Your Math Students: Engaging and Understanding Every Day
Your Math Students

Engaging and Understanding: Every Day

Francis (Skip) Fennell, PhD
McDaniel College

Tim Hudson, PhD
DreamBox Learning

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Established in 2009, [www.mathspecialists.org](http://www.mathspecialists.org) has been expanded to include a monthly project blog related to leadership challenges for specialists and also contains professional development considerations related to implementation of the Common Core State Standards. The ems&tl Project staff regularly presents at regional and annual NCTM and NCSM conferences. Such presentations will continue to focus on leadership issues and transitioning to and implementation of the Common Core State Standards. The Project is also considering national elementary mathematics specialist events at regionally hosted sites.

The project continues to develop print, pencast, and online case-based leadership modules to advance the dialogue related to challenges specialists face. Such challenges include: mathematical content knowledge, pedagogy, mentoring, and professional relationships, as well as other aspects of the role of the mathematics specialist/instructional leader.

The ems&tl Project is focusing on the location and development of documentation efforts which analyze and support elementary school mathematics specialists, while continuing to identify leadership issues and related challenges elementary mathematics specialists face in their work with teachers, students, other professionals, and the school community.
Principles to Actions

- Mathematics Teaching Practices

- EVERYDAY Considerations

- A planning guide…

NCTM, 2014
What I/we want...

Doing the math; gettin’ dirty – it’s all good!
Tasks
Implement Tasks that Promote Reasoning and Problem Solving

“effective mathematics teaching uses tasks as one way to motivate student learning and help students build new mathematical knowledge through problem solving” (NCTM, 2014, p. 17).

• Every day!
• How do I/we find them?
• How do we know if they are “good?”
Grade 4: Measurement & Data

- Stacey and her friends from fourth grade measured their heights. Here are some of the heights they recorded:

<table>
<thead>
<tr>
<th>Student</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper</td>
<td>50 inches</td>
</tr>
<tr>
<td>Ken</td>
<td>4 ¼ feet</td>
</tr>
<tr>
<td>Cam</td>
<td>1 ½ yards</td>
</tr>
<tr>
<td>Mia</td>
<td>4 feet and 4 inches</td>
</tr>
</tbody>
</table>

- List the friends from tallest to shortest.
Tasks – Ideas and Sources

• The Illustrative Mathematics Project: https://www.illustrativemathematics.org
• Learn Zillion: https://learnzillion.com
• Mathalicious: http://www.mathalicious.com
• Yummy Math: http://www.yummymath.com
• NCTM’s Illuminations: http://illuminations.nctm.org
<table>
<thead>
<tr>
<th>Mathematics Standard (e.g. 4.0A.A or other related state code)</th>
<th>Mathematics Content Focus (e.g. multiplication and division concepts)</th>
<th>Is the mathematics appropriate for this grade level? (yes/no)</th>
<th>Is the context/setting of the task appropriate? (yes/no)</th>
<th>Will the task engage students in doing mathematics? (yes/no)</th>
<th>Are representational tools needed? (yes/no; if yes, indicate tools)</th>
</tr>
</thead>
</table>

Insert task here:
CCSS 6.RP.3
Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
Representations
Pape and Tchoshanov (2001) recognized that depth of understanding is related to the level of connections among mathematical representations students have not only experienced, but have, through their use, internalized. This is important: Student involvement with representations, physical, virtual, or otherwise, can’t be a ‘once and done’ opportunity for important mathematics concepts and related procedures.
Use & Connect Mathematical Representations

• First grade: Subtract multiples of 10…, using concrete models or drawings…
• Third grade: Understand a fraction as a number on the number line; represent fractions on a number line diagram.
• Fifth grade: Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and…
• Eighth grade: Construct and interpret scatter plots for…
| Mathematics Standard (e.g. 1.NBT.A or other related standard code). | Provide Standard here |
| Mathematics content focus (e.g. place value). | Note content focus here |
| What representations will be utilized? | Indicate representations to be used |
| How will students independently use the representations? | Brief description of how representations will be used |
| Will the representation’s use engage students in mathematical sense making? | Circle one yes no |
| Are the tasks completed using representations mathematically and pedagogically appropriate? | Circle one yes no |
| Approximate time for students to use and discuss problem solutions with the representations provided/used. | Provide approximate time |

**Comments:**
CCSS 5.NBT.1
Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
Conceptual Understanding & Fluency
Build Procedural Fluency from Conceptual Understanding

- fluency is important, but it’s not well understood.

- Your grade level team should find the time to reach a better understanding of fluency and agreeing on what it “looks like” in student performance.
Fluency: Facts and Procedures

• While *related*, fluency in recalling related addition and subtraction and multiplication and division facts is *different than* fluency with procedures for adding, subtracting, multiplying, and dividing whole numbers, fractions, and decimals – a lot different.

• Most importantly, you seek fluency (efficiency and accuracy) with understanding – the how’s and why’s of procedures and their use.
A Plan

• As your grade level or school learning community begins your discussion of fluency, consider the following:

  – When and where (which standards) is fluency expected at your grade level?

  – Are the expectations, at particular grade levels, related to fact acquisition, the use of algorithms, or both (e.g. grade 3 CCSS-M)?

  – How can the developmental trail from counting and place value to fluency with procedures be accomplished along with developing a sense of number?
CCSS 6.NS.3
Fluently subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Choose a monster that The Amazing Algorithm can solve in the fewest number of steps.

\[
\begin{align*}
3.49 - 1.68 &= 1.81 \\
4.93 - 2.20 &= 2.73
\end{align*}
\]
CCSS 5.NBT.7
Add decimals to hundredths, using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
Assessing to Monitor & Inform
Formative Assessment Strategies

1. **Clarifying** learning intentions and sharing criteria for success.
2. **Engineering** effective classroom discussions, questions, and learning tasks that elicit evidence of learning.
3. **Providing** feedback that moves learners forward.
4. **Activating** students as the owners of their own learning.
5. **Activating** students as instructional resources for one another.

Willam and Leahy, 2007; William and Thompson, 2007, and NCTM Research Brief
Formative assessment is:

• Students and teachers,
• Using evidence of learning,
• To adapt teaching and learning,
• To meet immediate learning needs,
• Minute-to-minute and day-by-day.

Love this...

Thompson and William, 2007
Elicit and use evidence of student thinking – CBFA’s

These are connected to planning & teaching...

• Observation -
• Interviews
• Show Me

• Hinge Question
• Exit Task
Thinking about the CBFA’s

• **Observations** – what will you look for and how will you know “it” when you see it?

• **Interviews** – not a deficit model but an 1-on-1 or small group opportunity.

• **Show me** – conceptual and procedural knowledge opportunities.
Thinking about the CBFA’s

• **Hinge Questions** – gauging lesson success; students respond in about one minute; teachers analyze quickly (Wiliam, 2011); “Lesson deal-breakers.”

• **Exit Tasks** – evidence of student learning. Not a slip or ticket. Capstone problem/task. Provides a product. Use 1-2 times per week.
What we discussed today

• Implement tasks that promote reasoning and problem solving.
• Use and connect mathematical representations.
• Build procedural fluency from conceptual understanding.
• Elicit and use evidence of student thinking.
EIGHTH GRADE ALGEBRA

Factoring Quadratic Expressions with Arrays

Students use an array to represent quadratic expressions written in either standard or factored form.

View Teacher Tool
 Teacher Tools: Factoring Quadratic Expressions with Arrays

<table>
<thead>
<tr>
<th></th>
<th>$x^2$</th>
<th>$ax^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Form</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>$x^2 + 2x + 1$</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Factored Form</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>$(x + 1)(x + 1)$</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Partial Products</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>$51 \times 39$</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>
Interactive Whiteboard Open Array
www.dreambox.com/teachertools

Create an array that represents this expression.

\[(3n + 3)(2n + 5)\]
Interactive Whiteboard Open Array

www.dreambox.com/teachertools

Create an array that represents this expression.

\((3n + 3)(2n + 5)\)
Interactive Whiteboard Open Array
www.dreambox.com/teachertools
Interactive Whiteboard Open Array
www.dreambox.com/teachertools
Teacher Tools: Factoring Quadratic Expressions with Arrays

<table>
<thead>
<tr>
<th>Standard Form</th>
<th>x²</th>
<th>ax²</th>
</tr>
</thead>
<tbody>
<tr>
<td>x² + 2x + 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factored Form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(x + 1)(x + 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51 × 39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interactive Whiteboard Open Array
www.dreambox.com/teachertools
Interactive Whiteboard Open Array

www.dreambox.com/teachertools

Interactive Whiteboard Lesson

Create an array that represents this product.

26 \times 35

30

30

5
Interactive Whiteboard Open Array
www.dreambox.com/teachertools
Interactive Whiteboard Open Array
www.dreambox.com/teachertools

Interactive Whiteboard Lesson
Use the partial products and the array to determine the value of this product.

26 × 35 = 

900 + 150 - 120 - 20

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Mathematics Teaching Practices

But, what about? Here’s your flipped PD!

• Facilitate meaningful mathematical discourse.
• Pose purposeful questions.
• Support productive struggle in learning mathematics.
• Establish mathematics goals to focus learning.
Questions?

http://www.mathspecialists.org

ffennell@mcdaniel.edu
DreamBox Learning K-8 Math

Rigorous Mathematics Curriculum
• Reporting Aligned to CCSS, Texas TEKS, Virginia SOL, Canada WNCP, & Canada Ontario Curriculum Reports
• Standards for Mathematical Practice

Intelligent Adaptive Learning™ Engine
• Millions of personalized learning paths
• Tailored to a student’s unique needs

Motivating Learning Environments
• Student Directed, Empowering
• Leverages Gaming Protocols

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DreamBox Lessons & Virtual Manipulatives

Intelligently adapt & individualize to:

• Students’ own intuitive strategies
• Kinds of mistakes
• Efficiency of strategy
• Scaffolding needed
• Response time

Seeing is believing! dreambox.com/request-a-demo
Progress Monitoring Reporting

School: Springfield Elementary
Class: Grade 2
Teachers: Mr. Anderson
Date Range: April 7, 2014 – June 23, 2014
Student: Jennifer Smith

![Progress Monitoring Chart]

<table>
<thead>
<tr>
<th>Domain</th>
<th>Time Spent</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition &amp; Subtraction</td>
<td>09:03</td>
<td>80%</td>
</tr>
<tr>
<td>Comparisons &amp; Ordering</td>
<td>02:34</td>
<td>43%</td>
</tr>
<tr>
<td>Fractions &amp; Decimals</td>
<td>00:24</td>
<td>37%</td>
</tr>
<tr>
<td>Measurement</td>
<td>03:02</td>
<td>84%</td>
</tr>
<tr>
<td>Multiplication &amp; Division</td>
<td>06:35</td>
<td>44%</td>
</tr>
<tr>
<td>Place Value</td>
<td>02:47</td>
<td>104%</td>
</tr>
<tr>
<td>Overall</td>
<td>24:25</td>
<td>66%</td>
</tr>
</tbody>
</table>
Seeing is believing!

Develop critical thinking, deeper understanding, and lifelong confidence in math.

www.dreambox.com/request-a-demo
We value your feedback, compliments, suggestions, and complaints!

Let us know how we’re doing:

https://www.surveymonkey.com/s/9GPCRKRZ

Also, join us for a 15 minute Tweet-Up Session immediately following this webinar: #edweekmath