



MDC's Influence on Teaching and Learning

Prepared by Research for Action

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Introduction

About MDC

The Math Design Collaborative (MDC) offers a set of mathematics instructional and formative assessment tools. The tools were developed to help educators better prepare all students to meet the Common Core State Standards (CCSS) and succeed beyond high school in college and careers. MDC's goal is to provide supports for educators to implement the instructional shifts called for by the CCSS. MDC offers Classroom Challenges, which help secondary mathematics teachers facilitate CCSS-based mathematics learning and provide teachers with feedback about student understanding and mastery.¹ Classroom Challenges are now a critical component of the Mathematics Assessment Project (MAP), the next generation of MDC that aims to bring the CCSS to life for teachers in classrooms in both the United States and the United Kingdom.²

About RFA's Research on MDC

Research for Action, a non-profit education research organization, began studying MDC in 2010. With the support of the Gates Foundation, RFA examined the implementation of MDC, as well as the context and conditions necessary for scaling up and sustaining MDC tool use, and for maximizing its impact on teacher effectiveness and student learning. The resulting research products aim to inform a wide audience including funders, intermediary organizations and MDC partners, districts, and the teachers and administrators using the tools. A complete set of products associated with this project can be found at <http://www.researchforaction.org/rfa-study-of-tools-aligned-ccss/>. This brief draws on a national 2013 survey of 1,239 mathematics teachers in 21 states (response rate of 60%) and interview data from four sites in 2011-12.

About CRESST's Research on MDC

Partnering with RFA, the National Center for Research on Evaluation, Standards and Student Testing (CRESST) examined the implementation and impact of MDC tools in 9th grade Algebra 1 classes. The study used a quasi-experimental design to compare MDC student performance to a matched sample of students from across Kentucky comparable in prior achievement and demographic characteristics. CRESST used multiple measures to gauge tool implementation and

¹ Classroom Challenges are sometimes called Formative Assessment Lessons.

² <http://map.mathshell.org/materials/index.php>

impact, including student performance on the statewide PLAN assessment.³ Findings from CRESST's research are indicated in italics below; a more complete report of CRESST research findings will be available shortly.

Purpose of this Brief

This brief presents RFA's research on teachers' perspectives on how the MDC tools are affecting their teaching practice; how these changes seem to be influencing their students' engagement and learning and CRESST's findings related to teacher practice and student learning. This brief may be useful for:

- **Teachers and administrators** interested in learning more about implementing CCSS-aligned instruction in their classrooms, schools, and districts;
 - **Experienced MDC teachers** who wish to understand how their MDC experience fits into the larger universe of teachers' work with MDC tools across the country; and,
 - **School and district administrators** interested in understanding more about how MDC may affect teaching and learning in their district.
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Teacher Practice

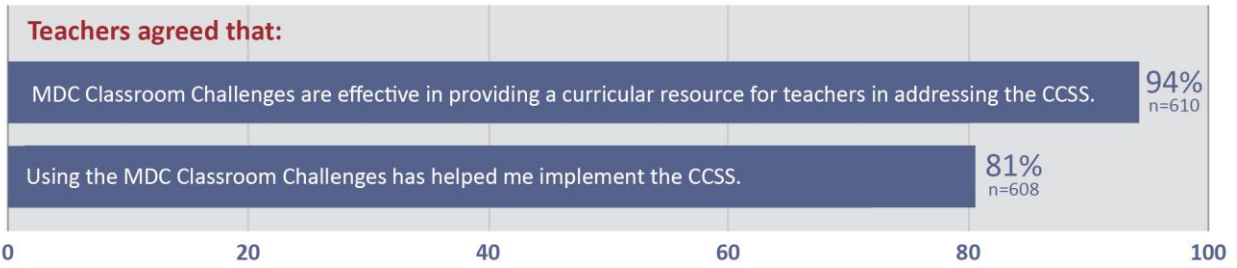
In the spring of 2013, three years after the introduction of MDC, over 700 participating teachers shared their experiences in a survey. A large majority of teachers responding to the survey reported that MDC had positively affected their practice in multiple ways, including helping them to:

- Implement the Common Core State Standards;
- Take on the role of facilitator-coach;
- Raise their expectations for students;
- Learn new strategies for teaching subject matter;
- Use formative assessment; and
- Differentiate instruction.

Below we explore these areas in greater depth, report challenges teachers faced in integrating MDC into their instruction, and share CRESST findings related to teachers and instruction.

³ The study used tenth grade ACT/PLAN scores for Algebra as the primary outcome. ACT/PLAN is administered to entering 10th graders as part of Kentucky's statewide assessment program.

1. MDC Helps Implement the Core Common State Standards



The vast majority of teachers reported that the Classroom Challenges were supporting their implementation of the Core Common State Standards. As one high school math teacher said:

I do [think participating in MDC will help me teach the Common Core]. Because the common core is all about “do fewer things better.” We want to be able to get into these investigative things, and we want to be able to emphasize reasoning over mechanics, and so this is dead on that.

2. MDC Supports Teaching as Coaching

Almost all participating teachers indicated that the role of teacher as instructional “facilitator” or “coach,” which is embodied in the Challenges, supports increasing students’ mathematical understanding. Compared to providing direct instruction, coaching enables students to take on a more active learning role.

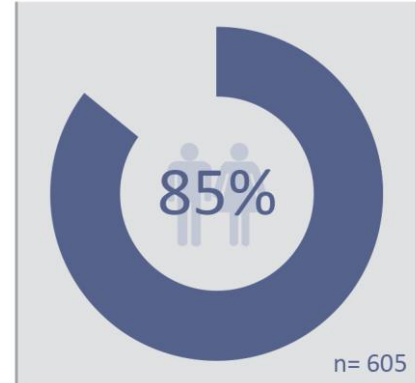


Teachers agreed that the teacher taking on the role of facilitator coach strengthens students’ mathematical understanding.

I’ve been teaching for 36 years, and teaching the same way. It’s hard to change; to teach an old dog new tricks. But now that I’m doing it, I love it....At first, I felt like, I’m not teaching! [laughs] But now I realize that they really are learning, and doing more on their own. And I don’t have to stand up there, and teach my heart out, and they [are] just looking at me and still not getting it. Now...they’re probably learning more. – High school math teacher

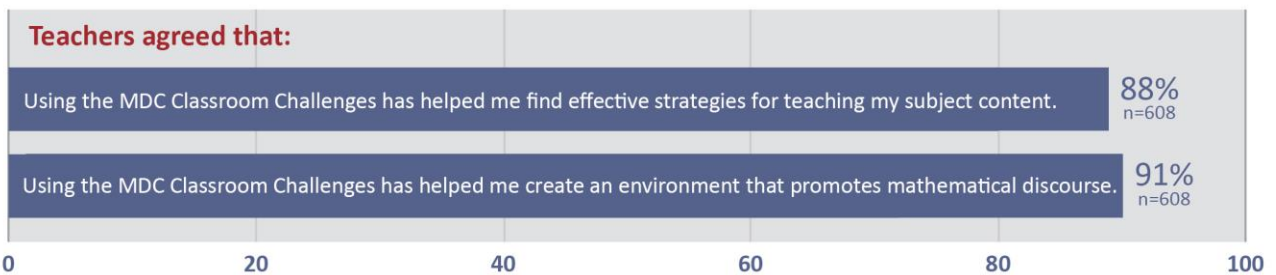
3. MDC is Raising Teachers' Expectations

The Classroom Challenges are rooted in the rigorous demands of the CCSS and designed to raise the level of mathematical content in instruction. Teachers reported that the Classroom Challenges were increasing their academic expectations for their students.



Teacher respondents agreed that using the MDC Classroom Challenges raised their expectations for students' mathematical work.

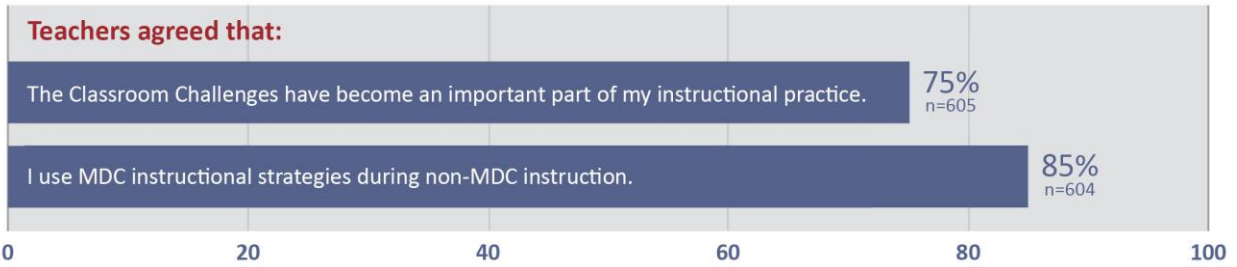
4. MDC Provides Effective Teaching Strategies and Changes Overall Instruction



The vast majority of MDC teachers reported that the lessons provided them with effective strategies for teaching math and strengthening mathematical discourse in their classrooms.

The students actually talk about math and they are actually having debates and they are debating between who is correct. Before, without this type of teaching, they never talked about math. It was always the teacher talking and they never got into good discussions or justify their answers, and they were never responsible for understanding what other people were thinking as well. – High school math teacher

In addition, teachers reported that MDC practices were affecting their instruction, even when they weren't using the Challenges.



At least three-quarters of MDC teachers said that the lessons had become important to their instructional practice and that they were infusing strategies from the Classroom Challenges into their ongoing instruction.

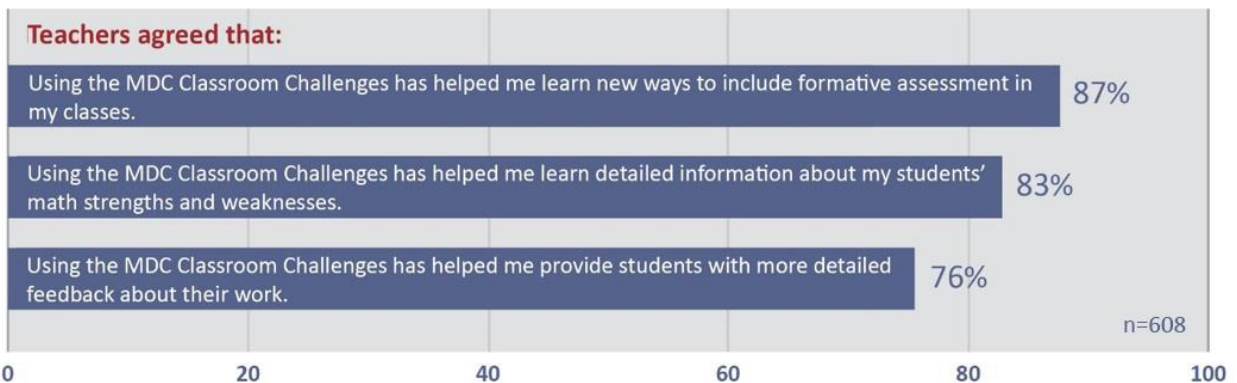
High school math teachers reported:

This has expanded me to do more work in groups, even more than I have done in the past.

I think it's helping us grow as teachers in how we question the students.

It has definitely made me more aware of putting the responsibility on them-for them to be their own learners and I love the questioning technique and being their facilitator to learning. It has definitely changed my way of teaching.

5. MDC Offers Formative Assessment

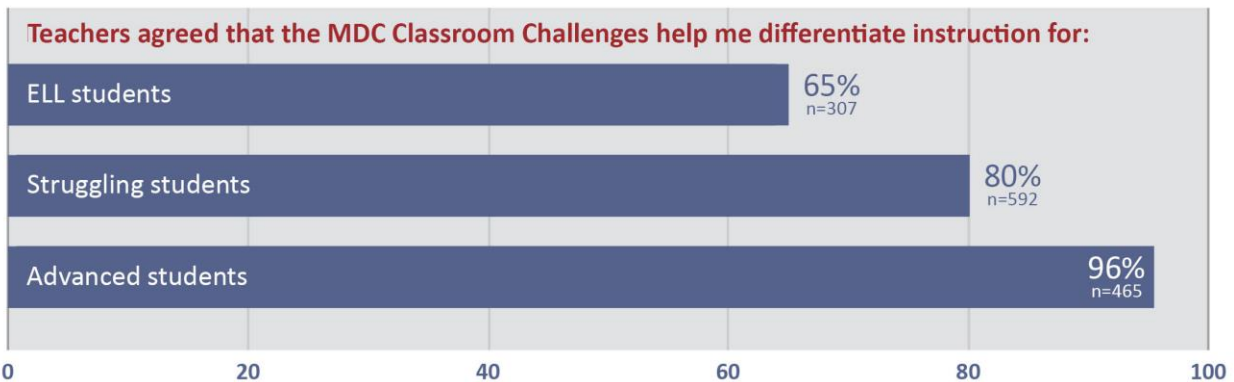


Large majorities of MDC teachers agreed that using the lessons helped them incorporate more formative assessment in their classes, learn information about students' math strengths and weaknesses and give students more detailed feedback about their work. In interviews, teachers reported that analyzing the pre-assessment and post-assessment enabled them to identify gaps in student knowledge and detect growth. Teachers also reported using information about students' misconceptions to develop feedback questions or re-teach content.

If you are working with groups, you are constantly going around and monitoring and talking, and that's the most important formative assessment you can have. ...Getting around to the groups, having them share out. – High school math teacher

When you take a look at this pre-assessment you realize, "Oh my God" – you think they got it and you present something like this and then you realize there is not the understanding that we expected...The pre-assessment definitely tells you where the understandings are or where they are having difficulties. – High school math teacher

6. Differentiation: MDC Classroom Challenges Provide Flexibility



Teachers said that the Classroom Challenges are flexible enough to meet the needs of all their students.

The majority of MDC teachers reported that the Classroom Challenges helped them differentiate instruction. MDC teachers were especially likely to report that the tools helped them differentiate for advanced students.

*I think the [Classroom Challenges] are designed for students to share and gain knowledge together. I had very little difficulty, and I was anticipating major issues with my ELL students but I had very little issues due to their working in groups and pairs.
– High school math teacher*

For the advanced kids, there's lots of challenges in it and they enjoy the discussion and the interaction. For the weaker kids, it's neat when you see those kids trying to make some connections and you do see that. – High school math teacher

CRESST's research with teachers in Kentucky confirmed these findings. Teachers reported positively about the professional development they received. They found the tools helpful and effective in meeting a variety of goals, including implementing Kentucky Core Academic Standards, using formative assessment, incorporating more complex thinking and problem solving into curriculum and instruction, and improving student learning.

Areas of Opportunity: Teacher Practice

While survey and interview data indicate a number of ways that the Classroom Challenges are positively influencing teachers' practice, teachers also reported a few barriers to implementing MDC. These included:

Preparation. Over half of teachers (59%, n=595) agreed that the preparation of materials required for the Challenges is an impediment to using them.

Time. Over half of teachers (57%, n=594) reported that using the Challenges takes too much time away from covering required curriculum topics. Some teachers reported a tension between covering material needed for state test preparation and using the Challenges, which take approximately 2-3 days each.

Differentiation. While teachers found ways to differentiate Challenge instruction, almost three-quarters (72%, n=446) also indicated they would welcome additional professional development on differentiating instruction when using Challenges.

Need for Strategies and Supports. *Both CRESST's teacher survey and student performance on CRESST measures indicate that the new standards are challenging for many students. Struggling students may require additional supports and strategies to acquire the prerequisite knowledge and skills assumed by MDC's Classroom Challenges and to move their productive struggles to success in new mathematical understandings and problem solving.*

Student Engagement and Learning

What do teachers say about whether the MDC tools are engaging students and enhancing student learning?



Teachers agreed that MDC Lessons are effective in making instruction more engaging to students.

MDC Supports Student Engagement

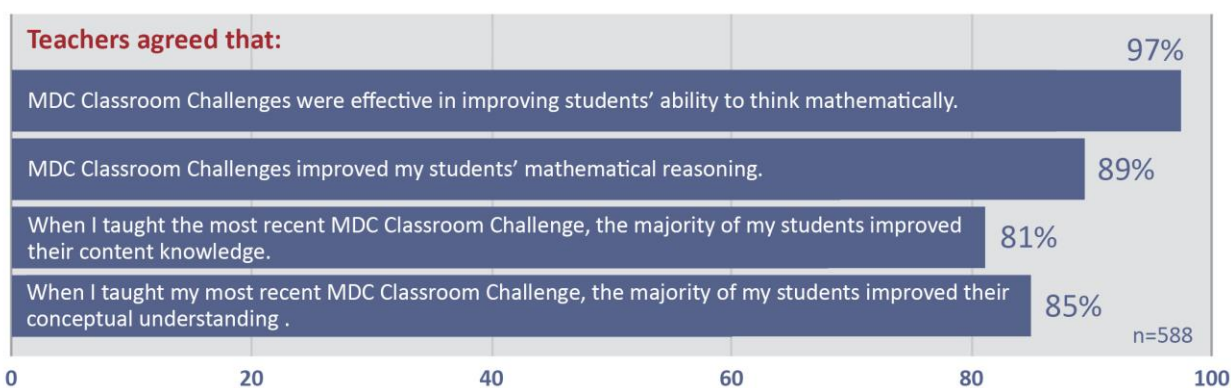
The vast majority of MDC teachers reported that the Classroom Challenges were effectively engaging students. They reported that the students liked the hands-on work, the collaborative activities, and the opportunities to participate in discussions. Increased student engagement supported increased student ownership of their own learning.

The [Classroom Challenges] allowed students to have rich conversations; there was more ownership of their learning. Most of my students who are typically quiet and don't participate in class, they actually got that opportunity to participate. They know that they may not get all the answers correct or they may not finish the entire thing, but at least they'll get a good foundation. – High school math teacher

For my lower math students, I find the [Classroom Challenges] very encouraging to participate. Before, they were very passive. Now, they have to be actively participating. They are forced to express some idea. – High school math teacher

[When students work on Classroom Challenges,] they're more willing to try things. I tend to notice the biggest difference in students who are reluctant to do work, or apathetic at best; they're more willing to go out on a limb and try some of these. That's where you notice the most. – High school math teacher

1. MDC Enhances Students' Mathematical Knowledge and Skill

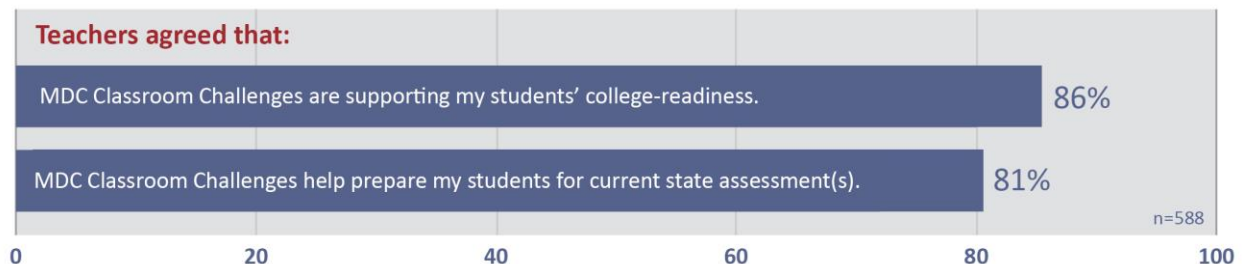


More than four-fifths of MDC teachers responding to the survey reported that tool use was leading to positive learning outcomes in a variety of areas, including increasing students' content knowledge and conceptual understanding and improving students' mathematical reasoning.

The time-distance graph really, really helped their reasoning skills. They all misinterpreted the graphs at the beginning and then by the end, the majority knew how to read the graphs and look and see that, if it's going up, that doesn't mean that he's going uphill. It means that his distance is increasing. So, I thought that that one really helped their reasoning skills and their ability to read a graph. – High school math teacher

It'll stick with them a lot more, because they're creating it themselves, so it's going to make sense to them. It's not, the teacher said this is so, so that's it, and now memorize it. It's more of, 'well, I understand this is how I got this,' so you don't have to memorize, because you could always use the same logic to get to the same place. – High school math teacher

2. MDC Supports Student Academic Preparation



At the time the survey was conducted, participating states were still in the process of transitioning to full implementation of the CCSS. Despite the fact that curricula, assessments and the CCSS were not yet fully aligned at the time of the survey, more than four-fifths of MDC teachers agreed that MDC was supporting students' college-readiness and their preparation for state assessments.

3. MDC had a Positive Impact on Student Learning

Relative to typical growth in math from eighth to ninth grade, the effect size for MDC represents an additional 4.6 months of schooling.

Areas of Opportunity: Student Engagement and Learning

Students and Teachers Embracing New Roles. Student comfort level in adjusting to the new student and teacher roles was mixed. These new roles require teachers to facilitate discussion by asking guiding questions instead of teaching through direct instruction or giving students specific answers to their questions.

Engaging Students. Teachers commented that student engagement with the Challenges was not necessarily automatic. However, teachers noted that student engagement increased as students became familiar with their new roles and responsibilities within the various components of the Challenges.

Possible Differential Impact. *Initial student outcomes analysis raises questions about whether MDC may be differentially effective for various groups of students. For example:*

- *Students who began the school year with higher prior achievement may have benefited more from MDC than did students who entered the school year with lower prior achievement.*
- *Students of teachers with high prior effectiveness ratings fared better than did students of teachers with lower ratings.*

Note: CRESST regards these findings as tentative, meriting further replication.

Conclusion

This research took place while many participating districts were scaling up their MDC implementation. Twenty-five percent of teachers responding to the survey were new to MDC and many other teachers were still building their knowledge about how best to incorporate the instructional shifts called for by the Common Core. In this survey and previous surveys of MDC participants, responses of educators with MDC experience were consistently more positive than those of teachers still learning about MDC. Yet, majorities of all responding teachers reported that MDC was positively affecting their practice, student engagement, and student learning in a number of different ways. These responses indicate promising trends. The Mathematics Assessment Project, along with participating MDC districts and intermediary organizations, can continue to track teacher perceptions as implementation grows broader and deeper.