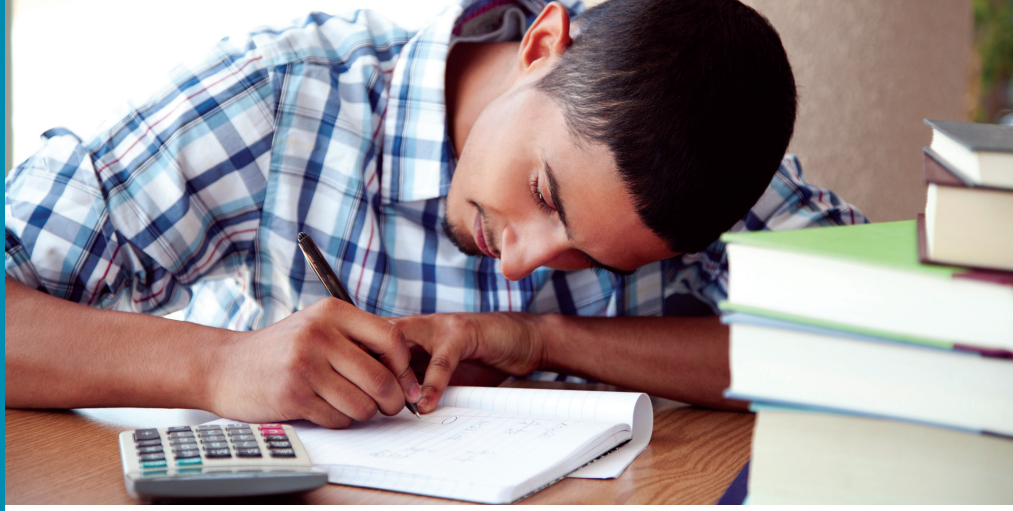

Mathematics Strategies: Professional Development for Schools and Districts

Today's students participate in a highly competitive global economy. It is more important than ever that teachers balance their approach to mathematics with strategies that prepare students for careers, advanced training and further study after high school.

The Southern Regional Education Board (SREB) is committed to providing teachers and school leadership the tools necessary to improve students' mathematics skills and **significantly increase the percentage of students meeting state college- and career-readiness standards**.

Why Choose the Mathematics Design Collaborative Instructional Framework for Your School or District?

We have never asked more of our educators, and they deserve the tools that will prepare middle grades and high school students to meet the challenges that lie ahead. The Mathematics Design Collaborative (MDC) provides teachers with instructional tools and strategies that help them implement state college- and career-readiness standards. At the same time, this gives them the flexibility to use their own textbooks and other resources to design engaging assignments that help students reach higher achievement.

MDC uses formative assessment lessons to engage students in a "productive struggle" that builds fluency of procedural skills and deepens mathematical reasoning and understanding. Students learn individually or in groups, and teachers use formative assessment lessons and research-based formative assessment strategies to check students' understanding and address students' misconceptions. Rather than following predetermined steps to find an answer, students are encouraged to use reasoning and problem-solving skills to solve complex, conceptual and applied mathematics problems.

SREB | Southern Regional Education Board

SREB has worked with hundreds of teachers since 2010 to spread MDC practices across schools and districts in 38 states. These teachers tell remarkable stories:

"MDC engages and motivates my students to learn," and "MDC helps me better understand my students' mathematical strengths and weaknesses."

SREB's publication, *Students Step Up When Teachers and Leaders Transform Classrooms and Strategies That Work* testimonials document successes and provide data that show the difference MDC is making in classrooms. Read about them here: SREB.org/StudentsStepUp and sreb.org/strategies-work

How is the Mathematics Design Collaborative Different From Traditional Mathematics Instruction?

Well-designed assignments aligned to states' college- and career-readiness standards for mathematics **will lead students to a greater understanding of mathematical concepts and procedures and will improve their ability to apply that knowledge to solve abstract and real-world problems**. Created specifically to advance mathematical readiness for college and careers, MDC provides a flexible framework for teachers to engage students in a productive struggle as they grapple with complex multi-step, grade-level mathematical assignments.

Formative assessment tools and strategies advance students' problem-solving skills and uncover their misconceptions so teachers can re-engage students in learning key mathematical content. Students deepen their mathematical understanding and recognize connections among mathematical concepts when solving complex problems.

Formative Assessment Lessons

The main tool MDC teachers use to determine gaps in student learning is a series of formative assessment lessons that address college- and career-readiness standards for grades six through high school. Each lesson follows a common structure:

- Students are given an initial assessment task. This provides teachers with a qualitative sense of students' grasp of the targeted math standards they must apply to complete the assignment.
- Teachers analyze data from the assessment task and use it to purposefully group students and develop feedback questions based on students' misconceptions.
- Students collaborate in small groups, engage in rich mathematical discussions, take responsibility for their own learning and learn from each other, often by examining each other's work. Teachers ask feedback questions designed to move students' learning forward without giving them step-by-step procedures.

> *Seeing what my students are truly able to do with formative assessment lessons is eye opening … My students' reactions to the first formative assessment lesson left me realizing that the depth I pushed students to on a daily basis was not enough, and I was leading them rather than letting them explore and struggle.*
>
> **Jillian W., math teacher, Alabama**

- Students engage in a culminating discussion with the whole class, which pulls the lesson together, strengthens their understanding of the concepts involved and allows teachers deeper insights into students' reasoning.
- Students return to the initial assessment task to redo the assignment, applying what they learned. This provides teachers with feedback on the effectiveness of their instruction.

The strategy underlying formative assessment lessons enables students to advance their understanding of math concepts and ability to solve multi-step math problems. Teachers use data from formative assessment lessons to re-engage students in special assignments that address their major mathematical misunderstandings and to rethink their future instructional strategies so that students will be better prepared for their next formative assessment lessons.

Moving Beyond the Formative Assessment Lessons

As MDC teachers become more comfortable with the strategies within the formative assessment lessons, they begin to infuse those research-based strategies into their daily instruction. Formative assessment becomes a natural part of their daily instructional practice. Teachers build units of instruction that incorporate the research-based tools and strategies of MDC including short- and medium-cycle formative assessments; tasks and problems that advance students' mathematical understanding, reasoning and application skills; and a lesson cycle that supports both individual and collaborative work and promotes a student-centered classroom.

Traditional Classroom	MDC Classroom
Teacher as lecturer	A balance between direct and facilitated instruction
Teacher as expert	Student as expert
Teaching focused	Learning focused
Students working alone or in groups that are haphazardly chosen	Students purposefully grouped, particularly during formative assessment lessons where pairs are determined based on similar math understandings
Step-by-step instruction	Focuses on key concepts with students identifying multiple solution paths
Students completing pen- and-paper problems	Students using hands-on manipulatives to understand and complete lessons
Only the teacher discussing or using math	Students discussing math and using math terminology in oral and written formats
Teacher guiding students through a series of steps to solve problems	Teacher posing questions to develop students' abilities and reasoning through multi-step math problems

SREB's training has given me the tools to make my students passionate about math. They see a need for math.

Randy R., math teacher, West Virginia

SREB's Five-Element Professional Development Approach

The goal of SREB's professional development (PD) is to significantly increase the percentage of students meeting college- and career-readiness standards. SREB aims to build capacity and sustainability within schools and districts by developing local expertise to spread MDC practices to all mathematics teachers. This includes a five-element approach that involves principals, local trainers and classroom teachers.

Element 1 – Build Capacity of Teacher-Leaders: SREB provides MDC professional development sessions to selected teachers in a school. They become MDC teacher-leaders, proficient in MDC tools and strategies, and work with other teachers to engage students in math assignments that advance students' mathematical understanding and reasoning skills.

MDC teacher-leaders implement six to eight formative assessment lessons in their course instructional plan, using the data to create a plan that re-engages students in assignments that close their mathematical learning gaps. MDC teacher-leaders infuse research-based tools and strategies into daily lessons, which leads to students being better prepared for the next formative assessment lesson.

Element 2 – Develop Local Trainers: Participating districts dedicate a mathematics educator to become an SREB-certified MDC local trainer, who provides coaching and support to teachers. The local trainer helps teachers embed formative assessment tools and strategies into their instructional plans. SREB-certified MDC local trainers meet the following requirements:

- Attend all trainings, webinars, electronic coaching and site visits.
- Launch formative assessment lessons in a classroom with students.
- Help teachers analyze student data from formative assessment lessons to determine student growth and develop a plan to re-engage students based on remaining misconceptions.

- Assist teachers to review the lessons learned from a formative assessment lesson and develop a series of lessons for the next unit that will result in students achieving greater understanding on the next formative assessment lesson.
- Support teacher-leaders and school leaders in all schools in the district; assist with initial feedback reports; and provide additional feedback to schools.
- Master classroom observations using college- and career-readiness best practices for mathematics.
- Assist teacher-leaders and principals with spreading MDC tools and strategies to other teachers during Years 2 and 3.

Element 3 – Conduct Classroom Observations and Provide Teacher Feedback: SREB and local trainers participate in a series of school visits between MDC training sessions to conduct classroom observations; attend professional learning community meetings; and provide feedback to teachers and principals.

Element 4 – Expand Schoolwide and Districtwide Implementation: In Year 1, SREB and local trainers conduct after-school workshops that focus on the research-based tools and strategies of MDC. While not directly participating in SREB professional development, many teachers work with MDC teacher-leaders to utilize formative assessment lessons and other tools and strategies. **SREB offers two approaches for supporting schools and districts in spreading MDC schoolwide and districtwide in Year 2:**

1. Year 2 Collaborative Plan: SREB and local trainers provide step-by-step professional development to spread MDC tools and strategies. These resources provide math teachers with 60 hours of collaborative planning on deepening students' mathematical reasoning and improving students' ability to apply mathematics in real-world and non-routine assignments.

2. Web-Based Courses: The MDC online courses, with the assistance of local trainers and skilled MDC teacher-leaders, guide teachers through the process of implementing MDC tools and strategies. SREB trainers work with districts to create a customized learning plan that utilizes the courses to effectively meet each school's specific goals for improved mathematics instruction.

Element 5 – Work With Principals: SREB and local trainers meet with principals to conduct classroom observations that focus specifically on supporting MDC implementation. SREB has identified a set of instructional shifts that trainers and principals should look for as they determine if MDC tools and strategies are being used effectively.

I believe in and embrace the math formative assessment lessons. They are student-centered, and the students can make a deeper sense of concepts as they discuss and share solutions with one another. It is the way we should be teaching if we are truly concerned about students' knowing, understanding and using math.

Ellen T., math teacher, Alabama

My instructional delivery is quite different now that I embrace the MDC strategies. Rather than teacher-led lectures and demonstrations, I focus more on student-based learning. Since implementing MDC, my students are now taking more responsibility for their own learning.

Toni C., math teacher, Mississippi

This observation protocol provides effective feedback and support to teachers as they make instructional shifts from procedural-based math instruction to instruction that is more balanced, which places a greater emphasis on reasoning, understanding and application. As instructional leaders, it is imperative that principals be actively involved in major initiatives that impact teaching and learning. **The principal has two critical roles in spreading MDC. Principals must:**

1. Understand what MDC looks like in a classroom and give teachers timely feedback and support to make the desired shifts in instruction.
2. Create, monitor and sustain effective professional learning communities for math teachers so that prepared MDC teachers can support other teachers to use MDC research-based tools and strategies.

To encourage teacher engagement and sustain the integration of MDC, principals must:

- Attend MDC professional development sessions with their teachers to get a clearer picture of MDC and the types of instructional changes expected. (Breakout sessions for principals are conducted during these sessions.)
- Join SREB and local trainers during MDC school visits and classroom observations and collaborate with trainers to give teachers feedback.
- Attend a two-day workshop in Year 1 to learn how to use the MDC classroom protocol to improve teaching and learning; redesign the school schedule to support teacher collaboration; and create and sustain effective professional learning communities.
- Attend follow-up workshops and webinars in Years 2 and 3 to learn strategies for spreading MDC schoolwide.

SREB'S Three-Year Professional Development Plan

SREB partners with schools over three years to train enough teachers, local trainers and principals to ensure schools and districts can sustain the MDC framework moving forward.

Year 1: During eight days of professional development, SREB prepares select teachers from each school to implement at least six, preferably eight, formative assessment lessons that address grade-level content and process standards for mathematics. All formative assessment lessons are implemented in one course with the same students.

Participating math teachers will:

a. Re-engage students who fail to demonstrate adequate understanding of math concepts through the formative assessment lesson in a set of instructional strategies based on proven practices until students achieve the desired level of understanding.

b. Reflect on the method of instruction that led to students' inability to demonstrate sufficient understanding of math concepts. Develop a different set of instructional learning activities aimed at students demonstrating greater understanding on their next formative assessment lesson.

c. Begin by mid-year to work with other teachers to study and launch a formative assessment lesson in their classrooms.

Year 2: To spread beyond Year 1, SREB and local trainers, teacher-leaders and principals use professional learning communities to disseminate MDC practices schoolwide. It is expected that 40 percent of the participating mathematics teachers will utilize MDC tools and strategies.

Participating teachers are expected to:

1. Implement six to eight formative assessment lessons.
2. Re-engage students in learning after a formative assessment lesson based on student data.
3. Reflect on how each unit is taught and evaluate how it can be redesigned to advance students' mathematical achievement.

Year 3: SREB and local trainers work together to sustain the MDC effort in participating schools and to spread MDC to all schools in the district and the region. During Year 3, school and district teams continue the work of Years 1 and 2 while spreading MDC tools and strategies to at least 80 percent of the mathematics teachers in participating schools.

Virtual Support

In addition to direct face-to-face workshops and coaching, SREB's professional development plan includes virtual support through online courses and learning communities, webinars, screencasts and video conferencing. Teachers are invited to connect with other MDC teachers around the country through social networking.

Contact us if you are ready to improve outcomes in your school.
If not now, when?

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Students are learning to use each other as resources, ask appropriate questions of each other and me, and justify work and critique each other. My students are becoming critical thinkers and no longer just accept an answer at face value.

Tiffany M., math teacher, North Carolina

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