PBS Lesson Series

Math: Grade 3, Lesson 16, Multiplication Facts and Strategies

Lesson Focus: Multiply with 3 and 6
Practice Focus: Students will focus on practicing using strategies to multiply with 3 and 6 in order to develop fact fluency.
Objective: Students will use strategies to multiply with a focus on the factors 3 and 6.
Key Vocabulary: multiply, factor, product, equation
TN Standards: 3.OA.C.7
Teacher Materials:

- Toothpicks, paper, pencil, and dry erase board/marker
- Student Practice Packet

Student Materials:

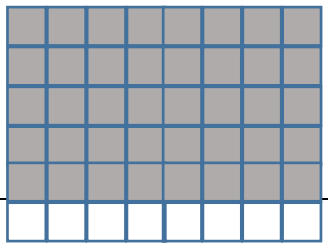
- Paper and a pencil, and a surface to write on

**Note: This may not be included in every lesson. In round 1, there were very few notes to the teacher delivering. If you have them they go here.*

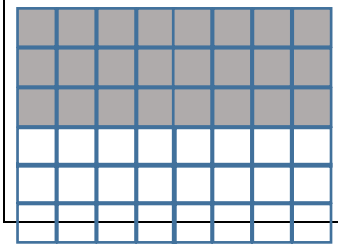
Teacher Do	Student Do
Opening (1 min) **Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 3rd graders out there, though all children are welcome to tune in. This lesson is the sixteenth in our series.** **My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!** **If you didn't see our previous lesson, you can find it on the TN Department of Education's website at www.tn.gov/education. You can still tune in to today's lesson if you haven't see any of our others. But, it might be more fun if you first go back and watch our other lessons since we'll be talking about things we learned previously.** **Today we will be learning about using strategies to multiply with 3 and 6 in mathematics! Before we get started, to participate fully in our lesson today, you will need:** • **Paper and a pencil, and a surface to write on** • **The student practice packet for Math, Grade 3, Lesson 16 which can be found at www.tn.gov/education.** **Ok, let's begin!**	Students get materials ready for the lesson.
Intro (5 min) **First, let's multiply by factors of 2 or 5 to solve some review problems. Listen as I read the first problem.**	

Karly scored 18 points in her last basketball game. All of her points were scored by making baskets worth 2 points each. How many baskets did Karly make? Write a multiplication equation to solve this problem. I'll give you a minute to write the multiplication equation and find how many baskets that Karly made. [Pause.]	Students listen to teacher read a problem. Students write a multiplication equation on their paper to solve how many baskets Karly made.
I know that 18 points is the product in the multiplication equation because those are the total points she scored. I know that one of the factors is 2 because that describes how many points for each basket. I don't know the number of groups or the number of baskets that Karly made. The equation that matches the problem has an unknown factor. I can write it like this: ____ x 2 = 18. [Teacher writes ___ x 2 = 18.] **What factor makes that a true statement? Show me the missing factor with your fingers.** [Pause.] **Yes, the missing factor is 9. Karly made 9 baskets that were 2 points each. Our multiplication equation is 9 x 2 = 18. Give me a thumbs up if you wrote 9 x 2 = 18 and that Karly made 9 baskets. Great!**	Students hold up 9 fingers to show the missing factor. Students give a thumbs up for writing the equation 9 x 2 = 18.
Let's do one more review problem. John and his dad own 7 banjos. They need to replace the strings on all of them. Each banjo has five strings. How many strings should they buy? Write a multiplication equation to solve the problem. I'll give you a minute think about and to solve the problem. [Pause.]	Students listen to teacher read the next problem. Students write a multiplication equation for the story problem.
Having the seven banjos is like having seven groups so 7 is the first factor in the multiplication equation for this problem. Each banjo or group has 5 strings each. My second factor is 5. I need to find the product of 7 x 5 to know how many strings they should buy. Our equation is 7 x 5 = ____ or 7 x 5 = 35. John and his dad need to buy 35 banjo strings. Check your multiplication equation to see if you found the same thing.	Students check to see that they recorded 7 x 5 = 35.
Great job reviewing multiplying with the factors 2 and 5 to solve problems. Those are known facts for most of you. Before they were known facts, you used strategies such as skip counting and drawing arrays to find the product. Today we will practice using strategies to multiply with the factors 3 and 6.	
<u>Teacher Model</u> (10 min) Objective 1: Teacher modeling using skip counting by threes as a strategy to multiply with the factor 3.	Objective 1: Students will be reviewing using skip counting as a strategy to find the product of a multiplication problem that has 3 as one of its factors. This will support

Help me solve this problem. Sabrina is making triangles with toothpicks. She uses 3 toothpicks for each triangle. She makes 4 triangles. How many toothpicks does Sabrina use?	students developing multiplication fact fluency.
Before we solve the problem, let's make sense of it. Why does Sabrina use 3 toothpicks for each triangle? [Pause.] **Give me a thumbs up if you said she needs 3 toothpicks for each triangle because a triangle has 3 sides. Great! Show me with your fingers how many triangles that Sabrina is going to make.** [Pause.] **Right, the problem said that Sabrina makes 4 triangles. We need to find out how many toothpicks she'll use for the 4 triangles.**	Students listen to teacher read the problem. Students reason that Sabrina uses 3 toothpicks to build a triangle because a triangle has 3 sides. Students hold up four fingers to show how many triangles Sabrina is making.
I'm going to make the triangles using toothpicks. As I do this, you draw the triangles on your paper. [Teacher builds 4 triangles with toothpicks so students can view.] **Here are my 4 triangles. I built each triangle using 3 toothpicks. This means I have 4 groups of 3. Look at your drawing. Check to see that you have drawn 4 triangles and that each triangle has 3 sides.** [Pause.] **How can we find out how many toothpicks Sabrina uses? Let's skip count by threes. Count with me.** [Teacher points to the triangles during skip count.] **3, 6, 9, 12. Sabrina needs 12 toothpicks to make 4 triangles. On your paper, write a multiplication equation for this story.** [Pause.] **The multiplication equation is 4 x 3 = 12 because we have 4 triangles or groups of 3 and this equals a total of 12. Now, give me a thumbs up if you already knew 4 x 3 = 12 before we drew the triangles. That's awesome! Over this school year, you have become more fluent with your threes facts!**	Students draw four triangles on their paper as teacher builds triangles out of toothpicks. Students check drawing for accuracy. Students skip count by threes with teacher. Students write a multiplication sentence to match the problem. Students give a thumbs up if they knew 4 x 3 = 12 without having to draw the triangles.
On your paper, find the total number of toothpicks needed to make 6 triangles. [Pause.] **If you're having trouble, did you try drawing a picture of the 6 triangles?** [Pause.] **I'm going to draw 6 triangles.** [Teacher draws six triangles for students to view.] **We can skip count by threes just like we did in the previous problem. Count with me. 3, 6, 9, 12, 15, 18. Our multiplication equation is 6 x 3 = 18. What does the 6 mean in our equation?** [Pause.] **Right, 6 is the number of triangles or groups. What does the 3 represent?** [Pause.] **Yes, 3 represents the number of toothpicks or sides in each triangles. What does the product 18 mean?** [Pause.] **Great! 18 is the total number of toothpicks needed to make 6 triangles.**	Students use equations or drawings to find the total number of toothpicks needed for 6 triangles. Students skip count by threes with teacher. Students listen to teacher explain what the factors and product mean in this situation.
How can we use what we know about the number of toothpicks needed for 4 triangles to find the number of toothpicks needed for 8 triangles? [Pause.]	Students consider how they can use a known fact to solve an unknown fact.

I know that 8 triangles is the double of 4 triangles. That means that the total number of toothpicks needed for 8 triangles is double the total number needed for 4 triangles. Since we needed 12 toothpicks to make 4 triangles, we'll need 24 toothpicks to make 8 triangles. Does that make sense to you? [Pause.] **Think about it this way. We need 12 toothpicks to make 4 triangles. If I make another set of 4 triangles, that means I need 12 more toothpicks. 12 plus 12 is 24. So remember, sometimes we can use one problem to solve another problem! Or we can use a known fact to find an unknown fact.**	
Objective 2: Teacher modeling using strategies to multiply by the factor 6. **Now let's consider some strategies we can use to multiply by the factor 6. If you already know your sixes facts, that's wonderful! This is a great opportunity to practice and make mathematical connections.**	Objective #2: Students will be multiplying with the factor 6 by using their known five facts and adding another group. This will support students developing multiplication fact fluency.
Help me solve this problem. Jessica is using toothpicks to make 6 octagons. How many toothpicks will she use? [Pause.] **Show me with your fingers how many sides are in an octagon.** [Pause.] **Yes, there are 8 sides in an octagon. If Jessica is making 6 octagons, what multiplication equation are we trying to solve? Write the equation on your paper.** [Pause.] **We are trying to solve 6 x 8 = ____. The factor 6 is the number of octagons and the factor 8 is the number of sides that each octagon has. The product is the total number of sides or toothpicks. That's what we need to find out.**	Students write 6 x 8 = ___ on their papers.
To solve this problem, I could build the octagons with my toothpicks or I could draw them, but that seems like it may take a long time. Let's think of some other strategies.	
We already know how to multiply by 5. Can that help us multiply by 6? [Pause.] **We are trying to solve 6 x 8 = ____. I know that 5 x 8 = 40. So 5 groups of 8 equals 40. 6 x 8 is just another way of saying 6 groups of 8. So if 5 groups of 8 is 40, then I can just add another group of 8 to 40 to get 6 groups of 8. 40 + 8 = 48. Here is a picture to illustrate my thinking. Draw this picture on your paper.** [Teacher shows picture and uses it to explain thinking.]	Students consider if knowing their five facts can help them multiply with six. Students draw the area model on their paper.
 **The shaded rows of the area model show 5 groups of 8. The shaded rows plus the one unshaded row show 6 groups of 8. So 6 x 8 = 48.**	

An equivalent way to write this is 6 x 8 = (5 x 8) + 8 = 40 + 8 = 48. Write 6 x 8 = (5 x 8) + 8 = 40 + 8 = 48 on your paper. [Pause.] **So, we can use our five facts and addition to help us find our six facts!**	Students write the equation on their paper.
Tying the learning together: **There's another strategy we can use to find our six facts. The strategy is called "Doubling." We actually used this strategy with the factors 4 and 8 at the end of the toothpick and triangle problem to find the number of toothpicks needed for 8 triangles. In our original problem, we had found that 4 triangles required 12 toothpicks because 4 x 3 = 12. We then reasoned that since 8 triangles was double the 4 triangles, that we would need double the total number of toothpicks or 8 x 3 = 24.**	Students learn the doubling relationship between the six facts and the three facts. Students listen to the explanation of the doubling strategy.
Let's think some more about this doubling strategy. What's the relationship between the factors of 3 and of 6? [Pause.] **Six is the double of three. This is because if I double three, I get six. The doubling strategy says if I know a multiplication fact where one of the factors is 3, then I can double the product to find the related multiplication fact where the factor is 6 instead of 3. Let's look at some examples.**	Students think about the doubling relationship between the factors of 3 and of 6.
In the problem above where Jessica was building octagons, we found that 6 x 8 = 48 by using our fives fact and addition. We also could have used doubling if we recalled that 3 x 8 = 24. [Teacher records 3 x 8 = 24.] **Write 3 x 8 = 24 on your paper.** [Pause.] **Underneath this equation, write 6 x 8 = 48. What's the same about both equations?** [Pause.] **Both equations have 8 as their second factor. What's the relationship between the factor 3 and the factor 6?** [Pause.] **6 is the double of 3. What's the relationship between the product 24 and the product 48?** [Pause.] **48 is the double of 24.**	Students record 3 x 8 = 24 on their paper. Students record 6 x 8 = 48 on their paper. Students compare the multiplication equations.
I'll prove this with a picture of an area model. The shaded section of the area model describes 3 x 8 = 24. [Teacher shows area model below.] **That's 3 groups of 8 unit squares.**	Students listen to teacher explanation of doubling strategy.



The unshaded section of the area model also describes 3 x 8 = 24 or 3 groups of 8 unit squares. The total number of groups in the whole area model is 6. So 6 groups of 8 unit squares equals a total of 48 unit squares. 6 x 8 = 48. **Are you convinced? Say out loud the product of 3 x 5 as I write the equation.** [Teacher records 3 x 5 = 15.] **Use the doubling strategy to find the product of 6 x 5. What is the double of 15?** [Pause.] **Yes, 15 + 15 = 30. So 6 x 5 = 30.** [Teacher records 6 x 5 = 30.] **So doubling the threes fact gives us the matching sixes fact. Record 6 x 5 = 15 + 15 = 30 on your paper.** **Now let's do some practice using strategies to multiply by three and six.**	Students say out loud 3 x 5 = 15. Students use the doubling strategy to find the product of 6 x 5. Students record 6 x 5 = 15 + 15 = 30 on their paper.
<u>Guided Practice</u> (10 min) [I do.] **I'll do the first practice problem.** [Teacher reads the problem out loud and does a think aloud as she solves it.] **Use a fives fact and addition to solve the problem 6 x 4 = ____.** **I know that 5 x 4 = 20. To find 6 x 4 I just need to add another group of 4. That is, 6 x 4 is six groups of four which is equal to five groups of four plus another group of four. So 6 x 4 = 5 x 4 + 4 = 20 + 4 = 24.** [Teacher records the equation.] **Record this equation on your paper.** **Let's also use the doubling strategy to find 6 x 4. First we need to recall the fact for 3 x 4. I know that 3 groups of 4 is 12. If I didn't remember this fact, then I could have skip counted by fours three times. 4, 8, 12. So 3 x 4 = 12. Record 3 x 4 = 12 on your paper.** [Teacher records 3 x 4 = 12.] **I can use the doubling strategy to find 6 x 4 by doubling the product of 3 x 4. Write this equation on your paper as I write it.** [Teacher records and reads 6 x 4 = 12 + 12 = 24.] **Using either strategy, we find that 6 x 4 = 24.** [We do.] **Now let's do this next problem together.** **Use a fives fact and addition to solve the problem 6 x 7 = ____.**	Students listen to teacher use a fives fact and addition to find the product of 6 x 4. Students record 6 x 4 = 5 x 4 + 4 = 20 + 4 = 24 on their paper. Students record 3 x 4 = 12 on their paper. Students record 6 x 4 = 12 + 12 = 24 on their paper to show the doubling strategy. Students listen to teacher guided questions to solve 6 x 7 with the

On your paper, record 6 x 7 = ____. [Pause.] **What fives fact will we use to help us solve this problem? Write it on your paper.** [Pause.] **Give me a thumbs up if you wrote 5 x 7 = 35.** [Pause.] **Since we are practicing using strategies for multiplying with 6, notice that the factor 7 didn't change. So our fives fact is 5 x 7 = 35. Now what do we do next?** [Pause.] **We have to add another group of seven to the 35 that we have for the 5 groups of 7. Do this now on your paper and then complete the equation for 6 x 7 = 5 x 7 + 7 = ___ + ___ = ___.** [Pause.] **The completed equation is 6 x 7 = 5 x 7 + 7 = 35 + 7 = 42.** **Pat yourself on the back if you found that 6 x 7 = 42.** [Pause.] **Great job! We used a fives fact and addition to solve this problem.** **Try showing using doubling to solve 6 x 7 = 42. Write down the related threes fact.** [Pause.] **Check your paper to see that you recorded 3 x 7 = 21. Now write an equation to show that 6 x 7 equals the double of 3 x 7.** [Pause.] **If you are having trouble, you can complete this equation.** [Teacher records 6 x 7 = ___ + ___ = ___.] [Pause.] **The completed equation is 6 x 7 = 21 + 21 = 42. We doubled the 21 from the threes fact to get 42 for the sixes fact. Check your equation before we move on.** [You do.] **Now you try one by yourself!** **Use a fives fact and addition to solve the problem 6 x 3 = ___.** [Pause.] **Did you write the equation 6 x 3 = 5 x 3 + 3 = 15 + 3 = 18? You were asked to use the fives fact and addition to solve the problem 6 x 3 = ___. To use this strategy, you broke the problem into 5 x 3 plus another group of 3, or 15 + 3 = 18.** **Now use the doubling strategy to show that 6 x 3 = 18.** [Pause.] **Did you write the equation 3 x 3 = 9 then 6 x 3 = 9 + 9 = 18? You doubled the product of 3 x 3 to get the product of 6 x 3.** **Great job!** Additional Problems (if needed): **Remember the problem earlier where Sabrina made 4 triangles with toothpicks? What if Sabrina made squares**	teacher. Students record 6 x 7 = ___ on their paper. Students write the fives fact they'll use to help solve the problem. 5 x7 = 35. Students add 35 + 7 = 42. Students complete the equation 6 x 7 = 5 x 7 + 7 = 35 + 7 = 42. Students check that they found 6 x 7 = 42. Students record 3 x 7 = 21 on their paper. Students work to complete the equation 6 x 7 = ___ + ___ = ___. Students check to see they wrote 6 x 7 = 21 + 21 = 42. Students try problem on their own: use a fives fact and addition to solve 6 x 3. Students check that their equation is 6 x 3 = 5 x 3 + 3 = 15 + 3 = 18. Students use the doubling strategy to show that if 3 x 3 = 9, then 6 x 3 = 9 + 9 = 18.

instead? How many toothpicks would Sabrina need to make 4 squares? **Use the doubling strategy to find the number of toothpicks needed to make 8 squares.** **Would Sabrina use more toothpicks for 5 squares or for 6 triangles? Write equations to explain your thinking.**	
Independent Practice (10 min) **Great work, students! Today, we reviewed using strategies to multiply with the factors 3 and 6. I hope you are recognizing that you can use known facts to find unknown facts. You sure did a great job! I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, www.tn.gov/education.** [Teacher shows student practice page under document camera or camera zooms in on student practice page.] **Good luck and do your best!**	Students listen to teacher summarize today's learning and view the independent practice problems.
Closing (1 min) **Students, I enjoyed practicing strategies to multiply with threes and sixes with you! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series! Bye!**	