**The Number Strand: Outcome N4.4**

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| **Outcome** | **Indicators** |
| N4.4 Demonstrate an understanding of multiplication of whole numbers (2- or 3-digit by 1 – digit) by:* modeling the distributive property
* using personal strategies for multiplication, with and without concrete materials
* using arrays to represent multiplication
* connecting concrete representations to symbolic representations
* estimating products
* solving problems.

[C, ME, PS, R, V]*In support of the K-12 Mathematics goals of Number Sense, Spatial Sense, Mathematical Attitude and Logical Thinking.* | 1. Model a multiplication problem (concretely or symbolically) using the distributive property (e.g., 8 x 365 = (8 x 300) + (8 x 60) + (8 x 5)).
2. Use concrete materials, such as base ten blocks or their pictorial representations,, to represent multiplication and record the process symbolically.
3. Create and solve a multiplication problem that is limited to a 2- or 3-digits number times 1 – digit number.
4. Estimate a product using a person strategy (e.g., 2 x 243 is close to or a little more than 2 x 200, or close to and a little less than 2 x 250.
5. Model and solve a problem involving multiplication using an array and record the process symbolically.
6. Solve a multiplication problem and explain the strategies or processes used.
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| **Learning Space:** [**Top**](#top) |
| As the students are becoming more confident with multiplying whole numbers less than 10, they are ready to begin exploring multiplying 2 or 3 digit whole numbers by a whole number less than 10. The students’ learning activities should help the students expand the strategies for multiplication into this broader context. It is important that the students develop a thorough understanding of this level of multiplication concretely, visually and/or physically and that from those understandings they generalize strategies for multiplying using symbolic notation. It is important for teachers to realize that any standard algorithm they may know is only one of many possible ways to determine products and thus it should not be taught directly nor assessed. Instead, the focus of teaching should be on engaging the students in the sharing, critiquing, comparing, and generalizing of strategies that have meaning for the students. |

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| It is important that estimation is also included in the students’ activities. Estimation and decomposition of numbers done in order to perform calculations are strongly related to each other - both allowing students to expand and strengthen their number sense. It is also important to distinguish between estimation and rounding. Frequently students, teachers, and even resources will determine the exact product and then round it off to get a value they call the “estimate”. This is incorrect use of the terminology. What has been done is called “rounding” of the exact value. Estimation determines a “ballpark” value for a calculation. It is done to determine an approximate value or the reasonableness of a given solution. When students begin to show that they are decomposing the two and three digit numbers to determine sub-products, it is important to highlight the terms “decompose” and “distribution over multiplication”. This will give the students the terminology within the context of use.Again, there is potential for the inclusion of questions pertaining to other subjects that the students are taking or the inclusion of this mathematics directly into other subject areas. |
| **What Students Should…** [**Top**](#top) |
| **Know*** the symbol “x” is one possible symbol used in mathematics to denote multiplication
* the terms “decompose,” “estimate,” and “distributive property of multiplication”.

Concrete – base 10 blocksArraySymbolic EquationProductFactor Expanded Form | **Understand*** the distributive property of multiplication is directly related to the expanded form and decomposition of whole numbers
* symbolic representations for multiplication are directly related to concrete and pictorial modelling of the multiplication.
* when a multiplication problem involving whole numbers is most closely related to arrays, area, repeated addition or groups.
* the mathematical reasoning behind a particular multiplication strategy.\
* **-** Estimation is not exact. Estimation is done to determine an approximate value or the reasonableness of a given solution.
 | **Be Able to Do*** model multiplication using different concrete and pictorial approaches, including the use of the distributive property
* identify and apply strategies for multiplying whole numbers
* provide, with reasoning, estimates for multiplication of whole numbers
* write a multiplication statement for a problem and find the product using strategies are most efficient for the student.
* justify why they might select a particular strategy in solving a multiplication question
* identify a context in which multiplication could be involved and create a problem to reflect the situation.
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| **Key Questions:** [**Top**](#top) |
| * In what ways is multiplying 2-digit and 3-digit whole numbers by a whole number less than 10 similar to multiplying two whole numbers less than 10?
* How can writing a whole number in expanded form or using a different decomposition be useful in finding a product of two whole numbers?
* What in a problem or context would make you realize that a product needs to be determined?
* How are these two models/solutions the same/different?
* How else could you have determined the product?
* What generalization would you make about multiplying by a ten or a hundred?

**Why is place value important for solving multiplication questions?****Why is “0” important in solving multiplication questions?****When is it best to estimate a product?****What strategy did I use to estimate the product? and why?****What strategy did I use to solve the multiplication problem? and why?** |
| **Suggestions for assessment:** [**Top**](#top) |
| **Big Idea:**Determining the exact products for the multiplication of two- and three-digit whole numbers by single digit whole numbers.**Suggestions for assessment tasks:**1. Give the students two numbers to multiply and ask them to do the calculation and explain in words, pictures, and/or using concrete materials the strategies that were used.
2. Provide the students with concrete or pictorial representation of a product and ask the students to write the multiplication statement that is represented.
3. Provide the students with a representation of the process used to find a product and ask the students to explain the strategy that was used.
4. Provide the students with a calculation of a product and ask them to identify and correct an error made in the calculation.
5. Ask the students to find a product using their understanding of the distributive property and to explain their reasoning.
6. Have the students prepare a report (video, written, oral…) to describe what they know about multiplications including their strategies for determining products, the purpose of finding products, and how finding products with different types of numbers with different numbers of digits are similar.
7. In exit slips or a reflective journal, have the students record their understandings and questions that they have about the multiplication of whole numbers.
8. Provide the students with two different solutions to a product and in pairs have the students discuss and compare the strategies used.
9. Provide the students with a context and ask them to create a multiplication problem based in that context, solve the problem, and explain the meaning of the solution in the context.
10. Explain how decomposing numbers can be helpful in multiplying whole numbers.
11. Match representations, including arrays and the distributive property, to each other and their respective products

**What to look for:*** See the [*Determining exact products* Rubric](file:///C%3A%5CUsers%5Cru593%5CAppData%5CLocal%5CTemp%5CDetermining%20Exact%20Products%20Rubric.doc).

**Big Idea:**Estimation of the product of multiplication of two- and three-digit whole numbers by single digit whole numbers.**Suggestions for assessment tasks:**1. Give the students two different estimates for the same sum or difference and have them discuss the advantages and disadvantages of the different estimates. Ask the students to provide contexts in which each estimate might be more appropriate.
2. Give the students a word problem involving multiplication and have them solve the problem. In the solving of the problem, have the students decide whether or not estimating the product would be appropriate and to describe the strategies they use in solving the problem.
3. Give the students a product and a worked solution using estimates. Ask the students to create a problem that involves the original values and for which the worked solution would be appropriate.
4. Ask the students to represent an actual product and an estimate of the same product using the same type of model and compare the difference. Have the students explain the result of the comparison in terms of the comparison between the original number and the estimate used.

**What to look for:*** See the [*Estimating Products* Rubric](file:///C%3A%5CUsers%5Cru593%5CAppData%5CLocal%5CTemp%5CEstimating%20Products%20Rubric.doc).

In general, students should be encouraged through exit slips or a reflective journal to document their growth in understanding of multiplication. Such documentation should include strategies that are developing, errors that are occurring and have been corrected, and a wide variety of formats for representing and solving multiplication statements.  |

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| **Suggestions for instruction:** [**Top**](#top) |
| **Big Idea:**Determining the exact product for the multiplication of two- and three-digit whole numbers by single digit whole numbers.**Suggestions for instructional activities:**1. Have the students create concrete or pictorial representations to show the multiplication of single-digit whole numbers and multiples of 10 and 100. When the students have created each representation, ask them to write a multiplication equation (emphasizing that an equation means the two sides are equal in quantity or amount). For example, when they construct 5 x 200, ask the students to write 5 x 200 = 1000. Using think-pair-share, have the students generalize strategies for multiplying multiples of 10 or 100 by a single-digit whole number.
2. Show the students concrete or pictorial representations for each part of a multiplication done by decomposition. For example, base ten blocks could be used to model each of 2 x 400, 2 x 80 and 2 x 1. Ask the students to identify and write symbolically the multiplication statement for each of the individual representations. Next, in partners, ask the students to create a representation, using the same materials, for the overall product. (In this case, ask them to create a model for 2 x 482 using the base ten blocks). Have the pairs discuss how their model is related to the three that they were shown. Next, have the students discuss the relationships between the symbolic multiplication statements. (In this case “How are the statements 2 x 400, 2 x 80, and 2 x 1 related to/similar to 2 x 482?”) Repeat this process using different products. Eventually ask the students to predict what the original models will be equivalent to in terms of a single product. Have the students generalize strategies for relating products to the sum of the products for the decomposition of a number. This may take some time, but using examples, the students should be able to come to such a generalization – this will show that they understand the connection between decomposition, multiplication, and the distributive property. As the students begin to understand this relationship, ask them to share how they would show that relationship symbolically. Make sure that the students are correctly using the equal sign, taking time to revisit what it means if the students are interpreting the equal sign to mean “do the question”. As the students become more confident, show them alternative methods of recording the work symbolically and engage the students in discussing the reasoning behind the different formats. Students should not be expected to use one particular format when determining products symbolically.
3. As a homework assignment have the students collect examples of situations in other classes, in their activities, in their hobbies, and within their daily routines in which multiplication could be used to answer problems. Have students use these situations to create problems that they can in turn solve and share with a partner. Provide an opportunity for students to share at least one of their contexts and invite all students to pose additional multiplication questions based upon the situations they have shared.
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| **Suggestions for instruction:** |
| **Big Idea:**Estimation of the product of multiplication of two- and three-digit whole numbers by single digit whole numbers.**Suggestions for instructional activities:**1. Students may need more work with estimating whole numbers between 10 and 999. Use number lines, charts, concrete representations, and pictorial representations to help the students determine appropriate/possible estimates for given numbers. It is important for the students to keep in mind that the numbers represent quantities, and thus every estimate is changing the quantity to slightly less or slightly more. Have the students brainstorm ideas of contexts in which they might use an estimated rather than actual whole number. Have the students describe those contexts and what they would consider to be an accurate enough estimate – to the nearest 10, 100, 500, or 50 – and why.
2. Have the students brainstorm ideas of contexts in which they might use an estimated product of whole numbers. Consider these contexts as a class and have the students justify the accuracy they believe to be needed in the particular context.

 1. Have the students explore determining an estimate for a product using a variety of representations and strategies for estimating and multiplying. Engage the students in discussions regarding which estimates are closest, furthest, larger than, or smaller than the actual product and their reasoning for their claims.

In general, it is essential that the students explore, create, and select between a variety of strategies when multiplying whole numbers to ensure flexibility in thinking and to support the transfer of their understandings of multiplication to other types and sizes of numbers. It is tempting to instruct students to use a set procedure, however; this severely limits the likelihood of the students developing a true understanding of multiplication and can contribute to future problems in their study of mathematics. |