

ESTABLISHING A STRONG FOUNDATION

*District and School Supports for
Classroom Implementation of the MDC Framework*

Research for Action ▪ September 2011

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About Research for Action

Research for Action (RFA) is a Philadelphia-based nonprofit organization. We seek to use research as the basis for the improvement of educational opportunities and outcomes for traditionally underserved students. Our work is designed to strengthen public schools and postsecondary institutions; provide research-based recommendations to policymakers, practitioners and the public at the local, state and national levels; and enrich the civic and community dialogue about public education. For more information, please visit our website at www.researchforaction.org.

Acknowledgments

This research would not have been possible without the generous support of the Bill and Melinda Gates Foundation. We are very appreciative of the efforts of the district points of contact at each pilot site; they facilitated our work in many ways, especially by organizing our fieldwork, which included teacher interviews and classroom observations. Principals, teachers and other educators also graciously gave their time and openly shared their successes and challenges in piloting the tools.

RFA staff members traveled across the country to interview educators at the pilot sites and observe classrooms and professional development. Our team was also instrumental in developing interview and observation protocols and synthesizing fieldwork data into analytical memos. In addition to the authors, RFA math team members include Suzanne Blanc and Nicole Johnson. Kate Shaw, RFA's executive director, provided guidance and insight throughout all phases of the research process. We would also like to thank our intern Kamaila Sanders, who transcribed interviews and contributed to the analysis of interview data. Finally, Eric Foster of MDF Research & Associates consulted on the development of the literacy and math teacher surveys, administered the surveys, and analyzed the data; we appreciated his responsiveness to our many requests for just one more analysis. RFA's Michael Norton also provided guidance for survey development and data analysis. Our Communications Director, Alison Murawski, and our Communications Assistant, Allison Petrosky coordinated many aspects of report production.

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**Establishing a Strong Foundation:
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Introduction

The Bill and Melinda Gates Foundation has invested in the development and dissemination of high-quality formative assessment tools to support teachers' incorporation of the Core Common State Standards (CCSS) into their classroom instruction. Lessons from the first generation of standards-based reforms suggest that intense attention to high quality instructional tasks (Elmore, 2010; Hiebert and Carpenter, 1992; Hiebert and Wearne, 1993; Jones et. al, 1994), use of formative assessments embedded in those tasks (Black et al, 2004; Clarke and Shinn, 2004; Fuchs, 2004; Tunstall, 1996), and professional development (PD) that attends to both content knowledge and instruction (Birman et. al, 2000; Cohen and Hill, 1997; Kennedy, 1998) are essential considerations if teachers are to meet the demands of the CCSS.

Experts from the Shell Centre have developed a set of formative assessment lessons (FALs) for high school mathematics teachers to facilitate CCSS-based student mathematics learning and provide teachers with feedback about student understanding and mastery. The tools are designed to target the "instructional core" by:

- Raising the level of content;
- Enhancing teachers' skill and knowledge about instruction, content and formative assessment; and
- Catalyzing student engagement in their learning so that they will achieve at high levels (Elmore, 2010).

In 2010-11, the Mathematics Design Collaborative (MDC) was piloted in four districts and two networks of schools. In most cases, school districts applied for and received grants to implement MDC; in others, national networks were the grantee and the organizer. It is important to note that during the MDC pilot year, the use of FALs was limited in most sites. Many districts received the beta versions of the FALs towards the end of the school year and teachers did not have the opportunity to use them, as they were preparing students for state tests and end-of-course exams. Most teachers have only used the FALs as part of PD sessions.

In this report, which draws largely on data from three school districts and one school network, Research for Action (RFA) identifies the conditions and contexts for successful use of the tools, and examines the actions that district and school-based leaders can take to support teachers' adoption and effective implementation of the math tools. It provides specific recommendations to guide local leaders as they gear up to help year one teachers deepen their use of the MDC tools and teachers who are just joining the initiative to efficiently gain the expertise and skills they need to successfully implement the tools.

This report addresses the following research questions:

1. What are district and school-based educators doing to support robust implementation of the MDC instructional and assessment tools so that the initiative's intended early outcomes are achieved?
2. What district and school-based practices hold particular promise for assuring intended outcomes for teachers and students, as well as for sustaining and scaling up the initiative?

School and Larger System Conditions that Support Positive Early MDC Outcomes

It has long been known that local conditions matter and that strong supports are necessary to effect the fundamental changes in instruction that are necessary to raise the achievement levels of students (McLaughlin, 1990; Rand, 1977). Our multi-method research effort during the pilot phase of the initiative has drawn on the research base about instructional change to construct a theory of action that guides our investigation into the development, adoption, roll-out, and impact of the MDC instructional and assessment tools. Early qualitative research and conversations with foundation leaders, research partners, program developers, and MDC PD consultants have contributed to the continued refinement of the theory of action.

The success of this initiative begins with teachers. The first signs of successful implementation include teacher beliefs about math instruction that align with the MDC, teachers developing knowledge about how to use the tools, their ability to use them effectively and their reported strong buy-in and commitment to the use of the tools. For these early outcomes to emerge, teachers need strong support at the building and district level. Figure 1 presents a map of conditions that our research indicates are important supports for achieving early outcomes.

Figure 1. Map of Conditions for Early MDC Outcomes

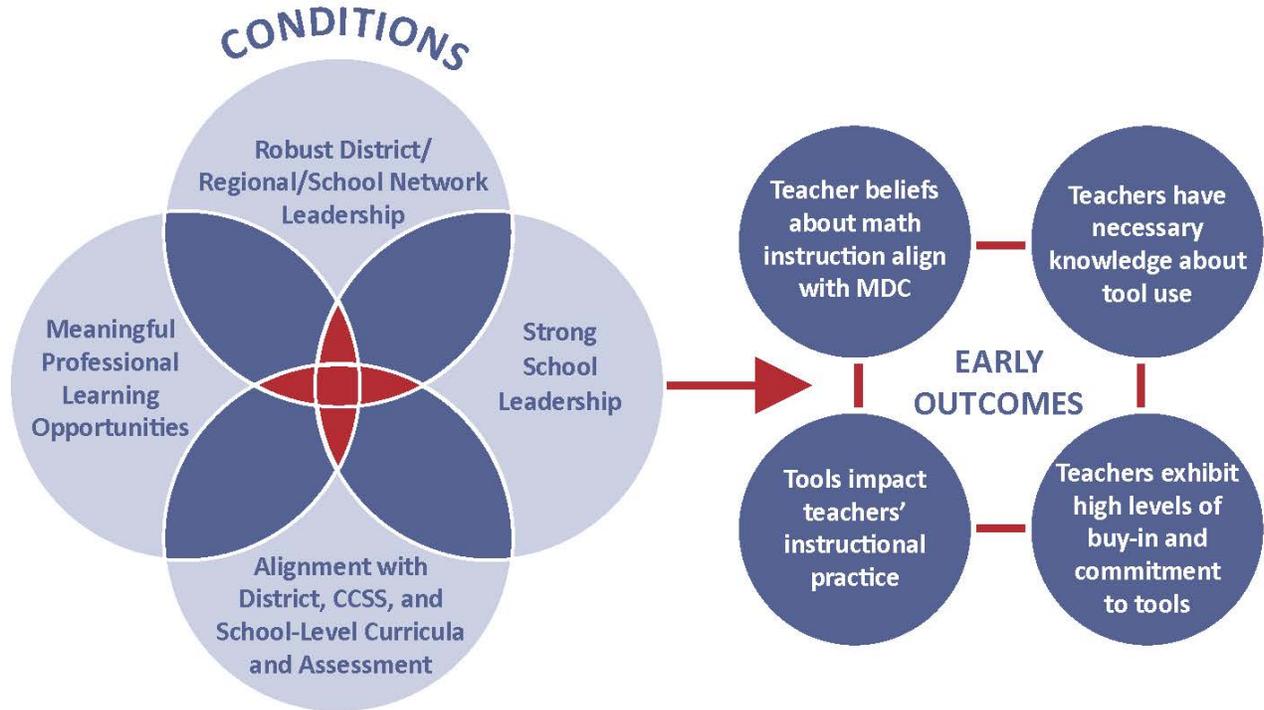


Figure 1 posits that four conditions will contribute positively to the necessary teacher beliefs, knowledge, practices, and teacher buy-in that will sustain and lead to successful implementation of the MDC initiative in school districts. These conditions for success were identified by analyzing their relationship with early outcomes exhibited by teachers that we would expect from the MDC initiative. Figure 2 below elaborates on these conditions.

Figure 2: Conditions that Support Achieving MDC Early Outcomes

<p>Robust district/regional/school network leadership to guide the initiative, oversee professional learning opportunities, build engagement and knowledge among stakeholders, and monitor alignment.</p>
<p>Strong school leadership that will champion the use of the FALs and that will establish and maintain the school structures (for example, time to discuss FALs with colleagues) and provide the necessary resources and support.</p>
<p>Meaningful professional learning opportunities that are intensive, ongoing, and incorporate content knowledge as well as instruction, and that include opportunities for collaboration with peers and classroom-based assistance.</p>
<p>Alignment with the CCSS, curricula and assessment so that teachers do not receive mixed messages about the importance of the initiative to achieving local goals for instructional improvement and student learning.</p>

Early Outcomes for MDC

Figure 1 also delineates early outcomes for MDC. Teachers are the primary users of the MDC tools. We would expect that early indications of successful implementation would be seen in changes in teachers' beliefs, knowledge of MDC, practices, and their buy-in into the initiative.

Early results are encouraging: At the end of the first pilot year, both survey and qualitative research indicate that the majority of teachers bought into the MDC initiative, that their beliefs aligned with the initiative's goals, and that they have acquired knowledge and adopted practices that support MDC. Table 1 below provides summary information on the status of early teacher outcomes. This information offers context for understanding this report's findings on how conditions correlate with early outcomes. We posit that the relationship between the conditions for success and early outcomes is straightforward: When the conditions and supports that we have identified are present, teachers are more likely to display and report early indicators of successful adoption and use of the tools.

Table 1. Overview of Early MDC Outcomes

MDC OUTCOME	Status of MDC Outcomes after Year One of Implementation
<p>Teacher beliefs about math instruction</p>	<p>The majority of teachers’ beliefs about teaching math are aligned to MDC. An overwhelming majority (94%) of teachers concurred that peer-to-peer problem solving is an effective way for students to learn mathematics. Teachers also strongly believed that all students can engage in mathematical reasoning (88%). Seventy-four (74%) percent of teachers said that the use of FALs had raised their expectations for students’ mathematical work.</p>
<p>Teacher buy-in to MDC</p>	<p>Most teachers report a high level of buy-in to the MDC initiative. The majority of teachers (87%) look forward to using the FALs during the 2011-12 school year, receiving additional FALs (87%), and making improvements in how they used the FALs (89%).</p>
<p>Teacher knowledge of MDC</p>	<p>Most teachers report knowledge of how to use the FALs and how to differentiate instruction for special student groups. Teachers report knowing how to respond to their students’ mathematical mistakes (93%) and that using the FALs has helped them learn detailed information about their students’ mathematical strengths and weaknesses (79%). Fewer teachers reported knowing how to differentiate instruction for ELL students (44%) and special education students (59%).</p>
<p>MDC impact on instructional practices</p>	<p>Most teachers report that their involvement in the MDC initiative has had an impact on their math instructional practices. Teachers reported that using the FALs helped them implement the CCSS (79%), provide more detailed feedback to students (82%), and engage the following student groups: students with varying mathematical abilities (89%), ELL students (67%), students who tend to be disengaged (78%), and students who are disruptive (79%).</p>

Methodology

In consultation with the Gates Foundation, RFA focused its fieldwork on four of the six pilot sites (three school districts and one school network), with one site visit in the fall and three in the spring. In addition, throughout the 2010-11 school year, RFA conducted fieldwork at separate PD events and at cross-site meetings, whose purpose was PD and sharing experiences related to the MDC initiative. In the fall, a brief survey was administered to teachers in the fieldwork sites in conjunction with the

teacher interviews. In the spring, a more comprehensive web-based survey was administered to a broader group of participating teachers. Table 2 below provides an overview of research activities.

Table 2. Overview of Research Activities

RESEARCH ACTIVITIES Fieldwork at four sites	Number of Participants
POC Interviews	6
Principal Interviews	9
Teacher Interviews	48
Other Educator Interviews	2
Classroom Observations	12
Professional Development Observations	5
Cross-Site Literacy Convening Observations	2
Fall Mini-Survey	17
Spring Teacher Survey (in all MDC sites)	83 Response Rate: 53%

RFA developed interview and observation protocols as well as the spring teacher survey to explore both conditions that might support implementation, and possible early outcomes. For example, the instruments explored the roles that school, district, and regional leaders played in the initiative, as well as MDC PD and other supports, and successes and challenges related to overall implementation and to the four conditions.

It is important to note the limitations of the data. Interview and survey data reveal teacher perceptions of areas such as conditions and outcomes. In some cases, teachers answer normatively and observation data reveal discrepancies, especially in the area of their classroom practices. It was also possible to triangulate the interview data – by analyzing whether differently positioned respondents (teachers in different sites) agree about outcomes. More information on research methodology can be found in Appendix B.

Organization of the Report

In the following sections, we report on the four key school and district conditions for robust implementation of MDC. In each section, we define the condition, describe what it looks like on the ground, and assess the specific contribution it is making to early indicators of success. Not surprisingly, these four conditions do not exist or operate in isolation; rather, they often co-exist and work synergistically. To illustrate this dynamic interplay, we present a brief case study of these conditions at work in two sites that were particularly strong in their implementation strategy.

Conditions that Support MDC Outcomes

This section focuses on the conditions that year one research has identified as central to robust implementation of MDC within districts, and examines their relationship to the four early indicators of success described above.

Condition 1: Robust District/School Network Leadership

Each participating site – whether a district or school network – developed a plan for the implementation of MDC. Leaders wrote a proposal to the Gates Foundation, deployed resources, identified participating schools, decided how school leaders and teachers would be involved, and, to a certain degree, the types of supports teachers received, especially the formal PD sessions that were offered. The district also selected a Point of Contact (POC) - a term coined to define the individual responsible for managing and maintaining the initiatives at the district or regional level - who facilitated and participated in many of the MDC activities. Most POCs were school district administrators. One site included in this study was a network of schools working with a leader who was located at their national headquarters.

Our definition of robust leadership at the district and school network levels is summarized in Figure 3.

Figure 3. Definition of Robust District/School Network Leadership

What is Robust District/School Network Leadership?

Year one research indicates that the following actions by district/school network leaders help create a firm foundation for positive early outcomes:

Bring expertise in math instruction.
While not all leaders involved with MDC need content expertise, when key leaders, such as POCs, are well-versed in math education, it gives the initiative greater credibility and positions the leaders to more effectively coach participants and engage in the other key activities below.

Build relationships and connections to educate and engage stakeholders in MDC.
POCs need to work across levels within the district with central office administrators, school-based leaders, and teachers. They need to be able to connect these stakeholders to each other for joint work on MDC.

Marshall resources to support MDC.
This includes identifying and facilitating the work of partner groups to provide professional development and other supports for MDC, monitoring changes at the levels of policy and practice in terms of their implications for MDC, and serving as an advocate for the effective allocation of necessary resources to support MDC.

Develop and communicate clear messages about the purposes of MDC and its connections to CCSS, curricula, and local accountability systems.
As high profile leaders of the initiative, POCs need to be able to effectively communicate the goals of the initiative to multiple stakeholders in order to create shared understanding and increase buy-in. Communicating the ways that MDC supports adoption of the CCSS and can align with existing curricula, programs, and state and local assessments is also crucial.

How did district/school network leadership relate to early indicators of successful implementation?

Qualitative data indicate that robust district/school network leadership contributes substantially to effective MDC implementation. Teachers in sites with a strong POC reported less confusion about the purpose of the MDC initiative and principals were more informed about the initiative.

What was the status of district/school network leadership during the first year of implementation?

Promising Evidence of Robust District/School Network Leadership

District POCs with expertise in math instruction were able to lead the initiative in a more robust way. One of the two POCs who had math expertise used her content knowledge and former teaching experience to provide a variety of supports to teachers as they piloted the FALs, including co-teaching

and observing teachers as they used the FALs in their classrooms. According to the district superintendent, administrators made a strategic decision to hire this POC to fulfill this unique role, after the first year of piloting MDC:

[In] Year 1, we didn't have the position. We did away with a position to create the position [that would manage the MDC initiative among other things]. For our schools, this is good work that our teachers need. We need a coach; we need a [PD Provider's name] all the time. [Our site's POC] was fresh from the classroom and she was the best person. It's about someone who understands math and someone who has been in the class recently. It can be carried forward because of people like [the POC] or other teachers in the building.

This POC had credibility not only with the teachers, but also with other district leaders who valued and trusted her math knowledge and professional experience as a math teacher.

The POCs who did not have math expertise worked with other school-based leaders who did whenever possible. In one site, several assistant principals participated in the MDC initiative. The participation of the assistant principals indicated strong credibility of the initiative in their school. In other cases, department heads played a similar role when the POC did not have math expertise. In these two sites, there were many participating schools or they were geographically dispersed. Therefore, the POC needed to partner with school-based leaders to ensure effectiveness.

POCs used their districts' involvement in the MDC initiative to leverage decisions about curriculum. Two sites were making decisions about adopting new textbooks and the POCs were able to discuss with both teachers and the school board the need for a more inquiry-based textbook that aligns with the CCSS of mathematical practice and the FALs. RFA observed one of the POCs describing the alignment of the new text to teachers during a math department meeting, which included the principal.

All POCs were highly involved in the MDC initiative and executed the most fundamental MDC activities. Their responsibilities included:

- serving as liaison to BMGF;
- coordinating PD and other meetings;
- participating in all or most PD, which included sessions for teachers and some observations of classrooms where teachers were using the FALs; and
- serving as a resource to participants for administrative and logistical issues.

Potential Challenges

In sites with unclear messaging about the purpose of the MDC initiative, teachers displayed a lower level of buy-in and commitment. In one site, teachers expressed a great degree of confusion about the purpose of the MDC initiative and how they were supposed to use the tools provided to them in PD.

Teachers were also confused about their continued participation in the initiative; many reported being surprised when they were asked to attend PD in the second year of MDC. Teachers reported feeling frustrated and confused about the district's purpose for participating in the initiative, which led to limited use of the FALs. When teachers in this particular site were asked if their participation was worth the time and effort involved, responses included:

It's always worth the time and effort to be able to be able to learn something. First thing I thought of, "Am I going to be able to use it later?" And I don't know if I'm going to be able to use it later. That's the big key.

I never saw how I was really supposed to take any of this stuff and use it in my classroom. I was just doing my time.

As we discuss the remaining conditions in this brief, it is important to keep in mind that the districts' MDC implementation strategy is an underlying factor in all of the analyses. There was a great degree of variability in how some of the conditions manifested in schools, including the roles and involvement of school leaders and teachers and professional learning opportunities. The case studies will examine how these variations played out and interrelated and will highlight the centrality of the district and the POC role in the MDC initiative.

Condition 2: Strong School Leaders

Research on school reform has long pointed to the important role of school leaders in making long-lasting, substantive changes to instruction that will boost student achievement (Edmonds, 1979; Davis, Darling-Hammond, LaPointe, & Myerson, 2005). Recently, research has also emphasized that school-based leadership cannot be located in a single person, but needs to be distributed beyond the principal. Teacher leaders can and should make contributions to the improvement of teaching and learning, not only in their own classrooms but across the school (Harris & Spillane, 2008; Leithwood, Seashore-Louis, Anderson, & Wahlstrom, 2004). In the MDC initiative, it was important to examine the role of principals and even math department chairs in supporting implementation of the MDC framework.

Our goal was to uncover whether and to what extent strong school leadership functions as a condition of successful implementation and use of the MDC tools. To examine this question, we explored the ways in which perceptions of school leaders correlated with early indicators of successful implementation – namely teachers' beliefs, knowledge, and practices relating to MDC, and their buy-in to the initiative.

Our definition of strong school leadership is summarized in Figure 4.

Figure 4. Definition of Strong School Leadership

What is Strong School Leadership?

Drawing on our early research in the MDC pilot sites, as well as existing research about school improvement, we argue that strong leaders exhibit the following traits and characteristics:

Communicate the importance of the MDC tools.
Strong school leaders communicate to teachers the importance of the initiative and the potential of the MDC framework to help them improve student learning.

Coordinate other efforts in the school to align with and support the use of the MDC framework.
These other efforts included school curriculum and textbooks.

Provide resources to teachers.
Resources such as time for professional development and meetings with MDC colleagues could help teachers develop a deeper understanding of the tools and better use of the FALs in their classrooms.

Provide direct help to teachers.
For example, strong school leaders provide feedback about teachers' use of the FALs, observe teachers' use of FALs and offer comments and suggestions so that teachers can make corrections.

How did strong school leadership relate to early teacher outcomes?

Strong school leadership was significantly and positively associated with all four of the teacher outcome measures: teacher beliefs, teacher buy-in, knowledge, and practices. As shown in Table 3, the relationship between strong school leaders and teachers' reports of changes in their practice was strongest, but all desired teacher outcomes displayed a significant, moderate relationship to the presence of strong school leaders.

Table 3. Relationship between Strong School Leadership and Early Teacher Outcomes

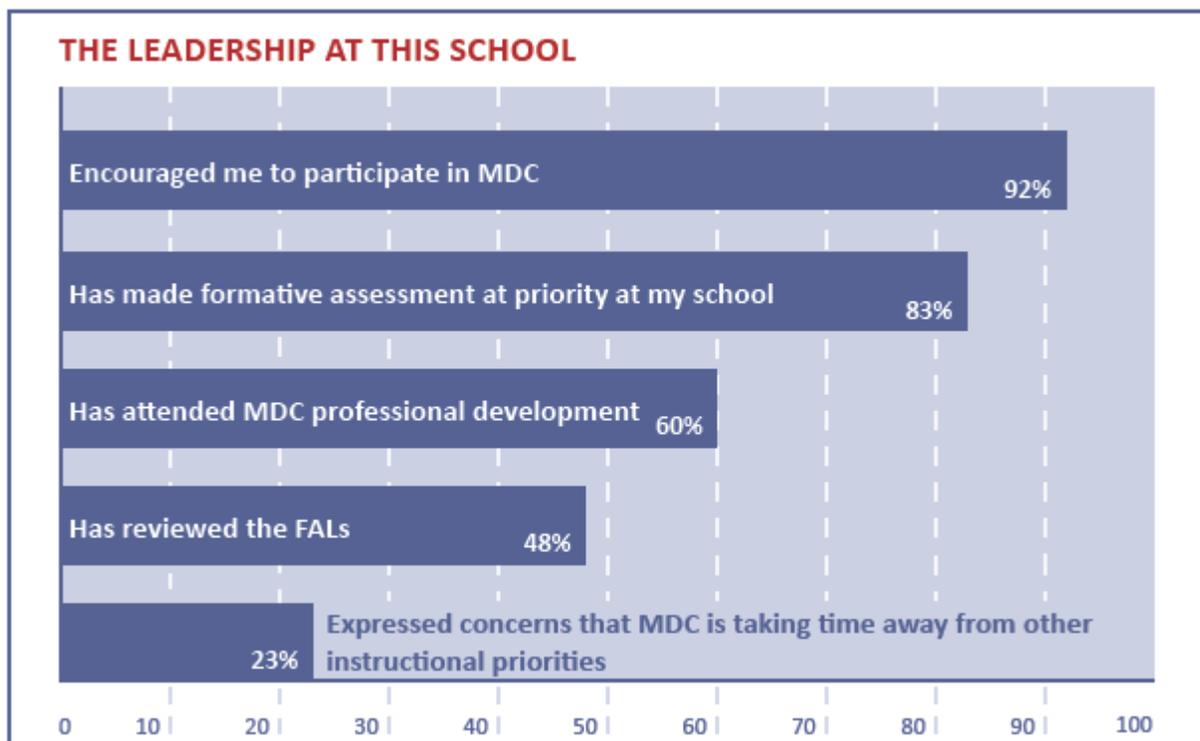
	Teacher beliefs are aligned with MDC	Teacher buy-in and commitment to tools	Teacher knowledge about tool use	Tool impact on instructional practices
Condition: Strong School Leadership	.26*	.31*	.30*	.37*
* p = ≤ .05				

What was the status of school leadership during the first year of implementation?

Promising Evidence of Strong School Leadership

Teachers perceived that their school leaders championed MDC and agreed that its underlying ideas were sound. As Figure 5 shows, 92% of teacher respondents reported that they were encouraged to participate in the initiative by school leaders. Our interviews with teachers and principals indicated that, in most instances, the invitation to participate came from the principal and or the department chair. The invitation also indicated to teachers that principals valued the math department and they believed teachers would be strong “early adopters” of the new MDC instructional tools and make important contributions to the initiative by their participation.

Figure 5. Teachers’ Perceptions of School Leadership



Most teachers also reported that their leaders were in agreement with important ideas underlying the initiative. Eighty-three percent (83%) reported that their leaders made formative assessment a priority. This perception reassured teachers that their work with MDC was well-aligned with their school’s instructional priorities and that school leaders would stand by teachers’ instructional practices and decisions.

Principals supported the MDC initiative by providing release time for teachers to attend PD during the school day. Though principals and teachers expressed concerns about the amount of instructional time lost to MDC professional development, principals reported securing substitutes so teachers could attend PD, giving teachers time to meet, and providing general encouragement.

I give them time, I give them encouragement... Being there to support them.

My role is to be very supportive of teachers who are having the training. I make sure they have everything they need to continue and support them...

I think my role is just making sure that the teachers have the time to be able to meet, that it is still seen as a school-wide priority, that it is not the 'flavor of the year.'

Potential Challenges

Fewer teachers reported that their leaders were involved in more active ways. Sixty percent (60%) of teachers reported that school leaders had attended MDC PD and 48% reported that their leaders had reviewed the FALs.

Principals were less involved than other school leaders. Only 17% of teachers reported that their principals had offered suggestions for using the FALs. Principals also generally had limited knowledge about the MDC tools. Many principals reported that their low level of involvement and their reasons for being less than fully engaged in the MDC work often had to do with size of school, too many demands, numerous initiatives, designating an assistant principal to the MDC, and not being a “math person.” Principals’ comments include:

Since we are such a large school, I have not been as directly involved as probably some of my colleagues in smaller schools. ... I have just gotten very superficial training in comparison to the level of training that the [assistant principal] and the teachers have gotten.

I haven't attended any professional development. I have pretty much left a lot of it up to my assistant principal. ...I would like to be more involved next year.

I think that I wish I had been a little bit more involved. As a high school principal, it's hard to keep up with everything and I wish I had made it a priority for myself. Like I said, I tend to opt out when it comes to math. I should not have done that; I should have taken on a more active role.

I feel like a cheerleader more than a principal sometimes, but I'd like to focus on instruction more.

Twenty-three percent of teachers reported that their school leadership expressed concern that MDC took away time from other instructional priorities. Some principals expressed concerns over the

amount of instructional time teachers missed in order to participate in MDC PD. Some teachers also expressed a similar concern.

Condition 3: Meaningful Professional Learning Opportunities

Research has indicated the central role of professional learning in supporting changes in instruction (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). In this section, we examine how professional learning opportunities can contribute to the successful adoption of MDC. Included in our definition of professional learning opportunities are: 1) formal PD; and 2) individualized support to teachers.

A summary of our definition of meaningful professional learning opportunities is presented in Figure 6.

Figure 6. Definition of Meaning Professional Learning Opportunities

What are Meaningful MDC Professional Learning Opportunities?

Drawing on our early data from the MDC pilot sites, as well as existing research about professional learning opportunities, we define meaningful MDC professional learning as exhibiting the following characteristics:

- Professional development activities have a clear connection to MDC initiative and FAL use.**
The goals of a particular professional development session are clearly articulated to participants and they understand how the material covered should be applied in their classroom and when they are using the FALs.
- Opportunities for teachers to work through FALs collaboratively with the facilitation of a professional development provider.**
Working through FALs allows teachers to simulate their students' future experiences with FALs and understand the unique and specific structure of the lesson.
- Individualized support that responds to teachers' specific needs, e.g., classroom visits, feedback on FALs.**
This support can come from a variety of sources including district administrators, content experts, school-based instructional leaders, and professional development providers.
- Rich and ongoing opportunities to meet and collaborate with colleagues.**
Collaboration can focus on using FALs and sharing and discussing student work. Educators also benefit from opportunities to visit each other's classes during FAL implementation.
- Logistics and scheduling of professional development activities align with curriculum pacing and district assessment calendar.**
Teachers have the opportunity to use a FAL with math content that is closely related to that particular unit of study in a course (i.e., chapter one of geometry). Professional development occurs at a time that does not compete with state assessments and end-of-course exams at the end of marking period.

How did meaningful professional learning opportunities relate to early teacher outcomes?

Meaningful professional learning opportunities were positively and significantly associated with teacher beliefs about math, teacher buy-in, and teacher practices. Teachers who experienced more PD and opportunities to use the FALs were also more likely to report that their beliefs about teaching math align with the goals of MDC. They also reported high degrees of buy-in, and that their practices have changed.

Interestingly, as Table 4 depicts, the correlation between professional learning opportunities and teacher knowledge was weak and not significant, suggesting that the degree to which teachers reported engaging in PD was not significantly related to their knowledge about MDC.

Table 4. Relationship between PD and MDC Outcomes

	Teacher beliefs are aligned with MDC	Teacher buy-in and commitment to tools	Teacher knowledge about tool use	Tool impact on instructional practices
Condition: Professional Development	.24*	.23*	.08	.31*
* $p \leq .05$				

What was the status of professional learning opportunities during the first year of implementation?

Promising Evidence of Meaningful Professional Learning Opportunities

Individual support for teachers to use the FALs is beginning to emerge as a necessary professional learning opportunity. Even though the MDC initiative has completed its second year, teachers' use of the FALs in most sites has been limited to PD because the beta versions of the FALs were not ready for use until the second half of the 2010-2011 school year. As part of the PD strategy, providers introduced teachers to the individual lessons by simulating FAL instruction so teachers could approximate the FAL experience of their students. Teachers have also used FALs in their classroom either in preparation for PD or while the PD provider and teacher colleagues could observe. Since most teachers have had few opportunities to use the FALs in their classroom teaching, they have not needed individual support. However, some early evidence of success comes from one of the pilot sites included in the case study (Millbrook School District) towards the end of this brief. The district POC and other educators, such as a department chair and special education teachers, have provided individualized support to their teacher colleagues, which bolstered teachers' use of the tools.

Most teachers valued the PD they received in the first and second years of the MDC initiative. As part of each site or school's implementation strategy, teacher involvement in the MDC initiative varied from year one to year two. For example, some schools decided to involve their algebra and geometry

teachers in year one (since the FALs were geared towards those content areas) and then include their entire math department in year two. Other schools involved their entire math department in years one and two. The first year focused more broadly on formative assessment as a pedagogical strategy, while year two focused on the implementation of the FALs themselves as they became available. Ninety-seven percent (97%) of teachers reported that the PD in year one of the initiative helped them use formative assessment strategies effectively. Ninety-three percent (93%) of teachers reported that PD in year two helped them use the FALs in their classrooms effectively.

Teachers valued the opportunity to collaborate with their peers during PD. As part of the PD sessions, teachers often worked collaboratively on the FALs and they reviewed sample and real student work. Teachers also reported that they benefited from working with teachers at other schools. Many teachers mentioned peer collaboration as their favorite aspect of the training. One respondent commented that, “I think that the best part is when I go to these meetings, I get to talk to different teachers... and I hear the stories of what worked, what didn’t work. That’s all very helpful.”

Similarly, 60% of teachers in one network mentioned how helpful it was to be presented with these lessons through PD rather than simply accessing the lessons on the internet, in part because the lessons require both a change in curriculum and change in the way that math is traditionally taught in classrooms. One respondent explained:

Teachers do not have the time to teach themselves through online resources alone. There are so many online resources and we need to prioritize what is important and what we should focus on. When there is professional development we focus on what we are learning. This requires some cultural changes - this is about changing teaching habits, and it is hard to change what teachers have been doing for so long unless you pull them aside from the everyday duties to focus on this work. Online assistance is okay, but there are so many resources that are dumped on teachers, but we do not have time to go through them all. There are so many that we are confused by the many choices.

This quotation emphasizes the importance of creating professional learning communities and allowing teachers to learn from one another, as opposed to implementing the lessons with teachers in isolation of one another and without the support systems to provide ongoing training.

Teachers benefited from many of the PD activities, but they especially benefited from observing the PD provider use FALs in classes with their students. One particular PD provider built credibility with teachers by using the FALs with teachers’ actual students. This approach gave teachers an opportunity to observe an expert using the MDC materials, including administering and facilitating the essential components of the FALs. This in-classroom PD also provided teachers with a chance to step back and observe their students’ responses to the lessons, paying particular attention to how students

with varied mathematical abilities engaged with the FALs. Some teachers commented on the benefits of this type of PD: “She was so hands on...She is in the trenches with your students” and “Just looking at [our PD provider] – she has been terrific modeling for us.” Another teacher said:

She came in to some specific classes and she actually ran some of them herself to kind of model for us what should happen in the classroom with kids in front of her – questioning techniques, building an expert, those kind of things. It was nice, like [my colleague] was saying, because we were able to see Ann struggle with questions from students and like how do you deal with that. So we were building a lot of knowledge on the whole system by watching her with our students.

Other PD activities that teachers found beneficial include: discussions of strategies centered on addressing student misconceptions, responding to student questions with guiding question, and using different methods to assess students.

Teachers’ participation in MDC PD led to changes in instructional practices. Many teachers reported that they benefited from PD that focused on helping them facilitate discussions with their students. For many teachers, this was a new and unfamiliar role and required them to suspend more comfortable practices while using the FALs. Teachers commented about the PD:

[There was] a lot of good questioning. [Our PD Provider] likes the idea of the multiple entry points. I like multiple representations and I like multiple questions...I answer my student’s question with a question and then I pull the others in – so there is that engagement going on...I like their style of questioning. The thought provoking questions – that is what I’ve internalized.

I think that the professional development has helped me ask questions in a different way, even when I’m not using a Gates task. I am more aware of using corporate wait time, soliciting those questions – try to pry it out of them as much as possible, asking more leading questions.

Potential Challenges

The proximity of PD to the state assessment was an issue for some teachers. With the pressure of state assessment systems and the push to prepare students, scheduling PD close to the assessment dates did not support their successful implementation of the lessons. While the teachers were interested in the tools and saw their value, it was a problem to lose time with their students at that point in the school year. As one teacher explained:

The timing has been absolutely terrible because...our state standards have been bumped up tremendously and what they really asked us to do is going to take two days out of my classroom right toward the end...when...I am judged, our school is judged, the county is judged; although it was a good activity, the timing was absolutely terrible.

Teachers reported that using the FALs out of context dilutes the instructional benefits for teachers and students. Teachers were asked to pilot these lessons at points in the academic year that were out of sync with where they were in the curriculum. Even though they were using the FALs in coordination with PD, teachers felt that they were misusing valuable instruction time by using FALs that did not alignment with their curriculum unit.

When the goals of the MDC initiative were not communicated effectively, teachers were confused and frustrated. The PD experiences of respondents varied, in part, due to the use of multiple providers. While all teachers reported benefiting from the PD, teachers in one site were particularly frustrated with PD that focused on scoring student work. They did not understand the purpose of these sessions and felt that too much time out of school was spent learning this process. One teacher stated, “We would spend a day on scoring. They would give us a stack of papers to score and that is how we spent our afternoon. Some teachers felt it was a waste of their time.”

The format and messaging of the PD varied across pilot sites and networks. While there were similar training themes across sites, different trainers seemed to emphasize certain pedagogical strategies more than others. For instance, in one case, there was an emphasis on “reengagement” while in another there was a reported focus on the “facilitation” for student discussions.

MDC PD competed with other PD initiatives in the districts and created confusion for teachers.

States and districts often have multiple PD initiatives in place at any one time. This was the case in two sites. Even though the initiatives were aligned with the MDC initiatives, requiring teachers to focus on multiple new teaching strategies at once made it harder for them to focus on the formative assessment lessons. In one district, a respondent explained that the two initiatives “are not contradictory and they do align...it is just hard to do both trainings and remember what you are supposed to do with each one. (It is) a little frustrating sometimes for us.” In the other district, “there were two groups doing PD...so we were doing two things simultaneously and it got a little confusing.”

Condition 4: Strong Alignment of MDC with the CCSS, Curricula and Assessment

Research on educational reform indicates the critical role alignment plays in adoption and sustainability. As Coburn notes, “Teachers and schools are more likely to be able to sustain and deepen reform over time when school and district policy and priorities are compatible or aligned with reform” (Coburn, 2003, pg. 7). Teachers who perceive alignment between the educational goals of their schools and districts with the goals of the MDC initiative may be more willing to fully engage or buy-in to the new initiative, which could lead to the deepening, spreading, and sustaining the initiative.

Our definition of strong alignment with MDC with curricula and assessments is summarized below in Figure 7.

Figure 7. Definition of Strong Alignment

What is Strong Alignment?

Drawing on our early research in the MDC pilot sites, as well as existing research about school improvement, we argue that there are three levels of alignment:

Alignment with district and state accountability systems.
Teachers’ perceptions of whether MDC complements and even enhances teachers’ ability to achieve the student performance goals set forth by the district and state accountability systems, specifically their standardized tests.

Alignment with district and school strategies.
Teachers’ perceptions of whether MDC aligns with district/school decisions about how to achieve the student learning goals, such as broad curriculum and instructional approaches.

Alignment with district and school programs and policies.
Teachers’ perceptions of whether MDC aligns with specific district tools and actual district programs and policies, such as pacing guides and other math programs.

How did alignment relate to early teacher outcomes?

Strong alignment is the condition most strongly correlated with the early indicators of success: teacher beliefs, teacher buy-in, teacher knowledge, teacher practices. As Table 5 shows, teachers who reported that the MDC initiative was aligned to their curriculum and assessments also reported that their beliefs about teaching math aligned with the goals of MDC, that they had strong buy-in to the initiative, and that they increased their knowledge and adopted new practices. Since math is an important “tested” subject, math teachers may feel more pressure than other teachers to ensure that their instructional practices are preparing students for assessments.

Table 5. Relationship between Alignment and MDC Outcomes

	Teacher beliefs are aligned with MDC	Teacher buy-in and commitment to tools	Teacher knowledge about tool use	Tool impact on instructional practices
Condition: Alignment	.44*	.60*	.37*	.61*
* p = ≤ .05				

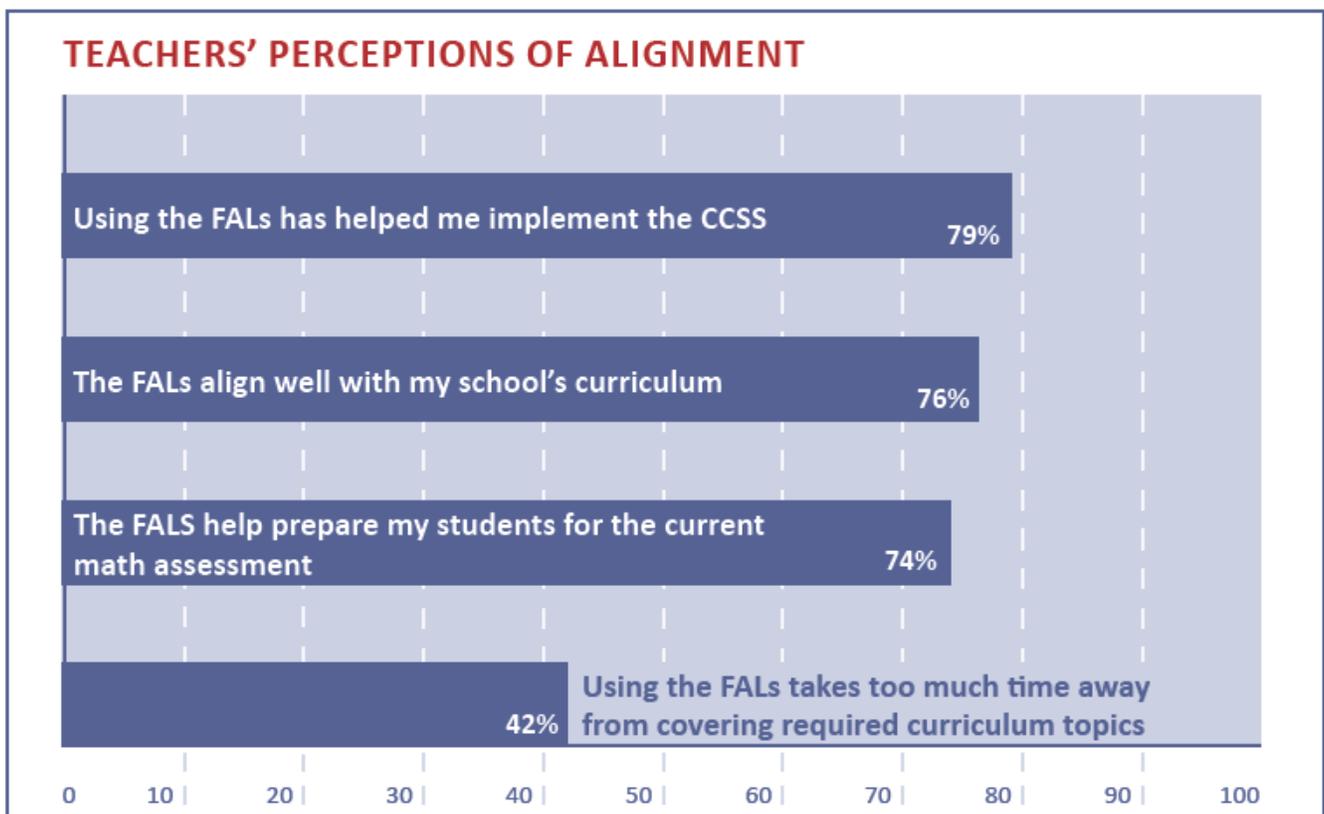
What was the status of alignment during the first year of implementation?

Promising Evidence of Alignment

Most teachers (79%) teachers agreed that using the FALs has helped them implement the CCSS. Generally, teachers reported that the FALs will help them implement the CCSS. For example, one teacher stated:

They [the FALs] would fit better with the common core for next year because these are developed for the common core, not for specific state standards. Since we are all going to use common standards, I think these lend nicely with those standards.

Figure 8. Teachers' Perceptions of Alignment



Most teachers (76%) believe the MDC tools are aligned with their curriculum. The interview data also suggest that many teachers perceive a great deal of alignment between their curriculum and the tools. One district is planning to adopt a new textbook call *Springboard* and many teachers reported that the new text is very aligned to the MDC initiative. In a different district, the POC was concerned about textbook alignment because their district just adopted a more traditional math text that focuses on procedural math. She stated that the FALs are increasingly more important because students need the inquiry-based tools to compensate for the traditional text. One school was deeply involved in a

professional learning activity they called *Best Practices of Instruction*, which incorporated two key areas: the Habits of Mind and Habits of Interaction. One teacher said:

We've also done best practices and so best practices have those habits of mind and habits of interaction so we use those things in disperse with the Gates and that kind of stuff so the kids having to stop and think before they answer the question or to justify their answers or can you show it a different way, they were kind of used to it.

We've had other workshops system wide, a mingling of ideas in a complementary way. We've had workshops from a company from Oregon that has Habits of Mind - the idea again is to try to get this math talk going. It's ok to make mistakes, mistakes are a way of learning. The whole idea is to get some clarification in there. Sometimes one of the interaction things is to have some quiet time so they can look at things on their own, which is usually done at the beginning on an activity. The professional development is aligned with other initiatives and things going on in the district.

Teachers in this school not only perceived curricular alignment with the MDC tools, but also instructional alignment.

Most teachers (74%) believe that the MDC tools align with their current or future state assessment.

Interview data corroborate this finding. For example, one site has open-response test items on their state assessment, and teachers and principals saw a great deal of alignment between the FALs and those types of questions. One teacher stated, "I would say yes [there is alignment] because if they can get through the Gates task, they pretty much an answer the state assessment questions."

Potential Challenges

Almost half (42%) of survey respondents raised concerns that using FALs can interfere with curriculum coverage. Many teachers were very concerned with time needed to implement a FAL, partly due to the fact that they needed two to three days to use them and they had not incorporated FALs into their curriculum pacing guides. Many teachers felt pressure to prepare their students for the state exam, and it was difficult for them to shift from preparing students for the state test to using the FALs that required two to three days. Many teachers and POCs reported that over the summer they planned to align the FALs to their curriculum and include them in their pacing guides for more seamless use next school year.

Case Study

MDC and a tale of two districts: Central and Millbrook School Districts

As noted in the introduction, there were two kinds of grantees in the pilot year: school districts and national networks. In these case studies, we focus on two particular school districts because both

qualitative and survey data revealed strong conditions for implementation in these sites. As a way to illustrate how the four conditions of successful early implementation work in concert to create an environment that supports teachers' acquisition of the kinds of knowledge, skills and beliefs necessary for effective use of the FALs, we present two case studies. We selected these two sites because of teachers' reports of strong and positive conditions in their sites, the unique roles of the two POCs, and the striking differences in terms of district size and other demographics. Our intent is to illuminate how the MDC initiative rolled out in two very different contexts but with a common end result: active district and school leadership and engaged and enthusiastic teachers.

The first case study examines two schools, Roosevelt and King, within a large, urban school district – Central School District. In the second case study, we look at Millbrook School District, a much smaller, more suburban/semi-rural site where all three of the district's high schools are participating in the MDC initiative.

Central School District

Central is a large urban district and 14 of its high schools participated in the MDC initiative. Most schools included a small portion of their math department in the initiative, but the two schools included in RFA's fieldwork included their entire math department of teachers. One of the participating schools is Roosevelt – a large high school broken down into seven Small Learning Communities (SLCs) with about 350 students or less in each. One of the SLCs is participating in the MDC initiative; its math department has five teachers and all are involved. King is a much smaller high school overall, with approximately 476 students and 24 teachers participating in MDC.

District Leadership: An Emphasis on CCSS

The role of Central's POC is centered around rolling out the district's numerous pilot programs, including the MDC, that are focused on helping the district implement the CCSS. In this role, the POC attended and coordinated PD, visited schools, and worked with the district's many networks that support teachers. With regard to the MDC work, the POC was charged with, in her words, "working with teachers...more on the collaboration side and not so much on the [mathematics] content side". Her district-level position signaled to principals and teachers that administrators perceived strong alignment between MDC and the CCSS. The POC brings to the MDC initiative a complex understanding of the many initiatives and activities the district is involved in, while maintaining focused attention on the CCSS. She relied on Assistant Principals and district network leaders, when possible, with strong mathematical backgrounds and expertise to help support and sustain the MDC work in individual schools.

School Leadership: Sharing Responsibility

Both Roosevelt and King had assistant principals deeply involved with the MDC work. In addition to their typical administrative responsibilities, the two school leaders were also concurrently teaching

mathematics classes. Wearing the hats of both a school leader and a classroom teacher provided the assistant principals with unique perspectives – a big picture awareness of where the MDC initiative fit within the larger context of the district’s goals and activities, as well as deep content knowledge, and an intimate familiarity with the challenges of teaching high school mathematics. As well, both assistant principals played a pivotal on-site training role within their schools. One teacher said of the assistant principal, “[He] is very, very supportive. He offers his advice, ‘You might want to have a summary at the end, tweak it a little bit, change the assessment and then when you are able to go back to it, what would you do now.’”

Every school in this district also works with a network that provides services and supports to teachers including instructional staff who deliver PD on the CCSS and curriculum mapping. The network leaders have a presence in the school, and both leaders at Roosevelt and King attended the MDC PD. Network leaders have been supporting their teachers’ use of the FALs and learning along with them in PD. Their involvement also adds another layer of to teachers’ perceptions of alignment, as one of responsibilities of the network leaders is to help schools and teachers implement the CCSS.

The school principals of both King and Roosevelt acknowledged that while they were very supportive of the MDC work, they were not especially involved. Yet as the King principal noted, being “supportive” is much more than being a cheerleader (although cheerleading can be important) for the MDC work: “[Next year] I have restructured our programming so that we have 2-hour blocks every week that are devoted to teacher time. One block is devoted to inquiry work and the second one is devoted to student enrichment or support.”

Professional Learning Opportunities: Meaningful PLOs that support teachers

District and building leaders and teachers were enthusiastic about the training. Both principals praised their teachers’ content knowledge but also acknowledged that the MDC initiative required teachers to teach somewhat differently. The Roosevelt principal described it as a “...shift for teachers on how to present material in a different fashion” to students. This same principal also expressed concern that his veteran teachers might be less willing to make the necessary changes to their teaching, saying, “They are usually more reluctant to make significant shifts in how they do things.” However, the principal credited the collaborative professional experiences for moving the work forward:

I have been very pleased with what has happened... The teachers teaching 25-30 years are usually more resistant to making changes in their practices, and I think this process of them having worked together as a group, having had the meetings with teachers of other schools, and having them see the focus of this, has really moved them at a much quicker paces than it would have had it been [the AP] or myself saying, ‘You need to make changes.’

The AP/math teacher at King felt strongly that the PLOs were an essential component to engaging teachers in the MDC work:

It's a way to help teachers develop a better sense of who they are as teachers and a better sense of reflection. When you are immersed in work like this, when you are asked to work with others, it really forces you to reflect, think, talk. It's that work that I think teachers have gotten away from or never really had because they've never had the time to put themselves in situations where they are forced to think and talk about the work.

Collaboration and individual support emerged as an important component of the MDC work at King High school. It is a rather small math department and they have become close colleagues, supporting one another when possible. The network leader also added another supportive dynamic to this close-knit department. One King teacher stated:

My department here, we spent a lot of time talking about these activities and evaluating them in house and I have a lot of trust and faith in the people that I work with, we have all been pretty much all of us have been together for the last 7 years, there hasn't been a lot of change over in the staff here and so we all have a pretty good rapport. And the coordinator that we have from the network has been a big help with that too. Rose has been here a lot working on this also so from a support standpoint I felt that I had plenty of support on it [MDC], that's not a problem.

Alignment: MDC supports CCSS

A driving force in the district has been the adoption of the Common Core State Standards (CCSS), and school leaders and teachers perceived strong alignment between the CCSS, the MDC, and with activities both schools were already engaged in. According to the AP at King, "The purpose of [MDC] coincides with the transition to CCSS, and we have to do things differently. [MDC] is a nice vehicle for transitioning to our CCSS and teaching math differently." The Roosevelt principal also credited MDC with supporting and advancing the CCSS.

Millbrook School District

In contrast to Central, Millbrook is a much smaller suburban/semi-rural district with just three high schools, all of which are participating in the MDC initiative. However, like Central, Millbrook has also adopted the CCSS and is strongly committed to the new standards. Central's three high schools are roughly the same in terms of student population: School A has 1258 students; School B has 1166 students; and School C has 1434 students.

District Leadership: Deeply Engaged and Accessible POC

Millbrook's POC played a unique role in the MDC initiative. She served as a liaison between the other district administrators, principals and teachers regarding MDC activities. She also organized and convened PD. She joined the MDC initiative at the beginning of its second year after spending 15 years

in as a math teacher. She had a great deal of credibility with her district and school colleagues as a result of her professional experience and it also allowed her to work with teachers in the classroom. Most importantly, the Millbrook POC had a presence in each of the district's three high schools and she provided many supports to teachers to help them use formative assessment in the classroom and the FALs. She co-taught lessons, observed teachers, video-taped lessons to use in PD, and interacted with teachers over email about MDC issues, in addition to her other work responsibilities. Many teachers in the district commented that they often used her as a support and that she was extremely effective in her district MDC POC position.

She was in the classroom for 15 years and just came from there so she has a lot of great ideas, a lot of different things that we may not have thought of. She's been so beneficial to us. She has been so open to coming into the classrooms and helping us with these tasks and her being in the trainings with us and seeing and working with the tasks and just really backing Gates grant.

The POC is an email or a phone call away. She's always available and willing to come to class. I have one class where I wouldn't try it without her help.

Teachers from other sites did not talk about their POC in this manner, probably because their POC played a different role in the initiative or the district. In a smaller district, with only three high schools, the Millbrook POC was able to provide these unique types of supports to teachers.

School Leadership: Supportive Principals and Emerging Leaders

Principals seemed to be fairly knowledgeable about the MDC initiative in their schools. All principals conveyed their support for the initiative and all three had attended some PD related to MDC. One of the three math department chairs has also emerged as a leader of the MDC initiative. A few teachers in his school commented that they seek him out, in addition to the district POC, if they have questions about how to use the FALs, among other things:

I go to the department chair, or [the POC]. Today [the department chair] did one of the same lessons that I did with the expressions, and we saw each other in the hallway because our classes are close together and we talked about it.

This particular department chair has also emerged as a leader in the state's MDC initiative. He has presented at two state level convenings regarding his experiences in the initiative.

Professional Learning Opportunities: An Evolution from Confusion to Clarity

Teachers' experiences with PD evolved over the two years that they participated in the MDC initiative. Teachers reported being confused at the beginning of the initiative. Some teachers were unsure of the initiative's purpose and others reported that they were unsure of the how they were supposed to work in the formative assessment strategies without the tools used to model that instruction.

***Challenges in the beginning:** When we first went into it we weren't told a whole lot about it, and we felt like we were going in kind of blind. It took us until the 2nd or 3rd time until we went, 'Okay it's starting to make more sense.' Maybe if we just had more information leading in we would have felt more comfortable with it... There were times where you'd get frustrated because we're changing. We're having to do an about face and do some changes of the things we were comfortable with. So I think there was some struggle with it...*

***Overcoming the obstacle:** But I think we all said, I like what I see....Now that we're start to get more of the resources geared to the core content, that's when we're starting to see it will fit in and I can feel like I can develop their thinking skills as well as moving my class forward to accomplish what I need to by the end of the trimester.*

After overcoming the initial hurdle of lack of clarity, most teachers reported valuing the experience of working through the lessons and learning the multiple ways their colleagues approached solving the FAL problems.

Alignment: MDC Complements and Reinforces District's Educational Goals

Teachers and principals reported a high degree of alignment of MDC with the new math textbook the district chose to adopt, *College Spring Board*. One teacher stated, "I think Spring Board compliments Gates in that students have to own a lot of their learning. It's not very fast-paced, but it does require that you do what you have to do to move on. It doesn't include Gates-like activities but we did see where we could slide them in." Teachers and principals also saw a great deal of alignment with a portion of their state test that requires students to answer open response questions by showing their work. They felt that the FALs and the formative assessment strategies would reinforce conversations teachers have with students about how to answer those questions.

Millbrook's teachers were especially concerned about the time it takes to use the FALs and the POC actively worked to address these concerns. At the time interviews were completed with teachers, they had not had the opportunity to align their pacing guides around using a FAL that requires 2-3 days. During a follow interview with the POC, she reported that:

We have begun doing our curriculum mapping and are starting to put the FALS into the maps to allow timing. That was one of our teachers' concerns, about the amount of time the FALS take and teachers' need to get through their curriculum. Springboard is very inquiry based, and we are hoping the whole idea of covering content and lecture as the sole way of teaching math goes away.

Lessons Learned from Central and Millbrook

Central and Millbrook provide a first glance into how strong, positive conditions can work together to support and enhance the use of the FALs. The high degree of coordination by the district leaders, along with the structures and practices they initiated, helped to create those positive conditions. District and

school leaders and researchers should pay more attention to these conditions as more teachers begin to use FALs that align with their curriculum pacing guides.

Making the Most of MDC: Implications for Pilot Sites and Beyond

Policy makers and educators are in the beginning stages of processing how teachers will implement the CCSS. Some school districts and even a few states have gained a head start by piloting the MDC in math classes at the secondary level. District administrators, school leaders, and teachers have all reported that their work with the MDC has not only been a rigorous experience for them, but for their students as well. Most educators in the pilot sites have used the MDC framework with great success, but it has also presented challenges. Below we offer recommendations for how districts and school networks can more fully support and sustain the use of the MDC framework in their schools.

Recommendations

Condition 1: Creating and Sustaining District/School Network Leadership

- **District/regional/ school network leaders should identify and develop building-level MDC experts who can help the POCs provide on-site support to teachers.** Ideally, these individuals would have deep mathematical content knowledge and be able to provide hands-on instructional support to their colleagues. As more teachers become involved in the MDC work during subsequent years, POCs will need assistance to support teachers' PD and their use of the FALs.
- **District/school network leaders need to clearly communicate the purpose of the MDC initiative and its connections to the CCSS and existing curricula and state assessments.** It is important for leaders to monitor and quickly address teacher concerns about purpose and alignment, so that perceptions of conflict between for example, curriculum pacing or preparation for state assessments and use of FALs do not become barriers to effective implementation.

Condition 2: Creating and Sustaining Strong School Leadership

- **Develop school leaders' understanding of the MDC initiative.** Involve principals, department heads, and instructional coaches in professional learning opportunities so that these leaders will have sufficient understanding of the work to champion the initiative, coordinate resources to support it, and provide teachers with constructive feedback about their use of the FALs. A certain level of familiarity with MDC is important for principals to have because, in the words of one principal, "We need to observe classes, and if principals have to observe [classes] in

terms of what the teachers learn in the training, it's much better to have the principal or VP [attend PD] to understand everything that is going on." School leaders' participation in at least some MDC PD would provide them with a better sense of the initiative and how they can support the work.

- **Principals should continue to provide dedicated sustained time for teachers implementing the FALs to meet.** Teachers reported that the collaboration during PD was an important learning opportunity. Time to collaborate allowed teachers to discuss student work, exchange strategies, and work through challenges.
- **Cultivate on-site teacher leaders who will encourage their colleagues to participate in the MDC initiative,** thus building a cadre of teachers actively engaged in the work. In turn, these teacher leaders can offer guidance, encouragement, and support as more teachers are brought into the MDC initiative and can help continuing teachers who are struggling. Scaling an initiative is challenging work, especially garnering enough teacher buy-in so that teachers will actively engage in learning and adopting instructional strategies and practices. Colleagues can serve as catalysts for teachers reluctant to try something new.
- **School leaders should include a range of individuals within a school – the principal and/or the AP, department chair, and a mathematics teacher.** Some of these leadership positions will emerge organically as the MDC initiative takes hold in individual classrooms. When leadership roles are distributed across district, building, and school levels, the likelihood for depth and sustainability improves.

Condition 3: Providing a Rich Array of Professional Learning Opportunities

- **Begin PD by clearly communicating goals of the session to teachers.** Teachers need to understand where the MDC work fits within the larger scheme of their profession – how it advances and strengthens the activities and goals of their school, district, and state.
- **Provide teachers with a range of professional learning opportunities,** including formal sessions, where PD is provided by external consultants, meetings of all participating teachers within a district/school network, and school-level meetings of MDC teachers. Prioritizing and scheduling time for teachers to meet, collaborate, learn together, discuss and analyze student work, and work through common challenges is vitally important to sustaining the MDC initiative.
- **PD should be responsive to teachers' needs.** Teachers need opportunities to provide feedback about the PD, especially with regard to the degree it is meeting their individual needs and any

additional supports they need to use the FALs more effectively, including PD.

- **As teachers begin to include FALs in their curriculum pacing, they may need more individualized support to use them in their classrooms.** Teachers could benefit from some in-class coaching and observation of their lessons to continue to learn how to effectively use the FALs in their classrooms. The individualize support teachers received in Millbrook was very beneficial teachers.

Condition 4: Ensuring and Communicating Strong Alignment of MDC with the CCSS, Curricula and Assessment

- **Align FALs with curriculum pacing guides.** To ease the pressures many teachers feel around using FALs while also covering their curriculum, work with teachers to include FALs in their pacing guides. Teachers may not have had the opportunity to do incorporate FALs in their pacing guides during the pilot year because they were unsure of the time requirements. As more teachers become involved in the MDC initiative, some up front planning could ease their transition. Working with teachers to identify appropriate places in their pacing guides to use individual FALs would go a long way toward ensuring both effective use of the tools and also resolving perceived conflicts with curriculum pacing and preparing students for state assessments.
- **POCs, PD providers, and school leaders should address teachers' concerns about the role the FALs play in preparing students for local and state assessments.** Responding to teachers' concerns may involve tweaking implementation to match local contexts.
- **Continue to educate teachers and leaders about the CCSS and MDC's connection to the standards.** An ongoing emphasis on the CCSS while implementing FALs is required for the initiative to reach its potential in helping teachers rigorously implement the standards.
- **Encourage and support exchanges with other pilot districts about math-related PD, curriculum, and programs that support the MDC initiative.** Many pilot sites have adopted new programs and texts and/or infused current curricula and programs into the MDC work, and teachers reported that these newly integrated programs have bolstered teachers' use of the FALs. The exchanges have already begun as evidenced by the informative discussions at the College-Ready-to-Work (CRW) convening in June 2011. However, a more explicit and documented sharing of these programs can help other sites who may be experiencing similar challenges, such as integrating the FALs into curriculum or identifying curriculum that aligns with the MDC initiative.

- **Share evidence of student learning as a result of MDC.** When teachers see a clear link between using the FALs and increased mathematical understanding, there will likely be less tension around using the FALs verses covering content.

Appendix A. Survey Measures

The box below provides more detail about the contents of the survey measures for conditions and early teacher outcomes.

SURVEY MEASURES RELATED TO CONDITIONS AND EARLY OUTCOMES

CONDITIONS FOR IMPLEMENTATION

1. District/Regional/School Network Leadership

While there is robust qualitative data about the central role of district/regional/school network leadership, there is no discrete survey indicator measuring this condition. The scope and importance of this indicator only became clear after the survey was constructed. In year two, RFA will add survey items to measure this condition.

2. Strong School Leadership

This indicator measures the degree to which teachers report that their school-based instructional leaders have supported and been involved in the MDC initiative.

3. Meaningful Professional Learning Opportunities

This indicator measures the degree to which teachers have been involved in the MDC initiative, including MDC professional development.

4. Alignment with the CCSS, Curricula and Assessment

This indicator measures the degree to which teachers report MDC is aligned with their school curriculum, helps them implement the common core state standards, and prepares students for state assessments.

EARLY OUTCOME MEASURES

1. Teachers have necessary knowledge about tool use

This indicator measures the degree to which teachers feel that they have the knowledge they need to use the MDC tools well.

2. Teacher beliefs about math instruction align with MDC

This indicator measures the extent to which teachers agree with the initiative's basic assumptions about the teaching of math, such as peer-to-peer collaboration.

3. Tools impact teachers' instructional practice

This indicator measures the extent to which teachers feel that the MDC tools helped them adopt new mathematical practices and skills, such as using formative assessment strategies, engaging students with different math abilities, providing students feedback about their math work.

4. Teachers exhibit high levels of buy-in and commitment to tools

This indicator measures the degree to which teachers report that they plan to make improvements to how they use the FALs and if they plan to use FALs next school year.

Appendix B. Methodology for MDC Research

Both survey and qualitative research explored conditions for MDC implementation and early outcomes, as well as challenges and successes of program implementation.

Teacher Survey

Instrumentation and Administration

The instruments for this study were designed and developed by RFA principal investigators in conjunction with an outside consulting firm (MDF Research). The initiative's theory of action, extant literature on how changes in instructional practice occur, and RFA's early qualitative research in schools and classrooms provided the underpinnings for the independent and dependent constructs measured in the survey. These constructs included: teacher knowledge, etc.

Programming the instrument for web self-administration took place concurrently with numerous instrument revisions for content validity, logic, length, and ease of reading and use by respondents. During the revision process, the instrument items were trimmed in half from approximately 200 initial questions.

Web administration provided a number of advantages for respondents and researchers alike. After simultaneous delivery to all recipients, the survey could be accessed directly from the invitation with a clickable link; it could also be returned to as many times as the respondent found convenient. Certain questions were automatically skipped, depending on the answers given, thus reducing respondent burden. The electronic instruments contained internal checks for out-of-range data and missed questions, increasing accuracy and completeness of the final database.

Teachers' e-mail addresses were supplied by the participating schools (coverage was virtually 100%, with only two undeliverable addresses). An initial e-mail containing the recipient's unique login passcode solicited their cooperation in the study, followed by e-mail reminders to non-responders. Recipients received six e-mail reminders spaced between three and nine days apart after the first solicitation. Eighty-three teachers responded to the survey for a response rate of 53%.

Data Analysis

In addition to requesting descriptive statistics for all items, the researchers identified a number of questionnaire items that were used to develop independent and dependent "constructs." Reliability and factor analyses determined which items were most reliable and which items loaded well on distinct factors. Subsets of the items were summed to form composite scores for each construct: school leadership, participation in professional development, individual support ¹, and alignment. These

¹ Individual support was a valid construct for literacy only.

composites, unlike most of the individual items, were near normal in their distributions. Using these composites supported efficient correlation analyses between the conditions of the program and the teachers' experience of MDC. The outcome items included: teacher beliefs, teacher buy-in, teacher knowledge, and MDC impact on instructional practices. These outcome categories were generated conceptually, as opposed to statistically, because factor analysis did not produce conceptually meaningful outcome composites. Next year, with the inclusion of more teachers and a revision to the survey items, factor analysis should produce a more meaningful outcome composite.

Qualitative Data

Data Collection

During the 2010-11 school year, RFA researchers visited 4 districts and 14 schools. During our site visits, we interviewed teachers who were participating in the MDC initiative, school principals, and the district POC. Interviews explored the roles that school, district, and regional leaders played in the initiative, MDC professional development and other supports, and successes and challenges related to overall implementation and to the four conditions. In addition, teachers were asked questions about early outcomes such as their beliefs about teaching math, whether the MDC tools have been helpful in adopting new mathematical instructional practices and their early assessment of their students' learning.

RFA also conducted classroom observations during site visits. A protocol directed the observation write-up and focused on topics including use of the FALs, rigor, and student engagement.

Research team members took notes during the interviews and, with respondent's permission, also audio-taped the interview. In some cases, interviews were transcribed. After researchers left each site, they developed an analytic memo of the site visit in an effort to capture and describe important characteristics of each site and key themes that arose as important during the visit. These memos enabled us to begin to contrast sites, and to think more deeply about how the four conditions were operating in each location and about signs of early outcomes.

RFA researchers also attended professional development sessions to observe how the PD providers framed both the lessons and the expectations around their use and to gain insight into teachers' concerns and questions during the PD sessions. Researchers wrote analytic memos after each observation.

Data Analysis

In addition to the site memos and PD memos, researchers worked intensively with the interview data. Team members met to develop and refine a series of analytical codes based on the research questions and analytic memos. Once the codes were finalized, they along with all interview data were entered into Atlas.ti, which is a qualitative analysis software package. Team members coded the interview data,

which is the process of applying the codes to corresponding interview text. Once the coding process was complete, team members analyzed the data to identify themes which emerged within codes. Analysis focused on themes and their degree of strength within and across sites, as well as on contradictory themes, if they emerged. All analysis was reviewed by at least one team leader to ensure accuracy and clarity of the code analysis.

Appendix C. References

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