

#### **Resource at a Glance**

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**Grade 4: Computations and Algebraic Thinking** 

**Primary Skills Addressed:** 

Practicing multiplication skills

**Supporting Skills** 

- Developing quick recall of multiplication facts and related division facts
- Developing fluency with whole number multiplication





## **Teacher-Directed Lesson**

### Lesson Objective

The primary purpose of the lesson is to help increase students' motivation for math practice by engaging them in a mathematics game. In this lesson, students will play a dice game to strengthen their quick recall of multiplication facts.

#### Prerequisite Skills and Knowledge

- Basic understanding of the base-10 system
- Some work with multiplication facts
- Fluency with addition facts
- Understanding of the relationship between addition and multiplication (that multiplication can be described as repeated addition or skip counting)

#### Materials and Resources

- Pencils and paper
- Number cubes or dice
- Teacher Resource 1 (optional)
- Multiplication facts table (optional)
- Manipulatives such as counters, pennies, blocks, etc. (optional)

#### Voæbulary

<u>basic fact</u> – multiplication problems in which each factor is less than 10

<u>factors</u> – two or more numbers multiplied together, the result of which is a product (e.g., 4 and 8 are factors in  $4 \times 8 = 32$ ; 4 and 8 are factors of 32)

<u>multiple</u> – the result of multiplying by a whole number (e.g., the multiples of 5 are 5, 10, 15, 20, ...)

<u>product</u> – the result of multiplying two or more numbers

whole numbers – the counting numbers, including 0 (the set of whole numbers is {0, 1, 2, 3, ...})

### AdditionalAccommodations

You may differentiate activities according to each student's skill level by limiting the range of multiplication facts in the game. This can be achieved by combining number cubes or dice that display the numbers 1–3, 1–6, or 7–12, and alter the list of products for students to cross off.

*Tier 1:* Instead of providing the list of products for students to copy, show students the game rules, and before they begin to play, direct them to find and write all the possible products for multiplying the sets of numbers they might roll.

*Tiers 2 and 3:* Students may need manipulatives or other types of visual representations to assist them when multiplying or using mental math. If necessary, provide students with a multiplication facts table to reference.





Note: Words in bold are said aloud by the teacher.

### Introduction

Many different games in the real world involve math, and in today's lesson, you will play a game that involves rolling dice (or number cubes) to practice multiplication facts. Becoming more comfortable and confident with your multiplication facts will help you move on to more complex math problems in the future. Remember to practice the strategies you have learned like drawing or visualizing arrays and the Commutative Property.

#### Model

**On your paper, I want you to write the following numbers.** Display Teacher Resource 1, or write the following numbers for students to see. Read them aloud.

1	2	3	4	5	6	
8	9	10	12	15	16	These numbers are the products you'll try to make
18	20	24	25	30	36	while you play the game.

Before we begin the game, let's review some of the multiplication facts you'll need to know. If you have any trouble recalling your multiplication facts, remember that you can also use repeated addition to find the product. For example,  $5 \times 2$  is the same as 2 fives or 5 + 5. It equals 10. Write  $5 \times 2 = 5 + 5 = 10$  on the board.

What does 3 × 6 equal? (18) Call on a student to answer, and praise him or her for answering correctly or for his or her effort. Great job! Can anyone tell me two factors that are each less than 10 and that we can multiply to get 24? (4 and 6) Review other factors and multiplication facts for the listed products, giving each student an opportunity to answer, and praise each student for his or her answer or effort.

Good work, everyone. I think we are ready to learn the rules for today's game. This game is best for two to four players. Point to the rules on Teacher Resource 1, or write them on the board, as shown below. Read them aloud.

- 1. The first player rolls two number cubes or dice and states the multiplication fact.
- 2. If the player is correct, he or she crosses off the product on his or her list.
  - \* If one player makes a mistake, and another player corrects it, then the player who made the correction gets to cross off the number on his or her own list.
- 3. The next player on the left rolls and states the multiplication fact.
- 4. Players take turns until one person crosses off all the numbers on his or her list.

We'll practice a round together, and then you'll play with your classmates. I want you to state the full multiplication fact, including the factors and the product. If you roll a 5 and a 2, together with the state of the state





### Model (cont.)

**you will say, "5 × 2 = 10." Here is another example.** Roll two number cubes or dice and state the multiplication fact.

You can use repeated addition and any other math facts strategies you can think of to help you in the game. Everyone will take turns, and the game is not timed, so you can take as much time as you need to find the product for the numbers you roll.

#### Cuided and Independent Practice

Guide students through a few rounds of the game, ensuring they understand the rules of play. Once students understand how to play, encourage them to continue on their own, occasionally checking their answers for accuracy. Throughout the game, offer specific verbal encouragement for each student's efforts.

### Evaluation/Feedback

Review independent practice problems with students. Ask a student volunteer to read a problem and then tell how he or she solved it. Write the solution in front of all students as the student volunteer walks you through the solution, or if the student is comfortable doing this, have him or her write the solution on the board and describe his or her reasoning. If the student struggles with an explanation, praise the student's efforts and guide him or her with leading questions.

#### Reteaching/Extensions

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Students may need more guided examples to learn and recall multiplication facts. Independent practice problems can be used for this purpose. If students have difficulty remembering facts, make sure they have a multiplication facts table available to them.

A similar game as the one presented here may also be used to teach fact families or division facts, or you may want to use this type of lesson to help students develop strategies to recall extended multiplication and addition facts, such as by directing students to multiply each or both number cubes by 10.





#### Reteaching//Extensions((cont.))

There are many possible rules variations to increase the difficulty of the game. Here are a few:

- 1. Instead of giving students the list of products to cross off, give them the list of factor sets they could roll, and instruct students to state the multiplication fact from memory for each roll before crossing off the factor sets on their lists.
- 2. Each player may roll the number cubes or dice twice to generate two larger numbers. For example, the first roll is 4 and 5 and the second roll is 2 and 4. The player adds 4 and 5 to get 9 and adds 2 and 4 to get 6, then multiplies 9 and 6 to get 54.
- 3. Have each player multiply at all steps instead of adding. As an example for the same roll from the previous variation, multiply 4 × 5, then 2 × 4, and then 20 × 8. For a game of mental math such as this, it would be advisable for players to simply write down the final product on their turn instead of crossing off numbers on a list. After 10 turns, each player finds the sum of the 10 products (with paper and pencil), and the player with the greatest sum wins.

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Praise students for their efforts and successes in the game. Remind students that the objective of the game was to help them practice and become more comfortable and confident with their multiplication facts. Emphasize that many games include math—usually addition or multiplication. Remind students that learning multiplication facts is a lot easier if they remember there are many ways to derive facts, especially when they're having trouble learning them for quick recall.





TeacherResource1

# Write these numbers on your paper:

1	2	3	4	5	6
8	9	10	12	15	16
18	20	24	25	30	36

#### Rules:

- 1. The first player rolls two number cubes or dice and states the multiplication fact.
- 2. If the player is correct, he or she crosses off the product on his or her list.
  - \* If one player makes a mistake, and another player corrects it, then the player who made the correction gets to cross off the number on his or her own list.
- 3. The next player on the left rolls and states the multiplication fact.
- 4. Players take turns until one person crosses off all the numbers on his or her list.





## Appendix

## Integration of the Content and Research-Based Instructional Practice

The Institute of Education Sciences (IES) recommends that Tier 2 and 3 mathematics interventions include motivational strategies. Across all grades, this means ensuring that students are praised not only for their achievements at home and at school, but also for their persistence and effort. For low-achieving students who have become used to failure in math classes by the fourth grade (e.g., low scores and notes home concerning poor performance), interventions that include individualized positive reinforcement in the form of rewards may motivate these students to greater achievement and effort.

By the time students receive an intervention, many have experienced failure and frustration with mathematics. It is especially important that teachers find ways to build fourth graders' confidence levels and help them make links between effort, engagement, persistence, and achievement in mathematics. As students learn new algorithms for multiplication, they need to understand that developing practice and patience is more important than quickly mastering new skills.

#### **Strategies Identified to Change Student Outcomes**

In connection with IES Recommendation 8 and Curriculum Focal Point 1 (CFP 1), intervention instruction, as supported by the IES Practice Guide, should often include, but not be limited to, the following examples:

- 1. *Rewarding effort with specific praise* Working with properties and representations of multiplication might seem meaningless to some struggling students. These students, in particular, may benefit from both concrete and verbal rewards based on their performance, effort, and level of engagement. Praise is most effective when it points to something specific the student accomplished or demonstrated. Therefore, to encourage the development of conceptual understanding in low-achieving students, interventionists may highlight students' efforts or in building a model of multiplication or in attempting to identify or apply properties. Both teachers and students often overlook these topics, so careful praise in these areas can be effective in promoting their value.
- 2. Rewarding accuracy and quick retrieval of basic multiplication and division facts It is also important to praise and reward achievement when students are learning basic math facts. Although quick retrieval of basic facts is essential for future achievement in mathematics, students often perceive study of these facts as boring or meaningless. One research study revealed that students were especially motivated when they were awarded points or play money that they could then use to buy prizes, although being awarded the prizes directly wasn't as effective. For example, students might work with multiplication fact flash cards or on a computer-assisted program that tests facts in a playful way. Then, depending on their





scores or correct answers, students might earn points or play money. These kinds of pointprize strategies are effective in motivating students in all tiers.

- 3. *Encouraging family involvement* Recruiting parents to be involved in their children's learning increases student motivation and achievement. Parents can help students make flashcards to practice their math skills and help students work on a single real-world word problem that is designed to encourage brainstorming, discussion, and resourceful thinking. Notifying parents of students' efforts and persistence is also important. This can be achieved with simple letters home that describe a student's successes, such as scores or engagement in classroom activities.
- 4. Helping students make visual representations of their achievements Provide students with opportunities to graph their own progress and achievements in learning. In fourth grade, students might track the different ways they know how to multiply: with arrays, with area models, with manipulatives, using basic facts, using the standard algorithm, using partial products, using mental math, and so on. They could also make a line graph that tracks completed problems or quiz scores over time. As a cooperative effort, a class could work together to make a single-bar bar graph that tracks their cumulative efforts in completing difficult multiplication word problems.
- 5. *Helping students set goals* Empowering students to set their own math goals, with help and input from the teacher, should be an important part of Tier 2 and 3 math interventions. In fourth grade, a clear-cut goal might be to master the basic multiplication facts through 10. Once these facts are mastered, students might expand their efforts to multiplication facts through 12 and then to extended facts (e.g., 20 × 90, 6 × 80, and so on). Other practical goals could include learning to use mental math strategies or learning a variety of multiplication algorithms.

Please see the IES Recommendations and Curriculum Focal Points documents for further information.





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