Effective Differentiation in 6-12 Mathematics

presented by
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ISBE Math Content Specialists

Today’s slide decks are available at http://www.mathteachersinaction.org/
Session Objectives

✓ Define Differentiation

✓ Explore DI strategies for math.
  • Math Talks
  • Open Questions
  • Multiple Access Points
  • Student Choice

✓ Considerations
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.

ilteachandtalk.org
If I bought a computer for $150 and used a 75% off coupon, what was the original price of the computer?
Why it works...

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

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

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

• 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.
Robert Kaplinsky shared this example...

Kaplinsky is looking for student work examples for these problems. If you are interested in trying this out with your students, here is the form to share your results

https://goo.gl/forms/xr3fQIBUsPE7vvUQ2

**PROBLEM ONE**

Solve for \( x \).

\[ 4x + 3 = 2x + 7 \]

**PROBLEM TWO**

Using the digits 1 to 9, at most one time each, place a digit in each box to create two equations: one where \( x \) has a positive value and one where \( x \) has a negative value.

\[ \phantom{+} x + \phantom{a} = \phantom{a} x + \phantom{a} \]
74 is ___% of ___.

6.RP.3
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.

\[( \_\_\_ ) \times ( \_\_\_ ) \]
Using the whole numbers 0 through 9, no more than once, fill in the following boxes to make one function to have one real root and the last function have two real roots.

\[ y = \square x^2 + \square x + \square \]

\[ y = \square x^2 + \square x + \square \]

\[ y = \square x^2 + \square x + \square \]
Why it works...

• Students are exposed to many different ways of thinking.

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

• Many different ways of thinking are acknowledged and validated.

• 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
“My ideal Oreo cookie would be a triple double. What would be the nutritional information of a triple double?”
Why it works...

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

• The problem is grade level appropriate.

• Students see connections between the various strategies.
Student Choice

• Engage 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.
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
  
  • ISBE Choice Board Examples(Grades 2-7)
  • Grade 8 and Algebra 1 (Thank you, Trish DeFino and Sarah Wentworth for creating and sharing these with us!)
  • http://www.mathteachersinaction.org/choice-boards-2-algebra.html
<table>
<thead>
<tr>
<th>Task 1</th>
<th>6.RP.1</th>
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<tbody>
<tr>
<td>Given the Tape Diagram, write a ratio and a word problem to go along with the picture.</td>
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<thead>
<tr>
<th>Task 2</th>
<th>6.RP.2</th>
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<tr>
<td>Yellow and blue paint were mixed in a ratio of 5 to 3 to make green paint. After 14 liters of blue paint were added, the amount of yellow and blue paint in the mixture was equal. How much green paint was in the mixture at first?</td>
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<td>Represent this multi-step problem with two pairs of tape diagrams.</td>
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<tr>
<th>Task 3</th>
<th>6.RP.1</th>
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<tbody>
<tr>
<td>Engage NY Lesson Module 1 Lesson 7 Example 1 and 2 Handout Below</td>
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<tr>
<th>Task 4</th>
<th>6.RP.3</th>
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<tr>
<td>Solve each problem and describe how the problems are similar and different.</td>
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<tr>
<td>1. After a 20% discount, the price of a SuperSick skateboard is $140. What was the price before the discount?</td>
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<tr>
<td>2. A SuperSick skateboard costs $140 now, but its price will go up by 20%. What will the new price be after the increase?</td>
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<th>Task 5</th>
<th>6.RP.1</th>
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<tr>
<td>Slimy Gloopy mixture is made by mixing glue and liquid starch in a ratio of 3 to 2. How much glue and how much starch is needed to make 85 cups of Slimy Gloopy mixture? Use a Tape Diagram to solve.</td>
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<tr>
<th>Task 6</th>
<th>6.RP.3</th>
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<tr>
<td>A credit card company charges 17% interest on any charges not paid at the end of the month. Make a ratio table to show how much the interest would be for several amounts. If your bill totals $450 for this month, how much interest would you have to pay if you let the balance carry to the next month? Show the relationship on a graph and use the graph to predict the interest charges for a $300 balance.</td>
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<td>Source: Kansas Department of Education <a href="https://community.ksde.org/LinkClick.aspx?fileticket=J4xYrFOUWG%3d&amp;tabid=5646&amp;mid=15542">https://community.ksde.org/LinkClick.aspx?fileticket=J4xYrFOUWG%3d&amp;tabid=5646&amp;mid=15542</a></td>
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<tr>
<td>Choice Board Examples</td>
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<td>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. $y = 7x$</td>
<td>Using the current calculator you have for this class, create a function button sheet consisting of 5 essential buttons for graphing. Explain what each button 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.</td>
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<td>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.</td>
<td>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.</td>
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Why it works...

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

- Students are given opportunities to demonstrate their talents while exploring math concepts. Very empowering!
A few things to consider...

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

- Differentiate within the grade level.

- Empower students to reach their full potential.

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

The Mathematicians Project: Mathematicians Are Not Just White Dudes

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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