

## Activity: Word, Quantity, Symbol and Beyond

### Name of Lesson: Word, Quantity, Symbol, and Beyond

**Mathematics:** Investigating the digits 0-9

**Grades:** K-2

#### Materials Needed:

- Sets of digit cards – one per working pair
- Half sheets of chart paper
- Markers
- Paper and pencils

#### Launching the Lesson: Building the Context

1. *Our journey takes us to a small school in Rocky Ridge, Ohio. The principal's name is Mr. Maxwell. He is getting ready to order school materials for his primary classes so they can learn about patterns in our number system. Principal Maxwell is wondering what the fewest number of **digits** you would need to represent any number from 1 – 20. Can you help him so he can order the correct number of **digits** for his kindergarten teachers? He has to order the digits in sets of 0-9. Each of the sets costs 10 cents.*

Tell the students to turn and talk. Ask,

- **What is this question asking you to do?**
- **What might your students do to get started on this problem?**
- **What materials might you have available for your students to use?**

2. Clarify the math vocabulary being used.

- 3 is a number. It is also is part of the set of digits 0 – 9 that make up our number system
- A digit takes on the value of the place where the digit is located within the number.
- 23 has a digit in the ones place and a digit in the tens place. The **value** of those digits is related to their **place** or location.
- Digits can be found in our world in many different places.
- Sometimes digits just represent something and have no value or quantity. Telephone numbers are a set of digits with no value. Social security numbers are a set of digits used to identify a person. Our house numbers are made of digits.
- Ask the students to share other places in the world where numbers are used as digits. Chart their ideas.

3. Tell the students they will be working with a partner to explore how digits make up our numbers. Give each working pair a set of digits to explore the problem Mr. Maxwell is wondering about. Using half sheets of chart paper, tell them to show their math work and thinking.

### Exploring the Problem

1. As the students explore the number range chosen with base ten materials, walk around the room observing strategies being used to solve this problem. Ask probing or clarifying questions as you confer with the participants. Record your observations on an **Evidence Monitoring Chart for Word, Quantity, Symbol, and Beyond**.

- Decide which students' strategies you want to highlight during the Math Congress and write the **order** in which those students will present - from a less efficient strategy where trial and error approach was used to a more efficient example where the student was on the verge or used a systematic approach.

2. Display all the student samples for a **Gallery Walk**.

### 3. Sticky Note Gallery Walk Responses:

- Using sticky notes, ask the students to comment on two pieces of student work using the following coding system:
  - Use an *exclamation point* to make the comment **“Wow this is a great strategy and I want to try it!”**
  - Use a *question mark* to make the comment **“I think your work is interesting, but I am confused about the way you solved this problem.”**
  - Use a *star (\*)* to make the comment **“I like how you organized your work.”**

### Sharing the Learning

1. Call for a math congress by bringing the students together.
  - The purpose of this math congress is to highlight the work of students who were on the verge of using a “systematic approach.”
  - It is important to compare and contrast students' strategies used and to make connections between students' math work and past lesson experiences.
  - Highlight strategies students used to reach a conclusion that the fewest number of digits would be nine (one set of 0-9) as long as there is no number that needs to use the same digit twice. For example 11 needs 2 of the one digit. One set of 0-9 is not going to be enough, so to make the numbers from 0-20 would take 2 sets of 0-9 digits.

- As a whole group, write a generalization about the fewest number of digits needed to make the numbers 0-20. Ask them to explain why they think this rule will always be true.
- Look for:
  - **How will your strategy help us find all the ways that this rule is possible?**
  - **How do we know for certain that we have tried the strategy with enough numbers?**
  - **How does learning to use a systematic approach help students look for and make use of structure?**

### **Extensions:**

1. As time permits, have the students make predictions for making the numbers form 1-99, or 1-999. How many sets of 0-9 digits will you need? Explain how you know your rule will work and why.

2. Write a friendly letter to Mr. Maxwell to tell him about your findings for the numbers you investigated. He will need to know how many sets of 0-9 he will need to buy for the students in the primary classes and how much it will cost.

### **Assessment Tips:**

1. As the math congress comes to a close, consider these assessment ideas:
  - Using the progression of strategies is one way to look at what strategies students are using to help determine if students are using an efficient one or one lower on the scaffold. The goal is to move students toward using more efficient strategies as they travel the Landscape of Learning.
  - Formative Assessment is more than a written response, a pre-post test, or an answer to a question. Formative assessment can be questions you can ask to learn more about the thinking behind the answer.
  - Formative assessment questions you can ask yourself about your students
    - Which students are able to build numbers using the digit cards?
    - Which students are using trial and adjustment vs. a systematic exploration?
    - Which students are using the placement or location of the digits to change the value of a number?
    - Which students are noticing and using the patterns to discuss the digits 0-9?
    - Which students are making predictions and revisiting/revising those predictions?
    - Which students are making conjectures and collecting data to prove someone's ideas?
    - Which students are justifying their thinking - developing certainty of thought and logical thinking?
    - Which students are generalizing the patterns made by the digits in our counting system?

Digits 0-9

**1**

**2**

**3**

**4**

**5**

**6**

**7**

8	9	0	
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