

Balance and Inequality Lesson

Heather Brubach

Core Decisions

What:

Students will build on their knowledge of quantity to compare different quantities and learn how to use symbols to communicate the relationship between them and how they compare to one another. The focus is on building a useable, working knowledge of certain relational symbols ($=, >, <$). As stated in *Math Matters*, "Relational or relation symbols establish a relationship between two numbers, two number sentences, or two variable expressions" (Chapin and Johnson, 2006, p. 195). By embedding the equal sign ($=$) within the context of relational symbols, I hope to emphasize a more accurate interpretation of the equal sign. It indicates a relationship and does not just separate out an "answer". This is a misconception many students construct early on in school and I hope this lesson can address it.

The concept of "equality" is a fundamental skill for eventually progressing toward balancing inequalities and other algebraic thinking and reasoning in later grades. To encourage students to have a rich understanding of the concept of equality, I am as suggested in *Math Matters*, allowing equality to be "modeled by thinking of a balance scale" (Chapin and Johnson, 2006, p. 195).

How:

Students will start the lesson with the introduction of a shared problem. The problem is presented by the teacher within a real world context. The problem is one about inequality and how that inequality can be balanced. This task was chosen because it is slightly more challenging and requires more cognitive demand than what will eventually be required of them in their independent work. I will be careful to explain the situation, the materials, and the reason for wanting a solution to the problem. However, I will not yet introduce the mathematical concepts, symbols, or reasoning behind the problem type. I will encourage students to remember that there are different strategies and tools for solving problems. I will also encourage them to think about which of those is most helpful to them for solving the problem. The students will begin the task of working on that same problem but not in groups. Each individual student will be responsible for finding their own way of understanding, making sense of and finding a solution for the problem. They will have certain tools available (manipulatives, pencils and paper, and crayons). After some wait time, the different approaches will be shared as a whole group. I will have students stand up and share their approach/strategy and explain how/why they chose to do it that way. I will explicitly direct students to respond to each others thinking by saying "Who also solved the problem that way?, Can anyone explain

what ___ did in your own words?, What do you think about how ___ solved the problem? How is your solution or strategy different from ___'s".

Students will then be introduced to the math concepts through whole class instruction and guided practice. The teacher will explain to the whole group that these types of problems require us to compare numbers, quantities or amounts. The teacher will also use this whole class time to introduce the mathematical symbols related to these comparisons. Students will be engaged in guided practice of how they can model these comparisons with their bodies (pretending they are like a balance scale) and will have some guided practice for assigning the appropriate symbol for each practice problem.

Then students will receive their own individual worksheet to independently solve quantity comparison problems in the form of a pictorial balance scale. They will be encouraged to use whatever strategies/tools they feel comfortable using to find the solutions. The lesson will close with the development of a class list of examples of encounters with these types of inequality problems in our lives.

Why:

I chose to focus my lesson on teaching the concept of inequality and comparing number quantity because I believe it will positively increase my students number sense for numbers that they are beginning to feel very comfortable with and use almost every day in their math lessons through computation tasks.

Also, by embedding the equal sign ($=$) within the context of relational symbols, I hope to emphasize a more accurate interpretation of the equal sign. It indicates a relationship and does not just separate out an "answer". This is a misconception many students construct early on in school and I hope this lesson can address it. Although this lesson is focused on naming the relationship between the quantities, it will also set the stage for students to eventually think about balancing inequalities which is a very important foundational skill.

I wanted to start the lesson with a contextualized problem. I believe that having students engage with an authentic problem and making sense of it themselves first leads to them becoming more invested in the related math skills to be taught. This kind of initial personal investment in a problem will help students recognize their own strengths and weaknesses when dealing with that particular type of problem. This also allows me to get a formative assessment right away about where the students thinking and comfort level is with this type of mathematical reasoning and problem solving. The hope is that by watching the way students approach this problem without instruction will then deeply inform what I really need to concentrate on during the direct instruction later in the lesson.

I wanted to provide multiple entry points for students understanding about comparing quantity. This is why I insist on encouraging multiple strategies and use of a variety of tools. I also make a point to introduce them to the idea of thinking about quantities in terms of a balance scale. I believe the students in my class who

may be more visual or kinesthetic learners will benefit from conceptualizing the notion of equality this way. I also believe that by using kinesthetic activities like pretending our bodies are a scale, students are forced to stay energized and active throughout instruction and the lesson will be more engaging to all students.

Lastly, sharing ideas and discourse is often a struggle for my students. They are often not willing to actively listen to one another. So I need to try to structure the conversation after the initial problem solving so that they are required to build off of each others' ideas and knowledge. I believe although this a struggle for this class, they need to have structured practice in discourse so that they can learn from each other and not just the teacher.

Balance and Inequalities Lesson Plan

Grade Level: First Grade

Duration: 45 minutes

Enduring Understanding Goal:

Students will build better number sense of the numbers 1-20 through comparing quantities of numbers

Objectives:

Students will ~~be able to use various strategies to~~ compare whole number quantities using modeling and counting strategies

Students will ~~be able to correctly~~ identify ~~and name the following~~ relational symbols: =, >, <

~~Students will assign "greater than", "less than", or "equal to" symbols accurately to compare two quantities and communicate the relationship between them.~~

Common Core Standards for Math

Counting and Cardinality K.CC

Compare numbers

6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.1

Operations and Algebraic Thinking 1.OA

Work with addition and subtraction equations.

7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.

Materials:

12 Apples (5 green and 7 red) and 2 bags
Scale Balances
Chart Paper/Smartboard/Blackboard, etc.
Manipulatives (cubes, block, etc.)
Paper and Pencils
Inequality Worksheets
Large Scale Symbols for greater than, less than and equal
Poster/Anchor Chart of Math Strategies

Classroom Arrangement and Management Issues

My biggest concern with classroom management is that I am involving some kinesthetic movement where students are out of their seats. If I'm not careful to set clear and explicit expectations and consequences it could get out of hand. I will need to set the expectation that we are only moving our bodies in the way that is demonstrated for the scale balance. I will set a clear classroom norm that during this time our bodies can be used as a tool for math just like the balance scale. I also will set the consequence that if anyone is not using their body as a tool for understanding math they will be asked to sit down. Similarly, if students choose to use manipulatives as a tool to help them solve/make sense of problems, they are expected to use these tools appropriately. I will set the expectation that this is not a time to play with these tools but use them for math problems. I will make explicit that the consequence of them playing around with the manipulatives is that they will lose the privilege of using that particular tool. In this way I hope to set a classroom norm that these math manipulatives are a tool and not a toy.

Student will need to be able to spread out for this activity. So I think having them at their desks that are spread across the room is a better environment for this lesson than to have them on the rug which is a more contained space. Also if things do get out of hand it will be easier to enforce the consequence of just having them sit in their seat which will be right near them. The classroom norm I hope to reinforce is that we sometimes need personal space to do our best work.

I may want to have a table top or desk in the front of the room to set the apples on so that the students can better see how I am modeling the problem. Also I will need to use the board behind me to display large scale symbols. The overhead might be a helpful tool for the shared/guided problems before moving into the independent work.

The Plan

Hook – 10 Minutes

1. Have students seated at desks focused on the front of the classroom. Explain to student that you went to a farmers market in Philly to get apples. You bought some green and some red apples. You walked there and then had to walk back with the bags of apples. You have two bags to bring them home in. As you started walking home you realized that one bag was heavier than the other. Show what this felt like with you body (exaggerate the imbalance with your arms). Ask students if they have ever experienced this same problem when coming home from a store. Explain to students that this is one of your pet peeves (being unbalanced) and you needed to stop and make the bags balanced.
2. Show students the two bags you have with you. Take out the apples inside revealing how many were in one bag and how many were in the other bag (bag one = 2 green 6 red, bag two = 3 green, 1 red). I purposefully chose an uneven number of green and red to see which students would get caught up with color and who would feel the urge to balance color as well as number. Ask students to help you figure out how to balance the bags. Take a moment to remind them of the multiple strategies they can use to solve this problem (drawing pictures, counting, using manipulatives, writing number sentences, etc.). Tell students that they have the next 5 minutes to think about and help me solve this problem. Release students to get out of seats, talk to each other about the problem or start using strategies to solve it.

Body – 30 minutes

3. Walk around as students work out their solution to the problem. Use the checklist provided to note different strategies being used. Conference briefly with particular students who are not actively working on the problem to get them started. Also encourage students to regardless of what strategies they used, record their thinking somehow (writing, pictures, number sentences). This way you have physical evidence of their thinking. Make sure to reassure them that not all students will approach the problem the same way. Also reassure them that you are looking to see how they attack the problem not necessarily if they got the right answer, because we will work on that together.
4. After about 5 minutes ask students to find their seats and explain that we will be sharing out about how we worked on the problem. Call on students who are willing and excited to share. Make sure after students have shared to get

other students to comment on their strategies or approach before moving on to another student sharing.

5. After doing this with a 3 or 4 students, explain to class that they will be working today with looking at whether or not two numbers are balanced, just like the two bags of apples I had from the market.
6. Take out the pan/scale balance. Ask students if they have seen one of these before (formative assessment to see if you need to explain how a balance works). Ask if someone can explain how this balance is similar to my problem with the two bags of apples?
7. Have students stand up beside their chairs. Tell them we are going to pretend that our bodies are like the scale balance tool. Model for them what you mean by putting your arms out to your sides and tip back and forth. Have students try it.
8. Pick up two apples and put one in each hand. Explain to students if my body was a scale balance, it would look like this (put arms straight out to each side). Ask students how they would describe that to someone (equal, the same, balanced). Put down apples and explain to students that there is a special symbol we use for when the scale looks like this or is balanced. Ask students to volunteer what the symbol is (an equal sign, put up the large scale symbol).
9. Now pick up one apple and put your arms back out straight. Ask students how your arms would be different now that you have only one apple (students should show you the arm with the apple in hand is lower than the one without)? Move the apple to your other hand and ask "what about now" what would my body scale look like (students should show the opposite arm down now). Put the apple down and explain that when numbers are not balanced or equal we say that that are unbalanced or unequal. There are symbols for when two numbers or quantities are not balanced. Put up the large scale greater than and less than symbols.
10. These two symbols look very similar but have an important difference! Can anyone spot what is different? Explain that you like to think of it like a big alligator mouth. The alligator always wants to eat the bigger number (quantity or amount).
11. Do a couple example problems together to determine what the balance would look like and what symbol should be used. Have students show you the balance with their bodies and have student volunteers come up to show the symbol.
12. Tell students that they will now get a chance to practice comparing quantities or numbers on their own. Distribute the Balance and Inequality Worksheets (these are differentiated). Remind students with the anchor chart of strategies that they should think about what might help them solve the problems and that they don't always have to use the same one. Also be sure that you suggest to students that they should try to determine the

solution first without using the scale balances and then use the balance to check and see if their solution was correct.

13. Walk around as students work on the individual worksheets. Use the checklist to note strategy use as they work through the problems. Take a moment to conference if students are struggling or not engaged to encourage certain strategies. Early finishers should be encouraged to try the next leveled worksheets or come up with a few of their own inequality problems for someone else to solve.

Closure – 5 minutes

14. As students are finishing up explain to students that they will encounter lots of problems that have to do with inequality and balancing numbers. Ask them to give you some examples. Write them down to form a class list of ideas. Encourage students to be on the lookout for these types of problems outside of school, think about how they were solved and ask them to share them with you the next time they are in class.

Assessment of Goals and Activities

Informal formative assessments are performed throughout the lesson in the form of questioning students about their understanding of balance, inequality, and symbols and assessing their responses. You will also be making careful observations of how student model balance and inequality with their bodies (as scales). You will use the checklist to note what strategies you have observed students using while working on problems. Lastly you will collect and assess their worksheets to assess if students accurately applied the symbols equal to, less than, and greater than.

Anticipating Student Responses

During the initial hook problem, some students may be very quick to determine the solution. It may be that the above level students can do this in their heads. If so, I will want to encourage them to show me how that solution works or think of a way to explain their solution if someone didn't understand.

In the initial problem when thinking about balancing the inequality of the apples in bags, some students may not think about making the two bags equal by transferring apples from one bag to the other. Instead I may have some students that suggest that I should buy more apples to even them out or take some apples back to even them out. I want to recognize these as valid way to think about how they could be balanced and validate that thinking. However, I will push to see if any other children thought about the problem a different way (transferring apples and keeping the current number the same). Also some students may question the difference between the different colors of apples. They may also bring up the fact that not all

apples weigh the exact same amount. I will need to tell these students that although I commend them on thinking critically, for the purpose of this activity our unit is 1 apple (instead of pounds or grams) and we will act as if they all weigh about the same amount.

Some students may be confused or frustrated that not every student in the class has the same problems on their worksheet. I will remind students that this is similar to how they sometimes have different homework sheets. I will acknowledge that our class is the most successful when we have lots of different kinds of problems being worked on at once.

Accommodations

The main way that I will accommodate is by differentiating the worksheets.* Some students will be comparing modeled quantities, others individual numbers below 10, individual numbers above 10, and the above level students may be comparing additive expressions of numbers. There is a challenge question for early finishers. Students will be accommodated by the allowance to use multiple strategies to solve the problems and determine the appropriate symbol. Below level students will be encouraged to model and draw pictures, other students will likely not need that and will be encouraged to try to use counting or mental math.

*See student worksheets attached/below

Comparing Quantity # 1

Equal to

=

Less than

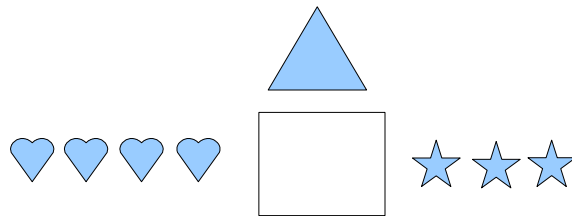
<

Greater than

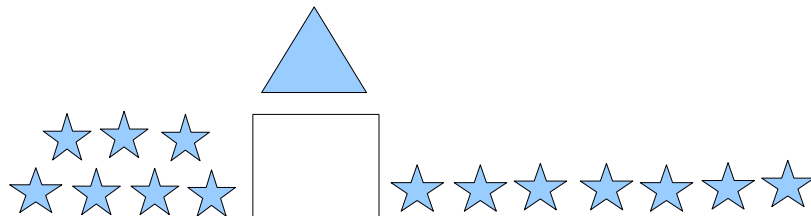
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Compare the two amounts by showing what the balance would look like and write the correct symbol in the box:

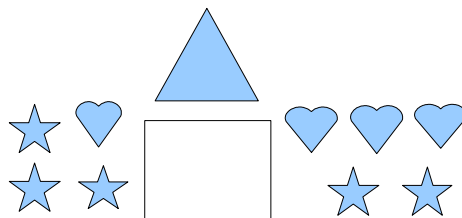
1.



2.



3.



Comparing Quantity # 2

Equal to

=

Less than

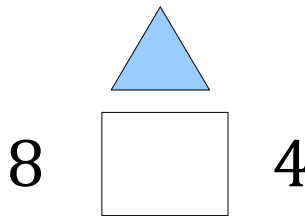
<

Greater than

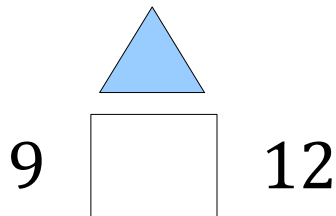
>

Compare the two numbers by showing what the balance would look like and write the correct symbol in the box:

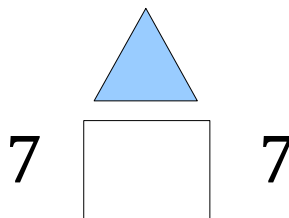
1.



2.



3.



Comparing Quantity # 3

Equal to

=

Less than

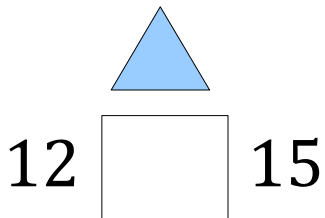
<

Greater than

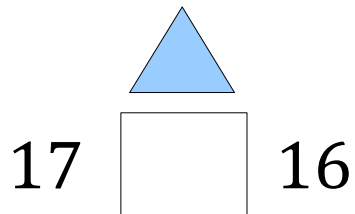
>

Compare the two numbers by showing what the balance would look like and write the correct symbol in the box:

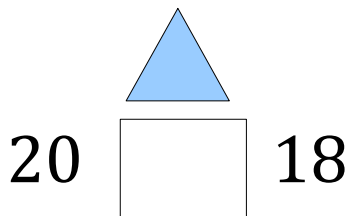
1.



2.



3.



Comparing Quantity # 4

Equal to

=

Less than

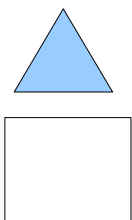
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Greater than

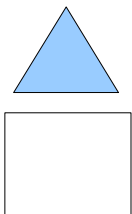
>

Compare the two numbers by showing what the balance would look like and write the correct symbol in the box:

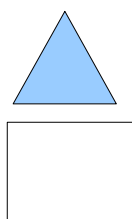
1.

$3 + 2$  $5 + 1$

2.

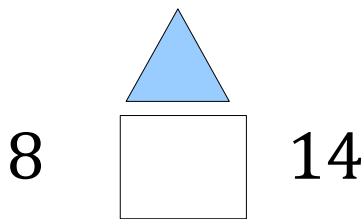
$6 + 2$  8

3.

$7 + 6$  $10 + 2$

Comparing Quantities – CHALLENGE QUESTION

Compare the two numbers. Show what the balance would look like. Write the correct symbol in the box.



How many do you have if you add the two numbers together? ($8 + 14 = ?$)

How could you change how many are on each side to make the scale balanced?

