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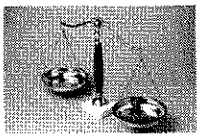
Mathematics Design Collaborative

Balancing Learning and Assessment



Dan Mollette
Chief Mathematics Consultant, SREB

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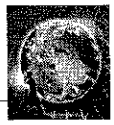
Why Change is Needed



To compete in the global economy of the 21st century, knowledge of math is critical. Today's high school graduates need to have solid math skills whether they are proceeding directly to college, or going straight into the workforce. In today's changing world, employers seek **critical thinkers** and **practical problem solvers** fluent in today's technology.

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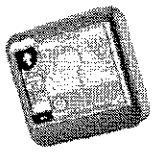
GPS vs. Google Map



Are you GPS-ing your students? How does this practice impact student learning?

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What is a balanced classroom?

Types of Knowledge

- Factual Knowledge
- Procedural Knowledge
- Conceptual Knowledge
- Meta-cognitive Knowledge

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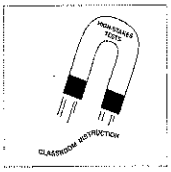
Teaching for Understanding



The drill and kill curriculum that often accompanies high-stakes, one-size-fits-all testing programs, lowers math achievement rather than advance deeper understanding of mathematical concepts and reasoning skills.

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Cognitive Demand

The results of the TIMSS Video Study showed that although U.S. teachers used many tasks that could have required a high cognitive demand from students, the actual implementation always lowered the cognitive demand of the tasks. Tasks were focused on procedures rather than problems focused on making connections.

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What is formative assessment?

The wide-ranging research review by Black and William (1998, summarized in 2001) described formative assessment as:

"... all those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. Such assessment becomes 'formative assessment' when the evidence is actually used to adapt the teaching work to meet the needs."

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Why Formative Assessment?

A growing number of researchers and educational leaders make a compelling case for formative assessment. Over the past twenty years educational research has pointed to the value of linking instruction to assessment

(Marzano & Haystead, 2008; Reeves, 2004; Wiggins & McTighe, 1998), examining student work to inform instruction (Dufor, Dufor & Eaker, 2008; Schmoker, 2006), and using formative assessment practices to drive learning (Black, Harrison, Lee, Marshall & William, 2004; Black & Wiliam, 1998; Reeves, 2007; Thompson &Wiliam 2007).

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Using Formative Assessment to Drive Learning

- It is a fundamental belief that quality math performance assessments, coupled with effective professional development for classroom teachers and leaders, can support improved instruction and student achievement.
- The Math Collaborative has been engaged in research and development efforts to create formative assessment practices and tools that support significantly improved teaching and learning.

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Using Formative Assessment to Drive Learning

Some teachers lack an in-depth understanding of math concepts and effective strategies for instruction. Without this understandings, it is impossible to design instructional experiences that drive significant improvement in student achievement.

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The Big Idea of Assessment for Learning

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

Marnie Thompson and Dylan William (2008)

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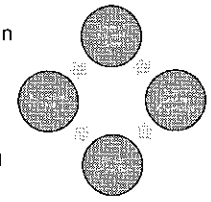
Using Formative Assessment Lessons to Drive Learning

- The Math Collaborative believes that teachers can improve their effectiveness by using a cycle of formative assessment. As they examine student thinking revealed in the assessments, teachers clarify and strengthen their own understanding of mathematical concepts.



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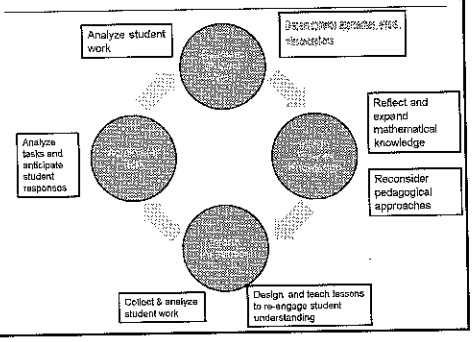
Formative Assessment Cycle



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Math Design Collaborative

- In both math and literacy, the foundation's goal is to support the creation of different forms of assessment and support materials that teachers, districts, and states can use.
- The grants advance the foundation's efforts to help ensure all young people in the United States graduate from high school ready for college and career, and obtain an education and training beyond high school that prepares them to succeed in the global economy.

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Math Design Collaborative

- The mathematics program focuses on building student understanding of mathematics concepts by working through problems, rather than just memorizing formulas and plugging them into a page of workbook problems.
- The goal is to improve classroom instruction and align content taught to high level standards by developing instructional strategies and tools in mathematics.

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The Five Strategies of Assessment for Learning

1. Clarifying and sharing learning intentions & criteria for success
2. Engineering effective discussions, questions, & 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

Marnie Thompson and Dylan Wiliam, 2008

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Productive Struggle

The five key ingredients are designed to ensure that students are engaged in a **productive struggle** with mathematics rather than on the receiving end of a lecture.

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Goal of Mathematics Instruction

"The goal of mathematics instruction is to equip students with the tools of the trade (mathematical practices, content, and productive dispositions) so that they can successfully engage with complex problems. Thus the goals for curricula, and assessment, should be to have students develop such skills and understandings, and to asses those competencies, on rich problems."

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Short Cycle Assessments

Novice Tasks

"Novice tasks are short items, each focused on a specific concept or skill, as set out in the standards."

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Short Cycle Assessments

Apprentice Tasks

"Apprentice tasks are substantial, often involving several aspect of mathematics, and structured so as to ensure that all students have access to the problem. Students are guided through a "ramp" of increasing challenge to enable them to show the levels of performance they have achieved."

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Short Cycle Assessments

Expert Tasks

"Expert tasks are rich tasks, each presented in a form in which it might naturally arise in applications. They require the effective use of problem solving strategies, as well as concepts and skills. Performance on these tasks indicates how well a person will be able to do and to use mathematics beyond the mathematics classroom."

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What is a formative assessment lesson (FAL)?

- Students must be able to use mathematics with precision—to get the numbers right, and also to solve problems that are not routine, to gain a conceptual understanding of the math and apply it.
- Formative assessment lessons are designed to help teachers uncover student misconceptions and find a path to help students progress.

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Formative Assessment Lessons

- A series of formative assessment lessons (FALs) for grades 7-10, focus on conceptual understanding and problem-solving.
- These lessons, intended to be embedded within a teacher's curriculum, are built around a set of rich tasks connected to the standards. These lessons are designed to engage students in a productive struggle with the mathematics essential for college readiness.

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Providing Feedback

- A key component of engaging students in the assessment of their own learning is providing them with descriptive feedback as they learn. Research shows descriptive feedback to be the most significant instructional strategy to move students forward in their learning.
- Descriptive feedback provides students with an understanding of what they are doing well, links to classroom learning, and gives specific input on how to reach the next step in the learning progression.

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FAL Structure

1. Students are given an initial assessment task which provides teachers with a qualitative sense of their students' grasp of the targeted mathematics.

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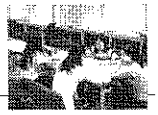
FAL Structure



2. Students are immersed in the mathematics of the assessment task through a set of collaborative activities. This part is designed as a guided inquiry. Students work in small groups, engage in discussion, take responsibility for their own learning, and learn from each other, often by examining each other's work. Teachers provide feedback to move their students' learning forward.

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FAL Structure

3. Students are engaged in a whole-class discussion designed to pull the lesson together. Students get to strengthen their understanding while teachers get to deepen their insights into their students' learning. It provides another opportunity to structure discussion, provide feedback, and allow students to learn from each other.

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FAL Structure

4. Students return to improve their response to the initial assessment. This gives students a look at what they've learned as well as more feedback, while providing teachers perspective on the effectiveness of their teaching.

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Let's Get Started

- You will experience the Formative Assessment Lesson as a student

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Let's Get Started

- Initial-Assessment (help is not given) 15 minutes
- Write feedback questions based on student work: after school
- Whole class introduction to the lesson 10 minutes
- Collaborative activity based on skills and concepts: teacher guides students as they work via leading oral questions 30 minutes
- Plenary Discussion 20 minutes
- Students use teacher-developed feedback questions to guide thinking as they correct pre-assessment papers15 minutes

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Formative Assessment Lessons

- The strategy underlying the FALs is to make sure students both understand the mathematical concepts and are able to put the math into practice. It is this application of math that can often get lost when the focus is on the development of discrete skills.