Differentiation Matters!
Learn to Differentiate Instruction for Middle School Students

Amy Hackenberg, ahackenb@iu.edu

Patti Walsh, pawalsh@iu.edu

Marie Johannisson, mjohanni@mccsc.edu

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Link to handout:
https://bit.ly/2ORiBQ7
Handout is also posted to Speakers Room.

- Mentimeter: www.menti.com, code: 33 24 8
- Index card:
  1. Rate your experience with differentiating instruction on a scale from 1 (not experienced) to 5 (experienced).
  2. What questions do you have about holding class discussions when students have worked on different problems or with different numbers?

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Plan for today

- Overview of differentiating instruction, lower prep tasks
- Work time (design problems for your students)
- Share out
- Discuss how to hold class discussions across different problems/numbers

What Differentiating Instruction is NOT

- Individualized instruction only
- Just another way to organize “homogenous” groupings within a class, i.e., tracking
- Giving a "normal" assignment to most students and a "different" assignment to struggling or advanced students. **Why can this be detrimental?**

What Differentiating Instruction *IS*

- **Providing multiple approaches to content, instructional processes, and what students produce**
  (Carol Tomlinson)
- Adaptive and student-centered
- Rooted in on-going formative assessment
- A blend of whole-class, group, and individual instruction
- About building community across differences

- **You can differentiate for students'**
  - different ways of thinking
  - Interests
  - learning preferences/styles
  - readiness or background knowledge

Foundations of Differentiating Instruction

- **Explore and clarify learning goals for students** about Big Ideas in mathematics
- **Implement on-going assessment** to get to know students' thinking
- **Provide choices**
- **Use flexible groupings** for different purposes
- **Establish specific classroom norms** about difference and autonomy

Norms for Differentiating Instruction

- **Respect for all**
- **Respect for differences:** Is it fair to NOT recognize differences, when everyone is different?
- **Self-directed learning**
- ***Group* autonomy:** Develop roles and group rules so groups can function effectively without immediate teacher support and amid different activities

Differentiating to address students' diverse ways of thinking

- Requires understanding different levels at which students think and learn…
- ***For example:*** Are some students reasoning additively when working on ratio problems? Do they persist in reasoning additively, even after teacher interventions?
- This can mean that they have not yet developed structures in their thinking that allow them to regularly reason multiplicatively. <u>Need to start where they are in order for them to have a chance to make progress</u>!

Techniques for differentiating to address students' diverse ways of thinking

LOWER PREP

- Choice problems
- Open questions
- Parallel tasks

HIGHER PREP

- Tiered lessons or assignments
- Compacting
- Learning Centers
- Contracts

Choice Problems

- **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.
- **Characteristics and notes:**
  - ***A Choice Problem*** is a question or problem in which teachers provide different number choices.
  - Usually three choices is best (more can be overwhelming).
  - Let students choose—their choice itself is instructive.
  - However, also feel free to suggest choices you think would be good ones, usually after they have solved—or tried to solve—the problem with their choice(s).

Strategies for Designing **Choice Problems**

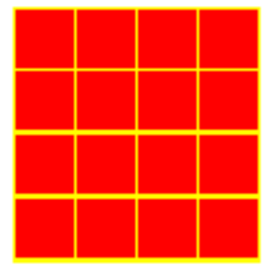
- Aim to tailor numbers to the different mathematical thinkers in your class.
- Must identify differences in students' thinking with regard to type or size of number.
  - You can do it as you get a feel for what types or ranges of numbers are sensible to students, and what types or ranges of numbers are challenging.
  - *This requires making careful observations of students.*
- Vary in what order number choices are presented (don't always list the most basic choice first).

Notes about 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 <u>proper</u> fractions
  - *Hardest:* <u>improper</u> 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%

Open Questions

- **Examples:** (adapted from Small & Lin, 2010)
- 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. (p. 22)
- The fifth term of a pattern is a design that looks like the 4 by 4 square shown. What might the first three terms look like? Why? Describe the pattern. (p. 27)



- You write a fraction as a percent, and the percent is of the form ___ ___ ___ . ___ %. What do you know about the fraction? (p. 66)

Open Questions

- **Characteristics and notes:**
  - ***An Open Question*** is a question or problem for which a variety of responses are possible, including more basic responses and more complex ones (Small & Lin, p. 7).
  - An open question typically has many answers.
  - Open questions can spark good mathematical discussions, in part because many students can contribute.

Strategies for Designing **Open Questions** (Small & Lin, p. 8)

- 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.

Strategies to Avoid in Designing **Open Questions**

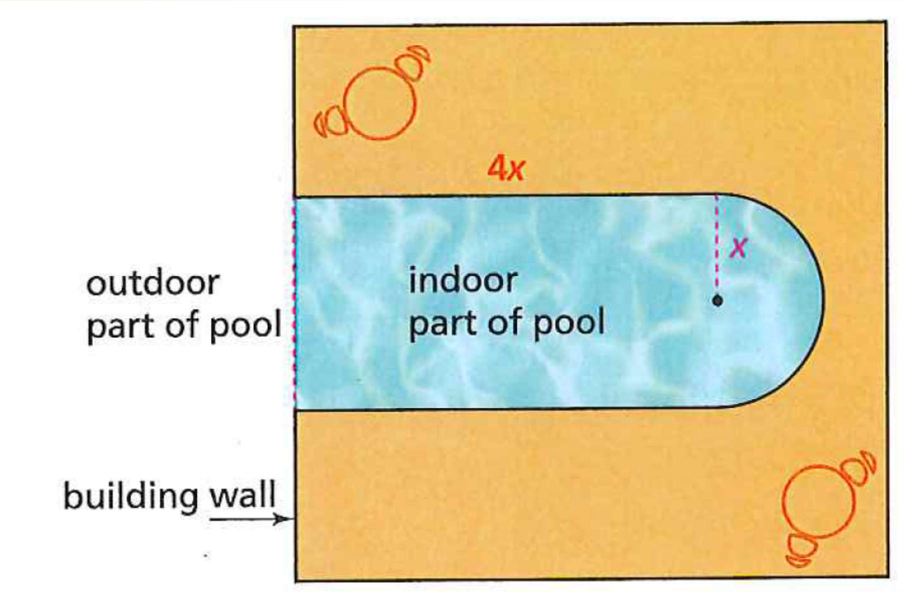
- Not having mathematical meaningfulness.
  It's okay to ask "what does the number 3/4 make you think of?" *occasionally*, but this kind of question by itself is not meaty enough.
- Too much ambiguity.
- Too much specificity.

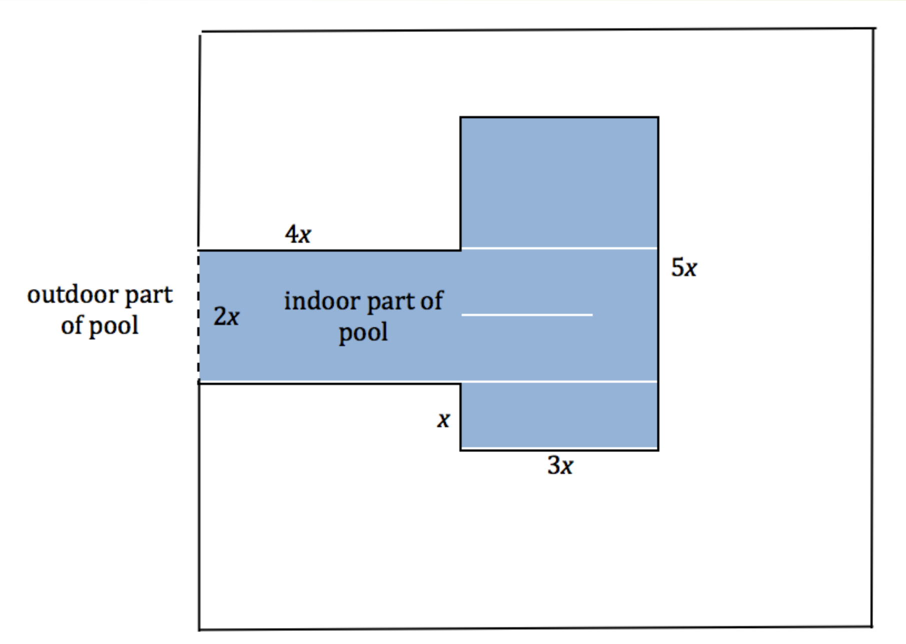
Parallel Tasks: example 1

- ***Weight of Candy Bars Problem.*** Ming has five identical candy bars. Each bar weighs *h* ounces. Draw a picture of what 1/7 of all the candy looks like. How much does 1/7 of all the candy weigh? Explain your drawing and your answer.

- ***Sharing Candy Bars Equally Problem.*** Ben has three identical candy bars. Each bar has the same unknown length. How can you share these bars equally with five people? Show how to make the equal shares. Draw out the share for one person and tell how much of a candy bar one person gets. How much of all the candy does one person get? Explain your answers.

Parallel Tasks: a "real" example





$$A = x^2 + \frac{\pi x^2}{2} + 8x^2 + \frac{\pi x^2}{4}$$

$$A = x^2 + 8x^2 + 15x^2 + \frac{x^2}{2}$$

Parallel Tasks

- **Characteristics and notes:**
  - ***Parallel Tasks are*** a set of tasks (usually 2) that are designed to meet students at different mathematical levels <u>but that target the same big idea and are close enough in nature that they can be discussed simultaneously</u>.
  - Let students choose the task they will work on—again, their choice is instructive.
  - However, you can certainly invite students to try particular tasks (usually it's best to do this after they have worked on their choice).
  - In whole class discussion, it's important to value contributions from students solving any of the tasks, rather than privilege discussion from the most or least advanced task, for example.

Strategies for Designing **Parallel Tasks**

- Must identify differences in mathematical thinking that you want to target with the set of tasks. This is the challenging part!
  - Understanding a variety of ways that students learn the topic, as well as what ideas students struggle with, is important.
- Choose contexts that are similar enough that whole class discussion can proceed together.
- Vary which choice is the more/most advanced one!

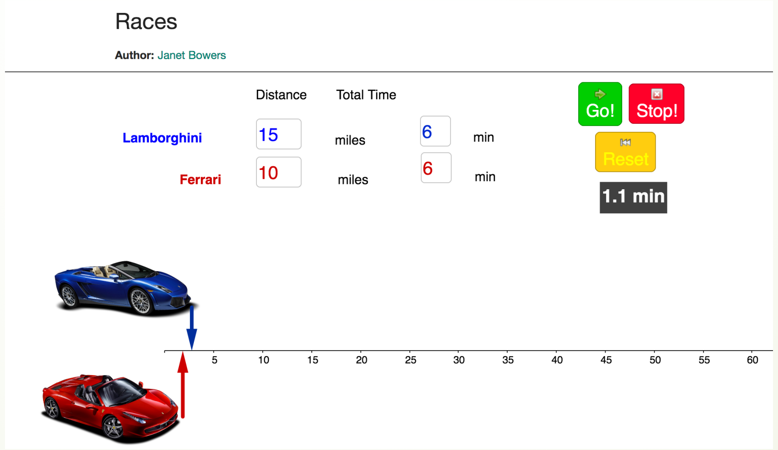
Your Task (p. 3 of handout)

- ***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)
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**
5. **Share your problem(s)** with groupmates and/or with the whole group.

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 blue 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.



Holding Whole Class Discussions across different problems

- With the student work on the Same Speed Task, how would you sequence the discussion?
  - Can you do it in a way where you don't put the most basic solution first?
- How could you shape the conversation to support students with the most basic solution to participate?

THANK YOU!

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- *What IDR^{2}eAM stands for:*
  Investigating **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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- Tomlinson's website: http://www.caroltomlinson.com/
- http://differentiationcentral.com/
- Amy's project called IDR^{2}eAM: www.indiana.edu/~idream

Why differentiate instruction?

- **Personal/professional reasons:**
  - Want to connect with the widest range of students possible;
  - Want to help the widest range of students learn the most;
  - **Can see that what I do in class works differently with different students:** My instruction is not "the same" instruction for all students in the same class.
- **Broader social/professional reasons:**
  - US classrooms are increasingly diverse in many ways: Culturally, ethnically, linguistically, cognitively
  - Classrooms without differentiated instruction are often not serving students well… even advanced students.
  - **Tracking has been found to be a source of inequity in US schools…**
  - In fact, NCTM (2018) recently recommended that high schools de-track math classes! San Francisco Unified is de-tracking…