Project INSPIRE Grades 2-5 Course 2 Lesson 5 (33:30)

SPEAKER: Welcome to Grades 2 to 5, Nemeth Code Symbols for Fractions and Spatial Problems, Instructional Tools, Materials and Technology. This is "Lesson 5: Instructional Tools and Materials."

Slide two has the objectives for this lesson. You'll be able to identify materials that can be used when teaching math computation and fraction concepts to your students, and recognize ways you can support math instruction for students in grades 2 to 5.

Slide three talks about how to teach odd and even numbers. I'd like to start by showing you a video that demonstrates the number 7.

[VIDEO PLAYBACK]

- Let's take a look at how a student can practice odd and even numbers using the 100s board. And in this case, my student has 7 blue squares. She's going to put the first square in the top row, first column, 1, and then right below that in the second row, she's going to do 2. Moving to the second column, she's going to do 3 in the top row, 4 in the second row.

She's going to go to the third column. 5 in the top row; 6 in the second row. And now she's going to do 7 in the top row, fourth column. Oh, she doesn't have anything else to do, so that means that 7 is an odd number.

You probably have an APH score card 'cause your student uses these to play games with classmates and maybe at home, as well. This is another tool you can use for practicing odds and evens. So all my bumps are up. We have two rows of bumps. So when we go to do 7, to see if it's odd or even, on the top row, she's going to push down the first bump, 1. Below it, 2.

Second column, 3. Below it, 4. Third column, 5. Below it, 6. And now when she goes to the top row, fourth column, and she pushes 7, she has nothing else to push. So that's going to let her know that she has an odd number.

[END PLAYBACK]

SPEAKER: As you saw in the video, we could use the 100s board from APH or the score cards. I want to point out that in many classrooms, we're focusing on having students recognize that when you have evens, there's none left over, and when you have odds, there is 1 left over. So students are often asked to write equations when we have even numbers, so you want to make sure that your student has their braille writer or another tool to write that problem.

And I also want to point out that when you use tools like the APH 100s board or the score card, that's better than using graph paper and stickers. That's going to help you save cost, and that, as we all know in today's day and age, is important.

Let's go on to slide four. It talks about comparing or adding three-digit numbers. Now, this is a second-grade skill, and I want to point out that there's more than one way that our student can compare, in this case, the number 346 and 507. The first way I'm showing you in the picture is with a sorting tray and base 10 blocks.

So, I have my sorting tray divided into three sections. I have first started with my number, 346. So, I've put 3 flats in the top left to represent the 40. I've put 4 rods in the middle. And to represent the 6, I've put 6 units on the right. So at the top, my student has written the number 346. Right below, on the bottom part of the tray, my student has represented 507 with 5 flats on the far left and 7 units on the far right.

And I do want to point out different teachers are going to call hundreds, perhaps, or flats. They might call them tens, or longs, or rods for the representation of 10, and then either units or one for the individual blocks. You want to find out what terms that teacher is using. So one option for comparing these two numbers would be to use my APH tray with my base 10 blocks.

Another way would be for my student to use the braille writer. So in my example on the first row, my student has brailled the number, 346, in Nemeth. And then using the full cell to represent the hundreds or the flats, my students has made 3 full cells, then 4 Ls, or dots 1-2-3, to represent the number 40. And then using dot 3, my student has done 6 cells of dot 3 to represent the 6.

So full cell for the hundreds, L, or dots 1-2-3, for the rods or the tens, and then dot 3 to represent my ones or units. Below, writing 346 on the next line, my student has brailled 507, and then has brailled 5 hundreds, full cell. There's no rods or tens shown. And then my student, using dot 3, has brailled 7 units. The nice thing about doing this with the braille writer is my student isn't having to go back and forth as much between having, you know, something in braille and manipulatives. For some students, that's a hard transition. Other students having that physical flat, or rod, or unit in their hand is helpful.

Slide 5 introduces another second-grade skill, adding or subtracting three-digit numbers. Now, for our sighted students, they're using open number lines, and let me describe what this is. In my example, I'm going to be adding 247 plus 325. So I have a number line that has four arches on it. You can think of an arch as a half-circle.

So I have numbers below the number line. In this case, it's 247, 547, 567, 570, and 572. And then I have my arches, and above those, I have + 300, + 20, + 3, + 2.

So let's go through this the way our second grader who is sighted would do this. Our second grader is adding 247 and 325. So our second grader begins by writing 247 below the number line. Draws the arch. Writes a + 300 above it. Thinks to herself, 247 + 300 is 547, so writes a 547 at the end of that first arch below the number line.

So from 547, our student draws another arch. Above that arch, writes + 20. What is 547 plus 20? It's 567. So our student will write a 567 below the end of that second arch. Now, our student

needs to add 5, 'cause 325, we have the five in the ones column. It's real easy to take 7 and add 3 and know that you're going to get 10.

So our student draws a small arch from the 567 and writes a + 3 above it. 567 plus 3 is 570, so our student writes 570 at the end of that arch. And now our student has 2 more left to add. Draws another arch. Writes a plus two above it, and writes 572 at the end. Some students may actually just do one arch with a + 5, if they recognize that.

For our braille reader, this is not going to work, folks. So we have two ways that you can help your braille reader demonstrate this concept that's a very visual concept. I am not going to have my student draw a number line.

Instead, we are going to go between the first line on the braille page, or wherever that student is, and the line below it. So I have my student go to the second line that they're using and braille 247. My student needs to add 300 'cause we're starting in the hundreds column, so my student is going to roll the braille writer up a row and braille + 300.

Okay, student is going to either use their abacus or in their head, what's 247 plus 300? 547. So my student is going to roll down and put a 547 on the same row as the 247. Okay, next thing my student needs to do is the tens column. So we're adding 20. Student's going to roll up and put a + 20. 547 plus 20 is 567. My student's going to roll down and put a 567.

Same concept. Roll up, put the plus 3. Roll down, 567 + 3 is 570. Roll up, put your plus 2. Roll down, 572. So you can see that my student is working through the same concept, but without the arches and the actual number line.

Another way I can have my student do this is with a table. So I'm going to have four rows. In the first row, my student is going to braille 247. What's my digit in the hundreds column? It's a 3, so my student's going to put a space and then braille 300 with a plus sign in front of it, because we're adding, and get the answer 547. So that's going to be the first number on the second row.

What's my digit in my tens column? It's a 2, so my student's going to do a space and + 20. Student's going to do the math, get this partial sum of 567. Do a space, a plus sign, a 3. 567 plus 3 is 570. And then my student's going to do a + 2. And actually, there's a fifth row because we need an answer, folks. So my student adds 570 plus 2 and gets 572. So make sure they put their answer in there. Your narrator forgot that.

So let me point out one other thing. I've been saying one space between the first number in the row and then when the student does the plus. It could be two spaces. It could even be three spaces. The important thing, and I want you to look at my example here, is that my plus signs line up. In other words, I have two columns of numbers, and that's the concept you really want to reinforce with your student.

On to slide six. We're going to talk about fraction skills that are taught in second grade. So our students who are sighted are partitioning paper. They have rectangles. They're, you know, folding; they're drawing lines to put them into parts. Our braille users can use the APH score

cards that you can cut down to represent different fractions. So for example, 2 by 6, you could do halves, thirds, fourths, and sixths. Or 2 by 5, you could do halves and fifths. So I'd like to show you a video demonstrating this.

[VIDEO PLAYBACK]

- In second grade, students are drawing models using rectangles to represent halves, thirds, and fourths, and being asked, you know, to show, let's say, three-fourths, for example. APH score cards are great for this. You can cut your APH score cards. In this case, I've cut a card so that I have 12 circles, 6 on the top row, 6 on the bottom row. I've got another card I was getting ready to show you that has tenths. So that one has 5 on the top and 5 on the bottom. So having these handy that the student can use in class.

But let's focus on this yellow one that has my 12 circles all pointed up. So if my student needs to demonstrate half, my student can count across and see how many they have. If they have 6, and they're going to push down 3 in the top row and 3 in the bottom row, and they will have pushed down half of the circles in the rectangle.

And now, when they get to third grade, they begin to work in fifths. So we'll go ahead and we'll take out our score card, the one that's 10. And my student needs to represent three-fifths.. So in order to do that, my student's going to do 3 on the top row and 3 on the bottom row, and now my student has represented 3/5, or 6/10.

[END PLAYBACK]

SPEAKER: Okay, so you got to see how we use those APH score cards for fraction skills taught in second grade.

Alright, slide seven brings us to the third-grade skill of the distributive property. And I have a problem demonstrating for our students using what they call area models. This particular problem is 3, open parenthesis, 4 plus 2, close parenthesis. I'm going to use my APH 100s board and my manipulatives-- my red circles and my blue squares, in this case-- to illustrate this problem. My student could just as easily do this with a braille writer.

So I want to focus on this number 3. We're actually doing 3 times 4. The 3 tells me how many rows I'm going to have. So how many rows of circles am I going to have? 3 rows of circles. How many columns do I need? Well, it's 3 times 4, so I need 4 columns of red circles. Now I'm going to do 3 x 2. How many rows do I need? 3 again. How many columns? 2. So I'm going to put down 2 columns of blue squares.

So I have 3 rows, and in my top row, I have 4 red circles and 2 blue squares. So 4 plus 2 is 6, which is inside of my parentheses. And you can see that my total is 18, and our student can see that, as well.

Slide eight is multiplication, another third-grade skill. Now, students are introduced to a window or grid model. So basically, this is just a square divided into four equal parts. Now, there's a

handy-dandy APH tool that's not meant for this purpose, but works really well, and that's the Punnett Square, which we use in science class for dominant and recessive genes. So you could grab some of those for your student. Or you could use graphic art tape to create a window for them to do their math in.

So let's look at the print example. I have 38 x 24 = 912. So what my student is doing is going to write the problem out. The 38-- the 30 goes above the top-left square; the 8 goes above the top-right square. On the left side, the 20 goes on the left in front of the first square, and the 4 goes on the bottom row in front of the left square.

So now my student is going to actually fill in the square. So I've set the same thing up in braille for this student. My student is first going to say 20 times 30 is 600, and fill in that 600 in the square on the top left. Then my student is going to say 20 times 8 is 160, and is going to fill in that 160 on the top row on the second square.

Now, my student is going to go to the second row and is going to do 4 times 30 is 120. And so my student is going to write 120 directly below the 600, so in the first square on the second row. And then we're going to do 4 times 8, and my student is going to write in 32. Then my student is able to add up the numbers 600, 160, 120, and 32, to get 912.

So you can help your student set up these visual models or windows, grid models or windows, using their Perkins braille writer or Punnett Squares that are tactual, available from APH.

Slide nine gets us into fraction skills. These are third and fourth-grade concepts, and I really like the APH Math Builders Fraction Kit. It has both fraction tiles that go on a tray that they provide, and it also has circles, so two molded circle frames with pieces that fit into those. When you get this kit, gang, the stickers are not on it. So it makes it really hard for people who are braille readers to read what we have here. Please put the stickers on before you leave these materials in a math classroom.

Let's start out by comparing fractions. So I have my tray. It has a 1 at the bottom that's showing me, hey, 1 is the whole row. I want to compare 3/5 and 2/3. Which is the larger fraction? So I'm going to get out my fifths and I'm going to get out my thirds. So I have 5 red fifths and I have 3 yellow thirds. So, I'm comparing three-fifths to two-thirds.

I'm going to lay down 3 of my red fifths and 2 of my yellow thirds on the row below it. And I can see that when I have 3 of the fifths and I'm comparing them to 2 of the thirds, that actually, two-thirds is larger than three-fifths. So it gives me a great tactual way to compare these two fractions.

I can use my circle with the fraction pieces to do my equivalent fractions. So I want to compare one-half and two-fourths. I can get out my half and lay that down. How can I make it feel the same or look the same? I'm going to need 2 of my pieces that are labeled 1/4. So 2/4 is equivalent to 1/2.

Let's go on to slide 10. I'm pretty excited here about the idea of using APH number line devices to compare fractions. I do want to point out that you have to check your two strips to be sure that they have equivalent fractions. So for example, with thirds, and sixths, we're good. But if I were to have my student, like, use the thirds strip and the fifths strip, you would find out that the five-fifths, or 1, is not directly under the three-thirds.

So, what I do is I, instead, use one strip that has whole numbers on it. And I have the student use the top row to represent fifths, so placing a peg at 5 and 10 to represent 1/5 and 2/5, and use the row below to represent thirds, so placing pegs at 3, 6, 9, and 12 to represent 1/3, 2/3, 3/3, and 4/3, and then a peg at 15 to represent 5/5, so there's also a peg right above that represents 3/3.

I have a video that shows this to you, so let's go ahead and watch that.

[VIDEO PLAYBACK]

- Let's take a look at a skill that's a third-grade skill, which is comparing fractions. So I have my APH number line device. And on the top row, I've laid out my strip that goes in sixths, so 0, 1/6, 2/6, and so on. On the bottom row, I've laid out my strip that goes in thirds, so 0, 1/3, 2/3, and then 3/3. Notice that the 3/3 on the bottom strip is right below the 6/6 on the top strip, and they both have a 1. So that's helping my student understand whole.

Now, the question being asked in the classroom is, "Is 1/3 or 1/6 larger?" So, I'm going to help my student find 1/6 and put a peg. Now my student's going to go to the bottom row and is going to find 1/3 and puts a peg right above it. My student can compare where those two pegs are and see that 1/3 is larger, or to the right, of 1/6. So 1/3 is larger than 1/6.

[END PLAYBACK]

SPEAKER: Slide 11 talks about division with a remainder. This is a fourth-grade skill. We're getting harder here. So, I have a problem, 25 divided by 4, and I'd like to show you how my student can do this problem that involves a remainder with the APH 100s board, so let's watch the video.

[VIDEO PLAYBACK]

So, with the 100s board, I can have my student, who is a fourth-grader, practice division with remainders. So, I'm picking up here with my student who is doing the problem 25 divided by 4. So the first thing my student needs to do is to lay out the problem. So since we're dividing by 4, she's using 4 rows. And so far, she's put down 20 circles. So in the first 5 columns, she has 4 circles in each column.

So, let's have her finish setting up 25-- so 21, 22, 23, 24, and then that last one for 25 goes in the seventh column, first row. She's going to start counting over 1 column, 2, 3, 4, 5, 6. So, her, she's got 6 with 1 left over, so her answer is 6 remainder 1.

Another way the student can do this problem, 25 divided by 4, is with the Perkins braille writer. So, my student is going to start out finding out how many 4's that they can get. Using a full cell, my student does the first row of 4 of them, then a second row of 4 cells, and after the sixth row, my student, who has now done 24 full cells, representing 24, goes to the seventh line and brailles one more full cell. We're now up to 25. So, my answer is 6 remainder 1.

I want to point out that the key is groups of 4 here. So it would be okay if your student did columns or rows to represent 4. It doesn't matter which way they do it. The idea is four in this particular problem.

[END PLAYBACK]

SPEAKER: Let's go on to slide 12, where we're going to talk about how to compare decimals. This is a fourth-grade skill when we go out to two decimal place, the hundredths, or a fifth-grade skill when we go out to three decimal place, the thousandths. It's important for students to learn to compare decimals, and this can be a little tricky. So our base 10 blocks are really helpful with that APH tray. Let's watch the video.

[VIDEO PLAYBACK]

So, for example, if the class is working on how to represent 453 thousandths,, or point 453, and different teachers will say it differently, my student can have their base 10 blocks. So, to represent the 4 tenths, my student is going to put 4 flats in the left section of the divided tray. Then to represent the 5 hundredths, my student is going to put 5 rods in the middle section of the APH tray.

And now to represent the thousandths, my student is going to put 3 units. So I've now written 453 thousandths with the base 10 blocks. Question here. Is point 453, or 453 thousandths, greater or less then point 5? An easy way for our student, who is a tactual learner, to see this is to then set up point 5 using base 10 blocks. So, we begin again with the tenths. I have point 5, so I need 5 tenths. So, putting down 5 flats. We're putting these right next to or right above where I did my 453 thousandths, so my student can just feel that the stack with the 400 is less than the stack with the 500. And that makes a great tactual comparison and helps to build the understanding that point 5 is greater than point 453.

[END PLAYBACK]

SPEAKER: Now, you can also have your student do the same thing using the Perkins braille writer. On the top row, my student did point 5, or 5 cells of the full cell. And then below, my student did 4 flats or 4 hundredths. 1, 2, 3, 4, 5 rods using dots 1-2-3 and then 3 units. So my student can see that they brailled 5 flats, which is more than 4 flats.

Some of the students will find it easier to do everything on the braille writer, as I said earlier, rather than going back and forth to the manipulatives. So you really need to know your student. And then once they begin to understand the concept, they may not need those manipulatives anymore if they started out with the manipulatives.

Slide 13 talks about comparing decimals. And I actually can go back to my APH Math Builder Fraction Kit, and did you know that they have decimal tiles in there? So if I want my student to compare, "Is point 5 less than point 8?", my student can use the point 2 tiles lay out 4 of them to represent point 8, and then 1 of the point 5 tiles, and can easily see that point 8 is greater than point 5.

My student could also do math, multiplication, 4 times point 2 = point 8, by learning to move the decimal point. Some of these decimal tiles only go one decimal point-- the point 1, the point 2, and the point 5-- but they also do have point 25 decimal tiles. So you want to pay attention to that and share that with your student.

Slide 14 is a fifth-grade skill, which is rounding decimals. And I can go back to my APH number line device and I can have my student use Wikki Sticks with that strip that has decimals. And then the case I want to show you is my student rounding the decimal point 62. So let's watch the video.

[VIDEO PLAYBACK]

- I placed the strip on the device that has decimals in the tenths, so 0, point 1, point 2, and so on. My student needs to round point 62. So I'm going to have her go and read across until she finds point 6, and she stops on point 6. Now, to the right of point 6 is point 7. We know that point 62 is going to become between point 60 and point 70. So she's looking at the second digit, the 2, and is 2 closer to point 60? Absolutely.

So her answer is going to be point 6 or point 60.

[END PLAYBACK]

SPEAKER: Let's go on to slide 15, which is dividing a whole number by a fraction. This is definitely a grade five concept. And we have to have the student think about the idea of how many fifths are in 1? So, I have the problem, for example, 4 divided by one-fifth. So I can have my student do a table, where they have the problem written out-- so 4 divided by open fraction indicator 1, slash, 5, close fraction indicator. And it's really important that we use those fraction indicators.

My student can write 5 over 5 is 1. So let's see, what's 2? Well, 5 and 5 is 10, so 10 over 5, or ten-fifths, is 2. 3 is fifteen-fifths, and 4 is twenty-fifths. So my student can see that 4 is 20/5. So how many fifths are in each number is a skill to teach your student.

[END PLAYBACK]

SPEAKER: Slide 16 talks about adding fractions with unlike denominators. The student has ways that they can do this-- the braille writer, the abacus, or the math window. And I do want to demonstrate the math window for you here in just a second, so let me just give you a couple of caveats.

Teachers and paraprofessionals need to use the correct symbols when they're setting up problems, such as the opening and closing fraction indicator. A lot of times, folks want to leave those out because we don't have a print equivalent. If you expect a student to set up a complex problem with fractions, this takes a lot of time, so it makes more sense for you to set it up and for the student to then work the problem.

You want to pay attention to the way those tiles are labeled. So your indicators are different for each type of fraction. For example, a mixed number versus a simple fraction. So that leads us to the problem that our tile sets have limited numbers of indicators.

Let me show you my example. So I have laid out the problem 1/3 plus 3/4. So on the first line, I have made sure to use my simple fraction indicator, my 1, my fraction line, 3, my simple fraction indicator, my plus, my simple fraction indicator, 3, my fraction line, 4, and my simple fraction closing. And you notice that there's arrows on these tiles pointing in which direction they are opening and closing, so that's a good print equivalent for us sighted folks.

Okay, my student needs to do the work. So on the second line, my student has done 4/12 plus 9/12. Then what comes next? Well, that equals 13 over 12. Again, I've got my simple fraction indicator, opening and closing, and my fraction line. Well, what's the answer? It is 1. Don't forget that numeric indicator when you're working with your math window tiles. So 1, mixed number opening indicator, 1, fraction line, 12, mixed number closing indicator.

So, if I was helping my student to work through and understand the process and how to share the steps, the math window is a great tool for doing that. But to expect my student to find all these tiles and set this up is not realistic. My student's going to take a long time to do that. So this is a great demonstration tool or to have the student do the last step or two as you're helping your student build these skills.

Well, I hope that you've gotten at least two or three new ideas of ways to use materials and tools to support your student in building skills at the second to fifth-grade level. Thank you so much.