**Doubling & Halving**

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| In this lesson, students apply concepts of doubling one factor and halving the other factor to solve multiplication problems. |

**NC Mathematics Standard:**

**Number and Operations in Base Ten**

**NC.4.NBT.5** Multiply a whole number of up to three digits by a one-digit whole number, and multiply up to two two-digit numbers with place value understanding using area models, partial products, and the properties of operations. Use models to make connections and to develop the algorithm.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

**Student Outcomes:**

* I can determine the effect on a product when one factor is doubled and the other factor is halved.

**Math Language:**

* factor
* product
* double
* half

**Materials:**

* Video Game Fun handout (1 per student)

**Launch:**

1. Introduce Problem (5 minutes)

Ask students how many of them like to play video games. Discuss the different types of video games they like to play in order to gain interest.

Pose the following question to students.

*Ms. Chaney wants to buy her students video games but doesn’t want to buy more than 180 games. Would it be better if Ms. Chaney had 12 students in her class and bought each of them 14 video games or if Ms. Chaney had 6 students in her class and bought each of them 28 video games?*

**Explore:**

1. Solving the Problem (15 – 20 minutes)

Allow students time to work individually and then with partners in order to solve the task. Encourage students to share their strategies with one another and describe how they are answering each question. As students work, observe to see how they are solving the task.

 Observe:

* + How are students organizing and representing their thinking?
	+ Do students see the relationship between 12 students and 6 students?
	+ Do students see the relationship between 14 video games and 28 video games?
	+ How are they explaining their thinking to others? With you?

Carefully select students to present to the class. Look for students who modeled the problem and can explain their rationale. Also look for strategies that will generate discussion to help others move toward a deeper understanding of doubling one factor and halving the other factor. The teacher may ask why these problems have the same solution and prompt students to look for relationships between the numbers in their small groups.

**Discuss:**

1. Discussion of Solutions (15 – 25 minutes)

Bring the group back together and have selected students share their strategies for solving the task. Relate the task to doubling and halving and how these numbers were selected.

* Discuss how students displayed their information.
* Discuss which strategies students used to solve the equation.
* Relate the strategy to a model such as an array to demonstrate why this works.
* Discuss if doubling and halving always works.
* Discuss what type of numbers work well for this strategy (one factor is even in order for it to be halved and still be a whole number).

To close the lesson, have students explain the doubling and halving strategy to a partner and then record the strategy in their math journal. Encourage students to use words and pictures not just numbers in order to explain the strategy.

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Observe and monitor students as they solve the problem. How are they making sense of the problem? Are they using the doubling and halving strategy to relate the two problems? What strategies are they using to solve the problems?

**Formal Evaluation/Exit Ticket:**

* At the end of the lesson, give students a specific problem where they can double and half to make the problem easier to solve mentally. See if students are able to use the strategy to solve the problem. (Example: 24 x 25)

**Meeting the Needs of the Range of Learners:**

**Interventions:**

* Students that are struggling may need to start with simpler numbers to see the relationship. Include problems that have a multiplication combination that students should know automatically such as 24 x 6 (12 x 12), 22 x 5 (11 x 10).

**Extensions:**

* Ask students to create their own equations that will work for doubling and halving.
* Ask students if they can double and half more than once and still get the same product. Have students model how this works.

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| * Students do not understand the problem.
* Students cannot double and/or half a number.
* Students struggle to multiply.
 | * As a class, act out the problem or use manipulatives.
* Model using smaller numbers.
* Practice how to double a number and take half of a number.
* Students should use graph paper to draw smaller arrays or use other strategies to solve multiplication problems.
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*\*This lesson was adapted from Investigations Unit 3, Lesson 4.1 - Doubles and Halves.*

**Possible Solutions:**

12 x 14 = 168

6 x 28 = 168

**Video Game Fun**

Ms. Chaney wants to surprise her class by purchasing video games for their classroom. She wants to be able to purchase as many games as possible.

Would it be better if Ms. Chaney had 12 students in her class and bought each of them 14 video games or if Ms. Chaney had 6 students in her class and bought each of them 28 video games? How do you know?

Solve using another strategy.

