the denominator is a divisor. In practical terms, the denominator names the kind of fractional part that is under consideration. The numerator of a fraction counts or tells how many of the fractional parts (of the type indicated by the denominator) are under consideration. Therefore, the numerator is a multiplier- it indicates a multiple of the given fractional part.

In the Transitions in the Conception of Number: From Whole Numbers to Rational Numbers to Algebra seminar, we learned models for illustrating the key ideas of fractions that go beyond the traditional "pieces of pie "pictures and that promote thinking of fractions as ratios, or as making comparisons between different quantities of the same type, are important for advancing student thinking. We looked at the linear model(length) and the area models. We saw that the length model can be valuable for comparing fractions and for understanding addition and subtraction. Area models can help give insight into the processes of multiplication and division. During our seminar, we had a chance to work on word problems and discover multiple ways to solve problems. The Rational Number project states that “There is no single manipulative aid that is “best” for children and for all rational number situations. A concrete model that is meaningful for one child in one situation may not be meaningful to another child in the same situation nor to the same child in a different situation. The goal is to identify manipulative activities using concrete materials whose structure fits the structure of the particular rational number concept being taught.

According to Van De Walle, “Sharing tasks are generally posed in the form of a simple story problem. Suppose there are four square brownies to be shared among three children so that each gets the same amount. How much (or show how much) will each child get? Task difficulty changes with the numbers involved, the types of things to be shared (regions such as brownies, discrete objects such as pieces of chewing gum), and the presence or use of a model”. What better way to teach equal shares than to have students share items. Most of the time when students share things, they share the objects one by one.[7]

When this process leaves leftover pieces, it is much easier to think of sharing them fairly if the items can be subdivided. Typical “regions” to share are brownies(rectangles), sandwiches, pizzas, crackers, cakes, candy bars and so on. The problems and variations that follow are adapted from Empson (2002) When I present these or similar problems to my class, I will suggest that students draw models to help them solve the problem. I would also use this time to get my students to stop and reflect by asking the following questions. Which do you think is most difficult? Which of these represent essentially the same degree of difficulty? What other tasks involving two, four, or eight shares would you consider as similar, easier, or more difficult than these?

Appendix on Implementing District Standards

In second grade the geometry standard is

2.G.A.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

This relates to standard 2.OA.4 where students arrange objects in an array of rows and columns. Students partition a rectangle into rows and columns of same-size squares and use repeated addition to find the total number of squares. This work provides background for understanding area, for viewing multiplication as

repeated addition, and for connected multiplication to arrays and area.

2.G.A.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc. and describe the whole as two halves, three-thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape. In this standard, students will be able to partition rectangles and circles of various sizes into two, three, or four equal shares. Through experiences with multiple representations, students should use the words, halves, thirds and fourths, and the phrases half of, third of and fourth of (or quarter of) to describe their thinking and solutions. Working with the "the whole", students understand that "the whole" is composed of two halves, three thirds, or four fourths. This standard also addresses the idea that equal shares of identical wholes may not have the same shape. Students should understand that fractional parts may not be symmetrical.

Students divide 2-dimensional shapes into halves, thirds, fourths, and they learn that equal shares of the same whole can have different shapes. The big idea that students need to understand is that the name of each share refers not only to the number shares, but also to the fact that each of those shares represents an equal portion of the whole. This helps students learn that equal shares of the same whole can have different shapes. This content is a foundation for understanding fractions as numbers.

Students should be able to use Mathematical Practice 3 when working on standard 2: G.A.3. The student should construct viable arguments and critique the reasoning of others.

There are 8 mathematical practices that students should use regularly. Some of the practices that students will be using doing this fraction unit are as follows.

1. Reason abstractly and quantitatively.

2. Student reason abstractly when they identify that a shape can be partitioned in different ways and still result in equal parts.

3. Use appropriate tools strategically. For the purpose of this unit, this means that students must know how to use square tiles to identify equal parts in a share.

4. Look for and express regularity in repeated addition when they analyze and create repeated design using equal shares.

According to the Common Core State Standards in grade 3, fractions are a major emphasis, with attention to using fraction symbols, exploring unit fractions (fractions with numerator 1), and comparing fractions. Students need to master the second-grade standard in order to be prepared for the standards in third grade.

This unit will start with introducing the key vocabulary needed to understand fractions. Starting the unit with vocabulary is important. We will start with vocabulary such as fractions, whole, partitions, half, halves, thirds, thirds, quarters, and fourths. Once students understand the vocabulary, they have a better understanding of the skills you plan to teach.

I will start by showing a whole sheet of paper. Next, I will show students shares/pieces of the whole by folding paper. Studies show that when teaching fractions students should be taught concrete and representational methods. This will help lay the foundational skills needed. My method of teaching vocabulary is by introducing a game where I describe the definition and the student gives the correct vocabulary word for the definition.

Once the students understand what fractions are, they will be able to identify how big or small they are. I think that using fractions strips will help the students with a visual representation of the fractions. They will be able to describe the whole as being a multiple of a unit fraction.

Here is a list of Effective Teaching Practices published by The National Council of Teachers of Mathematics.

1. Implement tasks that promote reasoning and problem solving.
2. Support productive struggle in learning mathematics.
3. Pose purposeful questioning.
4. Facilitate meaningful mathematical discourse.
5. Establish mathematics goals to focus learning.
6. Use and connect mathematical representations.
7. Build procedural fluency from conceptual understanding.
8. Elicit and use evidence of student thinking.

Teaching Strategies

In our seminar *Transitions in the Conception of Number: From Whole Numbers to Rational Numbers to Algebra* we studied some useful models to teach fractions. One model is the number line. The number line is a versatile tool that can be used for teaching a wide range of things including fractions. In the early grades it can be used to place fractions on the number line. When placing fractions on the number line it will provide a visual for students to see. This model will be taught in third grade. The other useful model we learned about in the seminar is the area model. This is one of the models I will use. I feel that it is appropriate for second grade.

We are going to start with Academic Language. This will focus on Fraction Language. According to Van De Walle, children need to be aware of two aspects or components of fractional parts; the number of parts and the equality of the parts (in size, not necessarily in shape). Emphasize that the number of parts that make up a whole determines the name of the fractional parts or shares. They will be familiar with halves but should quickly learn to describe thirds, fourths, and eights.

Modeling paper folding

I will use modeling with folding to show fractional pieces. I will demonstrate how to fold 1/3 by using a square. We will also see that if we piece the pieces back together, they make the whole. We will use fraction strips as a visual as well. Students will show halves, thirds, fourths, sixths and eighth. This is a reinforcement of what they learned when they were folding.

Fractional Parts and Words

Once I have introduced the students to folding and learning the correct academic language to name fractions, I will continue to work with them regarding comparing the fractional parts to the whole. According to Van De Walle “Students learning about fractional parts should be able to tell when a region has been separated into a particular type of fractional part”. When teaching students about fractional parts it is important to teach symbols. Teaching students about the top number and bottom numbers of a fractions will help students

develop a strong understanding.

Using Fraction strips

Fraction strips are a versatile and engaging tool for teaching fractions in the classroom. Fraction strips can help students conceptualize fractions, as compare, add and subtract, and even multiply and divide them. Manipulatives and visual representations are evidence-based strategies that support learning new math concepts.

Fraction strips can help students not only understand the concept of dividing fractions. Using the strips helps students see how to solve these problems without having to do any calculations. Fraction strips are a versatile and engaging tool for teaching fractions in the classroom. “By using fraction strips, students can develop a deep understanding of fractions and build their math skills in a fun and interactive way” according to the Educate With Ease website (educatewithease.com). Teaching with fraction strips can help struggling students with spatial abilities. Using fraction strips helps students to see unit fractions are one piece of the whole. The strips help students learn to break fractions into parts. Using the strips also helps students with comparing fractions. Students can place fractions in order based on how big or small they are. Using the fraction strips helps the student see where the fractions are placed on the number line. Students will also learn about equivalent fractions. They will find that equivalent fractions might have different numerators and denominators, but they have the same value. Using fraction strips, along other with manipulatives such as number lines, fraction tiles, Cuisenaire rods, and fraction tower linking cubes can lead to a better understanding of fraction concepts.[8]

Partitioning Shapes

Partitioning involves dividing an object, set of objects or number of objects into parts. Students will be given a shape and they will divide the shape into equal parts. According to Johnathan Fisher “Knowing that shapes, sets and quantities can be partitioned into equal-sized parts, and understanding the importance of equal-sized partitions, is fundamental to recognizing the part-whole relationship between the numerator and denominator in fractions”. He also states, “One important aspect of partitioning is the reasoning that students employ to indicate how they know the partitions are equal sized, and how they could justify this to somebody else by drawing, showing or explaining. Students may need to fold or cut and overlay the pieces to illustrate their point”. Another aspect is that of encouraging students to find multiple ways of partitioning the same shape into the same number of equal parts.[9]

The area model represents a fraction as a part of a rectangle that is divided into equal parts. The area model will provide students with a visual. Models can help students clarify ideas that are often confused in a purely symbolic mode. Area models of fraction representation focus on the area of the whole unit being divided into equal portions.

My approach to teaching this unit is using the gradual release model. The gradual release of responsibility

model is a traditional approach to teaching that is centered around the idea that a teacher will model a skill or strategy for a few minutes, briefly allow students to practice with some support, and then release the students to begin practicing on their own. The gradual release of responsibility model of instruction requires that the teacher shift from assuming "all the responsibility for preforming a task … to a situation in which the students assume all of the responsibility". This approach has five stages that lead to effective learning. [10]

The stages are as follows:

1. The first is the no awareness stage. This is the "I do" stage or focused instruction. This is when the teacher models how to solve or work through something aloud so students can see an example of how to think about the new information.
2. Next, is the Awareness stage where the student becomes aware of the focused instruction after the teacher has modeled.
3. Performing with more help is the "We do." This is the Guided practice where the teacher and student work together.
4. Performing with less help is the "You do with a peer." Students work with peers to solve problems.
5. Perform with no help is the "You do" by yourself. Students work independently to solve problems.

During this model I will start with the "I Do" portion of the model. I will provide an anchor chart for each lesson. All the students should focus and pay attention as the teacher models. Students should not have anything in their hands. All eyes should be on me, the teacher. During this time students are only watching and listening to me model and demonstrate several problems. During the "We Do", students will work with me and guide me through a problem. Students will demonstrate that they understand and have grasped the concept of showing fractions using paper strips. Next, students will turn and talk to work on a problem with a partner. They will show a given fraction using number strips. They will then explain their thinking. This will allow all students to participate and learn from one another. The last part of the gradual release calls for the students to work independently. This is the "You Do" portion of the gradual release model. Once students are working independently, I plan to circulate the room to make sure all students are engaged in their learning. I will be checking for understanding and to see who needs intervention as I circulate the room. I will start pulling a small group of students who need extra support. This unit will help struggling students and will help prepare them for more geometry concepts as well as algebraic thinking.

Sample Activities

Activity 1 – What is a Fraction

I will make sure to set the ground rules and procedures for modeling. When I am modeling all pencils and books should be down. All eyes are on me, the teacher. My students need to understand that they learn with their eyes and ears. During modeling, I have my students seated on the carpet. I am standing at the front of the class so that all the students are able to see. Once I am done modeling, I will circulate around the room to make sure that all students are on task and assist students who need help.

I will start the lesson by displaying my anchor chart with the definition of a fraction and ratio. Next, I tell the students that: A fraction is a ratio or number or part that describes the size of a given quantity in comparison

to a unit of the same type. I will move on to tell the students that a ratio tells you how large a given quantity is in relation to a unit of the same kind. Here I have one sheet of paper. This sheet of paper is a shape. It is square. One whole sheet of paper can be divided into different fractional parts. I will hold up the paper for each student to see. I will fold the paper in half to show ½ of the paper. I will make sure to fold the paper evenly so that the parts are equal. A half is one of two equal parts. I will ask the students to notice that I folded the paper in half. If I cut the paper in half, I will have two halves. Now I put the two halves back together to make 1 whole sheet of paper. I will go to my anchor chart to show what 1 whole looks like. Once I have folded the two halves together, I will draw the corresponding figure. I will tell students this is what ½ looks like. I make sure to label ½ on the chart. Now I will introduce the vocabulary words numerator and denominator. I tell the students that the numerator is the top number of a fraction. The denominator is the bottom part of the fraction. It is the number of equal parts into which the whole has been divided.

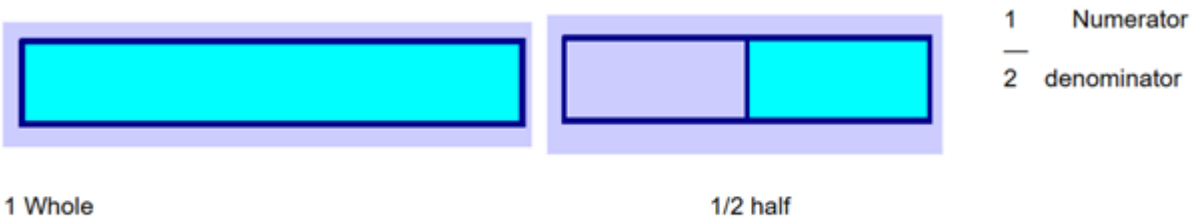


Fig. 1

1 whole strip of paper 1/2 half strip of paper

Next, I will fold 1 whole sheet of paper in half making sure that it is even. I will show the students that I have made halves. Now I am going to fold the paper once more. Now I have 4 equal parts. I will ask if I put the four parts together to make a whole like we did before? I will allow wait time so students can answer. Now that we know that we can piece the parts back together to make a whole. We can name the part of the fraction that we partition. There are four parts and the name for these fractional pieces is fourths or quarters.

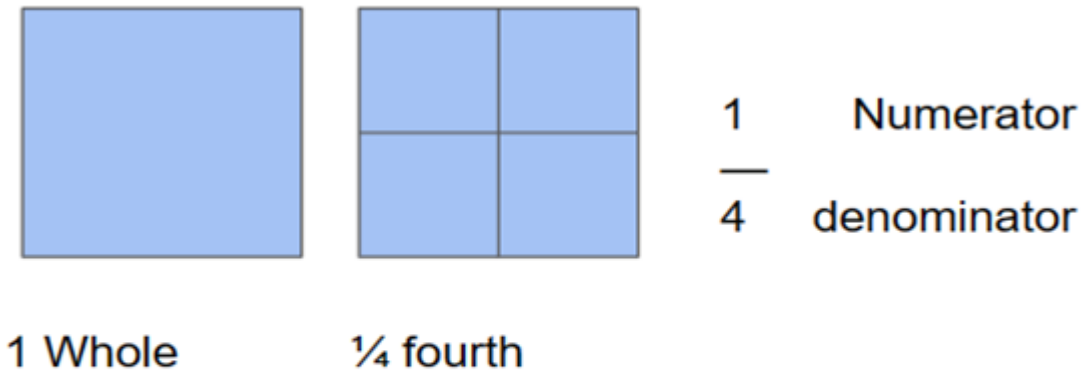


Fig. 2

1 whole sheet of paper. 1 sheet of paper folded into fourths

Now we will try one together. If we take 1 whole sheet of paper and fold it evenly 3 times how many equal pieces would we have? What would we name those fractional parts? Could we piece those shares together to make a whole? I will ask two students to repeat the instructions to make sure all students know what the task is. I will give each student paper and have each student fold the paper 3 times, then unfold to see if they can get 8 equal pieces. Once students have completed the task they will turn and talk to a partner and discuss what their results were. I will call on 1 group to share their results. When students are sharing out all students should be focusing their eyes on the presenters. Students will explain step by step how they got their answers.

Once the selected students are done sharing, I will ask what the students have noticed about parts and wholes. I will ask a student to name the parts of fractions. For example: If I have a whole sheet of paper and fold it into four equal parts, what is the name for the four parts? The student should say fourths. If I have 6 equal parts what is the name for six parts? The student should say sixths. I will model folding the paper into sixths. Now that students have grasped the concept of what a fraction is and have learned to name the fraction, it is time to work independently on naming fractional parts.

Students will answer the following questions and label the parts of the fraction. What is the name for the following fractional part? Label the numerator as well as the denominator for each problem. Students should say sixth. They should go on to label the whole as the fraction as 6/6. This demonstrates mastery. I will go on to tell them that 6/6 is the same as 1 whole. If some students are having trouble, I will have them count each part and piece them back together. I will ask them how many parts they have counted. I will have students to piece the parts back together to make 1 whole.

Activity 2

Naming Fractional Parts.

Students learned the vocabulary for fraction, halves, thirds, fourths, and a whole in the previous activity. Now is the time for students to apply what they have learned. Students will be given several problems. They will identify the fractions.

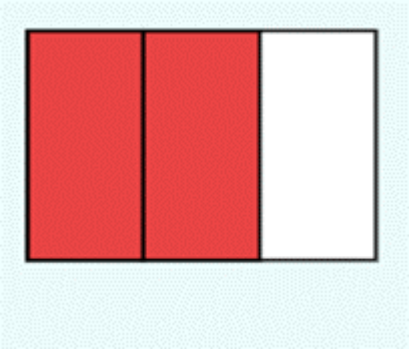


Fig. 3

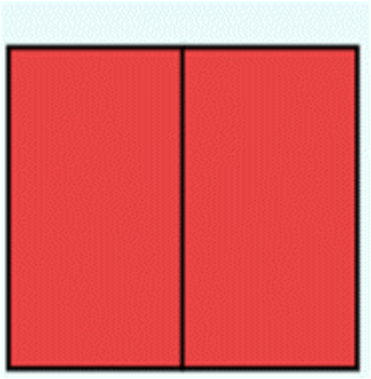


Fig 4

Figure 3 shows a square with 2/3 shaded red. Figure 4 shows a square that shows a whole square divided into halves.

How many parts are shaded ?___	How many parts are shaded ?_____
How many total parts in all ?___	How many parts in all ?_____
Are the parts all equal ?_____	Are all the parts equal ?_____
What is the name of the fraction? ___	What is the name of the fraction? ___

Activity 3

Partitioning shapes

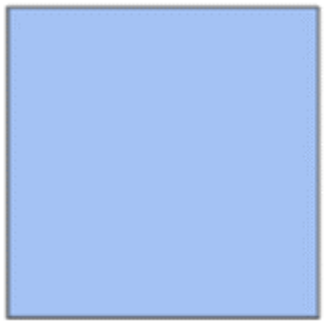


Fig 5

Figure 5 shows 1 square that students will partition into four equal parts.

Partition this shape into four equal shares. Tell me how many shares you will have. Fill in the blanks.

Each share is _____the whole. Each whole is _____.

Activity 4

Fraction strips

1. I will give each student a set of precut fraction strips made from construction paper. Then I will have the students arrange the strips based on color. Each fraction will be a different color to help students to see the size of each fraction once they fold them into strips. This will also make it easier for them to represent different fractions.

2. Use a fraction strip based on color to model ½. Next, I will have a student call out a fraction and model how to fold the strip to show that fraction. For an example they could call out 3/4. I will ask students should each part be equal? They should answer yes.

3. I will ask the students what each whole fraction strip is equal to? I will demonstrate how each fraction strip is equal to one whole and use this idea to introduce the idea of equivalent fractions. I will ask how many

halves equal one whole? I will ask how many fourths equal one whole, etc.?

4. I will ask students to use the fraction strips to identify 1/2. Next, I will see if they can find other fraction strips that are the same size as the 1/2 fraction strip. I will take time to explain for example, why three 1/6 strips are equal to 1/2. I hold both strips up to show students that the strips are the same size. At this time, I will introduce the word “equivalent” as “the same” or “equal to”. Once students identify fraction strips that are same size, I will emphasize that this is the reason they're called equivalent fractions. I will have the students arrange the strips in a square, with the largest strips on top and the smallest on the bottom. That way they can get an idea of how each fractional part compares in size to the others. I will use the fraction strips to show and explain that as the denominator gets larger, the fraction gets smaller.

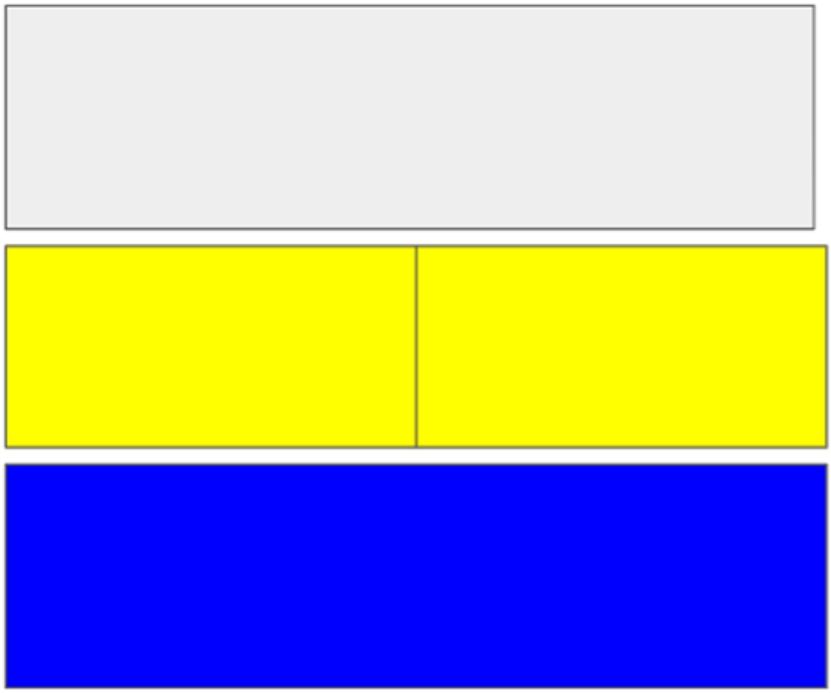


Fig. 6

Figure 6 shows fraction strips for 1 whole strip and half a strip. I will have students use the first strips to divide the third strip into fourths.

Using number 5 as a challenge.

5. I will have the students continue using the strips to model equivalent fractions for 1/4, 1/8, 1/3, 1/5, and 1/6. I will provide a number line that goes from 0 to 10 by ones. This will help students make fifths.

Appendix

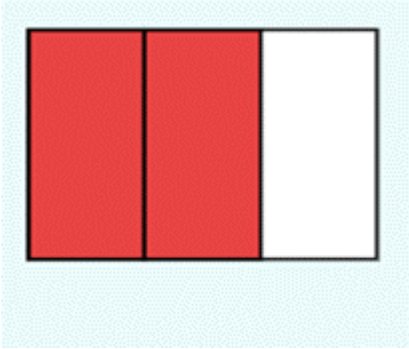
Name_____

Date_____

Naming Fractional Parts. Use the following image to answer the questions.

Vocabulary words

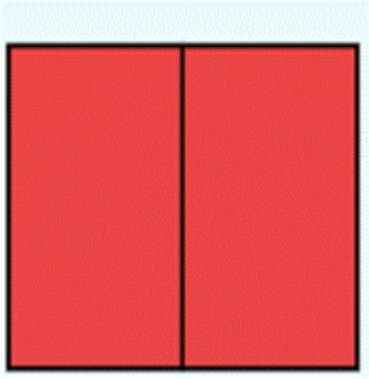
Students have been introduced to the concepts halves, thirds, fourths, and a whole in the previous activity. Now is the time for students to apply what they have learned. Students will be given the following sample problems. They will identify the fractions.



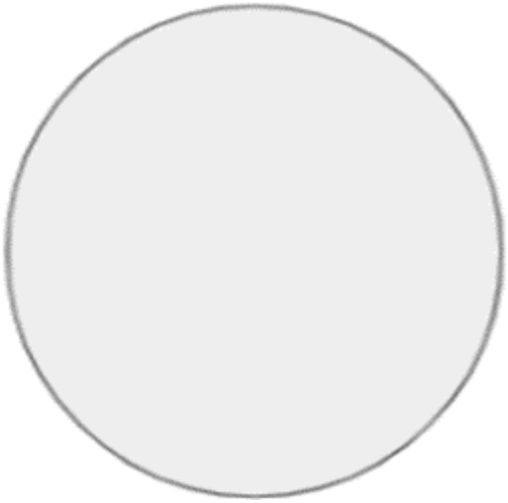
How many parts are shaded? _____

How many total parts in all? _____

What is the name of the shaded fraction? _____



Use the circle to shade in and show 3 out of 4 parts.



How many parts are shaded? _____

How many total parts in all? _____

Are the parts equal? _____

What is the name of the fraction that describes the shaded part in relation to the whole?

Use the square to shade in and show 1 out of 4 parts.

How many parts are shaded?___?

How many total parts in all?_____?

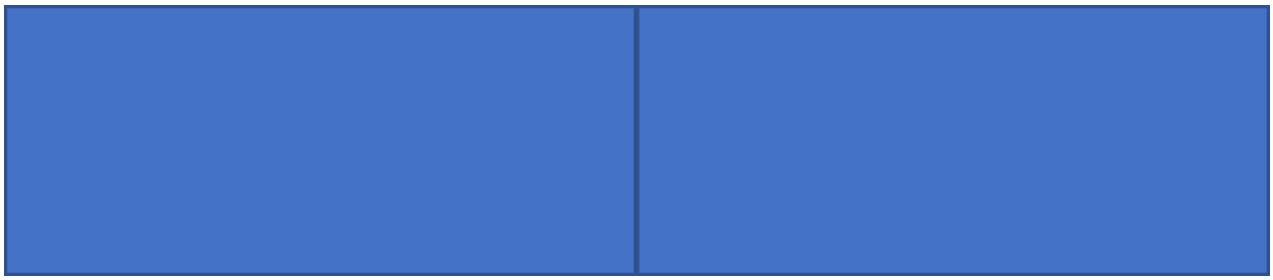
Are the parts equal? _____

What is the name of the fraction that describes the shaded part in relation to the whole?

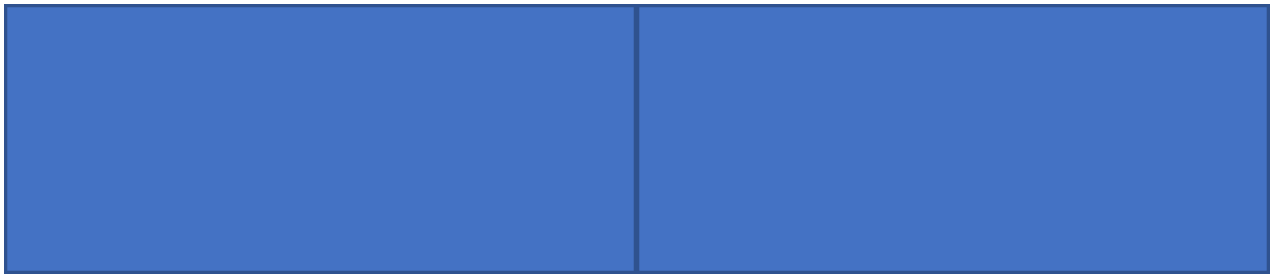
Name _____ Date_____

Partitioning Shapes. Look at the shape below. Partition the rectangle into two equal shares in two different

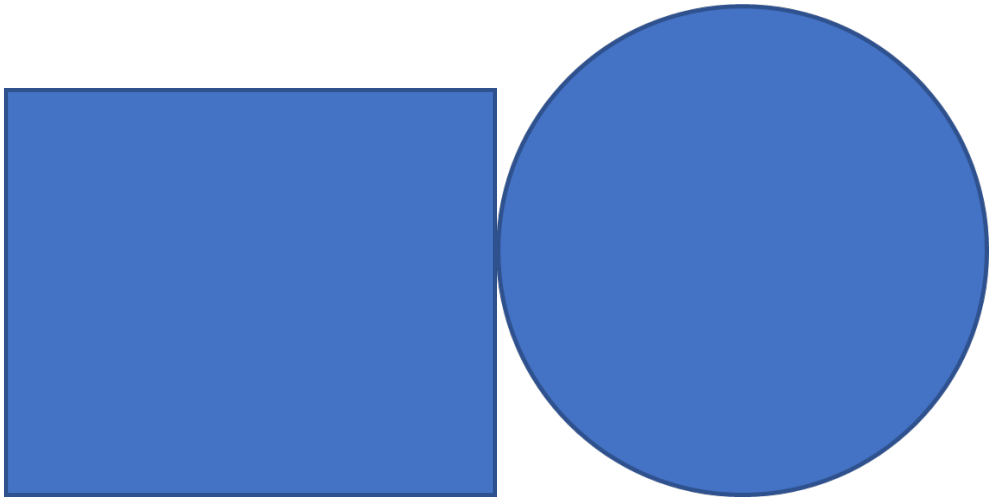
ways.



Partition the rectangle into three equal shares in two different ways.



Draw 2 lines to partition each shape into fourths.



Notes

Witzel Bradley & Riccomini Paul, *Computation of Fractions Math Intervention for Elementary and Middle Grades Students (New* Jersey: Pearson,2009), 6.

Fernell Francis, *Fractions are Foundational* (NCTM News Bulletin, December 2007)

National Center for Education Statistics. (2001). T*he nation's report card: Mathematics* 2000. Washington, DC: National Center for Education Statistics Press.

https://nces.ed.gov/nationreportcard/subject/publications/stt2022/pdf/2023011IL8.pdf

Maccini, Paula & Mulcahy, Candace & Wilson, Michael. *A Follow-Up of Mathematics Interventions for Secondary Students with Learning Disabilities. Learning Disabilities Research & Practice*. 22. 58-74 (2007)

Van de Walle John, *Elementary and Middle School Mathematic Teaching Developmentally* (Boston :Pearson, 2007) 293

Lamon S, *Teaching Fractions and ratios for Understanding: Essential Content Knowledge and instructional strategies for teachers.* (Mahwah, New Jersey,1999)

https://mathsnoproblem.com/en/approach/concrete-pictrial-abstract

https://educatewithease.com/fraction-strips/

Fisher Johnathan. *Fraction: Partitioning and the part –whole concept.* Teaching and Learning.

Neagoy, Monica. 2017. *Unpacking Fractions.* Alexiandria, VA.

Annotated Bibliography

---

https://mathsnoproblem.com/en/approach/concrete-pictrial-abstract

This site gives a very precise and clear explanation of the CPA Approach.

Duke, N. K., & Pearson, P. D. (2002). *Effective practices for developing reading comprehension.* In What research has to say about reading instruction A. E. Farstup & S. J. Samuels, Newark, DE: International Reading Association. This information explains the gradual release model.

https://educatewithease.com/fraction-strips/

This site gives different ways to use fraction strips in the classroom to build number sense.

Fernell Francis, *Fractions are Foundational* (NCTM News Bulletin, December 2007) This article explains how we should approach teaching fractions. It explains that fractions are the foundation of algebra.

Fisher Johnathan*. Fraction: Partitioning and the part –whole concept.* Teaching and Learning. This article discusses what partitioning is. This will help the teacher to understand the importance of teaching students how to partition shapes.

Lamo*n Susan, Teaching fractions and ratios for Understanding: Essential Content Knowledge and instructional strategies for teachers.* (Mahwah, New Jersey, 1999) This book talks about content knowledge and gives teaching strategies.

Maccini, Paula & Mulcahy, Candace & Wilson, Michael. 2007 *A Follow-Up of Mathematics Interventions for Secondary Students with Learning Disabilities. Learning Disabilities Research & Practice. This*

Neagoy, Moncia*. 2017, Unpacking Fractions: Classroom-Tested Strategies to Build Students' Mathematical Understanding.* Alexandria, VA: NCTM. The information in this book suggests how to unpack fractions. It gives insight on what teachers could do to help students to understand and master fractions.

National Center for Education Statistics. *(2001). The nation's report card: Mathematics 2000.* Washington, DC: National Center for Education Statistics Press. This report gives information regarding how students performed in Mathematics in 2000.

https://nces.ed.gov/nationreportcard/subject/publications/stt2022/pdf/2023011IL8.pdf

The Nation's Report Card: 2022 Mathematics Snapshot Report: Illinois Grade 8 (ed.gov) This report gives data regarding the performance of Illinois students in grade 8 for math.

Van de Walle John, *Elementary and Middle School Mathematic Teaching Developmentally* (Boston: Pearson, 2007) 293 This book is great and has a wealth of knowledge regarding developing fraction concepts. It also provides a list of stories to read about fractions as well as examples of activities for different fraction models.

Witzel Bradley & Riccomini Paul*, Computation of Fractions Math Intervention for Elementary and Middle Grades Students* (New Jersey: Pearson,2009) This book gave insight on how we can provide intervention for all learners.

[1] Witzel Bradley & Riccomini Paul, *Computation of Fractions Math Intervention for Elementary and Middle Grades Students (New* Jersey: Pearson,2009), 6.

[2] Fernell Francis, *Fractions are Foundational* (NCTM News Bulletin, December 2007)

[3] National Center for Education Statistics. (2001). The nation's report card: Mathematics 2000. Washington, DC: National Center for Education Statistics Press.

[4] CPA Approach Explained | Learn the Concrete, Pictorial, Abstract Method (mathsnoproblem.com)

[5] Van de Walle John, Elementary and Middle School Mathematic Teaching Developmentally (Boston :Pearson, 2007) 293

[6] Neagoy, Monica. 2017. Unpacking Fractions. Alexiandria, VA.

[7] Van de Walle John, *Elementary and Middle School Mathematic Teaching Developmentally* (Boston :Pearson, 2007)

[8] Using Fraction Strips to Build Fraction Number Sense - (educatewithease.com)

[9] Fisher Johnathan. *Fraction: Partitioning and the part –whole concept.* Teaching and Learning.

Lamon S, *Teaching fractions and ratios for Understanding: Essential Content Knowledge and instructional strategies for teachers.* (Mahwah, New Jersey, 1999)

[10] Duke, N. K., & Pearson, P. D. (2002). *Effective practices for developing reading comprehension. In What research has to say about reading instruction.* 2002, p 211