

# *Great Ways to Differentiate* Math Instruction

Based on book by Marian Small

Presentation by EHSD Math Coaches  
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# Mathematical Tasks: A Critical Starting Point for Instruction

Not all tasks are created equal, and *different tasks will provoke different levels and kinds of student thinking.*

Stein, Smith, Henningsen, & Silver, 2000

# Today's Objective:

Teachers will learn two manageable strategies for differentiation and be able to apply them to the resources they presently have.

# Expected Outcomes

Students Will:

- ✓ Be more motivated to learn
- ✓ Develop deeper mathematical understandings
- ✓ Build confidence in their math skills

Teachers Will:

- ✓ Meet the needs of all the learners in their classroom
- ✓ Have a tool to quickly assess their students' developmental level in math

*If you were a 3<sup>rd</sup> grader, how might you respond to this question?*

In one cupboard, you have three shelves with five boxes on each shelf. There are three of those cupboards in the room. How many boxes are stored in all three cupboards?

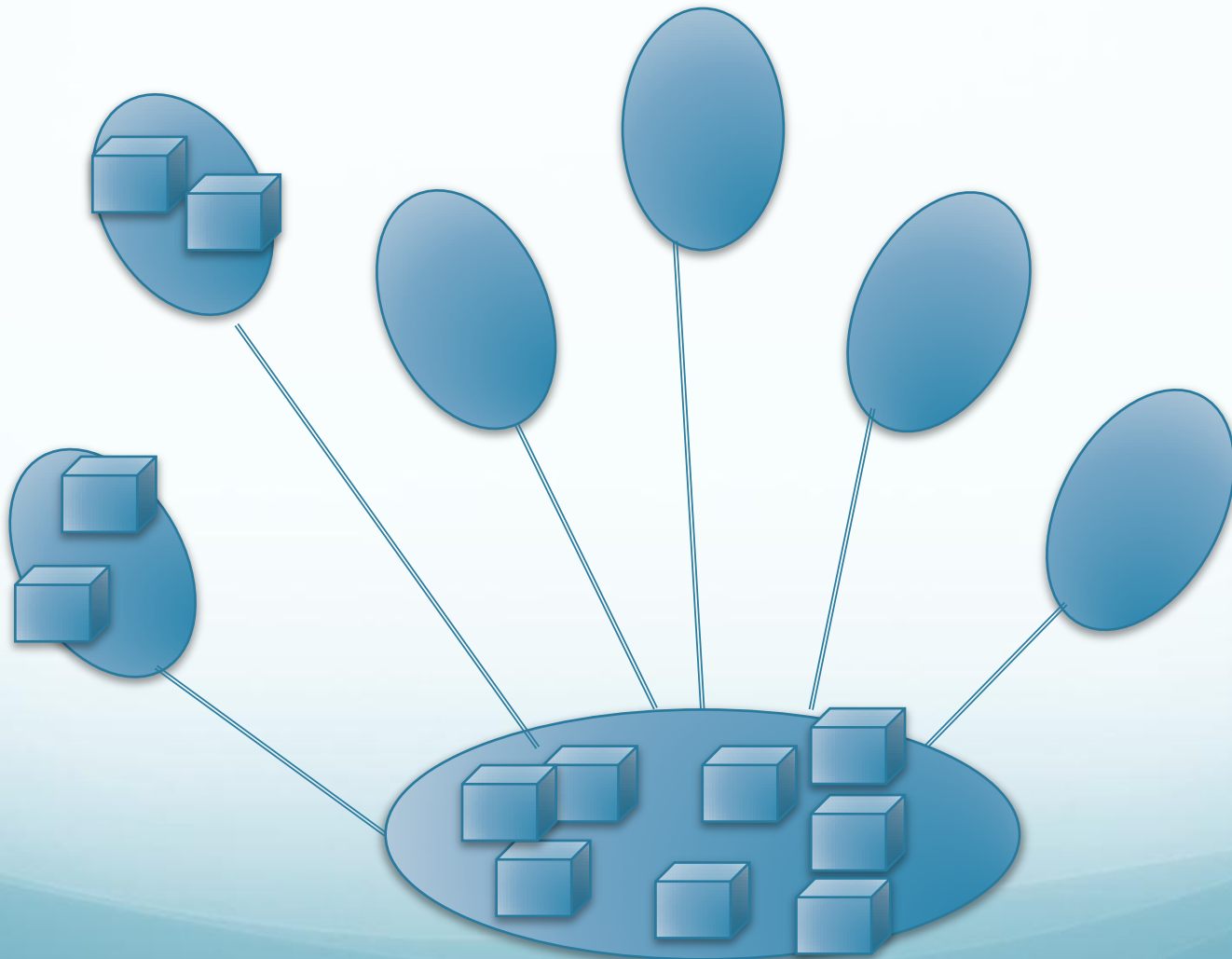


# How Students Differ

- Liam immediately raises his hand and simply waits for the teacher to help him.
- Amanda Bean draws a picture of the cupboards, the shelves, and the boxes and counts each box.
- Tara uses addition and writes  $5+5+5+5+5+5+5+5+5$ .
- Jason uses addition and writes  $5 + 5 + 5 = 15$ , then adds again, writing  $15 + 15 + 15 = 45$ .
- Sam uses a combination of multiplication and addition and writes  $3 \times 5 = 15$ , then  $15 + 15 + 15 = 45$ .

# Safety-Net Lesson

## *2 Types of Division Problems*



# *How do you meet the needs of the different students in your classroom?*

1. Provide tasks within each student's *zone of proximal development*.
  
1. Ensure that each student has the *opportunity to make a meaningful contribution* to the class community of learners.



# *Zone of Proximal Development*

Allows students to access **new** ideas that are close enough to what they already know to make the access feasible.



# Key Elements

- 1. Big Ideas.** The focus of instruction must be on the big ideas being taught to ensure that they all are addressed, no matter at what level.
- 2. Choice.** There must be some aspect of choice for the student, whether in *content, process, or product*.
- 3. Pre-assessment.** Prior assessment is essential to determine what needs different student have.

# *Big Ideas* for Number & Operations

- There are many ways to represent numbers.
- Numbers tell how many or how much.
- Number benchmarks, such as 10, 25, 100, 1000, are useful for relating numbers and estimating amounts.
- By classifying numbers (e.g., in terms of how many digits they have, whether they are odd or even, etc.) conclusions can be drawn about them.
- The patterns in the place value system can make it easier to interpret and operate with numbers.
- It is important to recognize when each operation (add, sub, multi, divide), is appropriate to use.
- There are many different ways to add, subtract, multiply & divide numbers.
- It is important to use and take advantage of the relationships between the operations in computational situations.

# Big Ideas

- Benchmark Numbers. A way to make sense of other numbers.
  - 1<sup>st</sup> grader – relates number 8 to more familiar 10
  - 3<sup>rd</sup> grader – relates number 93 to more familiar 100
  - 5<sup>th</sup> grader – relates fraction  $\frac{7}{8}$ ths to the number 1
  - 8<sup>th</sup> grader – relates  $\pi$  to the number 3

# Provide Choice

## 1. Main lesson goal

- ✓ Open Questions
- ✓ Parallel Tasks

## 2. Follow-up activities to the main lesson

- ✓ **Menus** where students choose from an array of tasks
- ✓ **Tiered lessons** where teacher instructs whole group then varies follow-up for different students
- ✓ **Learning stations** where different students attempt different tasks

# Pre-assessment

- *Drives* differentiation instruction
- Essential to know students developmental level
  - Abilities and deficiencies
- Can be combination of oral or written questions or tasks – keep it simple

# Make it Manageable!

- **Single** question or task
- Different approaches
- Different processes and strategies
- Different stages of mathematical development

Task with in zone of proximal development for entire class

# 2 Core Strategies

- Open Questions
- Parallel Tasks



# Standard vs. Open Questions

- Framed in such a way that a variety of responses or approaches are possible.
- Standard question: To which fact family does the fact  $3 \times 4 = 12$  belong?
- Open question: Describe the picture below by using a mathematical equation.

X X X X  
X X X X  
X X X X

# Suggestions for Writing Open Questions

- Turn a question around  
What is half of 20?  
10 is a fraction of a number? What could the fraction and number be?
- Asking for similarities and differences  
How are 85 and 100 alike? How are they different?
- Replacing a number with a blank  
 $\square + \square = 31$ . What can the 2 numbers be?
- Asking for a number sentence  
Create a number sentence using the numbers 3 and 4, along with the words “and” and “more.”
- Changing the question  
What number has 3 hundreds, 2 tens, and 4 ones?  
Can you model a number with 11 base-ten blocks? What could the number be?

# Parallel Tasks

- Set of tasks (2 or 3) that are designed to meet the needs of students at different levels, but get at the **same big idea** and can be **discussed together**.

Option 1: Create a word problem that could be solved by multiplying two one-digit numbers.

Option 2: Create a word problem that could be solved by multiplying two numbers between 10 and 100.

# Rich Conversation

- *What numbers did you choose to multiply?*
- *How did you know how many digits the product would have?*
- *What was your problem?*
- *How did you solve it?*

# Classroom Scenario

You want to teach division of three-digit numbers by one-digit numbers. Many students in your classroom are still struggling with multiplication facts and they're not ready for the types of questions that were originally planned.

## **Text Question:**

*Suppose that 4 students were delivering 176 newspapers and decided to share the task fairly. How many papers would each deliver?*

## **Open Question:**

*Choose a number of newspapers to be delivered and a number of students to deliver them. The job should be shared fairly. How many papers should each student deliver?*

## **Parallel Task:**

*Two students are delivering 24 papers on Sunday morning. The job should be shared fairly. How many papers should each student deliver?*

## **Discussion Questions:**

- *What operation did you choose?*
- *Why would you use that operation?*
- *Is there another way you could have determined the answer?*
- *How did you know that each student had to deliver more than 10 papers? Less than 100?*

**Let's try it!!**

**11Q - Q**