Fraction Action: An Embodied Approach to Teaching Fractions

by Heather Richmond, 2021 CTI Fellow
Starmount Academy of Excellence

This curriculum unit is recommended for:
3rd, 4th, or 5th Grade
Math

Keywords: fractions, embodiment of learning, active learning, equivalent fractions, inquiry-based learning, mindset

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: We do not teach 'heads on a stick'! This unit focuses on how to use embodied teaching strategies to help students develop a focused, social, and physical mindset while learning about fractions. The lessons in this unit will help students develop a conceptual understanding of how fractions work. Specifically, students will be actively engaged in discovering equivalent fractions. Teachers often use 'tricks' which students must memorize to determine whether fractions are equivalent, leaving the students without the conceptual understanding and the ability to apply the skill in real-life situations. In this unit, you may select from a variety of activities that will get your students moving, modeling, and mad-gabbing about fractions.

I plan to teach this unit during the coming year to 20 students in 4th grade math.

Fraction Action: An Embodied Approach to Teaching Fractions

Heather Richmond

Introduction

Rationale

I am creating a unit focused on equivalent fractions using embodied teaching methods. After several years of teaching 4th grade math, I am well aware that finding equivalent fractions is a concept with which students really struggle. Given the fact that the students have missed a great deal of instruction over that past year and a half, due to the pandemic, I foresee that the struggle will be even greater this year. In addition to the academic struggle, being back in the classroom may be challenging behaviorally considering students haven't had to sit at a desk or be in a confined room with others for full days. Using methods that actively engage the learners will strengthen their understanding while allowing them to move, therefore creating a positive classroom environment. While teaching equivalent fractions, I plan to incorporate activities that encourage students to 1. Be in the moment (focused mindset) 2. Build relationships between themselves, others, and the content (socialized mindset) 3. Get moving while learning (physically healthy mindset).

School/Student Demographics

Starmount Academy of Excellence is a Title 1 school and has 430 students. We provide the dual language program in grades K-4. Our diverse population includes Latinx, African-American, White, and Asian students. The shortage of teachers has actually opened up the opportunity for our principal to hire teachers from a Global program. This year we have added teachers from Honduras, Mexico, Puerto Rico, and the Philippines. The diversity of staff has enriched our culture and has helped ALL students feel welcomed.

Through community partnerships, our principal has been able to expand our special-area class offerings. In addition to the regular Art, Music, PE, Media classes, we have 'Nature Lab' and 'Maker Space.' These classes provide hands-on experiences in which students actually garden and design their own creations. Students who may struggle in an academic area are able to show their strengths in these special classes.

In my new role this year, as an Expanded-Impact Teacher, I support, coach, and mentor the 4th and 5th grade teachers as well as teach strategic groups of students. These lessons will support each member of the team during the upcoming fraction unit. The class for which I am planning this unit is 20 students from diverse backgrounds. Over eighty percent of my students are Latino (Honduras, Mexico, Colombia) and have Spanish as their home language. Sixty percent of these students are English Language Learners (ELL), and are working to develop their

speaking, listening, reading and writing skills. The lessons are designed to build/strengthen students' academic language which benefits not only ELLs, but ALL students.

I am creating this unit for a Fourth Grade math class. This unit will be taught during the latter part of the second quarter. Based on EOG results and Beginning of Year MAP testing results, students have experienced a greater loss of learning in Math than in Reading during the pandemic. Due to the pandemic, the students have missed 1 ½ years of in-person instruction. We do not have the time to go back to previous years' standards, so we have to ensure we are planning grade-level instruction that meets the wide-range needs of the learners. Because fraction concepts are such a large part of the tested curriculum, in 4th grade as well as future grades, it is imperative the students gain a thorough understanding of finding equivalent fractions.

Unit Goals

The goal for this unit is to actively engage students in the reasoning about equivalent fractions. The lessons will involve students interacting with one another, manipulating materials, and demonstrating physical movements to represent and reason with equivalent fractions.

Upon completion of this unit:

- Students will be able to identify equivalent fractions.
- Students will be able to explain how they determined fractions are equivalent.
- Students will be able to explain how the number and size of the parts differ even though the fractions are equivalent.
- Students will be able to apply concepts of equivalent fractions to real-world situations/scenarios.

Content Research

What is Embodied Learning?

"We are not heads on a stick." *Marissa Nesbit*

When I read over the CTI seminar list this year, I was intrigued by the title 'Embodied Teaching and Learning.' When we attended the instructor introductions to the various seminars available, the above quote really stuck with me. I immediately began thinking about how active my students are (other teachers may interpret it as 'unruly') and that perhaps, through this seminar I could get students to be productive learners with all that energy. But as it turns out, it is so much more than that!

Rather than thinking we *have a body*, we should remember that *we are bodily.* Many prominent thinkers have explained that all sense-making is through the body and that teachers should consider the mind and body as a whole-being rather than divided. (Latta and Buck 2008)

Embodied teaching/learning is about building relationships between self, others, and subject matter (Latta and Buck 2008). I had not previously thought about the importance of relationships in learning. Based on this research, I am considering three categories of embodied learning. The categories are 1. Focused Mindset-relationship with self and with subject matter 2. Socialized Mindset-relationship with others and 3. Physically-healthy Mindset-which enables the focused and socialized mindsets.

In addition to incorporating physical movement, the lessons in this unit will require students to interact with each other as well as reflect on their own understanding of the concepts, therefore building relationships between self, others, and subject matter. Benefits from implementing these embodied learning strategies include: positive classroom climate, deeper understanding of content, and healthier students.

Embodied Learning-Focused Mindset--Relationship with Self and Subject Matter

Embodied teaching/learning demands being in the moment (Latta and Buck 2008). Again, 'being in the moment' was not something I previously associated with 'embodied teaching/learning.' After reading the research and participating in the seminar activities however, I have learned the following strategies that can help the learner become aware of their body and clear their mind, allowing them to focus on the topic or task at hand:

- Body Scan.
    - During the seminar, Marissa played soothing music while having us 'bring our attention' to different parts of our body (ex. ribs, hands) and 'notice' the position of each or how each part was feeling, if it was still or moving; this was a calming, peaceful practice that caused me to be hyper-aware of my body and be 'in the moment.'

- Brain Dance (Gilbert)
    - During our next seminar, Marissa led us through a series of patterned movements which in addition to getting me actively thinking, gave me feelings of comfort as well as making me aware of my body.
        - Post-seminar, I led the brain dance the week I learned about it with my students before the EOG. I'm not certain that it improved their scores, but the students enjoyed it! It was something new/special for them and I noticed that during our 3-minute stretch breaks, many students were repeating some of the movements of the brain dance.

- Walking Propositions (Lee 2019)
    - During class, we were instructed to go on a walk with a specific purpose. At that time, I discovered that walking with a purpose, or focus, relieved the brain from the other thoughts/noise hammering in my head and allowed me to experience my surroundings.

- My note from the seminar: I was surprised at how having a proposition totally changed my neighborhood walk. Picking up a stick and concentrating on what I could do with it totally erased thoughts of school work. I was also surprised to notice the intentional actions vs. automatic actions with the stick (poking in mud vs. twirling leash around it).

In this unit, I have included strategies to help students be in the moment, or focused, for learning. For example, the students will participate in 'walking research' to find examples of fractions around the school.

Using inquiry-based learning activities helps students create and develop their own ideas about a topic or concept, thus developing their personal relationship with the subject matter.

Embodied Learning--Socialized Mindset--Relationship with Others

The research says, "a relational approach to education insists that we must focus on the process of learning and consider very deeply how we can help students, as social beings-in-relation-with-others become knowers" (Thayer-Bacon 2004). To me, this signifies the importance of recognizing students as social-beings and planning lessons that promote communication of thoughts and ideas between students. The lessons included in this unit will provide guidance for teachers to implement a socially-relational approach to learning.

From *Developing Kinesthetic Classrooms that Promote Active Learning:*

> Students involved in active learning are encouraged to think critically, construct knowledge, and explore their own attitudes and values (Handelsman, Miller, & Pfund, 2007). Theoretical basis for this strategy is rooted in constructivist learning and social learning theory (Piaget, 1971; Vygotsky, 1978).
>
> Example "active" activities include:
> - small-group discussion
> - class discussion
> - think-pair-share activities
> - demonstrations
> - quick writes from prompts
> - polling
> - turn and talk
> - debates
> - concept mapping
>
> (Culp, Oberlton, & Porter 2020)

Many teachers are familiar with these strategies and may already be using them. But this research provides the rationale for incorporating such strategies. Many of the above strategies are used in this unit's lessons, some of which are kicked up a notch!

Embodied Learning-Physically Healthy Mindset-Get moving!

Teachers need to develop 'a pedagogy of embodiment, bringing the 'body in from the educational margins' (Satina & Hultgren 2001). Rather than limiting lessons that involve the body to PE and Health classes, teachers need to be mindful of how to plan lessons that will allow a student's whole body to work together for sense-making in all subject areas.

How can we incorporate the whole body into content area lessons? Parker (2017) suggests that the following activities help students remain attentive by taking advantage of the mind-body connection:

- Gallery walks-word problems, discussion questions, or artifacts are posted around the room and students walk to each with their group
- Visual survey questions-students respond to a question by walking to a certain area of the classroom
- Opinion groups/Jigsaw-students with similar opinions meet and discuss, then one student from each group gathers in a new group (of other opinions) to share/discuss.
- Human process, timelines-students are assigned a part of a process or an event and they arrange themselves in the correct order
- Speed sharing-one line of students stays put, the other line faces them for discussion when time is up, they rotate to the next person

All of these strategies can be adapted to fit teachers' given curriculum. In this unit, I will provide examples of each of the above strategies using our district's current curriculum. All of these strategies also align with practices geared towards meeting the needs of ELLs such as SIOP (Sheltered Instruction Observation Protocol) and GLAD (Guided Language Acquisition Design). But I've discovered good teaching for ELLs is good teaching for all.

When learning vocabulary, GLAD promotes the strategy of associating words with movements/gestures. This was reinforced during my research for embodiment of teaching/learning, "There is a link between memory and movement, or what is often termed 'gesture to remember'" (Kreider 2018). Having students come up with the movements/gestures for a given unit's vocabulary would be extra-meaningful!

Why Embodied Teaching/Learning?

Research shows a positive correlation between classroom-based physical activity and indicators of academic performance and behavior. As extended periods of inactivity during the day is detrimental for children, it is recommended that movement be incorporated into academic lessons when possible (Kreider 2018). There has been additional widespread research regarding

the positive effects physical activity has on cognitive development, so it makes sense that teachers should incorporate physically active learning strategies.

The research is clear, embodied teaching/learning is what students need. Given the current state of our world, it is especially important during this time, as we are nearing the end of the pandemic. Being in a class of 20+ students, after a year and a half of being online or in half-size, distanced classes, wearing masks, attending school 5 days a week, and trying to catch up academically has led to high levels of stress for students, as well as teachers. School initiatives that have infused movement as part of the curriculum have shown increased efficiency in learning, while decreasing stress and contributing to a positive classroom climate (Centers for Disease Control, 2018).

Instructional Implementation

Teaching Equivalent Fractions

Upon completion of this unit:

- Students will be able to identify equivalent fractions.
- Students will be able to explain how to determine if fractions are equivalent.
- Students will be able to explain how the number and size of the parts differ even though the fractions are equivalent.
- Students will be able to solve word problems involving equivalent fractions

Warm-up Activities

This is a menu of activities from which you may select to help students get in the mathematically-focused mindset:

- Have students quietly walk around the room, using only their eyes to greet classmates...as they are walking ask them to show how they feel about the following scenarios:
    - they have a whole pizza to eat by themselves, show with your hands how much that would be
    - they have to share that pizza with a friend, show with your hands the size of your piece
    - they have to share that pizza with three friends, show how much your share would be
- Have students quietly, carefully walk around the room using normal size steps. At varying intervals, call out different sized steps for them to use. Example: Walk using steps that are ½ the size of your normal step, ⅓ the size, ¼ the size, ⅛ the size, etc.
    - To spice it up, you could also encourage students to change directions as they change the size of their steps--examples: walk backwards with steps that are 1/4 the size, walk sideways with steps that are 1/8 the size, etc.

- Have students quietly, carefully walk around the room noticing fractions about their classmates. Call out questions, such as the following, for them to ponder:
    - What fraction of our classmates are girls? boys?
    - What fraction of our classmates are wearing long sleeves? About half? Less/more than half?
    - What fraction of our classmates are wearing white shoes?
    - What fraction of the desks have a pencil sitting on them?
- Have students quietly, carefully walk around the room, greeting classmates with a silent gesture. At intervals, begin calling prompts, such as the following, for them to stop and show:
    - Show how tall you would be if you were ½ of your current height.
    - Show how tall you would be if you were ¾ of your current height.
    - Show how tall you would be if you were ⅓ of your current height.

The following lessons could be viewed as a menu of activities to select from. They do not have to be sequential.

Using Models to Find Equivalent Fractions

Embodied strategies: Gallery Walk, Turn and Talk, Class Discussion, Quick Write, Vote with your Feet

Objective: Students will explain why a fraction is equivalent to another fraction using models.

Mathematical Practices: 4. Construct viable arguments and critique the reasoning of others
5.Model with mathematics
6.Use appropriate tools strategically

Materials:

- Fraction Cards-write fractions on 20 index cards-include the following:. 1/2, 1/3, 1/4, 2/6, 2/4, 3/6, 4/8, 2/3, 8/12, 9/12, 6/12, 3/4, 6/8, 3/12, 4/12 (it's ok to repeat several of them)
- Fraction Models(10 sets), could be bar, strips, or circle models
- Sentence frames posted
    - ___ is equivalent to __ because____
    - ___ is not equivalent to ___ because___
- Student notebooks for recording at each station, and quick write

Set-up:

- Place a pair of fraction cards at 10 stations around the room (some equivalent, some not)
- At each station, also place fraction models (circles, bars, strips)
- Students will work in pairs or triads and rotate to each station

Lesson Flow:

Launch:
-Teacher demonstrates how to use fraction models to determine equivalence.
(You may need to review vocabulary for fractions: numerator, denominator)
-Students turn and talk to practice using the sentence frame based on what the teacher models.

Explore:
-In pairs, students rotate to each station to work with models and determine equivalence.
-Teacher will observe and listen to ensure students are explaining their reasoning and using vocabulary.

Discuss:
-What are equivalent fractions?
-How can you prove two fractions are equivalent?
-How does a model help you?

Evaluate:
-Quick write: Ask students if they would rather have ½ of a pizza or 3/6 of a pizza
-Vote with feet: have them walk the predetermined sides of the room. Once in those groups, have them share why they chose that fraction.
-Close by having students from each group share their thoughts.

Fraction Scavenger Hunt	
Embodied strategies: Walking Research, Pair & Share Objectives: Students will identify real-life examples of fractions and record the fractions that they find. Students will extend their understanding of fractions by recording equivalent fractions. Mathematical Practices: 2. Reason abstractly and quantitatively Materials: ● Clipboards or notebooks (something students can carry around to record findings) Set up: ● Scout out some good fraction examples around your school so that you may guide students if they get stuck for ideas ● Examples: ○ stairway that bends halfway (equivalent would be how many steps in each half?) ○ monkey bars-how many to go all the way across would be denominator, how many to go half-way across?	Lesson Flow: **Launch**: -Explain that students will be going on a walk to find examples of fractions around the school (could be part of the school or in nature around the school) -Model a sample sketch and label of a fraction found in your classroom. Ex. What fraction of students sit in each group or row? (6 out of 24 is equivalent to 1 out of 4) 6/24=1/4 **Explore**: -While supervised, students will walk around finding examples of fractions. -Students will sketch the examples they find and label the fractions they discover -Extend by having them determine an equivalent fraction for their findings Observe: are students using 'area models' for fractions, are they using 'fractions of a set'?(See Appendix 3 for further explanation of these terms) Are they using numerators and denominators correctly? Are they able to find equivalent fractions? **Discuss**: -Gather together (either outside or back in the room), and allow students to share their findings in pairs or triads. -Call on several to share with the group. Questions to pose: -What objects does your numerator/ denominator refer to? -Is ½ always equal to ½? (they need to understand they could be different values based on the whole) **Evaluate**: -Quick write: Describe a fraction you found on our walk. How did you determine the numerator and denominator of that fraction?

Human Number Line

Embodied strategies: Human number line, class discussion, debating (with others about where they should be), quick sketch, think-pair-share

Objectives: Students will work with classmates to determine the value of a fraction and find equivalent fractions as they arrange themselves on a human number line.

Mathematical Practices: 2. Reason abstractly and quantitatively 3.Construct viable arguments and critique the reasoning of others

Materials:
- Index cards with fractions (one for each student)
-Fractions to use (0/2, 1/6, 1/2, 1/3, 1/4, 2/6, 2/4, 3/6, 4/8, 2/3, 8/12, 9/12, 6/12, 3/4, 6/8, 3/12, 4/12, 2/2, 3/3, 4/4, 6/6, 5/6, 7/8, 8/8, 12/12, 10/12)
-Fraction models or calculators may be used if needed

Set-up:
-Each student will be given a card, many of them have equivalent fractions
-In a large space, place tape on the floor to represent the number line (optional: place x's at each point from zero to 12/12)
-Extension-if you are working with mixed numbers, include fractions greater than 1 in the mix of cards.

Vocabulary to introduce or reinforce:
-equivalent fractions
-benchmark fractions (commonly used fractions, example 0, ½, 1)
-unit fractions (fractions with 1 as numerator)

Lesson Flow:

Launch:
-Explain that students will be creating a human number line. They will each be given a fraction card and have to find their place on the line.
Explore:
-Students are given their card and given time to think about the value of their fraction (they can jot their pre-thinking about the following on the back of their card)

- Sketch an area model of their fraction.
- Do they know of any equivalent fractions?
- Is their fraction equal to or closer to zero, one-half, or one whole?

-Students should pair and share as they walk to the point on the number line they think their fraction represents.
-Students may debate about the validity of their choices or how to show equivalent fractions.
Observe: How do students decide to show equivalent fractions (Are they spreading across the number line, standing on different spots, or are they lining up behind one spot?)
How are students determining which order to stand?
Discuss:
How did you decide if another fraction was equivalent to yours?
Which benchmark fraction helped you determine your place on the number line?
Evaluate:
-Quick sketch: sketch a number line to prove 3/4 is equivalent to 6/8.

Designing a School	
Embodied strategies: Jigsaw, think/pair/share Objectives: Students will design a space in school and determine equivalent fractions for the areas in that space. Mathematical Practices: 2. Reason abstractly and quantitatively	Lesson Flow: **Launch**: Given a 10x10 grid, groups are assigned an area of the school to design. The teacher should model selecting an area and showing how to shade in spaces and label the different areas. Playground- Cafeteria- Classroom- Media Center-
Materials: 10x10 grids (great for segueing into decimals equivalent to other fractions) Optional way to differentiate: Could use 6x4 grids or any size that works for your students Color Pencils Chart for each group to affix each part of their school Another option: give parameters for each area Example-If using 6x4 grid: In the cafeteria ½ of the space should be used for tables. ⅛ of the space should be used for trash. Designing Space Recording Sheet *This lesson is adapted from the NCTools4Teachers	**Explore**: Allow individual-think time-students will consider what needs to be included and which areas need more/less space. (Let them get creative as they think about their 'dream' space!) Set the parameter that only 'whole squares' are allowed--they cannot color ½ of a square for two different spaces. Like-assigned areas gather to discuss their thoughts and use color pencils to label and shade in their designs. If they finish their designs early, they may begin labeling fractions and determining equivalent fractions. Once designs are completed, one person from each area gathers with other areas to create a 'school'. **Explain** The group works together to count the squares for each area in their space. (count the squares for each color--that is the numerator--100 is the denominator, if using the 10 by 10 grids) Students may use calculators to test for equivalent fractions.

	(ex. 40/100, using a calculator they hit ‘simp’ then ‘=’ and continue until it doesn’t change; this is what may happen-- 40/100=20/50=4/10=2/5) If your students are more familiar with division, they could determine a common factor and divide to simplify. **Discuss**: How did you determine an equivalent fraction? **Evaluate**: Given a blank grid of 4x6, students will write 2 equivalent fractions for 1/4. (6/24 and 3/12)

Finding Halves and Fourths

Embodied strategies: Students will be rotating to stations, working with manipulatives, collaborating with classmates, sketching and writing about their thinking

Objectives:
-Students will find fractional parts of a rectangular area and sets of objects
-Students will demonstrate that the same-sized fraction of a whole can be shaped differently.
-Students will interpret the meaning of a numerator and the denominator of a fraction

Mathematical Practices:
1. Make sense of problems and persevere in solving them.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.

Materials:
Students will need their math journal to record ideas at each station.
Adapt the following stations to meet your students' needs. Ex-if they are unfamiliar with clocks, you may want to skip that station, or use circles in their place.
For each station:

1-Tiles and crayons
2-Geoboards and rubber bands and recording sheets
3-Mini Clocks and clock templates
4-Play money

Set-up:
Be intentional as you create groups of students for each station. (Students who could help each other should be grouped together)

Lesson Flow:

Launch:
-Introduce the tasks to students.
-Explain what they should be doing and recording in their journal.
-Explain what signal will be used when it is time to rotate and the procedures for moving to the next station.
Explore:
Students will complete the following tasks (each at a different station in the room)
1-Tiles **Make a rectangle using 12 tiles, ½ of the rectangle should be green. Write two fractions to describe the part that is green.** *(6/12=1/2)*
Make a rectangle using 12 tiles, ¼ of the rectangle should be red. Write two fractions to describe the part that is red.
(1/4=3/12)
2-Geoboards **Use a rubber band to divide the geoboard in half. Find at least 3 ways to divide it in half, sketch each on the geoboard recording sheet.** *(Appendix 2)*
(8/16=1/2 but the sketches will vary-as you circulate be sure to ask, how can you tell that you have divided it in half?)
3-Mini Clocks **Set the clock to 12:00, then show 'half-past' 12. Talk about how many minutes are in half an hour. Record in your journal. How can you model half an hour using a circle diagram? Repeat with 'quarter past 12' and 'quarter til 12'**
If a whole hour is 60 minutes, what is equivalent to 'half' 1/2? 'quarter' 1/4?
(30/60=1/2 15/60=1/4)
4-Play money **Show 1/2 and 1/4 of a dollar using quarters. (Think: how many quarters make a WHOLE dollar?) Write 2 fractions to describe each amount.** *(possible answers-2/4=50/100=½ OR 1/4=25/100)*

Timer-Set timer for 8-10 minutes per station (depending on your students' needs and time available)	**Show 1/2 of a dollar using dimes, write 3 fractions to describe this amount. (Think: how many dimes make a WHOLE dollar?)** *(1/2=50/100=5/10)* **Discuss**: Come together as a class and ask volunteers to share discoveries they made. Record equivalencies on chart paper as students share out. **Evaluate**: Ask students to write two equivalent fractions for 1/2 and explain how they know they are equal to 1/2.

Lesson Adaptations

Some teachers may be restricted to using the curriculum lessons adopted by their district. In addition to the warm-up activities provided at the beginning of this section, the following are ways teachers may adapt a given lesson to provide embodied learning experiences for their students:

- If your lesson has word problems on a worksheet or workbook: Choose one or more of the following ways to get your students moving and talking:
    - Cut the problems apart and tape them on the walls around the room. Have students rotate, in pairs, to read and solve the problems.
    - Select one of the more challenging problems-make 4 or 5 copies (one for each group) and glue it to the top of a piece of chart paper for each group. Have students read and solve, showing more than one way to solve the problem. Upon completion, have groups do a gallery walk to observe how the other students solved, or have groups share their solutions.
    - Speed-sharing-Have students solve a problem independently, when time is up (all or most have finished) play music for them to walk around, when music stops, they compare and share their solutions with the person closest to them. They are allowed to adjust their work if needed. Then play music again so that they can talk with one more person about the problem. Show the correct answer and allow them to check for understanding.
- If your lesson has multiple choice questions, you may choose to do an activity such as the following to get your students moving and employ Mathematical Practice 3: Construct viable arguments and critique the reasoning of others:
    - After sufficient time for students to work out a problem and select an answer, give a signal for them to take their solutions to the matching designated corner (or area) in the room for A, B, C, or D. Once there, students should compare their work. Select volunteers to explain to the class how they solved the problem and try to convince others that their thinking is correct.*Ensure students feel safe in selecting the wrong answers, that mistakes are celebrated and evidence that learning is happening!

If you are able to plan with special area teachers, such as Art, Music, and PE teachers, be sure to communicate about your fraction unit. Music teachers can teach fractions related to musical notes, whole, half, quarter, eighth, and students can create patterned rhythms using those fractions. In art, students can create designs using fractions of the design as different colors. In PE, students can divide into different-sized teams, such as two teams=half and half, or four teams=quarters. The options are limitless! Have fun with fractions!

Appendix 1: Teaching Standards

CCSS.MATH.CONTENT.4.NF.A.1
Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ 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.

NC.4.NF.1 Explain why a fraction is equivalent to another fraction by using area and length fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

How these relate to the unit: The warm-up activities as well as the lessons included in this unit all contribute to the students' conceptual understanding of equivalent fractions. Students will be using the Standards for Mathematical Practice as they act out, model, discuss, and write about their understanding of equivalent fractions.

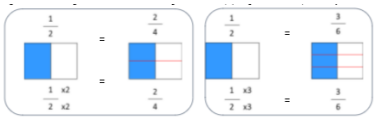
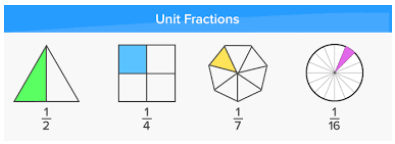
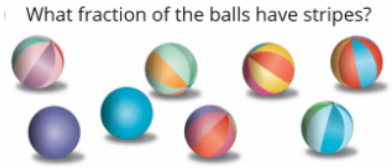
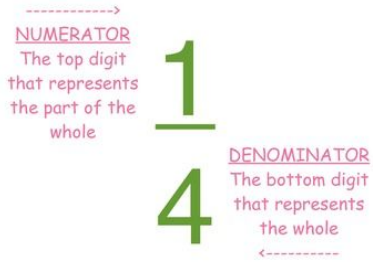
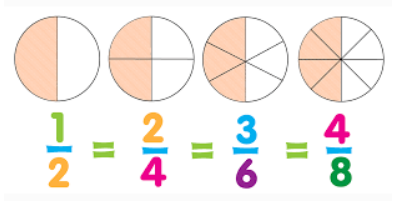
The research learned during the seminar, Embodiment of Learning, is interwoven throughout the lessons. Each lesson involves students actively learning about fraction equivalence (a 4th grade standard for the Common Core as well as North Carolina).

Appendix 2: Materials List

- Chart paper & Markers-these will be used to create anchor charts for vocabulary and sentence frames
- Index cards-the teacher will write fractions on index cards for students to use in various lessons
- Tape- (blue painters tape) to create a human number line on the floor
- Reusable tools, commonly provided by schools:
    - Fraction bars: Use to find equivalent fractions; Ex-Line them up and record how many one-fourths = how many eighths.
    - Pattern blocks: Students should become familiar with hexagons and recognizing that the trapezoid is one-half, parallelogram is one-third and triangle is one-sixth.
    - Geoboards & Rubber Bands-students should have experiences sectioning off ½ in a variety of ways and explaining how they know it is one-half. (ex. Total is 16 squares, so I know it is one half, because the area of my shape is 8 and 8 is half of 16.)
    - Fraction circles Students should stack the fraction pieces to find equivalent amounts, (ex. 4/8=1/2=3/6=2/4)
    - Color tiles Students should have experiences making rectangles with set parameters (ex. Using 8 tiles, make a rectangle that is 1/2 yellow.)
    - Snap cubes Students could make towers that show certain fractions a certain color. OR Students could use cubes to make rows and a fraction of the rows is a set color. (ex. Using 12 cubes, make 3 equal rows, one row should be green, write two fractions to describe the amount that is green.)
    - Mini-clocks Students need to become familiar with how we describe half-past, quarter-past and quarter-till and that these words represent fractions. Relate the clock face to a circle and demonstrate halves (write 30 on each half), then repeat with quarters (write 15 on each quarter). Explain that a quarter of an hour is different from a quarter of a dollar because the whole is different.
    - Protractors Students need to know 360 degrees is a whole circle, therefore 180 is half and 90 is a quarter. Students can use protractors to help draw angles that are a half, fourth, sixth, eighth of a circle. They should identify how many degrees is equivalent to each of these fractions.
    - Measuring cups-students can measure water or rice (depending on what your space allows), as they measure they should make discoveries such as ‘there isn’t a 2/4 marked on the cup, 1/2 is equivalent to 2/4’.
    - Scissors-Students will be cutting pieces of paper into fractional pieces.
    - Texas Instruments TI-15 calculators with a function key that generates equivalent fractions.
    - Chromebooks-In the additional resources, there are many digital games students can play and learn.
- Additional consumable materials
    - Construction paper-Students cut different colors into different fractions to make their own set of fraction strips

- Graph paper-Students draw a rectangle around a given amount, ex. 24, and shade a half, third, fourth, sixth, eighth. This will also be useful as they transition to decimal fractions, tenths and hundredths, as they can quickly sketch and shade the amounts given.
- Crayons, pencils, markers Students will use these to record their thinking.

Appendix 3: Key Fraction Terms

Area Models-shapes that have an equivalent amount shaded, but have a different number of parts. 	**Benchmark Fractions-common fractions that we compare other fractions to (examples 1/2, 2/3, 3/4)** ***during the human number line, students may refer to benchmark fractions as they arrange themselves in order**	**Unit Fractions-fractions that have a numerator of 1. ex. ½, ⅓, ¼,** 
Fractions of a set-  **6/8=3/4**		**Equivalent Fractions** 

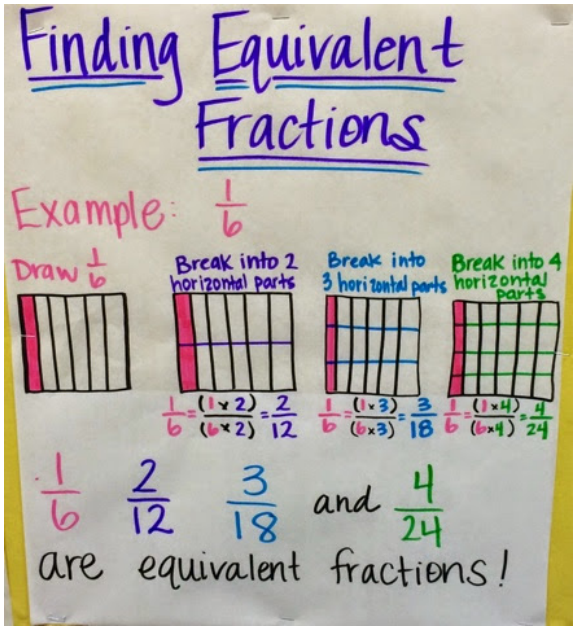
Appendix 4: Teaching Tools

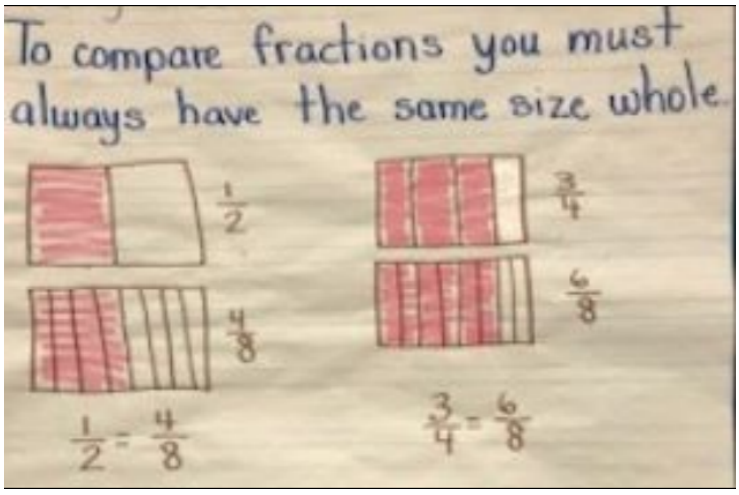
Geoboard Recording Sheet-this is a page students can use to show the ways they divide their boards into halves and quarters.

Design a School-this is a worksheet students may use to plan and color their space of a school, included is a table to help students determine the equivalent fractions.

Equivalent Fractions Assessment-this assessment focuses on 4.NF.1, whether using NC standards or CommonCore standards. There are pictorial representations and word problems in which students apply their knowledge of equivalent fractions.

Appendix 5: Anchor Charts





Appendix 6: Teacher Resources

1. NC Tools4Teachers This is an excellent website that provides detailed lessons, slide presentations, assessment tasks, writing prompts, and teacher background information. It is made by North Carolina educators, but available to all and it aligns with CommonCore standards.
2. NC Tools4Teachers has created this 'additional resources' document with many resources that contains videos, literature, games and more to explain how to find equivalent fractions. This resource would help teachers gain a stronger understanding of fractions. It also has suggestions of videos and games to share with parents and students.

3. Quick Writes about equivalent fractions-This is created and provided by NC Tools 4 Teachers. The resource is a document, it explains the procedure for quick writes and at the bottom there are prompts about equivalent fractions.
4. Here is an article with practical suggestions for energizing the classroom: Parker, Sara. "Get Up! Five Ways To Energize A Classroom With Physically Active Learning." *College Teaching* 66, no. 1 (January 2, 2018): 1–2. https://doi.org/10.1080/87567555.2016.1232694.

5. See other resources in the Bibliography, there are excellent articles that provide tips and rationales for embodied teaching and learning!

Bibliography

Culp, Brian, Mia Oberlton, and Kandice Porter. "Developing Kinesthetic Classrooms to Promote Active Learning." *Journal of Physical Education, Recreation & Dance* 91, no. 6 (July 23, 2020): 10–15. https://doi.org/10.1080/07303084.2020.1768178.

Gilbert, Ann G. (2018). *Brain Compatible Dance Education* (2nd. Ed.) Champaign, IL: Human Kinetics.

Kreider, Carri. "Physically Active Students Learn Better: Finding New Ways to Implement Movement in the Elementary Classroom." *Childhood Education* 95, no. 3 (May 4, 2019): 63–71. https://doi.org/10.1080/00094056.2019.1616472.

Lee, Nicole, et al. "Walking Propositions: Coming to Know A/r/Tographically." *International Journal of Art & Design Education*, vol. 38, no. 3, 2019, pp. 681–690., https://doi.org/10.1111/jade.12237.

Macintyre Latta, Margaret, and Gayle Buck. "Enfleshing Embodiment: 'Falling into Trust' with the Body's Role in Teaching and Learning." *Educational Philosophy and Theory* 40, no. 2 (January 1, 2008): 315–29. https://doi.org/10.1111/j.1469-5812.2007.00333.x.

Parker, Sara. "Get Up! Five Ways To Energize A Classroom With Physically Active Learning." *College Teaching* 66, no. 1 (January 2, 2018): 1–2. https://doi.org/10.1080/87567555.2016.1232694.

Satina, B. & Hultgren, F. (2001) The Absent Body of Girls Made Visible: Embodiment as the focus in education, Studies in Philosophy and Education, 20.

Thayer-Bacon, B. J. (2004) Personal and Social Relations in Education, in: C. Bingham and A. Sidorkin (eds) No Education without Relation (New York, Peter Lang).

Tools4NCTeachers, a website available for the public to use

enVision Mathematics, SAVVAS Learning Company, our district math textbook adoption