Rice and More Rice

Summary

These activities help students develop number sense, discover what happens to the product when factors are doubled, and understand the properties of multiplying by factors of 10/100/1000.

Group Size

Large Groups

Materials

- *One Grain, Two Grains, Four Grains...*
  1 red 6" circle,
  1 green 6" circle
  Overhead base 10 manipulatives
- *One Grain of Rice*
  6 jars, same size
  Rice, small grain
  5- 1oz medicine cups

Additional Resources
Books
About Teaching Mathematics, A K-8 Resource, by Marilyn Burns; ISBN 978-0-941355-76-6
Lessons for Extending Multiplication, by MaryAnn Wickett; ISBN 978-0-941255-31-5

Background for Teachers

Traditionally, teaching multiplication to students has emphasized memorization of multiplication facts and developing computational skills. These activities allow students to develop a more active approach to learning and developing a greater understanding of multiplication.
Students often do not possess number sense when looking at the relations of factors and products. The following activities help students develop number sense, discover what happens to the product when factors are doubled, and understand the properties of multiplying by factors of 10/100/1000. As students complete the activities, patterns will appear that encourage students to develop their own understanding of how multi-digit multiplication works. As students develop their own understanding of simpler related problems they will also develop strategies to solve more complex problems based on their foundational knowledge. Students need to be able to see, at the end of the lesson, the concept that when a factor doubles, the product doubles. On the flip side, the lesson can be extended to help students see that halving a factor also halves the product. Developing mental math skills is a strong byproduct of this lesson.
In order to make this lesson successful and worthwhile, teachers need to be comfortable with the teaching method of silence and allow students time to process and then later express their thoughts and ideas. When a red light is posted, there is no speaking. Gesturing and note writing can occur by students and teacher but no voice. Only when the green light is posted can verbal communication occur. This is a method that can work effectively in other curriculum areas when you desire to have the students discover the lesson. These activities are broken down into a two/three day lesson depending on the abilities and strategies of the students.
For the final activity, you must determine the number of grains within the jar based on 1783 grains of rice per a 1 oz medicine cup. Answers will vary depending on the size of jar and number of scoops necessary to fill it.

Intended Learning Outcomes

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.

Instructional Procedures

Invitation to Learn

Place before the students a jar filled with rice (which has been counted beforehand). Ask each student to make a guess as to the number of grains of rice in the jar. Have students record their guess and explain their thinking behind their guess in their journal. Post the movement chart and have students perform the physical action corresponding to their guess. Students will group themselves and discuss methods for determining their guess. Bring the class back together and allow them the opportunity to share strategies. Do not share the correct answer at this point, only strategies. The correct answer will be shared at the end of the lesson.

Instructional Procedures

Day 1:

1. Red Light/Green Light - Explain to the students when the red light is posted there is no verbal communication. Only when the red light has been removed and the green light posted will students be allowed to speak. This is important to allow all students a chance to learn from the activity and develop their own thinking.
2. Show students the three signals used to respond during the game. Thumb up means they know or agree with the answer, thumb sideways means they are unsure, and thumb down means they do not know or disagree with the answer.
3. When everyone understands the first two steps, begin the activity. Post the red light on the board so all can see it. Write the problem 1 x 3 on the board. Students will indicate they know the answer with their thumb. Hand a marker to a student indicating they know the answer and have them write the answer on the board. All students will then indicate their response with a thumb.
4. Write a second related problem (for example, 2 x 3) on the board under the first and allow students to respond when they know the answer. Hand a marker to a student to write the answer. Have the rest of the class respond with thumbs.
5. Post the green light and lead a discussion as to how the first two problems are related. What can they use from the first problem to help them solve the second problem? What do they see happening?
6. Post the red light and continue the round with 4 x 3, 8 x 3, 16 x 3 and 32 x 3. Post the green light and allow students to verbally share insights. Direct discussion toward developing some predictions about the pattern evolving. Also show students that they may feel they are not challenged with 4 x 3 but do they mentally know 16 x 3?
7. Use arrays to show the process for students having trouble discovering the patterns. The visual cues help students to picture what is happening, also tying in underlying concepts of area. Students can be provided manipulatives at their desk to aid them if needed.
8. Continue to practice and discuss other sets of problems for students to develop skills of doubling. Students need to discover that when a factor doubles, the product doubles. Other sets to work with are:

With continued practice, students recognize that when a factor doubles, the product doubles. On the flip side, when a factor halves, a product halves. Students become more confident in multiplication and specifically their ability to easily multiply both on paper and mentally.

Day 2:

9. After reviewing the lesson of the previous day and the strategies students discovered, write 2 x 1,

then 2 x 10, then post green light and allow discussion. Post the red light and continue with 4 x 10, 7 x 10, 11 x 10, 15 x 10, 22 x 10, and 34 x 10. Post green light and discuss as necessary. Extend to include a factor of 100 until students understand the multiplication pattern of 10/100/1000's.
10. Have students write strategies and understanding of multiplication in their journal.
Day 3:
11. Read the book *One Grain of Rice* to class.
12. As you read the book, have students begin to fill out worksheet *One Grain, Two Grains, Four Grains...*
13. Discuss the strategies that students used to complete the worksheet.

Extensions

Curriculum Extensions/Adaptations/ Integration

Allow differentiation by using the red light/green light concept in small groups. One student writes the beginning problem passing the paper to the next. The next student answers the first problem and then writes a related problem, passing the paper to the next person. The next person checks the answer of the previous, writes answer and passes paper. Activity continues with children checking, answering and writing related problems.

Vary the green light times by having students share their findings with a partner or write ideas in their journal and then share.

Extend learning by providing sets that put the commutative property into work.

Extend the lesson by teaching through sets of problems to not only double the product but also to halve factors and thus halve the product.

Special needs students and those with a weak knowledge of multiplication facts can become proficient at multiplication with practice using the doubling concepts.

Family Connections

Make a take home lesson kit. Allow students to take the jar, rice and scoop home and have parents determine the amount of rice in the jar, sharing their strategies with their child.

Give a homework assignment to develop a set of problems to practice the skills learned.

Have students find a quantity item in the home and write a strategy for determining the amount present.

Assessment Plan

Provide each group with a jar, rice and a scoop. Inform students that there are 1783 grains of rice in a scoop. Allow groups to develop their own strategy for determining the amount of rice in the jar. Students will then write about their process and findings in their journal. Share findings and compare to predictions made on the first day.

During the lesson, have students write in their journal expressing ideas and learning.

Give a word problem for students to solve. Ask students to solve the problem in as many different ways as they can and explain why their answers make sense.

Give students a set of similar problems to solve, similar to sets done during the lesson.

Bibliography

Research Basis

Baek, J.M. (2006). Children's Mathematical Understanding and Invented Strategies for Multidigit Multiplication. *Teaching Children Mathematics*. 12(5) 242-247.

Research was conducted with fourth grade students showing students who demonstrate flexibility in the methods chosen to perform computational multiplication understand and can explain chosen methods. Strategies that students develop themselves become a window to explore their understanding of multiplication.

Brandenburg, M.L. (2002). Advanced Math? Write! *Educational Leadership*. 60(3) 67-68.
This article examines one teacher's attempt to incorporate journal writing into the mathematics curriculum. Her discoveries included encouraging others to start small, develop a rubric and realize that you will learn as much about student learning, through journal writings, as the students did.

Authors

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