Measurement: Converting Units of Measure
Transcript

Teacher: I'm getting ready to start planning my lesson on solving problems with measurement conversions. I would like us to find the best plan to help my fifth graders understand what's going on when we're going from a smaller unit to a larger unit or a larger unit to a smaller unit. I really want them to understand the relationship between those units. I came across this problem, and I was hoping we could talk through it.

"Maria bikes a total of 15 kilometers each week. What is the total number of meters Maria bikes in 5 weeks?"

Instructional Coach: Let's look at the student expectation for this item, 5(7), in the Supporting Information Document.

"The student is expected to solve problems by calculating conversions within a measurement system, customary or metric."

Let's start with how to calculate conversions in a lesson. There's a related fourth grade student expectation that we should look, 4(8)(B) TEKS. Fourth graders are expected to convert measurements when given equivalent measurements organized in a table.

Teacher: What would that look like? What did my fifth graders see last year?

Instructional Coach: Great question. They might have been given problems that show four pairs of related measurements, such as the relationship between ounces and cups. Let's look at a sample problem.

Equivalent measures are shown in the table below:

- 16 fluid ounces are equivalent to 2 cups
- 24 fluid ounces are equivalent to 3 cups
- 32 fluid ounces are equivalent to 4 cups
- 48 fluid ounces are equivalent to 6 cups

How many cups are equal to 80 fluid ounces?

Teacher: Oh, so they approached measurement conversions using an input/output table, right?

Instructional Coach: Yes, fourth graders look at the given information in a table to determine the relationship. So, for this example, what relationship do you want them to be able to see between ounces and cups?

Teacher: Well, if you divide the number of fluid ounces by 8, I can determine the number of cups. I'd also like them to connect to the idea that there are 8 fluid ounces in 1 cup. I would also like them to connect to the relationship between the sizes of the unit. One fluid ounce is smaller than 1 cup. So you're going from a small unit to a larger unit of measure. We are dividing because we are thinking of fluid ounces in groups of 8 to make 1 cup.

Instructional Coach: Exactly. Let's look at a metric conversion.

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Equivalent measures are shown in the table below:

- 3 meters is the same length as 300 centimeters.
- 5 meters is the same length as 500 centimeters.
- 6 meters is the same length as 600 centimeters.
- 7 meters is the same length as 700 centimeters.

How many centimeters are equal to 9 meters?

And, how do you use the same reasoning for this problem?

Teacher: Well, if you take the number of meters and multiply by 100, I can determine the number of centimeters. Again, I would want them to connect to the fact that there are 100 centimeters in 1 meter. One meter is longer than 1 centimeter. We're going from a larger unit to a smaller unit. I will need more of the smaller units because there are 100 centimeters in 1 meter.

Instructional Coach: Exactly. In fifth grade, we want students to use the connections between conversions and multiplication or division, with or without paired measurements in a table. What do you think your fifth graders might notice?

Teacher: With meters and centimeters, I think they will notice that we're just putting two zeros at the end of the number of meters. Now, how do we help get them beyond just adding two zeros to the end?

Instructional Coach: Well, in earlier grades they did a lot of work with place value and expanded notation. For example, they connected 300 to three 100s and 3 x 100. So we can help them connect the process of 3 x 100 to their understanding of place value by placing a 3 in the hundreds place and then writing two 0s to complete the tens and the ones place.

Teacher: So if they were converting from kilometers to meters, I might expect them to think about 3 kilometers as three groups of 1000 meters, which would be 3 x 1000. They would then put a 3 in the thousands place, and write three zeros to complete the place of the hundreds, the tens, and the ones, right?

Instructional Coach: Yes, and that's one way we can help build students' place value understanding. Let's look at the problem you brought in where students are *not* given a table.

To bridge from fourth to fifth grade, we're able to build a table from the given information. How might students use a table to answer this question?

Teacher: Well, to begin with, they need to convert kilometers to meters. I think my students would build a table. I think they would label the first heading "kilometers" because that is the measurement that I am given. I think they would then go on to label the second column "meters" because that is the measurement that is requested.

Instructional Coach: How do you think your students would begin to complete the table?

Teacher: Because they know that the conversions are on their reference materials, I would hope that they would take a look at this and see that 1 kilometer is equal to 1,000 meters. I would then probably ask them how they could record the conversion measurement on the

table. I hope they would write a 1 in the kilometers column, and then 1,000 in the meters column.

Instructional Coach: Yes, and that is different from fourth grade when they are given the values in a table. What do you think your students might write next?

Teacher: I think some would continue to this pattern and do something like this: 2 kilometers equals 2,000 meters, and 3 kilometers equals 3,000 meters.

I think some of my students would fill in the information of 15 kilometers in the kilometers column.

From there, we can use the relationship between kilometers and meters to determine the missing measurement.

1 x 1,000= 1,000.

If we use the same relationship, we would multiply 15 by 1,000, thinking 15 groups of 1000, so we write a 15 in the thousands place which means we write a 1 in the ten thousands place and a 5 in the thousands place followed by three 0s.

Instructional Coach: Yes, and we want to connect back to the idea that we are converting from a larger unit to a smaller unit, where it takes more, smaller units to represent the same length or distance. In this case, multiplying makes sense.

Teacher: One of my concerns is that I think my students might have a hard time remembering when to multiply and when to divide when converting units. I think the structure of the table would help them see the relationship and choose the correct operation, even if the numbers get messy. For example, if my students were asked to convert $7\frac{6}{10}$ kilometers to meters, they could use the same process to see they need to multiply $7\frac{6}{10}$ by 1,000. They could use their understanding of place value to see that this *(points to board)* is 7,000 and $\frac{6}{10}$ of 1,000, which is 7,600.

I really think this could work!

Now going back to the original question, “Maria bikes a total of 15 kilometers each week. What is the total number of meters Maria bikes in 5 weeks?” I noticed that 15,000 meters is one of the answers. I think my students might miss that, because they forgot the question. The question is about 5 weeks. They will need to multiply 15,000 by 5 to get the answer after 5 weeks.

Instructional Coach: You’re right. What other errors do you think are represented by the remaining answer choices?

Teacher: Answer choice F appears to be the result when you multiply the number of kilometers by the number of weeks.

Answer choice H appears to be either a misunderstanding related to place value or multiplying by 1,000.

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Instructional Coach: Yes. We need to keep these misconceptions and errors in mind as we plan.

Teacher: So, I'm curious. Where does this idea of conversions go after fifth grade?

Instructional Coach: Let's look at the Vertical Alignment Chart.

In sixth grade, they look at conversion through the lens of proportionality and use the conversion factors as unit rates or rates within proportions to convert within a measurement system.

In seventh grade, they use unit rates and proportion to convert between measurement systems.

Teacher: So continuing to build on the ideas and understanding of the relationship between units extends for a few more years.

Instructional Coach: Yes, so let's see what else you brought.