

Lesson 5: Relative Size to 10

Lesson type: Diagnostic Exploratory

Time Allocated: One hour

Overview:

Aim: To help students develop the concept of Relative Size to 10, challenging misconceptions and building understanding along the way.

Note: When students understand Relative Size to 10 it is much easier for them to understand how big numbers with two-digits are compared to each other. Spending time helping students to develop an understanding of this concept makes further teaching of Place Value much simpler.

This lesson is demonstrated in the Grade 1 Lesson shown on the DVD series, "Teaching Back to Front with Tierney" (<http://goo.gl/os3tfe>).

Concepts targeted:

- Numbers have one absolute value, but many different Relative Sizes. 100 is a big number when compared to one, but a small number compared to 1000.

Main tasks:

- Write the numbers between one and 10 on an open number line in the correct position relative to each other
- Place blocks which show amounts between one and 10 on an open number line in the correct position relative to each other

Resources:

You will need: at least 55 unifix cubes (cubes that can be stuck together in a line), masking tape and copies of the work sheet or blank paper for each student. You will also need to have space on your floor to tape a straight line at least 4m long, with space for your children to sit around this line in an oval.

Procedure:

Step 1: Diagnostic Question

Tape out a long line of masking tape that stretches across your classroom. This needs to be as long as possible, preferably at least 4 metres. Sit your children around the outside of the line, but at least half a metre back from the line as shown in the picture on the following page. Sit at one end of the line on a chair so that you can see everyone. Hold up one block in your hand and ask the kids how many you have (*one*). Put that one block at the end of the line closest to you. Next, count out 10 blocks together. Join these to make a single line. Ask the kids how many you have (*10*). Place the 10 blocks lying down at the other end of the line.

Explain to the kids that the one and the 10 are stuck where you have put them, but there are some other numbers that are missing from the line. Ask what they think might be missing (*two, three, four etc.*). Tell them that they are going to try writing the missing numbers on their own lines by themselves first, and then that you are all going to come back to the carpet and make the missing numbers with blocks and think about where they should go.

Give out the work sheets and ask all students to write the number two where they think it goes. Ask what else is missing. When they have some ideas, allow them to complete their first attempt at the number line task at the top of the page, then come back and sit on the floor. Check what they

Common Misconceptions:

- Squashing all of the numbers up near the one or the ten with no spaces between them.
- Equally spacing the two numbers that you say first (e.g. two and eight), then trying to fit the rest in to the remaining gaps.
- Numbers in the wrong order (this indicates a very big problem – go back to Lesson 1 with these students to check number conservation).
- Writing the numbers very largely to fill up all the gaps.

have written, paying close attention to which students have already worked it out. There is no need to ask those students the Confrontational Questions in the next part of the Lesson – they can try the Extension suggestions instead.

Step 2: Confrontational Questions for students who had trouble with the Diagnostic Question,
Extension Questions for students who were ok with the Diagnostic Question.

Task 1: Place unifix blocks representing the numbers from 1-10 on a taped line on the floor and stepping out the numbers to count them to see if it looks right

For students who do not write the numbers in their correct positions:

Bring the kids back to the floor and ask which numbers are missing. Starting at two (deliberately not starting at five) say the name of each number and make it with the unifix blocks. Have a student place the blocks on the number line where they think that number goes. Do not guide the placement of the blocks at this stage. The line will probably look a lot like it does in the picture on the right, with all of the numbers placed right next to the one and no spaces between.

Direct the students to look at the blocks and ask, "Does that look right to you?" They probably won't see any problem with it yet.

Tell the students that you are going to step the numbers out now and have them say the numbers (counting from one to 10). Take one step next to each number (deliberately exaggerating how squashed up everything is and how tricky it is to step next to each one and also how big the jump is from the nine to the 10). Straighten up and look quizzically at the line. Repeat the stepping out and counting process until the kids are giggling. Ask a student who had one of the misconceptions listed above, "Does that look right to you?" The kids will probably say that it doesn't. Ask, "Which bit looks funny?" They will probably tell you that the problem is that the nine is too far away from the 10 rather than that the numbers are squashed up. Say, "Ok, so can you fix it for me?"

Extension Task 1 for students who write the numbers in their correct positions:

Change the line to start at two and end at 12 and ask what number goes in the middle. Note: the answer is 7. $12-2=10$ and half of 10 is 5, so we have to add 5 on from the starting place of 2, or 5 back from the ending number of 12.

Extension Task 2:

The middle of my number line is 11. One quarter of the way the number is 7. What numbers go on the ends? Note: The answers are 3 and 19. If $\frac{1}{4}$ of the distance is the gap between 11 and 7, then $\frac{1}{4}$ of the distance is 4. So 4 less than 7 is 3. And 8 more than 11 is 19.



If they try to move the 10 down to the one end, or more the numbers to the 10 end:

Remind the kids that both the one and the ten are stuck. They will probably try moving the blocks to one end or the other. Repeat stepping out the number line while saying each number and ask again, "Does that look right to you? Which bit looks funny? How come? Ok, you fix it for me." Continue to the following page.

If they put the numbers in the correct spaces:

It is unlikely that this has really fixed the problem, so check by taking off all the numbers except for eight and see if they want to put it in the middle.

If they move eight, go to the box on the left.

If they leave it in the correct position,

congratulations you have fixed a misconception!

Send them back to have a second try on the work sheet, then go straight to the Leading Questions.

At this point the students will probably try either moving all the blocks to the one end again (sometimes getting a second "10" to put next to the line because the 10 is too far from the 9), or adding in a second "one", up near the two at the 10 end of the line. Repeat stepping and counting, making sure that you say each number as you step next to it (*one, one, two, three...*).

Allow the students to try as many ideas as they have to make it work. You will almost certainly have a student who wants to space the blocks out at some point during this process.

If you don't have a student who wants to space the numbers out:

Ask, "Is there a way that we could make it easier to step out?" Allow the students to experiment with number positions, stepping them out themselves and moving the blocks around until they are happy with the spacing. Be aware that this spacing is unlikely to be equal, but that is alright as long as they are trying to space the numbers out in the correct order. We will work on the exact positioning later.

If you do have a student who wants to space the numbers out:

Watch for a student who starts trying to measure the space between the blocks (e.g. with their foot or by holding their hands apart at a specific distance and moving along the line to measure each space).

Ask that student what they are doing with their hands. They will probably say that they are trying to make the spaces the same. Ask how come the spaces have to be the same. They will probably either look at you blankly, or reply that there is one between each so they should be the same.

If they look at you blankly, ask them how much the numbers are going up by each time. When they reply with "one", confirm this and ask "Oh, so they are going up by one each time? Is that why you are trying to make the spaces the same?" Confirm that their idea shows some good thinking, and let them have a try moving all of the numbers until they look right. **Congratulations you have fixed a misconception**, but this needs consolidating so continue to Task 2.

Task 2: Review written number line

Send everyone back to their desks to look at their written number line and answer the **Thinking it through** question and try again a few more times until it looks kind of right. They may need more paper. Once they have the numbers roughly in their correct positions, using the Leading Questions below.

Step 3: Leading Questions

- Bring everyone back to the carpet. Take all the numbers off the line, handing each to a student to hold, but leaving the five sitting on the line. Ask the students why they think you left five there. Ask the students how big five is compared with 10. Ask where it should go (being aware that as the line starts at one rather than zero it doesn't go exactly in the middle, but it is close enough for students to build the intuitive understanding of Relative Size).
- When a student suggests the idea that five is half of 10, spend some more time discussing this to consolidate the idea e.g.
 - "So you think five and five more makes 10? So how big is five compared to 10 then?"
Students answer: "It is half way" or "It is in the middle".
 - "Hmm, I wonder where it should go? Maybe it should go up here near the one."

Teacher steps near the one and looks at the kids so that they say "No!"

- "No? Maybe it should go up here near the 10 (Teacher walks to stand near the 10 end)? No? Well then where do you think it should go?"
Teacher hands the five blocks to a student, who places it in the middle.
- "In the middle? Well that makes sense if it is half way to 10 – let's sticky tape it down now that you have a good reason for where it goes"
Teacher tapes the five blocks down.
- "Let's put the other blocks back on now."
Kids put the blocks back on the line, roughly evenly spaced.

- Send students back to try the Extend your thinking questions, or to have another go at the initial line. If needed, fold their paper in half, pinching in the middle. Hold the paper at the fold with a pinch and ask, "If I open this up, what number do you think should go on the fold?" Once they have replied "Five", open the paper up and show it to them. They will then need to go back and try again. It is common for students to take five or more attempts to be happy with their line.

Step 4: Generalising Questions

- Bring the students back to the line on the carpet. Pick up the six and the seven from the line. Ask the kids if they think that you need to move the blocks again now or if they should stay where they are. They will probably want to close up the gaps. Allow them to move the numbers. They will have trouble because the five is stuck down. If they want to move the five ask, "Oh is five not half of 10 anymore? That's weird. Do five and five not make 10 anymore?" When they reply that they do still make 10, explain that the five should stay where it is because they have a good reason for it to be there. They will probably instead move the 8 and the nine down closer to the five. At this point, say that the blocks are now stuck and hand them the six and seven to put back on the line. They will try to move the eight and the nine back to make everything evenly spaced again. Stop them, and focus on this by asking, "So do we need to move the eight and the nine now? Well, do you think we should have moved them in the first place or kept them where they were?"
- Repeat the process, removing other numbers until the kids start arguing with each other saying, "No don't move them – she's just going to put the numbers back again after we move them all". Ask very pointed questions about the position of the numbers such as, "Does eight get smaller just because I don't have six on the line? Is eight really closer to five than to 10? Do we need to leave space for the numbers that aren't there?"
- Remove all the numbers (including five) from the line, and give the students just one number to place (e.g. three or eight). Ask if the number should be closer to one end or the other or close to the middle. Focus on the idea that each number really only has one right spot.

Differentiation:

Support students: Check Partitioning of single-digit numbers before using this task. Also, adapt this task to a number line to five first, then build up from there.

Relative Size to 10

Below is a number line with space for all of the numbers between 1 and 10. Please fill in the two and three first, then put on all the missing whole numbers.

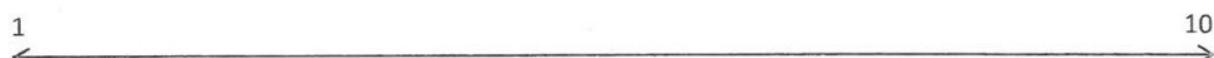
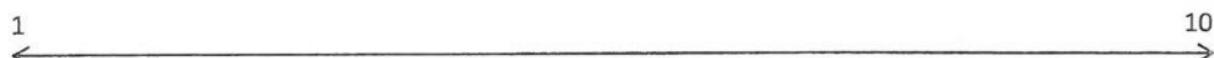
First try:



Thinking it through:

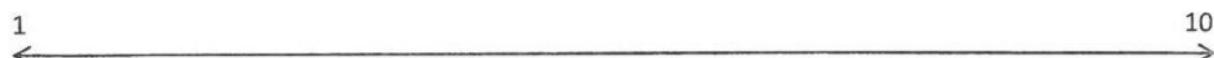
Does it look right to you? Is there a bit that looks wrong? How come?

Here is some space to try again, as many times as you need. You can get more paper if needed.



Extend your thinking:

This time, start by putting 8 on the line, then 2. Now fill in the rest. Did it still work? There is space for a second try if you need it.



Explain your thinking:

How do you know that your numbers are in the right place?