How to Reach the Unreachable in Algebra 1

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Setting the Stage

What is the meaning of the term "unreachable"?

What characterizes students who are unreachable?

Characteristics of "Unreachable" Students

Setting the Stage

What do classrooms currently look like where there are "unreachable" students?

Development of a Proposal

Were we happy with the Algebra 1 program and our results?

September 2006: Request Algebra 1 over Two Years

January 2010: Resubmit Algebra 1 in 2 Year Concept

Development of a Proposal

February 2010: Request pilot to examine practices of Algebra 1/Related Math

Summer 2010: Reorganize instructional sequence

School Year 2010-2011: Implementation of pilot

Setting the Stage

What are the 'big ideas' of algebra?

- How would teachers respond?
- How would students?

'Big Ideas' of Algebra

- **Seeing Structure in Expressions**
- **Arithmetic with Polynomials and Rational Expressions**
- **Creating Equations**
- **Reasoning with Equations and Inequalities**

From the Common Core State Standards

'Big Ideas' of Algebra/Functions

- **Interpreting Functions**
- **Building Functions**
- **Linear, Quadratic, and Exponential Models**
- **Trigonometric Functions**

From the Common Core State Standards

Professional Learning Community

Development of Common Lessons

Use of Videos

Video Discussion

Warm-up

What was the teacher's expectation of the needs of their students?

How did the teacher approach the content of the warm-up?

What was the role of the answer to the warm-up?

What would you imply was the previous lesson based on the way the teacher introduced the warm-up?

Development of a Proposal

How does this set of videos connect to the goals of the proposal?

- Explicitly
- Implicitly

Development of a Proposal

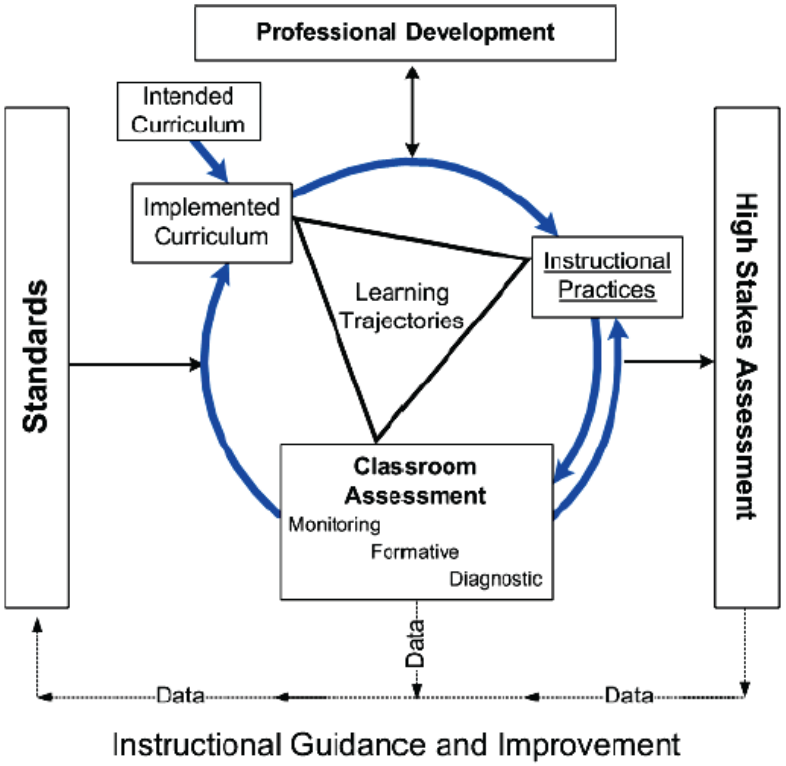


Figure 2: *Embedding the Instructional Core in an Accountability Framework (Confrey & Maloney, in press).*

Curriculum Design, Development, and Implementation in an Era of Common Core State Standards, **Summary Report of a Conference, Center for the Study of Mathematics Curriculum, 2010**

www.mathcurriculumcenter.org

Re-organizing Curriculum

An Early Question:

Where do we include pre-algebra support in our curriculum?

Re-organizing Curriculum Phase I

MP1: Pre-algebra skills

Data analysis

MP2: Equations

Inequalities

Functions

MP3: Polynomials

Quadratic Functions

Exponential Functions

MP4: Systems

Data Analysis/Probability

Re-organizing Curriculum Phase II

MP1: Polynomials

Single Variable Exploration

MP2: Two Variable Exploration

Exponential Functions

MP3: Data Analysis and Probability

Systems

MP4: Systems Continued

Quadratic Functions

Reflection

What might be the benefits of starting a grade 9 Algebra 1 program with the topic of polynomial operations?

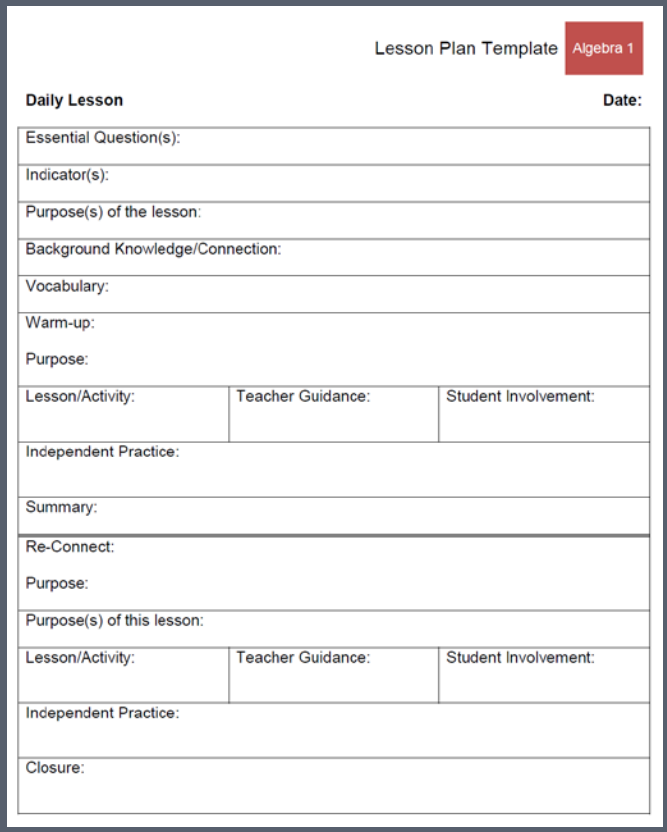
Professional Learning Community Revisited

Development of Common Lessons

Use of Videos

Lesson Plan Template

Lesson shell was designed, shared, reviewed, and revised to attempt to look at many aspects needed for lessons.



Lesson Plan Template Algebra 1

Daily Lesson **Date:**

Essential Question(s):		
Indicator(s):		
Purpose(s) of the lesson:		
Background Knowledge/Connection:		
Vocabulary:		
Warm-up: Purpose:		
Lesson/Activity:	Teacher Guidance:	Student Involvement:
Independent Practice:		
Summary:		
Re-Connect: Purpose:		
Purpose(s) of this lesson:		
Lesson/Activity:	Teacher Guidance:	Student Involvement:
Independent Practice:		
Closure:		

Rich Mathematical Tasks

Lesson/Activity: Teacher Guidance	Mathematics:	Student Involvement:
Teachers should lead students through the opening example of graphing each inequality, then combining them to create the compound inequality	CLASSWORK: Graph the following sentence on a number line: *All the real numbers that are greater than -3 and less than 9* (let's break this down) All real numbers greater than -3 All real numbers less than 9	Students follow teacher guidance to graph the two parts separately and then together on a guided notes sheet (graphs are stacked vertically).

Lesson/Activity: Teacher Guidance	Mathematics:	Student Involvement:
During the warm-up, teachers should include non-integral values to reinforce the infinite nature of the solution set, such as $-3.5, -\frac{18}{4}, 8.9999$, etc. Emphasizing when each of the individual inequalities are true and when the compound inequality is true is important to emphasize. Students should find a pattern that the teacher can build on for the discussion of inequalities involving 'or.'	*All the real numbers that are greater than -3 and less than 9* −6 −4 −2 0 2 4 6 8 10 How can we write this as a set of inequalities? The solution to the example is −6 −4 −2 0 2 4 6 8 10	Students should provide the teacher with values to test in the compound inequality and determine when each of the three inequalities are true.

Rich Mathematical Tasks

Students develop a much richer understanding of mathematics and its applications when they can view the same phenomena from **multiple mathematical perspectives**. . . . use instructional materials that are **intentionally designed to weave together different content strands** . . . problems that draw on a variety of aspects of mathematics, that are **solvable using a variety of methods**, and that **students can access in different ways**.

Principles and Standards for School Mathematics. National Council of Teachers of Mathematics (NCTM): Reston, VA. 2000.

Video Discussion

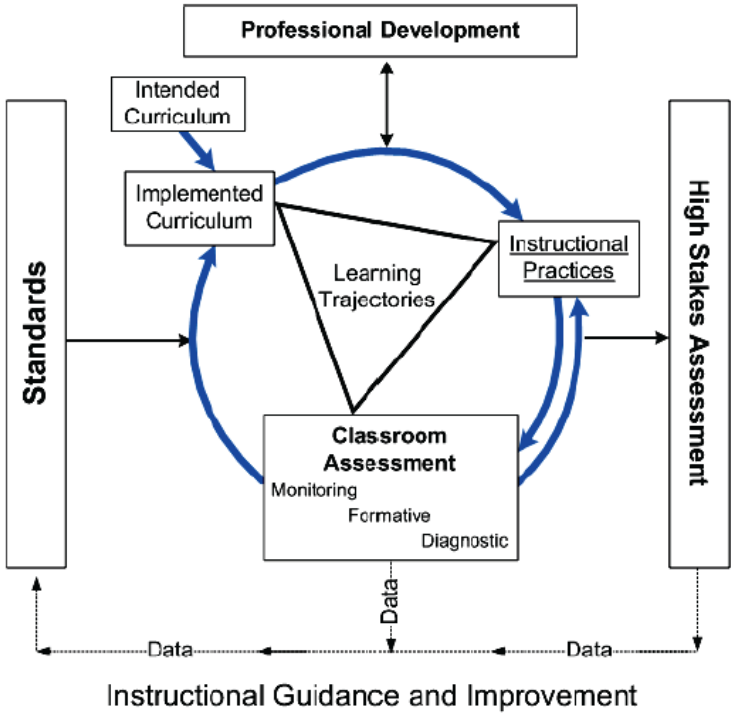
Introducing the Initial Problem

How does the teacher's approach to this problem mirror their approach to the warm-up?

What assumptions is the teacher making about their students?

What can you say about the classroom climate based on this observation?

Linking Pedagogy, Instructional Strategies, and Classroom Management



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Processes

Standards for Mathematical Practice

Mathematical Practices	*NCTM Processes*
Make sense of problems and persevere in solving them.	Problem Solving
Reason abstractly and quantitatively.	Reasoning and Proof
Construct viable arguments and critique the reasoning of others.	Reasoning and Proof, Communication
Model with mathematics.	Connections
Use appropriate tools strategically.	Representation
Attend to precision.	Communication
Look for and make use of structure.	Communication, Representation
Look for and express regularity in repeated reasoning.	Reasoning and Proof

Interpreting and Implementing the Common Core State Standards in Mathematics, K-8 *Jane Schielack, Texas A&M University*

Video Discussion

Concluding the Problem

Does the teacher allow for student reflection?

Who does more work – the teacher or the student?

What do the students 'walk away' with?

Classroom Environment

It's impossible to look at any classroom and pretend that all students are alike. Instead, **focus on the differences** that exist, **value the diversity**, and **allow each student the opportunity to shine**. Teachers should be **open to different approaches** and strategies as long as students are able to **explain their reasoning**. Students want the chance to be original, resourceful, or ingenuous.

http://www.nctm.org/resources/content.aspx?id=22624

Daily Formative Assessment

How will the teachers determine whether students understand the mathematics?

What about retention?

Video Discussion

Reflection

What have the teachers learned?

What should be the next step for this group?

Assessment

What data should be examined to determine the success of such a program?

Future Growth

Common Lesson reflection

Daily formative assessment

Examination of Standards of Mathematical Practices

Note: The pilot has been approved to continue for the 2011-2012 school year

Key Understanding

"In theory there is no difference between theory and practice. In practice there is."

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Presentation available at:
http://nolanmath.com/Unreach.htm