

What do educators trained in the Mathematics Design Collaborative (MDC) say about their experience?

“It (MDC training) really had a profound impact on me. I realize the student really knows the concept now, because she had to think through the problem and was not given the answer.”

Rachel S., eighth-grade math teacher, Florida

“The Math Design Collaborative has been a good experience for both me and my students. It has enabled me to improve my questioning strategies, and my students have become more persistent in their problem solving.”

Leona M., geometry teacher, Arkansas

“I realized that my students were capable of a much higher level of thinking than I was giving them credit. As I have turned into more of the facilitator in the classroom, my students are now reasoning in ways that I had never imagined.”

Amanda C., geometry teacher, Arkansas

“My scores in the algebra block increased by 25 percent, and I had 100 percent proficiency in my regular Algebra I class due to focusing on the individual needs of the students and clearing up their math misconceptions.”

Rhonda L., algebra teacher, Arkansas

“I have implemented three FALs the first quarter of this school year. The pre/post FAL assessments indicate 60 percent of my students are showing improvement.”

Susan R., algebra teacher, Florida

“Formative assessment lessons (FALs) have changed the way we teach, the way our students learn, and the way our classrooms look each day.”

Jami W., Math I teacher, Georgia

“I have been implementing the formative assessment lessons, and I have found them beneficial and enriching. I love the fact that students are forced into a productive struggle. I would say the Mathematics Design Collaborative provides a good tool for teachers to have in their toolbox.”

Toni C., geometry teacher, Mississippi

Students work in pairs to make sense of problems and persevere in solving them (MP1), reason abstractly and quantitatively (MP2), and model with mathematics (MP4).

Which Equations Describe The Story?	
A pencil costs \$2 less than a notebook.	Let x represent the cost of notebook.
A pen costs 3 times as much as a pencil.	A: $3x - 6 = 9$
The pen costs \$9.	B: $x - 6 = 9$
Which of the four equations opposite describe this story?	C: $3x - 2 = 9$
	D: $3(x - 2) = 9$

Standards for Mathematics Practice

The standards for math practice rest on important “processes and proficiencies” with longstanding importance in mathematics education.

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| MP1 Make sense of problems and persevere in solving them. | MP5 Use appropriate tools strategically. |
| MP2 Reason abstractly and quantitatively. | MP6 Attend to precision. |
| MP3 Construct viable arguments and critique the reasoning of others. | MP7 Look for and make use of structure. |
| MP4 Model with math. | MP8 Look for and express regularity in repeated reasoning. |

The Common Core State Standards (CCSS) for mathematics or other rigorous standards *describe* the various elements of what students should know and be able to do. The MDC formative assessment tasks show what the standards look like in performance terms. They enable teachers to assess student performance and move each student’s reasoning forward. MDC helps teachers translate the vision of CCSS math standards into their own classrooms.

“The standards for mathematical practices capture the processes and proficiencies that we want students to have. Not just the knowledge and skills, but how they use the knowledge and skills. They capture the habits of mind or thinking skills that are specific to mathematics.”

Professor William McCallum, a lead writer for the CCSS math standards

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SREB Training Helps Teachers Implement the CCSS or Other Rigorous Standards for Mathematics

The **Mathematics Design Collaborative** (MDC) provides schools with instructional tools needed to help teachers understand and implement the Common Core State Standards (CCSS) or other rigorous standards effectively while allowing teachers the flexibility to select topics and adapt assignments to their specific instructional plans. MDC helps teachers embed the new standards into instruction and engage students in assignments that address math understanding.

MDC uses formative assessment lessons (FALs) to engage students in a productive struggle that builds fluency with their procedural skills, and deepens mathematical reasoning and understanding. Students participate in both individual and group learning as teachers use FALs and questions to check for students’ math understanding and correct common misunderstandings. Rather than following predetermined steps to find an answer (the “GPS” approach), students are supported to deepen their math reasoning to solve problems.

Formative Assessment Lessons

Central to MDC are sets of FALs. The FALs are aligned to the CCSS and other rigorous standards and are designed to be embedded within courses. The FALs represent a major innovation in teaching and learning math by:

- focusing on student understanding of math concepts
- allowing students to have a productive struggle and make sense of math concepts
- assisting teachers in determining what changes in content and instructional strategies are needed to allow students to master rigorous standards
- engaging students in reasoning and increasing their ability to think through math problems

How is the MDC Framework Different From Traditional Math Instruction?

Mathematics Design Collaborative

SREB's Mathematics Design Collaborative (MDC) professional development initiative provides mathematics teachers with ongoing, high-quality professional development that focuses on both content and process.

Content

The Bill & Melinda Gates Foundation funded efforts by the Shell Centre in England and the University of California at Berkeley to produce a series of formative assessment lessons (FALs) for grades seven to 10 focused on advancing student mathematics understanding and problem-solving skills. The FALs are built around a set of rich learning tasks connected to math standards to be embedded within a teacher's curriculum. Formative assessment lessons strive to develop deep understanding of key math content. The FALs are designed to engage students in a *productive struggle* with their math learning.

Formative assessment lessons follow a common structure:

- Students are given an easily-administered initial assessment task. This provides teachers with a qualitative sense of their students' grasp of the targeted math standards.
- Students are immersed in the math assessment task through a set of collaborative activities. 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 questions to move students' learning forward without giving them step-by-step procedures for solving the problem.
- Students are engaged in a whole-class discussion. Discussion pulls the lesson together and strengthens students' understanding of math concepts involved and allows teachers deeper insights into their students' math learning gaps. Teachers provide the needed structure to allow students to discuss the mathematics, provide feedback and allow students to learn from one another.
- Students return to the initial task to redo the assessment. Students get an opportunity to apply what they have learned while providing teachers feedback on the effectiveness of their instruction. The strategy underlying the FALs is to enable students to understand math concepts and be able to put these into practice. Application of math is often lost when the focus is on the development of discrete procedural skills.

MDC expects teachers to use FALs at least once a month that are aligned to key concepts being studied. Individual teachers or districts can decide exactly how each FAL will be used. Some teachers could use an FAL to introduce a math topic; others might use an FAL two-thirds of the way through their teaching of the topic to raise questions and check for understanding. Other teachers may use it weeks later to consolidate learning of multiple strands within the curriculum.

Changes in Classroom Experiences

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 individually	Students working in pairs or small teams
Step-by-step instruction	Instruction focused on key concepts with students identifying multiple solution pathways
Students completing work by completing pen-and-paper problems	Students completing lessons that allow for understanding through the use of technology and hands-on manipulation
Only the teacher discussing math or using math terminology	Students actively discussing math and using math terminology in both oral and written formats
Teachers guiding students through a series of steps to solve problems	Teachers assisting students by posing questions to develop their math and reasoning skills in problem solving

The MDC process equips teachers with research-based strategies and a process for analyzing learning in the mathematics classroom. To fully implement the MDC formative assessment lessons, teachers need direct support that begins with an understanding of the changes in classroom instruction that must be made and the ongoing help teachers need to make the change.

Process

SREB has learned that a single workshop has little impact on changing adult practices. **For this reason, the MDC plan involves initial training lasting two to three days and three additional sessions each lasting two days, spread throughout the school year (approximately four to six weeks apart).** Each session will engage participants using adult learning best practices and include both pre-work and follow-up expectations. Follow-up sessions for math teachers are designed to support their use of the FALs and their efforts to support other math teachers to use the FALs. (Certain considerations can be made for the training and support of teachers in an electronic format.)

In addition, a school may choose to provide extra support with days of job-embedded content coaching between sessions. **A key lesson learned is that the change that schools must make to dramatically raise math achievement will not occur after a one-day "spray and pray" professional development session.** There has to be a major change in the beliefs of teachers that students of all levels can be successful.

An integral part of MDC is building capacity within a school/district to grow the MDC effort. With that in mind, each school will have a team of math teacher facilitators participate in the training. Teacher facilitators are defined as outstanding teachers who: have a track record of getting students to achieve at higher levels; will take the information learned and implement it in their classrooms; and who have the ability to get other teachers to follow their lead. A school leader will also participate as a team member.

The ideal middle grades team will include at least one math teacher for each grade and one administrator. The ideal team for a high school will include the administrator, at least one Algebra I teacher and a geometry teacher. Extremely large schools may elect to include additional team members. These team members will implement MDC lessons and strategies in their classrooms, model lessons for other teachers, and assist the principal in rolling out MDC to others in their department.

The concept of teacher facilitator teams was recently recognized by the National Council for Staff Development as a promising practice, one that strives to build the capacity in a school to continue the process well after professional development ends.

The initial workshop will prepare the lead mathematics facilitators to use the MDC FALs to develop students' abilities to reason, understand and apply mathematical concepts. This approach involves using formative assignments and assessments to determine students' knowledge and skills and respond accordingly in developing students' capacities to become more independent learners in math. Math teachers will become familiar with FALs that address the most essential standards for getting students ready for high school and ready for college and careers. During the workshop, teachers will work through several lessons and develop feedback questions. Teachers will leave with lessons and plans for the next weeks of the school year. Teachers must bring their textbooks and pacing guides to the training.

These math teacher facilitators will be trained to implement the FALs and also lead planning sessions with other math teachers in their school. The purpose of these planning sessions will be to share FALs, align other FALs to existing pacing guides, and instruct teachers on proven instructional strategies that give greater emphasis to understanding and reasoning. Facilitators will be expected to implement these practices in their own schools and classrooms, which can then serve as demonstration classrooms for others to visit and observe.

Students are working in a small group using white boards to make sense of problems and persevere in solving them (MP1), construct viable arguments and critique the reasoning of others (MP3), and look for and make use of structure (MP7).

