Building Mathematical Comprehension Using Literacy Strategies

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This curriculum unit is recommended for:
4th grade Math and Literacy

Keywords: fractions, problem solving, literacy strategies, comprehension, close reading

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit. (Insert a hyperlink to Appendix 1 where you've stated your unit's main standards. For directions on how to insert a hyperlink, see Fellows Handbook, p. 28.)

Synopsis: This unit was designed to integrate literacy best practices with critical areas of mathematical instruction in regards to fractions and the Standards for Mathematical Practice to ensure that scholars are making connections across subjects and developing a coherent understanding of the content. In regards to the Standards for Mathematical Practice, the main focus will be on making sense of problems and persevering in solving them, constructing viable arguments and critiquing the reasoning of others, and to look for and make use of structure as it relates to problem solving. They will be using literacy strategies such as predicting, visualizing, and close reading to help them solve problems throughout the unit.

I plan to teach this unit during the coming year to twenty four students in fourth grade math and literacy.

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Introduction

Lebanon Road Elementary School serves over 800 students in grades Pre K through 5th. The school is located in Charlotte, NC in the Charlotte-Mecklenburg School District. We are a Title 1 school and receive federal funding. 93 % of our students qualify for free and reduced lunch. We are a racially diverse school of approximately 2% Asian, 48% Hispanic, 40% African American, and 10% White. 66% of our fifth grade scholars scored at or above grade level on the Science End of Grade Test and Lebanon Road Elementary made Adequate Yearly Progress in 2014-2015 school year for fifth grade Math and Reading. We Exceeded Growth in fourth grade Reading and did not make Adequate Yearly Progress in fourth grade Math. Our school has a very small PTA and we are continuing to grow parental support, as well as community involvement. I will be teaching two blocks of Reading and one small group for math in the upcoming school year. My classes for the year were formed based on formal and informal data, specifically targeting scholars that are below grade level in reading with various backgrounds and abilities in math. I differentiate activities within the content objectives for both reading and math to meet the diverse educational needs of my scholars.

My reading curriculum is based on the Common Core Standards for Reading, Writing, Speaking, along with the fourth grade Scope and Sequence guide provided by Charlotte Mecklenburg Schools. Activities are chosen that will create a balanced literacy environment for my scholars. Most lessons are interactive and are divided into connection/hook, teacher input, guided practice, independent practice, and group sharing at the conclusion of the educational block. I incorporate the use of a Smart Board and video clips as hooks for the mini lessons, Reading A-Z for independent reading, and Scholastic News on a daily basis. Scholars are assigned individual Chrome Books to use during guided reading and are able to use Compass Learning to help differentiate their path for reading. This program allows scholars to work through a variety of steps at their own pace with videos embedded to help engage the scholar. One-to-one technology allows scholars to interact with web resources in a more inclusive manner and helps to engage scholars while I facilitate small group learning. Throughout instruction I engage scholars by including hands-on activities such as task cards and various reading materials during literacy blocks.

My mathematical curriculum is based on the Common Core Standards for Math, along with the fourth grade pacing guide provided by Charlotte Mecklenburg Schools. I have implemented math workshop into my classroom which follows a format similar to reading workshop. Scholars are engaged in some type of facts practice every day to build

mental math skills, scholars work with partners to practice the skills previously taught to spiral the curriculum, and scholars are involved in guided math groups based on skills that need further exploration and development. Scholars are assessed at the end of each lesson using an exit ticket. These exit tickets help to guide my instruction and guided math groups for the following day. I expect my scholars to make sense of and think about mathematics and strive to provide an environment in which scholars can build on the ideas they already have and learn new ideas through exploration and encouragement of peers.

Rationale

Based on the end of year test scores for Lebanon Road there is a deficit in our math instruction in relation to our reading instruction. After discussing this with fellow educators, I found that this is a pattern found across many classrooms. This presents a puzzle since the demands of teaching math and literacy are very similar. This unit will look at taking a balanced literacy approach and applying it to create a ¨balanced¨ math classroom where students are engaged and constantly working in small groups based on their individual needs. I will explore how we can use the Standards for Mathematical Practice, along with what are considered traditional literary strategies, to improve the quality of our math instruction in specific critical areas of mathematics such fractions and problem solving. These lessons will be geared toward addressing common misconceptions that scholars have with fractions. Further exploration will include lessons on developing and understanding fraction equivalencies and dissecting word problems. The unit will conclude by putting all of this into practice in real world situations through the problem solving process. Using close reading strategies, scholars will be able to transfer reading skills to help them understand what the information in the problem is telling them, what the problem is asking them to find, and what the most efficient and effective way is for them to solve the problem. The unit will provide numerous opportunities for scholars to collaborate with each other, discuss various problem solving strategies, and write to support their mathematical thinking.

Objectives

Charlotte Mecklenburg Schools reading and math instruction is based on the Common Core Essential Standards. Designing goals and activities based on these standards will create a unit consistent with national literacy and math objectives. I also plan on addressing the Eight Standards for Mathematical Practice to help ensure that our scholars' informal knowledge increases along with their academic understanding of mathematical practices. According to the Eight Standards for Mathematical Practice, students are expected to make sense of problems and persevere in solving them, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, use appropriate tools strategically, attend to precision, look for and make use of structure, and look for and express regularity in repeated

reasoning. During the unit, scholars will put these standards into their own words to make them more meaningful to them and ensure that they understand the expectations of these standards.
The following objectives to be taught in this unit are from the Common Core State Standards for North Carolina in Mathematics and Language Arts:

Explain why a fraction a/b is equivalent to a fraction (nxa) / (nxb) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

Compare two fractions with different numerators and different denominators, by creating common denominators or numerators, or by comparing to a benchmark fraction such as ½. Recognize that comparisons are valid only when the two fractions refer to the same whole.

Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing and speaking to support conclusions drawn from a text.

Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

Unit Goals

The Common Core State Standards for Mathematics describe *what* scholars should be able to understand and do in mathematics and the Standards for Mathematical Practice describe *how* scholars should engage with mathematics. My goal for the unit is to align them so that scholars are meeting the expectations of the state at the fourth grade level and there is an emphasis placed on the reasoning of mathematical ideas so that I am engaging all of my scholars in learning about mathematics as a whole, not just a process to follow. I want to support scholars as they struggle in making sense of mathematics and through that process they learn to become mathematical thinkers. The unit also aims to put in perspective that mathematics is a life skill, just as literacy is, and scholars will see the relevance of learning problem solving and fractions. Scholars will be involved in developing strategies for solving problems. They will understand the structure of the problem, communicate their solutions using academic discourse and writing, while exploring multiple ways to go about the actual process of solving for an answer. Scholars

will reflect on their work as problem solvers and be encouraged to persevere, even when they are frustrated and mistakes have been made. Hopefully, by the end of the unit, scholars will realize that mistakes are learning experiences and will welcome those experiences by working through them. Scholars will gain an understanding of what it means to have a growth mindset. Scholars will also be able to construct and defend mathematical arguments about problems they solve and the solutions they obtain. They will be able to provide feedback to their peers by listening to and evaluating the decisions made by other scholars in the classroom. Scholars will strive to use academic vocabulary throughout these discussions with their peers and in their own writings as well. Lastly, through a variety of problems that are solved, scholars will develop understandings of methods that are efficient and effective for particular types of problems. We will discuss these generalizations and develop theories with mathematical implications based on our findings.

Teaching Strategies

Integrating several subjects can help increase motivation and engagement. Scholars make connections across the subjects and meaningful information can be used in the real world. They are able to apply what they have learned to different academic areas and find a purpose for learning in their lives. A well-planned curriculum enables scholars to use higher order thinking skills in Bloom's Taxonomy to collaborate, explore, analyze, and construct new information as they relate it to other applications. By engaging scholars, behavior issues can be avoided and learning takes place throughout the classroom day. A large part of successful engagement is making sure the learning styles of the scholars in the classroom have been identified. At the beginning of every school year I give a short survey on how scholars enjoy learning that includes questions on what they enjoy learning about. The eight learning styles (multiple intelligences) include; kinesthetic/body, musical, interpersonal-social, intrapersonal-self, naturalist, linguistic-language, logical-mathematical, and visual-spatial.

My first strategy will be to use math story books that teach a key concepts. Using literature can help clarify math topics for scholars who are visual and linguistic learners. A fictional book with an underlying math theme provides valuable content and captivates the interest of many scholars. Fictional books can provide interesting and entertaining ways to present math material to scholars while integrating literacy best practices such as close reading and predicting.

Another strategy will be to use games, including technology which appeal to all the above mentioned learning styles. Games also allow scholars to interact with each other and develop social skills. The Math Investigations curriculum offer several varieties of games which can be taught easily and require few supplies. NCTM Illuminations: Online Resources for Teaching Math offer a way to incorporate the use of technology into the math classroom. Scholars enjoys playing games and are engaged in a learning activity at the same time. The best math games offer scholar's a challenge and have a specific math

objective to be learned. There are benefits to using games to help scholars learn math skills and concepts. For example, games provide a meaningful situation for the scholar to use math. The variety of the games available make it easy to meet the interest of scholars so they stay motivated and persevere in their own learning. Scholars usually progress through different levels of games so that they are increasingly challenged but maintain a sense of accomplishment in math throughout the process. Most games do not cause a language barrier and will not present your ELL students with complications from language usage. In fact scholars may enjoy the games so much they forget that they are actually practicing math and learning at the same time. Games played on the computer are also beneficial for the same reasons listed above, especially for those scholars whose learning styles lean towards intrapersonal skills. A computer game can allow scholars to learn, but also have a safe place to be able to make mistakes and be more independent. In games, scholars have to think at a higher level by applying, comparing, and evaluating the choices they make in the game. When scholars are doing something as routine as math facts, a game can be an effective approach instead of drill and practice.

Scholars will use manipulatives to model fractions and word problem situations. They will also create models to reflect understanding of operations with fractions, equivalent fractions, and apply them to the problem solving process. I will facilitate academic conversations in which I will informally assess all scholars understanding for adding and subtracting fractions and equivalence of fractions; as well as formal assessments done in class. I will use hands-on models for them to actually see what they are doing while collaborating with their classmates. This will offer support when it comes to misconceptions with equivalencies and problem solving. In finding equivalent fractions, they will make connections to previously used manipulatives from third grade, the multiplication chart and things found in nature. Scholars will have the flexibility to do what works best for their unique learning style. All of the concepts learned throughout this unit will be used to make connections in literacy and other standards in math because scholars will be given multi-step word problems involving fractions. They will use writing responses to document their understanding, connections, and vocabulary learned throughout the unit. Scholars will become mathematical speakers and use domain specific vocabulary, as they conduct discussions about strategies used to solve problems and play various games.

There are numerous ways in which to implement the strategies listed above in a fourth grade classroom. The teacher can present and model any strategy to scholars during the introductory lesson for a specific mathematical standard. A teacher may also choose to teach a concept and then use the strategies within the classroom practice during the course of a few days to help facilitate the scholar's understanding. A strategy can be used as part of a lesson that includes other problem solving activities. Strategies can be used with individual scholars, pairs of scholars, small groups, and full classroom groups. Using strategies in pairs (a math story with a game, or a problem solving activity with a discussion) during one math period is another way to help strengthen skills for scholars

and honor individual learning styles. Implementing a math workshop, with each strategy incorporated into a station, would allow differentiation as scholars rotate through activities during math time. Teacher assistance is needed in a workshop model to guide scholars and informally assess understanding. The teacher should not be tied to one station when using the workshop model, so that she may move throughout the classroom and facilitate instruction. It is important in the workshop model that scholars are taught classroom expectations for movement between centers, as well as, procedures for each center so that the workshop is successful. I find the workshop the most beneficial for my scholars because it provides an arena for reviewing multiple standards and allows for cooperative groups. If the teacher is strategic in the placement of scholars into groups, then scholars are able to learn from each other and the teacher is able to focus in on specific skills for small groups of scholars to practice effectively.

Activities

To introduce the unit on fractions I use a poem about fractions. I read it aloud but I do not share the title with the scholars because I want them to use the clues in the poem to help them to infer what mathematical concept the poet is referring to. This also allows me to get a glimpse of scholars' background knowledge about fractions and sometimes can lead to great discussions on misconceptions that they are bringing to fourth grade with them. Scholars tend to like this activity because they view it as a guessing game and love to come up with titles for the poems themselves. After discussion of what clues led us to the answer of fractions (denominator, numerator, halves, fair share), scholars create their own poems about fractions based on information and knowledge they already have.

To ensure that scholars understand that fractions represent equal parts of something, we spend time creating equal parts using classroom objects. I place students into pairs and have them find an object in the classroom that is either a square, circle, or rectangle. I tell them that it needs to be bigger than a deck of cards and smaller than our classroom dictionary. They are to trace and cut out the shape of the object they chose and then divide it into equal parts. I usually focus on halves, thirds, fourths, sixths, and eighths. As scholars are working with partners, I circulate the room and encourage discussion about what they notice as they cut and divide it into different parts. They should notice that as you try to fold it into more pieces, the pieces get smaller. Another great discussion point is that if you fold it in half and then in half again, each half gets cut in half. This leads to great predicting work on how to go from halves, to fourths, to eighths, and so on. This activity provides the foundation for the more advanced skills and allows for scholars to see patterns that arise when dividing shapes. You may wish to introduce the terms numerator and denominator if your scholars are not already familiar with and using them in conversations.

To prepare for the next activity I give my scholars a shape that is divided into fourths but one half of the figure is divided horizontally into two pieces and the other half of the

figure is divided vertically into two pieces so that you have four pieces but they do not look the same. They respond in writing on whether they believe that the shape is divided into fourths and must explain their reasoning behind their choice. This way they have all thought about the problem and will be able to contribute to our classroom debate on the issue. We review what respectfully critiquing the reasoning of our classmate's looks and sounds like before beginning and focus on using a calm voice and listening to others' ideas before sharing our own thoughts. Then I group the scholars based on whether or not they believe that the picture is divided into fourths or not. They are sent to separate sides of the room to generate evidence to support their view and prepare any posters or diagrams which they need to use to convince the other side that they are correct. They have mathematical tools such as rulers available for use and are given about fifteen minutes to collaborate and prepare. Then I bring them back together as a class and the two sides face each to offer up justifications for the position. After one scholar from the team shares, the other team is given a chance to either share their reasoning or try to counter the first team's idea and prove it faulty. Scholars are also told that they are allowed to switch sides at any point if they hear enough evidence to convince them to change their reasoning. It usually goes on for several rounds before someone from the team that knows it is divided equally challenges the other team to cut the shape and match up the pieces. Then the lightbulb goes off and we reach a classroom consensus that fourths does not mean four shapes of the same shape, but four shapes of the same amount.

Next I spend a day on exploring the idea of what one half is. Scholars are asked to take a five by five grid and shade in one half. They are also required to prove that they have shaded exactly one half with makes for some interesting explanations during our academic conversation. I spend several lessons on "math talk" and the importance of using math vocabulary so that anyone listening would be able to understand what it being presented clearly. Scholars work with a partner to create an anchor chart to show five ways to represent one half. They try to incorporate ways we can use the words, numbers, symbols, and illustrations to show thinking. Most scholars will draw different shapes or whole units and divide them into two equal pieces. I try to get them to branch out more by creating examples and then counterexamples. This seems to help them think outside the box a little more. Scholars get a chance to view each other's work by taking a gallery walk and leaving sticky notes for each poster about something they observed or stood out to them. This is also a common literary practice so they are very familiar with the expectations and that the sticky notes are supportive ways to respond to classmates. We usually follow up with a class discussion about what made a representation accurate or inaccurate and what common misconceptions might trick their classmates about the fraction one half. I feel as if it is important for scholars to have a solid understand of what one half really is before moving any further into the unit so I love to ask them a question such as, " Is one half always equal to one half?" This generates a lively and engaging discussion after completing our one half anchor charts and the also provides you with immediate feedback of which scholars really understand what one half is. I facilitate the

discussion for about five minutes and then I explain that we need to apply it to a real world situation. I bring out two cakes - one individual twelve inch round cake and then a rectangular 24 inch sheet cake. I have them write down on a sticky note which cake they would rather have half of. Finally, light bulbs go off. We discuss until we come to the conclusion that the fractional amount is totally and completely dependent on the size of the whole. I have students reflect on this in writing and give me another example to prove this statement is true.

After reminding scholars about the cakes, we review some of the conclusions that we drew about fractions from the previous week such as fractions refer to equal pieces, the numerator refers to the number of pieces we are working with, denominator refers to the total number of groups. I suggest putting these on an anchor chart, as well as having scholars write them down in their math notebooks for easy reference. Then each scholar gets six, three by four and a half rectangles of paper and I have them create their own models of one whole, halves, thirds, fourths, sixths and eighths. This is a great way for me to easily assess if they are developing and applying the concepts we have been working on and discussing in class. If they struggle to get six or eight equal parts, it may help to prompt them by having them think about what they did to make fourths and so on. Being able to see patterns and look for ways to connect to what they have already done helps them to persevere through this process. I also stress the concept of unit fractions and that a whole can be divided into smaller, equal parts that we can count with by relating it to counting with whole numbers. This helps them to understand addition and subtraction of fractions. I have students glue their folded models down in their math notebooks and then record a number sentence that reflects how the fraction can be decomposed. This is a big idea so that scholars are able to see how fractions are made of other fractions. I also like to use fractions bars to help them separate out each whole into its respective parts to model this another way for the class. I need them to see that unit fractions such as ¼ can be counted to make a whole and that a whole can be made up of any number of equal parts. If they grasp this concept early on in the unit, then addition and multiplication of fractions will actually make sense! For a quick check at the end of the lesson, I have students show me how to create a whole with eight parts- what I am looking for is that they understand that eight eighths make up the whole. You could have them model and explain it with fraction bars or draw it out on notebook paper.

The next set of activities focuses on fractions of sets. Start out with a question such as, "Which is bigger, one half of twelve cubes or one third of eighteen cubes?" Scholars should respond to this with words, pictures, or by modeling with manipulatives. Scholars made need a little prompting to get started and you can pull them into a small group with actual cubes to help them so they can then facilitate their own learning and find the answer for themselves. I love to use edible manipulative- Skittles, M&M's, and jelly beans are great ones because they come in a variety of colors and are yummy! Each scholar gets their own snack size bag of edible manipulatives to work with and is promised that they can eat them once the activity is finished. Ask questions such as:

How many Skittles are in the set? What fraction are yellow? What fraction are orange? What fraction are yellow? What fraction are green? What fraction are NOT orange? What fraction are NOT yellow or orange? What fraction are red and yellow? Then have scholars pretend that they have a bag of twenty four Skittles. How much would one third of the bag be? What about five eighths? How much would one twelfth be? What if you changed the bag to have twenty Skittles? How many Skittles would one fourth of the bag be? How much would three fourths be? Would one twelfth of the bag of twenty be more or less than one twelfth of the bag of twenty four? Discuss how they came up with the answers and how the initial questions help them build and find the comparison questions. Pair scholars with partners and have them do some comparison problems to determine which would be greater: one half a bag of fourteen Skittles or one third of a bag of eighteen Skittles, one tenth of a bag of one hundred Skittles or one sixth of a bag of fifty four Skittles, one half a bag of thirty Skittles or two thirds of a bag of eighteen Skittles, one sixth a bag of Skittles or one fourth of a bag of sixteen Skittles, one fourth of a bag of twenty Skittles or one third of a bag of eighteen Skittles and so on. You could even have them create some of their own problems and exchange with other pairs to solve. Discuss with scholars what patterns they noticed when solving these problems and have them reflect on the things that they found surprising when solving them. Centers with task cards and different counters would be beneficial to help scholars practice this during math workshop and solving real world problems will provide much needed repetition to make sure that scholars see fractions of a set. Have students answer the following real world question in their math notebooks for a quick check: If you received three fourths of twenty math problems correct, how many did you get right? If you received one sixth of twelve math problems correct, how many did you get correct? Which would you prefer to receive? Explain your reasoning. Stress the critical thinking and logical reasoning with these types of questions. If you receive three fourths of twenty math problems correct, you know that you are talking about almost all of the problems being correct because it is closer to a whole and one sixth will only be few because it is a very small piece of a whole.

To introduce the concept of equivalent fractions start by having scholars respond to the following prompt in their math notebooks- Can a fraction ever have more than one name? Explain. This is a great way to take the temperature of your class and see if they can apply some of the concepts that have been explored in previous lessons. Next divide your class into four groups and give each group a stack of fraction cards. Each set of fraction cards should contain the following fractions: one half, one third, one fourth, one fifth, one sixth, one eighth, one tenth, one twelfth, two thirds, two fourths, two fifths, two eights, two tenths, three fourths, three eighths, three tenths, three twelfths, four fifths, fourth eighths, fourth tenths, fourth twelfths, five sixths, five eighths, five twelfths, sixth eighths, sixth tenths, sixth twelfths, eight tenths, nine tenths, ten twelfths, eleven twelfths, one and one eighth, one and one fourth, one and one tenth, one and one half, and two. Ask them to work with their groups to order the fractions from largest to smallest. They can use any fraction manipulative or draw pictures to help them with the task. Explain

that if they come across two cards that have fractions that are the same amount, then they should stack them on top of each other. Walk around and observe how scholars are collaborating and record a few snippets of conversations to help with discussion points later in the activity. Once scholars have their fractions in a number line sequence, complete a gallery walk so that they can rotate and see the other group's work as well. Facilitate a discussion afterwards about the similarities and differences and reference the talking points you noted from earlier group conversations. This way you are able to steer the academic conversation the way that will benefit your scholars the most. Examples of great talking points might be that larger denominators mean smaller pieces, an accurate way to determine if fractions are equivalent, which fractions were the easiest to place on the number line and why. Explain to scholars you will revisit this activity at the end of the unit and they will be able to do it much more confidently and quickly. In order to differentiate, you may wish to select certain fraction cards to give to a group and limit the number of cards the group works with at one time. Remember it is okay to let groups struggle with the task. They need the experience of talking through it and being able to explain their thinking as to why the fractions go in the order that they choose. You can have each student record it in their notebooks after you go over it as a whole class and prove that the number line sequence is correct or leave it out in the room for them to continue to go back to over the next couple of days as their understanding grows even more.

In the next lesson scholars will continue working on equivalencies while using various models to help them show what it means when two fractions are considered equivalent. After reviewing what equivalent means and creating a Frayer model in their notebooks, scholars will rotate through math stations each with a different way to explore equivalency. The main task for the stations is that while using the manipulatives and discovering equivalencies, scholars will record them in their math notebooks and be prepared to explain to someone else how to decide if two fractions are in fact equivalent. Possible math stations for equivalency could include fraction dominos, fraction circles, pattern blocks, and fraction bars. Give scholars about ten minutes at each station and circulate to notice what they are wondering. Jot down the questions that seem to keep recurring on an anchor chart that you can refer to later in group discussion. If scholars are not considering fractions that are greater than one whole, nudge them gently with guiding questions to start thinking outside the box. Have scholars create a new whole with more than one yellow pattern block and then determine equivalent fractions based off of the newly created whole. Pose questions like, "If I cut the green pattern block in half, I could fill the rest of the space on the orange square. I already know that one green triangle is equal to one sixth, so using two of them would be two sixths. Is two sixths the same as one whole square? Let scholars discuss, debate and model these types of questions and before you realize it they may be asking their own questions like this. Manipulatives open up a world of discovery which makes not knowing okay and figuring things out much more exciting. Encourage them to notice patterns and record them, even if they are not sure what it means at this point. At the end of the station rotation give them

an exit ticket which has them to show all the fractions that they know are equivalent to one half and have them use pictures or words to tell how they know that they are equivalent.

For the next activity prepare six anchor charts with a common fraction on each. Divide your class into six small groups. Explain that scholars need to write three equivalent fractions on their posters which will be considered examples and one counterexample. As a group, they should decide how to create the counterexample so that it might trick the next group. Give each group five minutes at each anchor chart and then have them rotate to the next. When scholars get to their next rotation, they first need to identify the counterexample and cross it out. Then they should collaborate to come up with new equivalent fractions and a new counterexample to fool the following group. Once the activity is over, you have scholar created anchor charts for equivalent fractions to display in the room and reference throughout the year.

The next activity has scholars measuring different items in the classroom using Cuisenaire Rods. Cuisenaire Rods are plastic or wooden blocks that vary in length from one to ten centimeters so the objects you measure will need to be small in size. Each rod of a certain length is the same color. For example, all two centimeter rods are red and all one centimeter rods are white. By approaching it from a measurement perspective, scholars understand that equivalencies are naming the same thing in different ways. To begin the activity have scholars set up a chart in their math notebooks with three columns: item being measured, first way, and second way. Provide scholars with an item that is twelve centimeters long and some rods. Ask them to measure it using the brown rod and then the remaining length of the item will be measured according to where it stands in relation to the brown rod. So if a scholar says that it measures one brown rod and one purple rod have them look at the purple rod in relation to the brown rod to understand that the purple rod is half of the brown rod so the entire length of the item is one and one half brown rods long. Have scholars record this measurement under the column first way in their math notebooks. Remind scholars that when they used the purple rod to measure the remaining length, the denominator was two since it required two purple rods to make one brown rod. Have scholars measure the rod again using the brown rod first but this time use the red rods to find the remaining length. It should take one brown rod and two red rods to equal the length of the item that is twelve centimeters. Discuss the correct fraction name of the red rods in relation to the brown rod, referring back to how you did so with the purple rod. Scholars can place four red rods on top of the brown rod to visually see that a red rod is one fourth of the brown rod so the answer is one and two fourths brown rods long. Record this as second way. You can allow for scholars to work and see if they can find another way to measure the item but stress the importance of using the brown rod as the measurement unit or whole. Provide other classroom items to measure such a pencil boxes, markers, books, and crayons. As a challenge you could even work with different colored rods as the measurement unit or whole. The process should help scholars to understand why one half, two fourths and

four eighths are the same number but different names. It also allows them to see relationships such as one fourth is equal to two eighths and six eighths is equal to three fourths. Having scholars draw and color the Cuisenaire Rods to show these relationships provides them a great reference to keep in their math notebooks and use throughout the unit.

The last activity for showing scholars equivalencies scholars are placing fractions on a number line. Scholars will be able to see that some fractions represent the exact same point on the number line but are notated differently. It also provides a great lead into developing an understanding of fractions in relation to the distance from zero which will help when we discuss benchmark fractions and comparisons. Provide scholars with a number line that has an interval of twelve centimeter between zero and the number one and the number one and the number two. Have scholars determine what it half way between zero and one and one and two. Use the Cuisenaire Rods or centimeter squared paper to carefully partition the number line between the whole numbers. Have them label those points as one half and three halves. Have them use fraction notations for the whole numbers as well so that they include zero halves, one half, two halves, one and one half, and four halves on the number line. Using the Cuisenaire Rods have the scholar further partition the number line into fourths. You will need to monitor this closely to ensure that scholars are labeling two fourths to align with one half and one and two fourths to align with one and one half. Continue to have scholars partition into thirds and sixths, depending on what is appropriate for your grade level. I have found that using colored pencils works better so that scholars are able to align with the previous fractions they have written. For example, all the thirds could be partitioned and labeled using blue and then all the fourths could be partitioned and labeled underneath in red. As an assessment you could put any two numbers on a number line and ask scholars to put number between them. To challenge them you do not have to start the number line a zero.

Benchmark fractions are a great tool when it comes to comparing two fractions. For this activity scholars will need a set of headers labeled Close to Zero, Close to One Half, and Close to One, and a set of fraction cards. Divide the students into small groups and explain that each group will sort the fractions cards under the appropriate header. Scholars will focus on comparing the fractions to the appropriate benchmark and discuss with teammates if they are uncertain where it should fall. The whole point of the activity is to build on those academic conversations and discuss why each fraction belonged where it did. After allowing about twenty minutes of work time, groups rotated to see the other group's work and noted what was different about it. Once they had examined all the other group's work, we came back together as a class to discuss the strategies and defend answers. We were able to acknowledge how important it was to work neatly and precisely so that others could understand our work and so that we could alter our own work if groups were able to convince us and we needed to adjust our answers. At the end of the lesson, have scholars write down three fractions that are close to one half and three that are close to one as a check for understanding.

When comparing fractions, scholars must consider the size of the whole and examine each fraction based on the relationship between the denominator and the numerator. Fractions can be compared in various ways but finding a common denominator or cross multiplying to compare are two common approaches taught to elementary school scholars. These approaches do not explicitly require them to consider the size of the fraction. Providing experiences where scholars can find more of the same sized parts or same denominators, same number of parts but parts of different sizes, and compare it to benchmarks such as one half or one whole may help to support reasoning about the size of the fractions. Continue to focus on the reasoning to help build a logical understanding of fractions. Including academic conversations about misconceptions that scholars might have because of over generalizations is another tool to ensure this understanding takes place. For example, consider the posing this question to scholars, "Which fraction is larger, five sixths or seven eighths?" You would like for your scholars to all respond that seven eighths is larger and explain it using any of the strategies mentioned above. However the actuality of that happening is slim because of various misconceptions. We as educators need to capitalize on those misconceptions and create our teaching points from them. Discuss the generalization that "the smaller the denominator, the larger the fraction" and have them draw pictures, model with manipulatives to discover that it does not always hold true. Have scholars build on that generalization and narrow it down to times when it is true and when it is not true. They can then draw their own conclusions and will have developed a greater understanding of fractions in the process. How amazing would it be if scholars realize that they are only looking at one part of the fraction, in this case the denominator, instead of looking at both the denominator and the numerator? Many times it seems as if our scholars are relying on strategies that they use with whole numbers to solve fraction problems so we want to ensure that we provide them with classroom activities that help develop strategies especially for fractions.

To end the unit and allow scholars to practice all that we have learned I suggest using a few days before the assessment to do math stations. One station could utilize manipulatives and technology such as Kidspiration to model and build different fractions. Scholars could decompose and compose new fractions with unit fractions. This could involve traditional adding and subtracting of fractions depending on your grade level. Another station may include a teacher time where you are able to review specific material that each scholar needs to be successful based on exit tickets and warm ups throughout the lesson. Having scholars bring their math notebooks to conference during this time and allowing students to reflect on what they need more help with are ways to help hold them accountable for the learning. The final station may be a problem solving station. Scholars would have had previous exposure to word problems and strategies such as closely reading the problem and determining what it is asking before sending them off to practice by themselves. You may wish to do a few mini lessons on these skills if your class has not already been working on problem solving. Here are a few possible problem solving tasks you could have them complete.

1. Lucy helped her mom make cookies. They wanted to make a triple batch. If each batch of cookies required one and two thirds cups of sugar, how many cups of sugar would they need in all? If they have ten cups of sugar, will they have any left over? If so, how much?
2. Oscar is training to run a 5K race with his dad in a few months. He decides to train by running one and three fourth miles every day. How far will he run each week? How long will it take before he has run a total of fifty miles?
3. A can of soda is twelve ounces. If Sarah wants to pour servings for her basketball team that are each two thirds of a can, how many servings will she be able to get out of a twelve pack of soda? How many servings would she be able to get if each serving was four fifths of a can? Is this more or less than if she used two thirds? Prove it.
4. Darren's family is building a new fence around their backyard. Each section of the fence is six and one eighth feet long. They need eighteen sections. How many feet of fencing is that? The neighbors need one hundred and fifty feet to build their fence. Is this greater or smaller than what Darren's family needs? How do you know?
5. The class is making trail mix for a special treat. There are twenty four students in the class and each gets a one fourth cup serving. How much trail mix do they need? If exactly one fourth of all the trail mix is pretzels, how many cups of pretzels would they need?
6. The basketball team uses an enormous amount of athletic tape to tape up the player's wrists or ankles when they are injured. If one roll has fifty feet of tape and one ankle requires six and one half feet of tape, how many ankles can be taped with one roll? If a wrist can be taped with one and one fourth feet of tape, how many wrists could one roll tape?
7. At the candy store, they sell gummy bears by the pound. They had a display of twelve bags of gummy bear candy. If each one weighed one and three fourths pounds, how much did the candy weigh in all? If there are five pound of gummy bear candy left to put in the bags, how many complete (one pound) bags can they fill? How much will be left over?
8. Mikey is on the soccer team. If his games consist of two forty five minute halves and he plays two thirds of each half, how many minutes does he play in a full game? How many minutes would he play in a tournament of five games?

Appendix 1: Implementing Teaching Standards

The following standards are used in connection with this mathematics and literacy curriculum unit:

Math: Number and Operations-Fractions
4.NF.A.1 Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.
4. NF.A.2 Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. Build fractions from unit fractions
4. NF.B.3 Understand a fraction a/b with a > 1 as a sum of fractions 1/b.
4. NF.B.3a Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
4. NF.B.3b Decompose a fraction into a sum of fractions with the same denominator in
4. NF.B.3d Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.
4. NF.B.4c Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem .For example, if each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?

Common Core Standards for Mathematical Practice
MP.1: Students make sense of problems and persevere in solving them. Throughout the unit, students will be required to apply their understanding of objectives to real world problems and work through tolerating confusion and difficulty that may arise.
MP.4: Students model with mathematics. This standard is the primary focus of the unit. Students will be required to model all of their work using a rectangle for the visual representation.

English Language Arts: Speaking and Listening
SL.4.1- Engage effectively in a range of collaborative discussions with diverse partners, building on others' ideas and expressing their own clearly. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.

Bibliography

Einhorn, Edward. Fractions in Disguise: A Math Adventure. Watertown, MA: Charlesbridge, 2014. It is an amusing and engaging read aloud to introduce the concept of equivalent fractions.

Fosnot, Catherine Twomey, and Maarten Ludovicus Antonius Marie Dolk. Young Mathematicians at Work: Constructing Fractions. Portsmouth, NH: Heinemann, 2002. It is a teacher resource for background information on teaching students to develop number sense and a deep meaning of fractions. It also provides great strategies to have scholars solve problems with fractions using visuals.

http://math2.uncc.edu/~hbreiter/. This is the website of our seminar leader and professor Dr. Reiter. This web page is a great resource for texts discussed during our seminar. The page links to various discussions on fractions and problems that can be used for extending scholars' work with fractions and it provides word problems that you could adapt to meet your classroom's needs.

Investigations in Number, Data, and Space. 3nd ed. Glenview, Ill.: Pearson Scott Foresman, 2010. This is the curriculum provided to teachers in the Charlotte Mecklenburg School district. The curriculum is referenced in this unit and can be used to in conjunction with the unit to better support and differentiate for students.

Works Cited

Reiter, Harold. "Understanding Fundamental Ideas in Mathematics at a Deep Level." http://math2.uncc.edu/~hbreiter/. Accessed October 18, 2016

Whitehouse, J. “Gaming – Kids Can Learn and Have Fun.” http://www.howtolearn.com/2011/11/gaming-kids-can-learn-and-have-fun. Accessed October 18, 2016