Effective Differentiation *in* Mathematics

presented by

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Session Objectives

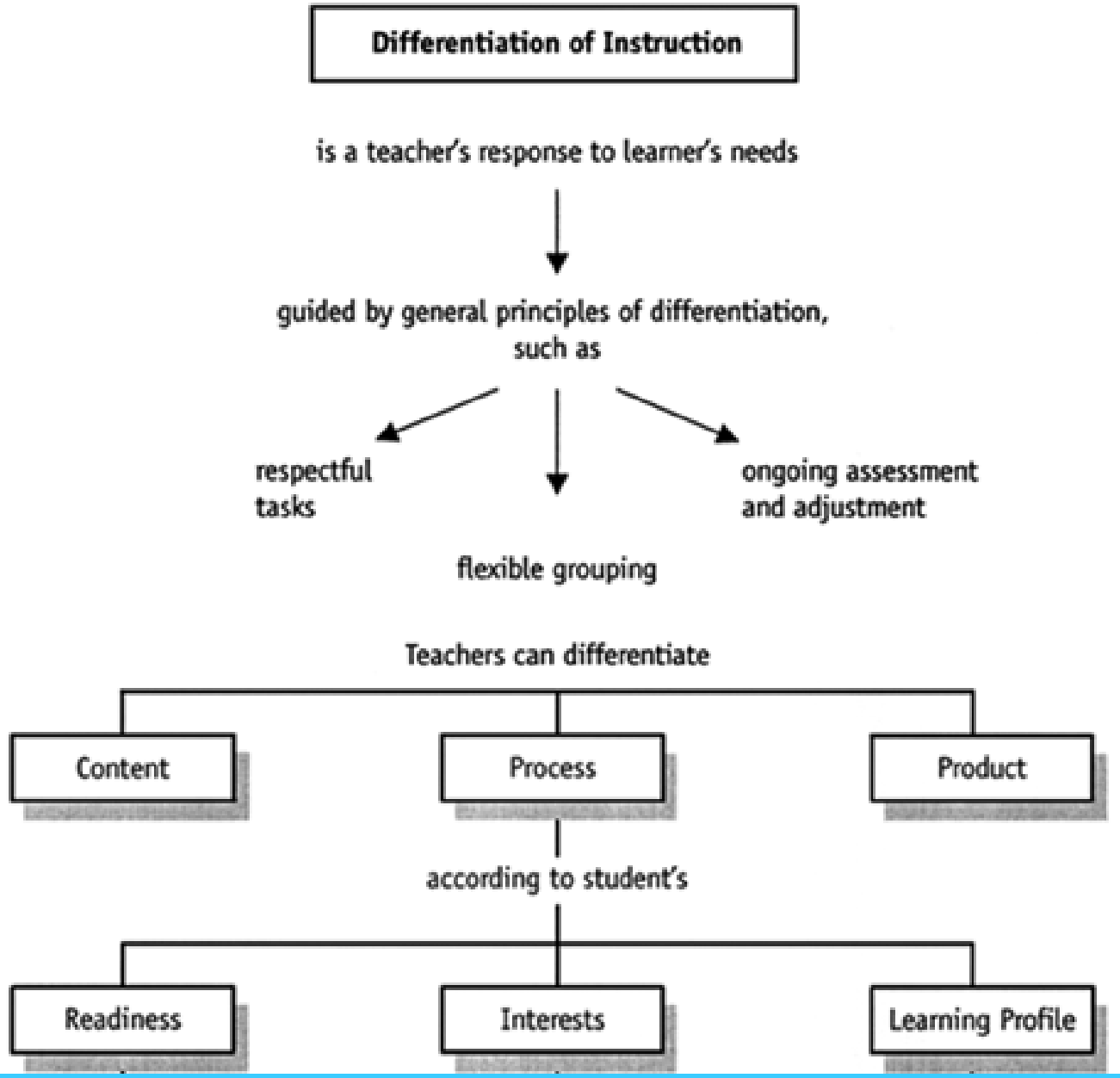
✓Define Differentiation

✓Explore DI strategies for math.

- Math Talks
- Open Questions
- Multiple Access Points
- Student Choice

✓Considerations

ASCD's interpretation of differentiation:



http://www.ascd.org/publications/books/100216/chapters/Understanding-Differentiated-Instruction@-Building-a-Foundation-for-Leadership.aspx

A definition for today…

Differentiation refers to a wide variety of teaching techniques and lesson adaptations that educators use to instruct a diverse group of students, with diverse learning needs, in the same course, classroom, or learning environment.

Differentiation is modifying the content, process, or product of a learning experience based on individual students' needs and/or interests.

Why is differentiation so important?

- Our classrooms are full of diverse learners
- Teaching everyone one way will alienate someone
- Meeting students needs and interests will help alleviate many discipline issues
- Meeting students needs and interests will help them achieve at a higher level
- Connections to Danielson

Roadblocks to Differentiation

What obstacles keep us from differentiating?

Strategies for Differentiating:

There are MANY different ways to differentiate math instruction to meet the needs of all the learners in your classroom. Today we are going to look at these 4 methods. Our focus is on “inclusive” differentiation strategies.

1. Math Talks
2. Open Questioning
3. Multiple Access Points
4. Student Choice

Math Talks

The teacher poses a purposeful problem. Students signal when they are ready to share a solution. The teacher collects answers orally. Students explain or defend their answers. The teacher records student strategies and asks questions to facilitate mathematical discourse. Finally, the class comes to a consensus.

Jo Boaler Video about Number Talks

http://www.ilteachandtalk.org/

38 + 37

Why it works…

1. Students become more active listeners, eager to hear the different strategies shared.

1. Emphasis is on the solution path or strategy not the answer.

1. Deeper conceptual understanding due to the analysis of the mathematical reasoning behind the strategies.

1. Students use the math skills they are most comfortable with to approach the problem.

Open Problems

Open refers to a problem which has more than one correct answer and more than one strategy to obtain an answer.

Video-Jo Boaler's TED Talk featuring an open-ended math problem

Grade 1 -

How could you organize 27 skittles to make them easier to count?

Grade 7 -

74 is ____% of ____.

Grade 8 -

Find 3 positive integers that add up to 10.
Use them to fill in the blanks in this expression.
Find the largest possible result.

(____) x (____) –

http://www.openmiddle.com/

Why it works…

1. Students are exposed to many different ways of thinking.

1. All students can approach the problem using the skills they are personally comfortable with.

1. Many different ways of thinking are acknowledged and validated.

1. Students reach a deeper level of conceptual understanding.

Problems with Multiple Access Points

Engaging students with problems that can be solved in multiple ways.

Approached with different skill sets.

Jo Boaler and Low Floor/High Ceiling Problems:
https://www.youtube.com/watch?v=Jeel4Qjow4s

“My ideal oreo cookie would be a triple double. What would be the nutritional information of a triple double?”

NUTRITION FACTS

Serving Size: 34 g
Serving per container about 12

Amount Per Serving

	3 Cookies (34g)
Calories 160	
Calories from Fat 60	
	% Daily Value*
Total Fat 7g	11%
Saturated Fat 2g	10%
Trans Fat 0g	0%
Monounsaturated Fat 3g	0%
Cholesterol 0mg	0%
Sodium NaNmg	6%
Potassium 55mg	2%
Total Carbohydrate 25g	8%
Dietary Fiber 1g	3%
Sugars 14g	
Protein 1g	

Vitamin A 0%		Calcium 0%	
Vitamin C 0%		Iron 8%	

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholest	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carb		300g	375g
Fiber		25g	30g

NUTRITION FACTS

Serving Size: 29 g
Serving per container about 15

Amount Per Serving

	2 Cookies (29g)
Calories 140	
Calories from Fat 60	
	% Daily Value*
Total Fat 7g	11%
Saturated Fat 2g	10%
Trans Fat 0g	0%
Monounsaturated Fat 3g	0%
Cholesterol 0mg	0%
Sodium 90mg	4%
Potassium 35mg	1%
Total Carbohydrate 21g	7%
Dietary Fiber 1g	3%
Sugars 13g	
Protein 1g	

Vitamin A 0%		Calcium 0%	
Vitamin C 0%		Iron 6%	

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
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Sodium	Less than	2,400mg	2,400mg
Total Carb		300g	375g
Fiber		25g	30g

Why it works…

1. Again, students are approaching the problem with the math that they are most comfortable with.

1. The problem is grade level appropriate.

1. Students see connections between the various strategies.

Student Choice

Engaging students with Variety and Choice. Provide your students with a variety of contexts in which they can apply the math. Provide different ways for them to explore the math – hands on manipulatives, technology, drawings, etc.

Examples: Math Menu, Choice Boards, Workshops, Math Pass

How can we make this easy to implement?

- Come up with a template or pattern that you follow.

- Find resources that you can easily use as a choice/station/workshop.

- Menu Video
- Choice Board Examples and how one teacher implements them for her 8th grade math class Thank you, Mrs. Delfino
- Math Pass Workshops Example

Workshop 1 $1,000,000	Workshop 2 DD	Workshop 3 Texting Facts
If 1 million, one-dollar bills are lined up end to end, how far would they measure? **First estimate a length (a football field, 10 miles, across Illinois, from California to New York)** **Determine a length and be prepared to share your strategy and your answer.** 	 How many Hot Chocolate choices are available?	Did you know that 8 trillion text messages are sent every day worldwide? Breaking it down, that comes out to 15.2 million text messages sent per minute. Our research team has done a deep dive and pulled together some interesting text messaging facts that we think you'll find thought-provoking. ❖ Average American checks their phone 46 times per day ❖ Text messages are read on average in under five seconds ❖ The average Millennial exchanges an average of 67 text messages per day **<u>Create 3 Mathematical Questions using the Texting Facts.</u>**
Workshop 4 Problem Solving	**Workshop 5 Challenge Questions**	**Workshop 6**
70 Must know Word Problems	Questions found on pg. 13	Math Facts Or Computer Challenge

Real World	Technology	Logic Puzzle	On Topic Extension	Refreshers
			Illustrative Mathematics Tasks	

Math Pass

Please complete 3 out of the 5 Problem Solving Centers

Due Date _____

Name_____

1	2	3	4	5
$1,000,000	Dunkin Doughnuts	Texting Facts	Question 61 Money and Fractions	Challenge Geometry Fractional side lengths

Choice Boards

The following are the Choice Boards for the year.

1. Students are to complete **two activities** each month.
2. These two will calculate as a test grade for that month.
3. Student can complete one extra Choice Board **per semester** for extra credit!
4. If the cover sheet is not handed in with the project, **5 points** will be deducted from grade.
5. Time management + responsibility = great score!!

Create a table showing the first ten digits of the following graphs: 1. $y = 3x - 2$ 2. $y = -5x + 8$ 3. $y = 2x + 3$ 4. $y = -6x - 9$ 5. $y = 7x$	Using the current calculator you have for this class, create a function button sheet consisting of 5 essential buttons for graphing. Explain what each buttons functions is and how to get to that button.	Track the temperature for 10 days in this month. Make a chart to show your data. Create a line graph to show the pattern over the ten days. Under your graph, find the mean, median, mode, and range.
Create a HOW-To worksheet or POSTER for linear equations. Have the sheet explain to students how to make an equation from a table. Show the difference between the slope(pattern) and the y-intercept(starting point)	Create a Wanted Poster for the People of Folcroft. Pretend you are an equation looking for your matching table and/or graph.	Create a practice worksheet for the class using ten patterns you make up. Attach an answer key.
Copy/write 5 linear tables down one column of loose leaf. In the column next to it, write the equation for the table. Then write a statement under each equation telling how to find the m and b given the table.	Find a worksheet online that you can print out and complete. The worksheet should have you plot points and/or find the coordinates for given points. There should be at least 20 questions.	Create a powerpoint of at least 5 slides reteaching a topic we learned this month. Include vocab, examples and practice problems with answers. Print out the slides or email them to me.

- Choice Board Examples

Why it works…

1. Students feel ownership of their learning and are therefore more engaged.

1. Students are given opportunities to demonstrate their talents while exploring math concepts. Very empowering!

A few things to consider…

1. Facilitate productive struggle.
    - I do… We do… You do… trains students to wait for the teacher

1. Differentiate within the grade level.

1. Empower students to reach their full potential.

1. Provide opportunities for students to identify with context/content.

Common Misstep	Recommendation
Blindly adhering to a pacing guide/calendar	**Use formative data** to gauge student understanding and inform pacing
Halting instruction for a broad review	**Provide just-in-time** support within each unit or during intervention
Trying to address every gap a student has	**Prioritize most essential prerequisite** skills and understanding for upcoming content
Trying to build from the ground up or going back too far in the learning progression	**Trace the learning progression, diagnose, and go back just enough** to provide access to grade-level material
Re-teaching students using previously failed methods and strategies	**Provide a new experience** for students to re-engage, where appropriate
Disconnecting intervention from content students are learning in math class	**Connect learning experiences** in intervention and universal instruction
Choosing content for intervention based solely on students' weakest areas	**Focus on Major Work** clusters from current or previous grades as it relates to upcoming content
Teaching all standards in intervention in a step-by-step, procedural way	**Consider the aspect of Rigor** called for in the standards when designing and choosing tasks, activities, or learning experiences
Over-reliance on computer programs in intervention	**Facilitate rich learning experiences** for students to complete unfinished learning from previous or current grade

https://achievethecore.org/aligned/designing-shifts-aligned-interventions-in-the-math-classroom/

Mathematicians Project - Annie Perkins

https://arbitrarilyclose.com/2016/08/21/the-mathematicians-project-mathematicians-are-not-just-white-dudes/

Need support with any of the materials included here? Reach out to one of our Math Content Specialists!

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Tools and Resources for:

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MATH
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Social Emotional Learning
Technology
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