Differentiation Matters! Learn to Differentiate Instruction for Middle School Students

From the IDR²eAM Project: **I**nvestigating **D**ifferentiated Instruction and **R**elationships between **R**ational Number Knowl**e**dge and **A**lgebraic Reasoning in **M**iddle School

http://www.indiana.edu/~idream/

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SUMMARY of three lower prep strategies:

Choice Problems

- Single problem with choice of numbers; can have a choice of pairs of numbers if needed
- Usually around 3 choices is plenty
- Need to get to know your students' thinking around numbers—see notes about number choices on back
- Vary in what order number choices are presented (don't always list the most basic choice first)

- **Example:** Sara bought a sweater on sale. It originally cost ($75.50, $80, $92.75). It had been marked down (10%, 15%, 22%). What was the sale price? Draw a picture to determine your answer and explain your solution.

Open Questions

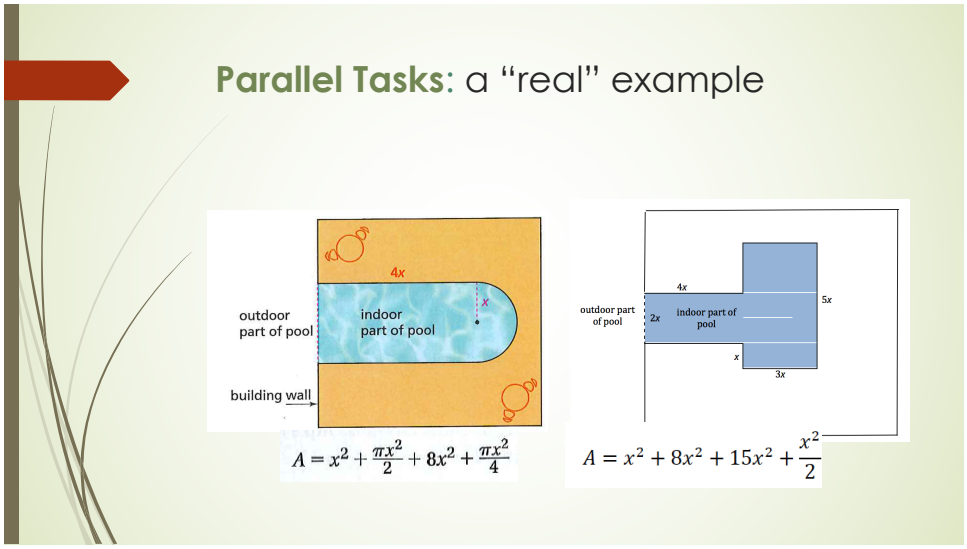
- Single problem where more basic and more sophisticated responses are possible (Small & Lin, 2010)
- Has many responses, can provoke good discussion
- Strategies:
  - Turn around a question: Instead of giving the question, give the answer and ask for the question.
  - Ask for similarities and differences between two numbers, shapes, graphs, probabilities, measurements, etc.
  - Replace a number (or more than one number) with a blank(s).
  - Ask students to create a sentence that includes certain numbers, quantities, and words.
  - Use "soft" words—words that are somewhat vague but not too ambiguous, such as "about" or "greater" or "slowly."
  - Use a standard textbook problem but change the question.
- Be careful of too much ambiguity or too much specificity, as well as having a mathematically meaningful question.

- **Example:** Jamie lists the first five terms of a linear pattern that grows quickly. Adrienne lists the first five terms of a linear pattern that grows slowly. What could their patterns be? Draw pictures and write rules to show them. (adapted from Small & Lin, p. 22)

Parallel Tasks

- A set of 2-3 problems that are designed to meet students at different mathematical levels but that target the same big idea and are close enough in nature that they can be discussed simultaneously (Small & Lin, 2010)
- Must identify differences in mathematical thinking that you want to target with the set of tasks. This is the challenging part!
- Choose contexts that are similar enough that whole class discussion can proceed together
- Vary which choice is the more/most advanced one!

- **Example:** Choose one of the two pools below. An equation is shown for the area of each pool, A.
  - Determine what part of the equation represents the area of the indoor part of the pool shown.
  - Then, use the equation to determine what the area of the outdoor part of the pool is, and draw a picture of an outdoor part of the pool that would have that area. (adapted from Connected Mathematics Project 3, *Say It With Symbols* unit)



Notes on Number Choices for Middle School Students

- **Whole numbers:** Almost any whole numbers are fair game; larger numbers will sometimes be harder to conceptualize, e.g., a rate of 12 gallons per minute v. a rate of 250 gallons per hour
- **Fractions:**
  - *Easiest:* ½, ¼, ¾, mixed numbers with ½, like 4 ½
  - *Harder:* other proper fractions
  - *Hardest:* improper fractions like 7/5 ←for some, 7/5 and 1 2/5 are NOT the same number
- **Decimals:**
  - *Easiest:* decimals with 0.5 like 2.5; decimals to tenths where the number is greater than 0.1, like 0.8, 4.3, etc.
  - *Harder:* decimals to the hundredths, like 0.12, 5.78, etc.
  - *Hardest:* decimals that go beyond hundredths and have 0s in some of the places, e.g., 13.075
- **Percents:**
  - *Easiest:* well-known percents like 25%, 50%, 75%, 10%, 5%
  - *Harder:* other whole number percents between 0 and 100%
  - *Hardest:* percents smaller than 1%, percents with fractions or decimal amounts (e.g., 33 1/3%, 57.5%), or percents larger than 100%

YOUR TASK

We invite you to:

1) **Choose a topic** that you will be working on soon with your students.
2) **Choose a lower prep strategy** and design or adapt a problem or set of problems for your students with that strategy. (If you have experience with differentiating instruction, feel free to choose a higher prep strategy—see next page!)
3) **Think about the choices you are offering**—why are they good choices for your students? Or, if you have designed an Open Question, what kind of more basic and more sophisticated responses do you expect?
4) **Work with groupmates at your table**, to help think about these issues!
5) **Share your problem(s)** with groupmates and/or with the whole group.

A Common Higher Prep Strategy: Tiering Instruction

- Provide different groups of students with different problems, or pathways of problems, that address the same big idea (Pierce & Adams, 2005; Tomlinson, 2005)
- Usually occurs after teachers have gotten to know students' thinking in a domain
- Usually occurs when teachers think students won't be a supported with a "one-size-fits-all" approach
- Have to develop ideas about problems, or pathways of problems, that may support different groups of students
- Having an anchor task can be helpful (a task students return to if they finish a particular problem or set of problems)

Other Higher Prep Strategies: (Tomlinson, 2005)

- Compacting
- Learning Centers
- Contracts

Same Speed Task:

The blue car goes ____ miles in ____ minutes. Find a distance and time for the red car so that it travels the same speed as the red car but in a different distance and a different amount of time. If you find a same speed pair, justify why it works with a picture and explanation.

Janet Bowers Races (geogebra app), from Joanne Lobato's Math Talk Project (mathtalk.sdsu.edu)

Choices: 15 miles in 6 min; 15 miles in 9 min; 18 miles in 3 min

References

Pierce, R. L., & Adams, C. M. (2005). Using tiered lessons in mathematics. *Mathematics Teaching in the Middle School, 11*(3), 144-149.

Small, M., & Lin, A. (2010). *More good questions: Great ways to differentiate secondary mathematics instruction*. New York and Reston, VA: Teachers College Press and the National Council of Teachers of Mathematics.

Tomlinson, C. A. (2005). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). Upper Saddle River, NJ: Pearson.