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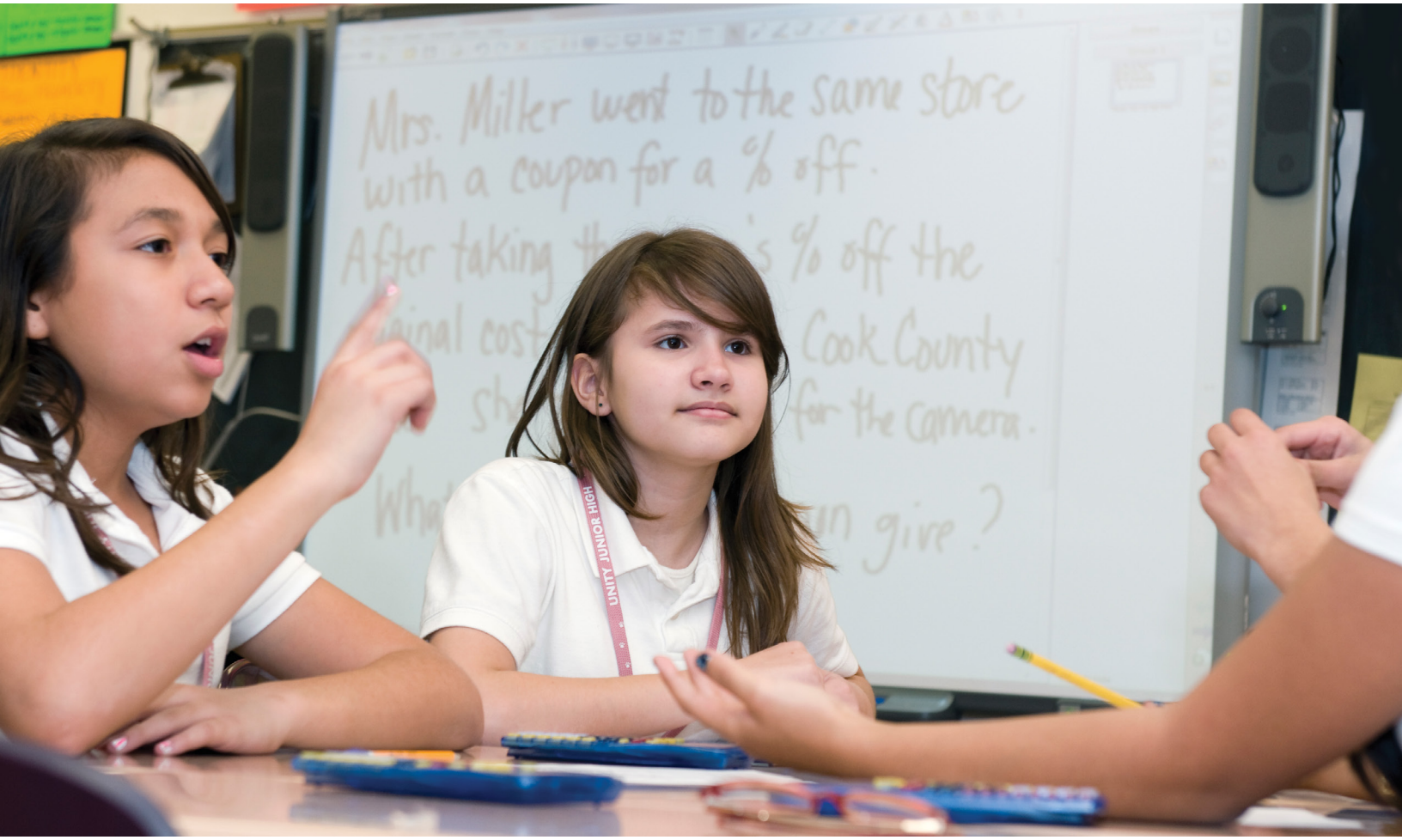

Getting Serious About Implementing

THE COMMON CORE STATE STANDARDS FOR MATHEMATICS

An Implementation Guide for Schools and Districts in Illinois

JUNE 2013

ABOUT C-STEMEC

The Chicago STEM Education Consortium (C-STEMEC) is comprised of four STEM-related university centers: the STEM Center at DePaul University, the Loyola Center for Science and Mathematics Education at Loyola University, the Center for Elementary Mathematics and Science Education at the University of Chicago, and the Learning Sciences Research Institute at the University of Illinois at Chicago. Support for C-STEMEC comes from the Searle Funds at The Chicago Community Trust. Photographs courtesy of The Chicago Community Trust.

ABOUT C-STEMEC POLICY PAPERS

C-STEMEC policy papers are written based on the best available research and the experience of C-STEMEC university partners. A full description of the guiding principles that undergird policy paper development are online at the C-STEMEC website.

FOR MORE INFORMATION

Please contact C-STEMEC at *http://www.cstemec.org/*.

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EXECUTIVE SUMMARY

The adoption of the Common Core State Standards for mathematics and accompanying PARCC assessments will have profound consequences for schools and districts. Since standards interact with other aspects of the educational system—curricula, assessments, human capital, district, and school organization—isolating collateral impacts is difficult. This decision has five important consequences for schools and districts:

- More (and different) learning for students.
- More (and different) learning for teachers.
- More (and different) learning for administrators.
- Different (and more challenging) assessments.
- The system is in a greater state of flux than in the recent past.

Based on these consequences, we present six major recommendations for schools and districts.

Recommendation 1: Craft a Mathematics Specific Strategy

Teaching, learning, and leading mathematics is different than in other disciplines. Content matters: the nature of mathematics content requires a mathematics-specific approach to instructional improvement. A generic strategy for "standards implementation" is insufficient, as the implications for learning and leading in mathematics are different than in English-language arts and social studies.

Recommendation 2: Use Assessments to Increase Capacity

Assessments are an essential tool of the school reformer, serving feedback, accountability, and diagnostic functions. In an effective assessment system, data comes from assessment components designed precisely for purposes for which they were intended, and this data is then used in a variety of structures and routines to increase the capacity of all involved. To successfully implement the CCSS-M, ensure that there is an alignment among assessment purposes and targets, and a robust process exists to make meaning from this data.

Recommendation 3: Professional Learning for Teachers Matters, and Must Be of High Quality

Ongoing professional learning is essential. The new standards demand a higher and deeper level of performance from students and teachers, so the overall capacity of the system must increase to match that demand.

Recommendation 4: Invest in Leadership Development Around Mathematics

It is important to develop and empower people with appropriate mathematics expertise, and to ensure that they are in leadership positions. School leaders—including principals, assistant principals, department chairpersons, and other teacher leaders—need to know how to support high quality mathematics instruction. These leaders need to understand what enactment of the CCSS-M looks like in classrooms and how to create and sustain the school structures, routines, and environments that enable ongoing collaboration and learning among teachers.

Recommendation 5: Real Opportunity to Learn for all Requires Significant Changes in School Structure and Organization

All students need to learn mathematics, but individual students differ in how they learn mathematics. Since the CCSS-M bring a shift in content and sharper definition of learning goals, their arrival provides an opportunity to rethink policies and traditions about grouping, sequencing, and organizing of content, students, and structures.

Recommendation 6: Appreciate that the Selection, Adoption, and Implementation of Instructional Materials and Tools Are Critical

Instructional materials matter in mathematics. For the vast majority of classrooms and schools, the text (or digital) materials define the order and nature of content that is taught. It will take some time to evaluate the efficacy of particular instructional materials with regard to CCSS-M; in the meantime, the focus should be on the best use of the materials that currently exist. To be successful with CCSS-M, every teacher in every school needs access to a robust set of instructional materials for all the children they teach.

Getting Serious About Implementing

THE COMMON CORE STATE STANDARDS FOR MATHEMATICS

An Implementation Guide for Schools and Districts in Illinois

WHAT IS THIS DOCUMENT, AND WHO IS THIS FOR?

The four university centers that constitute C-STEMEC have decades of combined experience researching and supporting teacher, administrator, school, and district improvements in mathematics teaching, learning, and leading. This document collects that experience, couples it with the research literature, and attempts to articulate a set of recommendations for schools regarding the arrival of the Common Core State Standards for Mathematics (CCSS-M) and new assessments in Illinois. While the primary audience is building and district leaders, our hope is that others such as classroom teachers and state-level policy makers will also find this document informative.

WHAT ARE CCSS-M AND PARCC?

For many decades, standards have been an important part of the United States education system. As Smith and O'Day mentioned years ago, "the first step in developing a coherent system of instructional guidance is to work toward agreement on a core body of challenging and engaging knowledge, skills, and problem-solving capacities as goals for all students." (Smith and O'Day, 1990) To that end, the Common Core State Standards for Mathematics were designed to define the knowledge and skills that students should learn in kindergarten through high school. Led by states and coordinated by the National Governor's Association Center for Best Practices (NGA) and the Council of Chief State School Officers (CCSSO), the effort has produced standards that "provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them." Having standards that are common across states and districts is a win for our current generation of highly mobile students (and teachers)—it allows for development of common high quality supports and resources that can be used at scale, as well as a common language for collaboration. Information on the roles and the history of the effort is available at *http://www.corestandards.org*.

The CCSS-M were designed with the goal of preparing students to be college- and career-ready at the end of high school, and are based on principles of focus, coherence, and rigor. The standards are fewer in number, clearer about expectations, and set a higher bar for performance than previous standards efforts. The two parallel and intertwined components of the CCSS-M, the Standards for Mathematical Content and the Standards for Mathematical Practice, set an expectation for a depth of understanding greater than similar standards efforts of the past. Illinois adopted the CCSS-M in June 2010 and provides some resources at *http://www.isbe.net*. By most measures, the CCSS-M are an improvement in specificity, design, and organization compared to the previous standards in Illinois.

The Partnership for Assessment of Readiness for College and Careers (PARCC) is a 22-state consortium, including Illinois, working to develop "next-generation" assessments in English and mathematics that will be implemented during the 2014-2015 school year. As of this writing, the assessment will be composed of two summative assessments: a performance-based assessment administered about 75% of the way through the year and an end-of-year test administered after approximately 90% of the school year, given for grads 3-8 and in high school.

CONSEQUENCES
FOR SCHOOLS AND DISTRICTS

The adoption of the Common Core State Standards for Mathematics (CCSS-M) and accompanying PARCC assessments will have profound consequences for PreK-12 schools and districts in Illinois. Since standards interact with all other aspects of the educational system—including curricula, assessments, human capital, school organization—isolating collateral impacts is difficult. However, the consequences listed below are among the most pressing.

1

More (and Different) Learning for Students

The CCSS-M call for high levels of student performance in mathematics, and it is not the same mathematics as before (McCallum, 2012). Students are expected to have a deeper understanding of the concepts they are learning and to be able to use mathematics to model real world situations. In the early grades, there is now a greater focus on number and operations, with the other domains supporting the learning of this content. In the middle grades, there is a focus on proportional reasoning with a greater emphasis on algebra, geometry, and statistics (including some that was previously taught only in high school). The high school content standards are organized in conceptual categories instead of by grade level, and mathematical modeling has been threaded throughout, which means high school course content will change significantly.

2

More (and Different) Learning for Teachers

In order to teach mathematics well, teachers must know and be able to use mathematical knowledge flexibly to help students learn (Ball, 2008). As the learning demands for students increase, so do the learning demands for teachers. It is likely that most current mathematics teachers will need to learn new mathematics content and pedagogy in order to engage students in the mathematical ideas demanded by the CCSS-M and measured by the PARCC assessments.

3

More (and Different) Learning for Administrators

Administrators are key for successful enactment of the CCSS-M. Administrators need to understand the expectations of the CCSS-M and their impact on schools and classrooms in order to develop and support successful mathematics programs in their schools. Understanding how to support high-quality mathematics instruction, what to look for in mathematics classrooms, how to establish effective professional development programs for teachers, and the effective uses of assessments should be priorities for the administrator (Kanold, *et al.*, 2012).

4

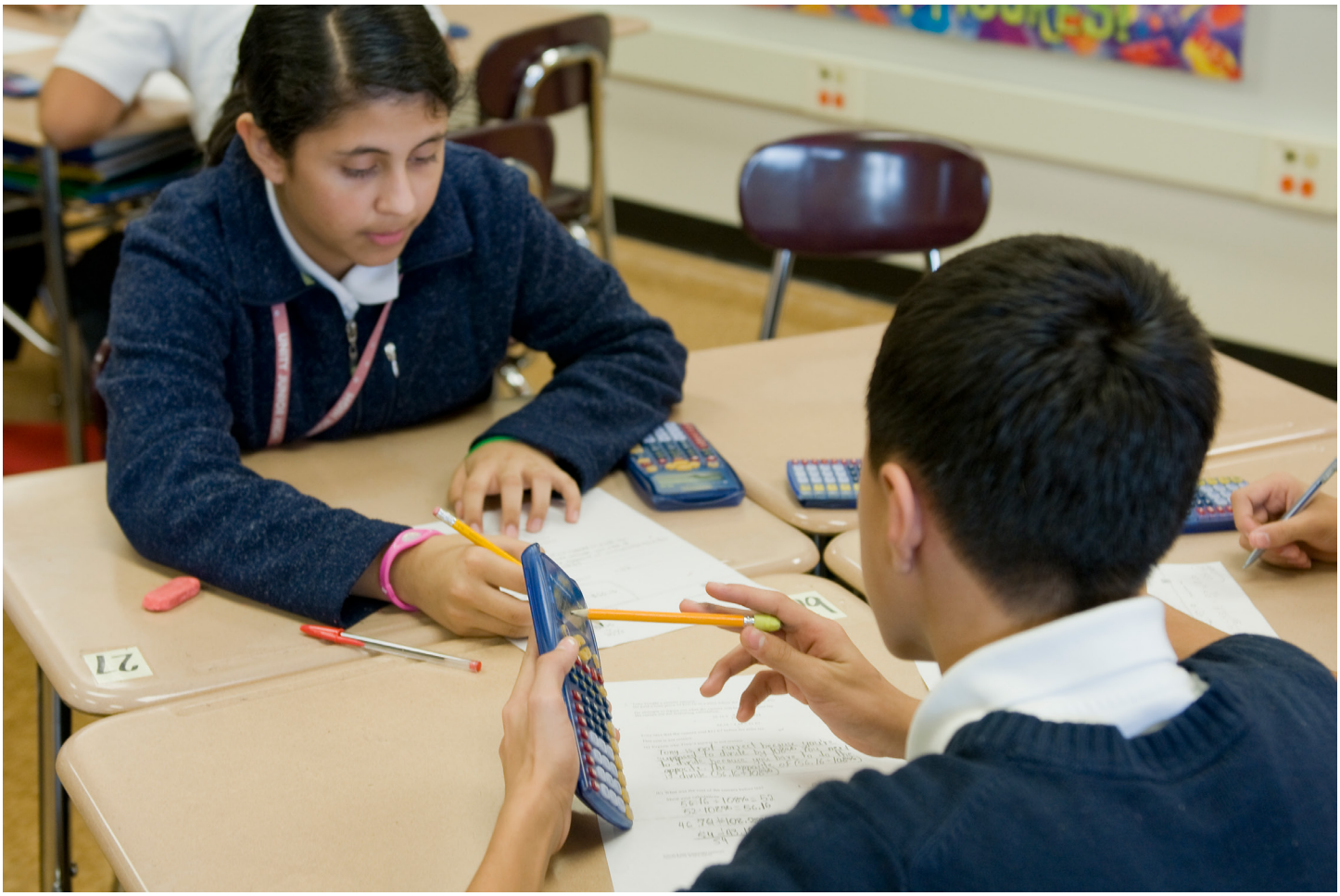
Different (and More Challenging) Assessments

Since the CCSS-M signal a significant change in mathematics content, assessments will change as well. These assessments will be different in many ways, and, since the depth of mathematics as described in CCSS-M has increased, will be more challenging for students. While cut scores for the PARCC assessment in Illinois have yet to be determined, they will be set at a level that will determine if students are on track to be college- and career-ready. We should expect that initial performance on this new assessment—in terms of the proportion of students meeting standards—will be lower than we are accustomed to seeing in Illinois. The new tests will require deeper understanding of mathematics from students than the current Illinois Standards Achievement Test (ISAT). The assessments will include more open-response items that will expect students to demonstrate proficiency with a range of mathematical content and processes. Technology-enhanced items will include new formats that will be more challenging than the current ISAT multiple-choice questions.

5

The system Is in a Greater State of Uncertainty than in the Recent Past

The move to CCSS-M is underway, but not yet complete. For the next several years, as tests are developed and refined, tools are written, and materials are produced, there will be considerable uncertainty about the quality of materials produced, their potential for impact, and the contexts and conditions in classrooms and schools. Until preliminary data are available, it will be difficult to make definitive claims about which products and/or strategies will have the largest impact. Change of this magnitude requires a systemic approach and not just tweaking at the margins. And as always, change is a process that must be managed.



RECOMMENDATIONS
FOR SCHOOLS AND DISTRICTS

A key ingredient for successful educational reform efforts is having aligned and coherent supports. Schools and school systems that show improvement in mathematics have all component pieces working together well: tightly interwoven curriculum and assessments are connected to management and evaluation processes, and these drive professional learning at all levels (Smith and O'Day, 1990). Dissonance in this system will create friction, which will quickly undermine even the most well-intentioned efforts. So, with this focus on coherence undergirding everything, we offer the following priority recommendations for implementing CCSS-M in 2014-15. While these recommendations are listed sequentially, they should be addressed in concert as many of the components intersect and support one another. And while the focus of this paper is on the mathematics standards, there are inevitable overlaps and intersections with other subject areas and other aspects of educational improvement.

RECOMMENDATION 1

Craft a Mathematics Specific Strategy

Teaching, learning, and leading mathematics is different than in other disciplines. Content matters; the nature of mathematics content requires a mathematics-specific approach to instructional improvement. A generic strategy for "standards implementation" is insufficient, as the implications for learning and leading in mathematics are different than in English-language arts and social studies.

KEY ASPECTS

YOUR MATHEMATICS STRATEGY SHOULD INCLUDE

A common vision | Since the CCSS-M present a new vision for mathematics teaching, learning, and leading, time and energy must be dedicated so that school communities can develop a sophisticated understanding of what these new standards mean for all students. This work demands collaboration, so that teacher teams can use evidence of students' understanding to help develop a shared grasp of the specifics of the standards and how the Practice and Content Standards are dependent on one another. Likely the most expeditious route to a schoolwide vision is to study the CCSS-M in the context of research-based instructional materials and student work products.

Changing instruction | Fundamental to an effective CCSS-M implementation is a strategy that promotes and supports high quality mathematics instruction. Given the CCSS-M vision of mathematics teaching and learning, your strategy must include the structures, routines, and processes that enable teachers to learn over time which types and which aspects of instruction are more effective than others.

Capacity development | Given that more mathematics learning is needed for students and teachers, your strategy should make explicit the mechanisms for increasing capacity of teachers and principals for teaching, learning, and leading in mathematics—including but not limited to educative instructional materials, robust assessments, team structures and routines, and professional development workshops and classes.

Coherence | Strategies should describe and drive the process to increase coherence between classrooms, grade levels, schools, districts, and the tools used by principals and teachers to support student learning. (see for instance, Smith and O'Day, 1990).

Communication | The new expectations for students will likely be surprising to many parents and community members, particularly if the upcoming scores on the PARCC assessments mimic those in other states that have moved to CCSS-M aligned scores. It is important that parents and community members understand the forthcoming changes in performance and expectations, their rationale, and the implications for their children.

Time and iteration | It takes time to do this work well, and plans should not only incorporate the extra time needed but also be evaluated on a regular basis. The plans will need to be updated to address changes in the system. In general, schools are more likely to engage in incremental rather than revolutionary change.

"When it comes to leadership in…schools, the subject matters. More sophisticated constructions of teaching are necessary that take into account the subject matter (e.g. mathematics or literacy) and the dimension of teaching (e.g. content and teaching strategies). …The practice of leadership…is structured differently depending on the school subject."

—Spillane, 2005

COMMON PITFALLS

REGARDING MATHEMATICS STRATEGY

Not attending to content area differences | A strategy that treats English/Language Arts and mathematics the same, or that uses the same tools to enhance rigor and coherence is inadvisable. The disciplinary differences demand different strategies. Design and implement a strategy that focuses primarily on mathematics.

Narrow interventions | All the pieces of the system matter. Merely purchasing new materials, or providing new PD, or changing assessments, without attending to all the other aspects that impact instruction will stifle your efforts.

Standards swapping | The CCSS-M are sufficiently different from other standards that they shouldn't be merely swapped in place of other standards via checklists or coarse alignment guides. Individuals and school teams need significant, time-consuming learning in order to lay a sufficient foundation for strong implementation. As you plan your transition, bring teachers, grade levels, and schools together for deep learning about these new expectations.

Manage human resources wisely | Strong teacher recruitment, evaluation, and placement systems are essential. But improving schools and school systems involves the development of human capital within them, not just hiring different people to do the same jobs. Utilize a comprehensive human capital strategy that recognizes and provides accomplished mathematics teachers with the time and resources to support other mathematics teachers, provides sufficient capacity development for all and removes the lowest performing teachers.

Unrealistic timelines | Schools are complicated places and work takes time. Provide ample time to implement new strategies.

Silver bullets | There aren't any. There's no magic textbook, PD system, accountability system, or technology tool. Avoid new fads, quick fixes, and simplistic solutions particularly when delivered piecemeal; instead, take the time needed to develop a consistent, coherent, ongoing, and connected system of supports.

RECOMMENDATION 2

Use Assessments to Increase Capacity

Assessments are an essential tool of the school reformer, serving feedback, accountability, and diagnostic functions. In an effective assessment system, you get the data you need from assessment components designed for purposes for which they were intended. To successfully implement the CCSS-M, ensure that there is an alignment among your instructional goals, what you are assessing, and how you are assessing.

> *"A precept of educational practice is the need for alignment among curriculum, instruction and assessment (e.g. NCTM, 1995, Webb, 1997)… Ideally, an assessment should measure what students are actually being taught, and what is actually being taught should parallel the curriculum one wants students to learn."*
>
> *—National Research Council, 2001*

KEY ASPECTS

TO CONSIDER ABOUT ASSESSMENT

Include assessments that enable teacher learning about student understanding | Assessment tools and the resulting data—including student work—should highlight student understandings and misconceptions, connections between mathematical ideas, and strategies for addressing student needs. Make sure your assessments help teachers and school learn more about their students.

What is assessed will be taught | An assessment system should embody the full range of CCSS-M, including both content and practice standards. Note that one of the "priority purposes" of the PARCC assessment system is to "assess the full range of the Common Core Standards, including standards that are difficult to measure" (PARCC, 2013).

Foster analysis and conversation | For teacher and student learning, the conversation and analysis of the assessments and resulting artifacts are important. Teachers often need support to understand the results of assessments—both numeric reports and student work samples—and generate strategies to respond to them. Structured time for teachers to examine student responses together and collaborate on their next steps is essential.

Diagnose at the beginning of the school year | Given that in many schools teachers receive new students each year with varied educational backgrounds and experiences, tools to identify the general level of student knowledge are particularly helpful at the beginning of the school year. In well-designed instructional materials, diagnostic tools are embedded and seamless.

Time and iteration | Using new assessments, and establishing structures and routines to learn from them, takes time and effort. Ensure your plans provide opportunities to reflect on process and practice so they get better over time.

COMMON PITFALLS

REGARDING ASSESSMENT

Using norm-referenced assessments as formative tools | Focusing on how students perform relative to a norm—rather than relative to the content that was taught—makes understanding student learning difficult at anything but the coarsest level. For formative purposes, use criterion-referenced assessments.

Assessments without clear purposes | More data isn't always a good thing, particularly when generating data takes time away from student learning. Avoid over assessing and overlapping assessments. Articulating a clear usage strategy for each assessment—"with this information, instructional teams will be able to do this"—is critical.

Prioritizing standards within grades | Attempts by schools and districts to identify "priority standards" or "power standards" often perpetuates misconceptions about how certain mathematical ideas connect to one another and creates incomplete learning goals for students. Instead, focus on the full range of CCSS-M.

Assessments disconnected from classroom content Many districts and schools are using an assessment system that is not aligned to the content and standards being taught at particular times in the school year. Instead, carefully align the content of assessment instruments to the content storyline of the instructional materials and resources used in the classroom.

Simplistic re-teaching | Without supports, many teachers reteach the particular content in the same fashion as before (Goertz, *et. al.*, 2010). School leaders should pay careful attention to the strategies and "next steps" generated from the review of assessment results, and push teachers and teacher teams to change their practices in light of the new data.

Assessments disconnected from professional learning | Without time for teachers to collaboratively process the results of assessments, it is difficult to gain a deeper understanding of student learning. Once robust assessment and information systems are established, ensure that professional development strategies and routines are connected with relevant or useful assessment practices.

Confounding reporting with knowing | When analyzing assessment reports, it is relatively easy to identify a general area of mathematics where a student is struggling. Few systems can explain to teachers why that student is struggling, or what interventions might be appropriate. For best results, select rich, multi-step assessment tasks that provide teachers with sophisticated insights into student understandings and misconceptions.

Test prep | Despite its popularity, "test prep" isn't very effective. In the era of CCSS-M, where student un-derstanding of mathematics is a priority, test prep is more inefficient than ever. Students are better served by a robust, content-rich curriculum delivered every day to students (Allensworth, *et. al.*, 2008).

RECOMMENDATION 3

Professional Learning for Teachers Matters, and Must Be of High Quality

Ongoing professional learning is essential, particularly in light of the CCSS-M. The new standards demand a higher and deeper level of performance from students and teachers, so the overall capacity of the system must increase to match that demand.

KEY ASPECTS

TO CONSIDER ABOUT PROFESSIONAL LEARNING

Use your teacher evaluation system to drive professional learning needs | Data from well-designed teacher evaluation systems should help identify teachers' learning needs and goals.

Link assessments to professional learning | Information that describes what students are learning and not learning should be used to set professional learning priorities and also should be an integral part of learning activities.

Focus on using tools in the classroom | Mathematics teachers rely on particular tools—instructional materials, textbooks, etc.—to sequence, organize, and deliver their lessons. A part of professional learning should focus on how to use those tools to make connections to classroom practice. Well-designed mathematics instructional materials can be educative for both students and teachers.

Keep the mathematics front and center | To improve mathematics teaching and learning, teachers need professional learning that is content-rich. Learning that is content neutral (even about such general practices as classroom management) won't be as effective, as content specificity is needed to devise appropriate solutions to common problems. The Standards for Mathematical Practice and the grade-level content standards should be utilized in concert throughout professional learning experiences.

Consider routines and structures in the school day Professional learning needs to be embedded throughout the workday for teachers and administrators. Make sure that routines and structures, such as grade-level team meetings, department meetings, coaching protocols, and all-day in-services, are focused on this learning.

Mathematics communities matter | Communities and networks of mathematics teachers—whether within the school, such as a high school mathematics department, or across schools, as in many externally-driven projects—have the potential to make it easier for teachers to learn knowledge and skills from their peers.

"[Effective professional learning] is sustained, ongoing, content-focused, and embedded in professional learning communities where teachers work over time on problems of practice with other teachers in their subject area or school. Furthermore, it focuses on concrete tasks of teaching, assessment, observation and reflection, looking at how students learn specific content in particular contexts."

—Darling-Hammond, 2010

COMMON PITFALLS

REGARDING PROFESSIONAL LEARNING

Workshops to "unpack the standards." | It is important to understand the goals or targets for student learning as described by CCSS-M, but just understanding what is expected doesn't mean teachers will know how to get there. Furthermore, it's important to realize that the CCSS-M documents were written to be consumed *in toto* rather than in a piecemeal fashion; "unpacking" often results in a checklist of discrete skills that can make conceptual understanding more difficult; and distributing the product of unpacking absent participation in the process of unpacking can often compound confusion rather than offering clarity (Kansas State Department of Education, 2011).

Vendor-driven professional development packages

Many vendors claim their instructional materials are standards-aligned. Schools and districts should be critical consumers, and should rely on tools and packages from sources with content expertise to aid in procurement decisions. At bare minimum, ensure professional development experts and not sales staff provide professional development to your teachers.

Teachers or districts designing their own curriculum

The CCSS-M are based upon focus, coherence and rigor, with mathematical progressions that develop important ideas across grade levels. Designing curriculum that builds these understandings across grade levels is a complex task. Teachers should focus on enacting high quality lessons and tasks that have been designed and tested by curriculum development specialists. (Banilower, *et. al.*, 2006) The choice of the verb 'enacting' is intentional: it is not a matter of taking pre-made lesson scripts and regurgitating them for teachers to follow, but rather a matter of taking well designed and tested sequences of lessons and evaluating, selecting, and modifying tasks for specific student contexts and learning goals.

One-shot workshops | Professional learning needs to be ongoing and connected to classroom practice in order to be effective. Brief, disconnected PD experiences aren't very effective. Instead, develop a comprehensive year-long professional development experience for your teachers and school leaders.

RECOMMENDATION 4

Invest in Leadership Development around Mathematics

Particularly in the era of the CCSS-M, it is important to develop and empower people with mathematics expertise, and to ensure that they are in leadership positions. School leaders—including principals, assistant principals, department chairpersons, and other teacher leaders—need to know how to support high quality mathematics instruction. School administrators need to understand what enactment of the CCSS-M looks like in classrooms, and how to create and sustain the school structures, routines, and environments that enable ongoing collaboration and learning among teachers.

KEY ASPECTS

TO CONSIDER ABOUT LEADERSHIP

School leaders need to know mathematics instruction | Many school administrators are math-phobic. It is common to hear administrators say, "I'm not a math person." Evaluation of mathematics instruction requires knowledge about the teaching and learning of mathematics and the use of tools that enhance mathematics classroom observation. Principals need to know how to support and challenge mathematics instruction, or how to find the appropriate supports and ensure they are in place (Stein and Nelson, 2003).

Principals don't lead by themselves | Most of the practice of leading is distributed over many individuals within a school or district, which makes it particularly important to address the capacities and roles of multiple individuals. (Spillane, 2006)

Structures and routines matter | The practice of leading is manifest in the structures and routines that are established and maintained. Get the right people in the right roles. Set up grade level teams. Identify expertise. Ensure teams are functioning well and stay focused. (Spillane, 2006)

Cross-grade teams matter more now | The CCSS-M learning progressions demand much tighter articulation across grade levels than most sets of previous standards. The need for coherence is greater than ever before.

Specialize roles | At the high school level, mathematics department chairs should have clear leadership and instructional support roles in their departments. K-5 mathematics specialists are a promising strategy for the lower grades. Organize school systems to enable implementation of a mathematics-specific strategy.

External supports matter | In mathematics, staff and school support often comes from sources external to the school. Principals and district leaders need to know how to establish and manage external partnerships that will complement and enhance local experts.

"As an elementary school principal you shape your school's culture and have both the challenge and opportunity to guide your school's development and emergence as a learning community. Mathematics is important. The instructional seeds planted and nurtured at the elementary school level become the mathematical foundation of the college and career readiness intent of the Common Core State Standards. As your school or school district moves toward full implementation of the Common Core State Standards, it is important to determine what is important to you, and how you can best support your teachers and students."

—Fennell, 2012

COMMON PITFALLS

REGARDING LEADERSHIP

Assuming that all school leaders know and understand mathematics or thinking that it doesn't matter whether they do or not. School leaders who directly or indirectly signal that only some students are "good at mathematics" or that mathematical content is not valued or needed by everyone will dampen efforts to improve mathematics teaching and learning. School leaders need to be comfortable champions of mathematics content.

Generic lenses for teacher observation | Efforts to use generic teacher observation protocols usually don't translate adequately to the specific characteristics of a mathematics classroom. Particularly for developmental purposes, separate protocols and tools for separate disciplines are critical, as are observers who understand the mathematics being taught well what to look for in mathematics classrooms.

Not enough time for mathematics | Time to teach matters. Ensure that all students have ample time to learn appropriate mathematics.

RECOMMENDATION 5

Real Opportunity to Learn for All Requires Significant Changes in School Structure and Organization

All students need to learn mathematics, but individual students differ in how they learn mathematics. Since the CCSS-M bring a shift in content and sharper definition of learning goals, their arrival provides an opportunity to rethink policies and traditions about grouping, sequencing, and organizing of content, students, and structures.

KEY ASPECTS

TO CONSIDER ABOUT PROVIDING OPPORTUNITIES TO LEARN

Analyze which students have access to which mathematics instruction | Schools routinely make critical decisions about access and opportunity: Which students get enrolled in which courses? Which teachers teach specific courses? How much time is allocated to mathematics instruction? How is extra support provided to individual students or groups of students? How will teachers receive professional development opportunities? Answers to these sorts of questions will determine which students will have access to the kind of instruction and support that will be required as the CCSS-M is implemented. The CCSS-M makes it necessary to rethink answers to these questions, and how these decisions are made. An essential element of planning for CCSS-M implementation is doing an "equity inventory" that looks carefully at the learning opportunities being afforded to all students, as well as to specific groups of students.

Staffing for change | All students need teachers with a robust command of mathematical knowledge for teaching. Ensure that all teachers who teach mathematics—including special education teachers and K-5 teachers—have the appropriate content and pedagogical knowledge. All else being equal, the most effective teachers in a school should work most with the students who need the most support.

English Language Learners | English Language Learners. Both the Common Core State Standards for English-Language Arts and Mathematics include a shift to focus more on communication and argumentation. This shift provides important opportunities and challenges for students and teachers. English Language Learners (ELLs) require language-rich classrooms in order to develop their mathematical and English language proficiencies. Teachers of ELLs need knowledge, skills, and tools to support the development of those proficiencies and to distinguish whether a student's difficulties resides with difficulties with mathematics or language.

"Conversations about the mathematical needs of American students must focus on what mathematics the students should learn, but also on how we, as a nation can insure that all students have the opportunity to learn it."

—Schoenfeld, 2002

COMMON PITFALLS

REGARDING PROVIDING OPPORTUNITIES TO LEARN

Slow down to catch up | Remediation strategies that offer student less mathematics, or slow down the pace at which they learn mathematics, mean they'll never catch up. Students who are behind in mathematics need more time, not less.

Incomplete acceleration | The learning trajectories that are inherent in the CCSS-M mean that skipping a grade-level of instruction will leave out essential content. Acceleration strategies must ensure that students have an opportunity to learn all required content. Otherwise, accelerating students might improve a students' course transcript but won't increase his or her chances of learning the material appropriately. In addition, tracking students for acceleration without multiple entry points is a barrier to equity.

Over tracking | Mathematics, more than any other subject, is characterized by multiple instructional tracks, even in the elementary grades. The increased demands of the CCSS-M may encourage districts to create more levels of mathematics instruction. While acceleration opportunities are important for some students, creating too many tracks—especially if there are limited opportunities for students to change groups—will mean large numbers of students will not have the opportunity to learn the mathematics required of all in the CCSS-M.

RECOMMENDATION 5

Appreciate that the Selection, Adoption, and Implementation of Instructional Materials and Tools Are Critical

For the vast majority of classrooms and schools, the text (and digital) materials define the order and nature of content that is taught. Ideally, teachers should focus on enacting well-designed and well-tested instructional materials, helping them come alive in the classroom by appraising, choosing, and modifying tasks for specific student contexts and learning goals.

It will take considerable time to evaluate the efficacy of particular instructional materials with regard to CCSS-M and to gauge what "aligned to the Common Core" means. To be successful with CCSS-M, every teacher in every school needs access to a robust set of instructional materials for all the children they teach. Decisions about instructional materials should be grounded in local contexts and needs. Our preference for schools and districts that currently have a robust set of instructional materials is to wait on major purchases until at least 2014-15, when more materials and better data about alignment will likely be available. However, if the current instructional materials are not particularly robust or well aligned, then consider purchasing new research-based materials. Some high-quality supplementary tools and resources have been developed (see below) to support the implementation of the CCSS-M. Consider using these resources as you transition.

KEY ASPECTS

TO CONSIDER REGARDING INSTRUCTIONAL MATERIALS

Think units, not lessons | The structure of CCSS-M focuses on developing ideas over time. Single lessons won't do this, but coherent units could—a major change from the way most teachers think, principals lead, and textbooks are sold. However, a string of units does not a coherent course make, so well designed and thoughtful curriculum is more important than ever.

Use an intentional, well-designed process for selection | Don't equate the declaration of alignment with quality. Robust tools to help districts make curricular decisions, such as the CCSS Mathematics Curriculum Materials Analysis Project, should be utilized as an important part of any procurement process.

Focus on teacher development, not curriculum development | Good materials are only one piece of the puzzle. A necessary component is professional learning to enable teachers to take the robust tools they have, enact them in their classrooms, and make them their own.

Iterate over time | Give reforms a chance to take root. Teachers get better at implementing specific lessons each time they do so. With new instructional materials or tools, provide plenty of chances for teachers to practice and improve their craft with particular lessons. Sustain implementation efforts for several years before making dramatic changes.

"A Harvard professor once developed an interest in the acoustics of the violin. As an experiment, he collected a range of instruments from a cheap beginner's model to the finest Stradivarius. He assembled a small audience in a concert hall and hung a screen between them and the stage. Then he had virtuoso Yehudi Menuhin stand behind the screen and play each violin for the group. He asked the audience to choose the best-sounding violin of the collection.

The professor was stunned by the result: Each violin received about the same number of votes. He expressed his surprise to Menuhin, who compounded his shock by agreeing with the outcome. 'Yes, they sounded about the same,' the great musician said. 'The difference was that the Strad played itself, while I had to work like hell to make the cheap violin sound like anything at all.'

Teachers know the feeling: A dedicated teacher willing to commit enough energy, skill, and imagination can make a dusty [mathematics] textbook seem like a passport to a magic land—but has to work like hell to do it. Besides, it is at best a short-term strategy. Even gifted teachers have neither the energy nor the stamina to work that hard every day, year after year, with every student in every class. Instead, to make it possible for all students to learn effectively and consistently, teachers have to rely to a significant degree on the quality of the materials they use and the learning experiences for students that those materials structure. A dusty [mathematics] book can too easily alienate students and render them apathetic or even hostile to a subject, regardless of what a teacher does (or does not do).

But an effectively designed student learning experience, structured through the use of the right materials, grabs students' attention, brings ideas to life, and fills a classroom—including the teacher—with new energy as effectively as a great piece of music."

—Their and Daviss, 2001

Consider an integrated approach at the HS level

Nearly every developed country in the world uses a secondary mathematics curriculum that integrates algebra, geometry, functions, probability, and statistics over three or four years (Mullis, *et. al.*, 1998). The United States is unique in that most students study algebra almost exclusively for the first year, then study geometry almost exclusively for the second year, and finally return to algebra almost exclusively in the third year. The CCSS-M provides pathways for both the traditional order and the integrated approach largely by rearranging the topics, so it is by no means necessary to use an integrated approach to implement the CCSS-M. However, we agree with Shaugnessy that the adoption of the CCSS-M presents an excellent opportunity to consider switching to an integrated curriculum similar to that used internationally (Shaughnessy, 2011). Not only are students better able to make connections between algebra and geometry with an integrated curriculum, but with such a fresh approach, students, teachers, and even administrators will be in a better position to integrate standards for mathematical practice and to integrate mathematical modeling into the curriculum.

Partner up | By joining with other classrooms, schools, and districts, economies of scale around the procurement of instructional materials and associated supports may become available. Not only are significant cost savings possible, but reform can be accelerated as educators collaborate to implement the CCSS-M.

COMMON PITFALLS

REGARDING INSTRUCTIONAL MATERIALS AND TOOLS

Having teachers design their own mathematics materials | Considerable evidence suggests that teachers aren't particularly well suited or situated to design their own mathematics materials—and they certainly don't have the time to do it regularly well. It is better to purchase well-designed, robust instructional materials—when available—and help teachers enact these materials given the specifics of their classroom context (Banilower, *et al.*, 2006).

Be careful with frameworks, crosswalks, and curriculum maps | Many districts (and some states) produce documents that divvy up the standards at a grade level into some sequence of units. When brought to teachers and classrooms, documents such as these frequently generate a fragmented curriculum that results from piecing together materials and resources without attention to the sequencing and development of big ideas, concepts and skills. The assumption seems to be that a district, school, or classroom can essentially fill in the blanks as defined by the framework with instructional materials from a variety of sources. Unfortunately, this rarely works well in practice—a collection of units or lessons that are tethered together does not typically result in a coherent, effective curriculum. Instead, recognize that short-term strategies, such as the use of replacement units, are temporary, transitional approaches that will need to be replaced by more coherent, permanent solutions to curriculum improvements required by the CCSS-M.

Poor criteria for materials decisions | Don't base purchase decisions on secondary criteria, such as the number of ancillary materials. Many publishers provide cursory or vague alignment charts making the CCSS-M alignment appear more robust than it actually is. Use robust tools and a carefully designed selection process to make curricular decisions.

Equating frameworks and maps with curriculum | A list of standards—regardless of the document title—is not a curriculum. To teach mathematics well, teachers need robust, well-designed and richly tested instructional materials.

Materials without PD | Even the most educative instructional materials are incomplete without a robust set of supports for teachers. Don't purchase instructional materials without accompanying professional development—and then make sure there is robust content and capacity with what you receive.

In-house integration | Purchasing multiple sets of materials and attempting to integrate or combine them in-house is incredibly difficult work, and generally results in a product that is less than the sum of parts. Schools would be better off picking a robust set of instructional materials, and spending a few years developing capacity to implement them with fidelity.

RESOURCES

The following is a selective and incomplete list of resources for CCSS-M aligned mathematics improvement efforts.

The Math Assessment Resource Service (MARS) [*http://mathshell.org/ba_mars.htm*] at the Shell Centre for Mathematical Education works with districts and states on the design and implementation of performance assessment, and on professional development for designers and teachers. They have created a suite of mathematically rich performance tasks and prompts and have considerable expertise in developing local capacity of mathematics educators. The Dana Center at the University of Texas Austin publishes a number of CCSS-M aligned resources, including a four-volume set of algebra performance tasks aligned to the CCSS-M.

Inside Mathematics [*http://www.insidemathematics.org/*] features classroom examples of teaching methods and insights into student learning, and tools for mathematics instruction that are aligned to the CCSS-M. *Illustrative Mathematics* [*http://www.illustrativemathematics.org*] in an online community that produces tools and assessment samples designed to make the mathematical content and practice embedded within the CCSS-M visible to the larger mathematics education community.

The *Lenses on Learning* [*http://www2.edc.org/cdt/cdt/cdt_lol1.html*] materials developed by EDC provide a robust set of coursework and professional development materials designed to help administrators and other school leaders understand mathematics. The Elementary Mathematics and Specialists & Teacher Leaders Project at *https://sites.google.com/site/emstlonline/* has a wealth of resources about credentialing, training, and supporting K-5 mathematics specialists. The Elementary Mathematics and Specialists & Teacher Leaders Project at *https://sites.google.com/site/emstlonline/* has a wealth of resources about credentialing, training, and supporting K-5 mathematics specialists.

The *TeachingWorks* [*http://www.teachingworks.org/*] materials at the University of Michigan identify "high-leverage" practices for beginning and early career teachers coupled with high-leverage content. Standards writer Bill McCallum's blog "Tools for the Common Core Standards" at *http://commoncoretools.me/* provides up-to-date information on standards implementation as well as a host of classroom resources. The National Council of Supervisors of Mathematics at http://www.mathleadership.org is a professional organization for mathematics leaders that provides a variety of tools and resources to support the implementation and a shared understanding of the CCSS-M, including the CCSS Mathematics Curriculum Materials Analysis Tools.

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