PBS Lesson Series

Math: Grade 5, Lesson 14, Multiply Whole Numbers with Zeros

Lesson Focus: Multiply Whole Numbers with Zeros
Practice Focus: Students will use knowledge about place value and multiplying with 2-digit and 3-digit numbers to multiply whole numbers with zeros.
Objective: Students will use the standard algorithm to multiply 3-digit and 2-digit numbers with zeros.
Key Vocabulary: partial products, standard algorithm
TN Standards: 5.NBT.B.5
Teacher Materials:

- Board/marker
- Student Practice Packet

Student Materials:

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

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 5th graders out there, though all children are welcome to tune in. This lesson is the fourteenth 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 seen 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 the standard algorithm and place value in order to multiply 3-digit and 2-digit numbers with zeros in mathematics! Before we get started, to participate fully in our lesson today, you will need:** • **Paper and pencil** • **The student packet for Math, Grade 5, Lesson 14 which can be found at www.tn.gov/education.** **Ok, let's begin!**	Students get materials ready for the lesson.

Intro (5 min.) **Today, we're going to think about strategies for multiplying whole numbers that have at least one zero.** **Let's start by looking at this problem:** **A school district is replacing all of the desks in its classrooms. There are 103 classrooms and each classroom needs 24 desks. How many desks will the school district need to buy?** **What is this problem asking us?** [pause] **Yes, it's asking us to find out how many desks the school district needs to order.** **What information do we have?** [pause] **Great! We know that there are 103 classrooms that each need 24 desks.** **What strategies could we use to solve this problem?** [pause] **Of course! We could multiply 103 equal groups of 24 desks to find the total number of desks needed. Good thinking!** **So, our problem will be 103 classrooms times 24 desks.** **One strategy we could use is the standard algorithm for multiplication. But wait! I see that one of the factors has a zero in it; will the standard algorithm still work in this case?** [pause] **Sure, it will! Let's try it now.** [As you think aloud, write the following.] **When we think about this problem, we can think about place value and multiply by multiples of ten. So, think of the factor 24 as 2 tens and 4 ones.** **Think about the factor 103. How can we break 103 into its place value parts?** [pause] **I see! 103 is 1 hundred, and 3 ones** [Write 100 + 3.] **How many tens are in 103?** [Pause.] **Zero tens is correct! We will want to investigate how that zero affects the multiplication process. Let's start multiplying now.** **Starting with the ones we can multiply each digit's place value in the number 103. We can't forget to regroup when we need to!**	This warm-up will support students' understanding of multiplying multi-digit whole numbers using strategies based on place value. The work of this warm-up will help students develop the essential understanding that the standard algorithm for multiplication does not change when a factor has at least one zero.

1 103 X 24 412 +2060 2472 **4 x 3 ones = 12 ones; regrouped 1 ten and 2 ones** **4 x 0 tens = 0; plus the 1 regrouped ten = 1 ten** **4 x 1 hundred = 4 hundred** **Now, we will multiply by 20** [Point to the 2 in 24.] **20 x 3 ones = 60 ones; or 6 tens and 0 ones** **20 x 0 tens = 0 tens** **20 x 1 hundred = 20 hundreds; or 2 thousand** **Adding the two partial products, gives us a final product of 2,472.** **Let's look back at our work. How did the zero in 103 affect the process of multiplication?** [pause] **You're right, it didn't affect the process at all! We dealt with the zero the same as we would any other number.**	
Teacher Model (6 min.) Objective 1: Teacher will explicitly instruct and model how to use the standard algorithm to multiply 3-digit and 2-digit whole numbers with at least one zero. **Let's continue with some more multiplication problems that include at least one zero. Here is a similar problem.** [Display and read the problem aloud.] **An antique steam train makes one sight-seeing tour each day. The train has a total of 208 seats. If every seat is filled for each trip, how many passengers can it carry for 31 tours?** **What number sentence represents this problem?** [Pause.] **Right, because we know that the train holds 208 passengers**	Objective #1: Students will be building off their work on multiplication to multiply 3-digit and 2-digit numbers with at least one zero.

and we are trying to find out the total number of passengers in 31 trips, we can multiply 208 times 31. [Write the expression.] 208 X 31 **First, we will multiply by the ones; remember to regroup if necessary.** [As you think aloud, model the following.] 208 X 31 208 **1 x 8 ones = 8** **1 x 0 tens = 0** [Stress the following.] Y**ou see, we multiplied zero tens by 1 which is zero. So, the value of the tens is zero** **1 x 2 hundreds = 200** [Quick pause.] **Hmm, I notice that this product** [Point to the product 208.] **is the same as the 3-digit factor** [Point to the factor 208.] **Why is that?** [Significant pause to give students time to contemplate this question.] **Oh! Because I was multiplying by 1! That's the identity property of multiplication; multiplying a number by 1 doesn't change the value of the number. Okay, let's continue.** Objective 2: Teacher will model thinking about how multiplying a 3-digit by a 2-digit number with at least one zero in one of the factors, the zero does not change the multiplication process. **Now, we will multiply 208 by the tens.** [As you think aloud, model the following.] **2** 208 X 31 208 +6240 6448 **30 x 8 ones= 240…40 ones and 2 hundreds. We need to regroup the 2 hundreds.** **30 x 0 tens = 0 tens plus the 2 hundreds we regrouped = 2 hundreds…Now we have 240.** **30 x 2 hundreds = 6000…plus the 240 gives 6240.**	Objective #2: Students will see that when applying the standard algorithm strategy to multiply a 3-digit by a 2-digit number with at least one zero in one of the factors, the zero does not change the multiplication process.

Adding the partial products gives us 6,448 passengers that ride the train in 31 tours. Tying the learning together: **Let's think about how the zero in 208 effect the standard algorithm.** [Pause.] **When we look back at the work we just did, we can see that when we multiply by the zero, the product is zero. You might recall that that's the zero property of multiplication! In our work that zero holds the place value of the tens.**	Tying the learning together: Students will listen to the teacher think aloud about the effect of zeros in multiplication algorithm. This ties back to the zero property of multiplication, work with place value, and multiples of ten.
Guided Practice (10 min.) **If you have a pencil and paper, work through this problem along with me.** [Write the following problem and think aloud.] [I do.] [Teacher thinks aloud through solving a multiplication problem with at least one zero using the standard algorithm.] **205** **X 23** **In this problem, we have a factor that has the digit zero in the tens place. Let's start by finding all the partial products. Ready?** [Pause.] 11 **205** **X 23** **615** **+ 4100** **4715** **Can you tell me which place value we start multiplying?** [Pause.] **Yes! Starting with the ones, we multiply:** **3 x 5 ones = 15…we write the 5 and regroup the 1 ten** **3 x 0 tens= 0 tens plus the 1 regrouped 10 gives 10** **3 x 2 hundreds = 6 hundreds** **Our partial product is 615.** **If I said that this partial product was 605, what mistake do you think I might have made?** [Pause.]	[I do.] Students work alongside the teacher as the teacher thinks aloud through solving a multiplication problem with at least one zero using the standard algorithm.

Exactly! My mistake would have been that I didn't add the regrouped ten! Good thinking. **Okay, let's continue.** **Now, I'm multiplying by the tens:** **20 x 5 ones = 100 ones; or 0 ones, 0 tens, and 1 hundred that I need to regroup.** **20 x 0 tens = 0 hundreds plus the regrouped 1 hundred= 1 hundred** **20 x 2 hundreds = 40 hundreds or 4000** **Our second partial product is 4100.** **We now have our partial products! Do you recall how to find the final product?** [Pause.] **You're right! Add them together!** **The sum of the 2 partial products is 4715.**	
[We do.] **Let's solve a similar problem together. Do you have your pencil and paper ready?** [Pause.] **Great, here's our problem** [Display the problem and read it aloud.] **In an auditorium, there are 120 rows with 24 seats in each row. How many seats are in the auditorium?** **We have 120 rows times 24 seats** [Write the expression, thinking aloud as you go.] **120** **X24** **The number we'll be multiplying 120 by is 24. Starting with the ones, multiply each digit's place value in 120.** **120** **X24** **4 ones x 0 = 0** **480** **4 ones x 2 tens = 8 tens** **4 ones x 1 hundred = 4 hundreds** **What's our first partial product?** [Pause.]	[We do.] Students will respond to teacher questions with less scaffolding than the previous example. Students will have more time to think and respond on their own prior to the teacher providing solutions. [You do.]

Good job! Our first partial product is 480. **Can you tell me what we'll be multiplying next?** [Pause.] **Exactly, we'll multiply by the number in the tens place which is 20.** **120** **X24** **480** **+2400** **20 x 0 ones = 0 ones and 0 tens** **20 x 2 tens = 4 hundreds** **20 x 1 hundred = 20 hundreds, or 2 thousand** **What is our second partial product?** [Pause.] **You're right, it's 2400.** **Remind me, how do we find the final product?** [Pause.] **Oh yeah! Adding the 2 partial products.** **What is the sum of the 2 partial products?** [Significant pause to let students calculate the sum.] **Did you come up with 4880?** [Pause.] **Excellent work!** [You do.] **Now, it's your turn to solve on your own! After you've had a few minutes to work, we'll come back together and check it. Ready?** [Pause.] **Great! Here's your problem:** [Display and read aloud.] **510** **x72** **Work on your own for about 2 minutes. Ten, we'll come back together.** [After approximately 1 minute, alert students that you will come back together in 1 more minute.] **Are you ready for us check your work?** [Pause.]	Students are working almost exclusively independently with the teacher providing answers at the end.

Okay, great! [Display the following as you and the student check work together.] **510** **x72** 1020 **Did you start by multiplying by the digit in the ones place?** [Pause.] **Multiplying each digit's place value in 510 by 2 ones, should've given you 1,020.** **How did multiplying 0 ones by 2 ones effect this product?** [Pause.] **The zero property of multiplication tells us that any number times zero equals zero. So, 2 ones times 0 ones is 0. Good job!** **Next, you multiplied by the tens.** **Multiplying each digit's place value in 510 by 7 tens, should've given you 35,700.** **Adding the 2 partial products, should've given you 36,720.** **510** **x72** 1020 **+35700** **36,720** **Great work, everyone!** Additional Problems (if Needed): 407 108 X39 x58	
Independent Practice (1 min.) **Great work, students! Today, we reviewed the standard algorithm to multiply 3-digit numbers by 2-digit numbers with at least one zero. I hope you're seeing some connections to multiplying with multiples of ten! You sure did a great job! After the video, you will have some problems to practice on your own. Good luck and do your best!** **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 a document camera or camera zooms in on student practice page.]	
Closing (1 min.) • **Students, I enjoyed reviewing using the standard algorithm to multiply with a focus on 3-digit and 2-digit numbers by zero 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!**	