MOVING FORWARD TOGETHER

Curriculum & Assessment AND THE CCSM

A Summary Report from the Conference "Moving Forward Together: Curriculum & Assessment and the Common Core State Standards for Mathematics"

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COMAP

The release and widespread adoption of the Common Core State Standards for Mathematics (CCSSM) represents an unprecedented opportunity for states to unite in support of new standards and assessments with the shared goal of strengthening teaching and learning across the United States. As states prepare to implement the CCSSM, two Consortia[1], Partnership for Assessment of Readiness for College and Career (PARCC) and Smarter Balanced Assessment Consortium (SBAC), have been given the challenge of operationalizing large-scale K-12 assessments under relatively short but urgent timelines. Ensuring that the development and implementation of these new assessments is informed by the expertise of the mathematics curriculum and assessment design community was the focus of the *Moving Forward Together Conference*.

In August 2010, an expert group of mathematics curriculum developers, front-line state and district mathematics program implementers, and policy makers met to produce a set of recommendations and action steps relating to curriculum design and development in support of the CCSSM (Confrey & Krupa, 2010)[2]. Recognizing the urgency of events, one recommendation addressed the need for curriculum developers to:

> Influence the quality and range of the mathematics assessed among multi-state consortia. There is widespread acknowledgment that what is tested and how it is evaluated and communicated to students, parents, and teachers has a profound influence on what is taught by teachers and learned by students…It is imperative that the writers, designers, and implementers of mathematics curricula be involved in that (assessment) development process. Curriculum designers have extensive experience in task development, know common student responses, and are sensitive to the nuances involved in the design of rubrics for scoring. (p. 16)

Understanding a critical need for collaboration among top mathematics education experts and consortia representatives, an additional conference was convened to facilitate the sharing of information and next steps that must be taken for both groups to realize the evidence-based design they both identify as a driving component of their development and design process. Nowhere in this reform effort is cooperation more essential than in the creation of curriculum materials and aligned assessments. Now is the opportunity to jointly strengthen assessments and curriculum, to create an infrastructure for long-term continuous improvements of both, and to focus on viable implementation strategies to support the integration of innovative forms of assessment and curricula, aligned with the CCSSM, for the advancement of student learning of mathematics.

Thank you to Jere Confrey for her expertise and thoughtful comments on an earlier draft.

[1] The U.S. DoE funded two state-based Assessment Consortia, PARCC and SBAC, to align assessments to the CCSSM by 2014-15. It is an ambitious goal for these two groups to create, test, validate, and disseminate innovative assessment systems in less than four years, however collaborations across states will be more efficient and should foster greater coherence than the current accountability system (Confrey & Krupa, *under review*).

[2] http://mathcurriculumcenter.org/conferences/CCSSM/SummaryReportCCSSM

Structure and Organization of the Meeting

Participants of the *Moving Forward Together Conference* included those with expertise in mathematics curriculum development, standards, implementation, and assessment, along with representatives from the leadership teams of the Assessment Consortia and state level representatives from each consortium (Appendix A). The meeting consisted of an opening plenary talk, three plenary panels, and three working group sessions. On the final day, summary presentations of recommendations were given by each of the working groups.

The opening plenary, delivered by Dr. Mary Kay Stein, addressed past lessons that should inform the transition to the CCSSM, challenges that lie ahead in doing such work, and recommendations for going forward in creating an improved educational system. She pointed out that historically "assessments can hijack standards" and that current state assessments have been criticized for emphasizing items with low-cognitive demand. She argued that by linking standards and high-quality assessments to curricular materials, teachers will be able to focus their attention on improving instruction. She defined the most salient challenge as improving everyday teaching and learning in classrooms across the nation and listed challenges for both the assessment and curriculum communities. She argued that from the start, assessments should be developed to improve teaching and learning so that new forms of assessment can advance teachers' instructional practices. Stein asserted the importance of creating assessments that can develop teacher capacity, such as formative assessments, "tests worth teaching to", and utilizing teachers in the scoring of performance-based assessments. She urged curriculum developers to integrate the mathematics content and practice standards and focus efforts on supporting teachers' use of curriculum, both through common professional development and unique curriculum-based features. Stein recommended that to successfully transition to the CCSSM at scale, the assessment and curriculum design communities must engage in on-going collaborations, conduct design-based research around the development of educative materials and assessments, and conduct efficacy studies of such materials and assessments.

The first plenary panel, made up of representatives from both Assessment Consortia, Laura Slover (PARCC) and Joe Willhoft (SBAC), and one state-level representative from each, Linda Kaniecki and Tim Kurtz, provided an overview of each consortia's organization and structure[3], assessment design, implementation timelines, and key challenges in moving forward. Slover, senior vice president of Achieve Inc., described PARCC's vision for a "distributed design" assessment system that includes summative assessments throughout the school year. Students would take these through-course assessments quarterly[4], followed by a comprehensive End-of-Year test. She also described PARCC plans, not just to design and disseminate assessments, but also, to help states create strategies for the implementation of next generation assessments as they transition to the CCSSM. This support included developing instructional and formative assessment tools. Willhoft, executive director of SBAC, discussed SBAC's design of summative

[3] For background information visit: http://www.parcconline.org/ and http://www.k12.wa.us/SMARTER

[4] "Through-course summative assessment means an assessment system component or set of assessment system components that is administered periodically during the academic year. A student's results from through-course summative assessments must be combined to produce the student's total summative assessment score for that academic year" (U. S. Department of Education, 2010, p. 18178).

assessments using adaptive technologies designed within content domains, optional interim assessments designed to help students and teachers understand performance expectations, and web-based formative assessment resources. In particular, he noted the challenge of defining how the content standards "bundle" to establish scoring categories for the adaptive assessment and how to incorporate a measure for the mathematical practices into the assessment design. Slover and Willhoft both expressed concerns about the technology infrastructure required to scale computer-based assessments nationwide and for the implementation of the assessments, especially for ongoing development to support long-term sustainability after the funding ends in 2014.

Participants at this meeting united in their view that their collective voice needs to be heard as the consortia begin assessment development. There was unanimous concern for the likelihood that the through-course summative assessments would constrain curricula and lead to a loss of coherence of the CCSSM. Additional concerns were raised that computer-scored adaptive tests will not produce valid and informative results for teachers to make instructional decisions and/or will not adequately address the standards for mathematical practice. Following the assessment panel, the diverse audience worked together with the shared goal of seeing the CCSSM to full implementation and to ensure that consortia-developed assessments would help realize the promise of the standards.

The second panel consisted of members of the curriculum development community: Alan Schoenfeld, Glenda Lappan, Chris Hirsch, and Joan Green. Schoenfeld, Professor of Cognition and Development at UC Berkeley, discussed the creation of formative assessment lessons that focus jointly on the CCSSM content and practice standards. He argued that these lessons should be "curriculum embeddable" for use with any CCSSM-aligned curriculum and should identify students' performance and common misconceptions to support teachers' use of formative assessments. Lappan, Professor of Science and Mathematics Education at Michigan State University, expressed concern that without careful collaboration in the transition period, innovation and experimentation in curricular development could be squelched. She discussed the revision process for the middle school mathematics curriculum *Connected Mathematics Project*, to ensure it is aligned at each grade level to the CCSSM, and the creation of accompanying teacher supports. Hirsch, Professor of Mathematics Education at Western Michigan University, addressed the need for reshaping high school mathematics by providing a non-calculus fourth year mathematics course for students and discussed the importance of embedding technology tools into curricula and assessments. He cautioned the group to avoid end-of-course assessments that disadvantage an integrated approach to high school curriculum organization, to avoid computer adaptive assessments, and to remain attentive to the mathematical topics on the assessments. Green, editorial director for McGraw-Hill, reviewed how the textbook publisher is attending to the needs of the customer to get curricula that are aligned to the CCSSM and that meet the mathematical practices. She provided summaries of alignments for current textbook editions and discussed changes that developers need to consider as they revise their texts to align with the CCSSM. Overall, these panelists argued for the importance of the mathematical practices to be emphasized in curriculum revisions and assessment development. Each panelist recognized the value of formative assessments to be "educative" for teachers to help them learn to diagnose what students have learned and next steps they should take to resolve student misconceptions and guide further instruction. However, Hirsch argued for formative assessments to be "modularized and designed around domains," whereas Schoenfeld suggested they "span important content (big ideas) and practices." Regardless of the grain size of formative assessment

items, panelists agreed they are important complements of curricula that must be used to inform instructional practice.

The final panel included perspectives from district and state representatives—Anna-Maria de la Fuente, Diana Kasbaum, Judi Fonzi, and David Foster. These expert practitioners are currently working on the implementation of the CCSSM in their communities. Panelists provided timelines for their states' implementation and specific challenges they are faced with in the transition to the CCSSM. De la Fuente, from Seattle Public Schools, discussed their plan for starting implementation with non-testing grades and for focusing efforts on the development of the standards for mathematical practice. Similar to the Assessment Consortia challenges, she confirmed district-level concern about technology capacity and equity. She also identified specific challenges for curriculum developers to address, including a request for curricular materials to be highly focused on the content standards, to explicitly address the practices, and to include differentiation strategies for teachers. Kasbaum, the mathematics consultant from the Wisconsin Department of Public Instruction, said she and her colleagues are beginning by communicating with all major constituencies, with the primary focus on the mathematical practices. She argued for the need for common clustering, sustained professional development for teachers, and curriculum programs that address the standards, with a plea for assistance from participants in the room to help with writing local curriculum. Fonzi, director of the Warner Center at the University of Rochester, noted the CCSSM is an opportunity to effect deep change by providing quality mathematics instruction to all students. However, she expressed concern that states are moving too fast and relying too heavily on internal efforts, failing to realize the economies of scale possible with the CCSSM. For example, New York is beginning full implementation of the CCSSM in the 2012-2013 school year with teachers currently writing PreK-11 grade curriculum. She encouraged national collaborations so that states are not inventing materials in isolation and for a *scientific* approach to the transition to the CCSSM. The final presenter, David Foster from the Silicon Valley Mathematics Project, discussed performance assessments designed to inform instruction and measure higher-level thinking. These assessments, graded by teachers, offer insights into student thinking in a unique formative assessment cycle. The majority of panelist advocated for slowing down the development and implementation process to ensure effective implementation of the CCSSM at scale, suggestions included a transition "grace period" for high-stakes assessments and making available nationally developed materials and resources. Another recommendation calls for the launch of a national campaign to inform the public of these reform efforts in mathematics education.

The remainder of the meeting, interspersed between the plenary panels, consisted of three working groups in which participants engaged in discussions and contributed recommendations regarding curriculum and assessment design and production that arise in an environment of the CCSSM. Though charged with the same main objective, working groups were structured at grade levels (elementary, middle, secondary) to facilitate focused discussions around specific needs at each grade level in light of the CCSSM. Recommendations from each group were presented during the final session of the conference. These recommendations, along with ones generated from conference discussions, are provided in the next section.

Conference Recommendations

Recommendations were synthesized into six categories and are presented in individual sections in the remaining portion of this document:

1. SIGNIFICANCE OF ASSESSMENT DESIGN AND DEVELOPMENT
2. NEXT STEPS IN CURRICULUM DEVELOPMENT AND FOR THE CURRICULUM DEVELOPMENT COMMUNITY
3. IMPLEMENTATION OF THE CCSSM, ASSESSMENTS, AND PROFESSIONAL DEVELOPMENT
4. COMMUNICATION AND COLLABORATION
5. POLICY AND EQUITY
6. ORGANIZATION AND STRUCTURE MOVING FORWARD

Each section below includes one or more recommendations, followed by a discussion of key issues raised by conference participants, and action steps associated with the recommendation. Recommendations in the various sections are not mutually exclusive, and should therefore be considered in concert as the complex task of supporting improved teaching and learning of mathematics is addressed. The community for the design and implementation in mathematics education will be referred to as DIME.

SECTION ONE: SIGNIFICANCE OF ASSESSMENT DESIGN AND DEVELOPMENT

Recommendation 1.: Ensure the standards for mathematical practice are embedded within the assessments.

Discussion: Conference participants recognized that the standards for mathematical practice must play a prominent role, for systemic changes of the magnitude proposed in the CCSSM to occur. For students to become College and Career Ready, they must utilize the eight mathematical practices as a vehicle for learning the content standards. At the August conference, participants were in agreement that curriculum developers and state-level implementers must lead their efforts with the mathematical practices. The same concept is transferable to the context of assessments in that measuring the mathematical practices must be a salient feature of assessment design and task creation. All key stakeholders need to understand how the mathematical practices will be assessed. These stakeholders include district-level administrators, principals, coaches, teachers, parents, university faculty in mathematics and mathematics-education, external professional development providers, and students. From what the field knows about the relationship between high-stakes assessment and instructional practices, teachers often teach the content they know will be assessed (National Research Council, 2002; Webb, 1992; Wilson, 2007) and schools design interventions to provide students with more experience to prepare for assessments (National Research Council, 1999; Padilla, et al., 2006). Hence, if the mathematical practices are not well assessed there is little hope to realize the vision of the CCSSM.

Action Items:

A. *Developers of assessment, curriculum, and standards should communicate with each other frequently to ensure that assessment items address the mathematical practices.*

B. *The state-led consortia should release items to show key stakeholders that the mathematical practices are assessed and the degree to which they are measured.*

C. *The CCSSM assessments should purposefully incorporate content from earlier grades while focusing on the mathematical practices.*

Recommendation 2.: Develop technology with the capacity to administer assessments equitably at scale, paying careful attention to how assessments are scored.

Discussion: The Assessment Consortia are already undertaking a technology needs assessment among states and districts, as they are charged with creating next generation assessments administered nationwide, electronically to students at different points throughout the school year. Because of the dual nature of these assessments, for accountability and instruction, an integrated system of formative and summative assessments must be created. Lazer, et al. (2010) contend that multiple assessments are needed for both "accountability and instructionally actionable data." Technology has the potential to provide quick, reliable data to inform teachers' instruction, but only to the means with which it is created and implemented.

Careful attention should be given to the design of the assessment system(s). It is imperative the assessments can be deployed, with similar characteristics, on platforms across the nation. Compatibility of the assessment system with school-based technology must be assured. The system must be usable by school staff members, teachers, and students. The integration of available technology tools for learning, often assumed in current curricular and instructional approaches, into assessments requires these audiences to be familiar with the tools prior to implementing the assessments. It would be inequitable to embed tools that are not widely used into assessments without providing teachers and students with exposure to the technology tools before implementing the assessments.

Finally, scoring of performance tasks necessitates the need for human scorers until improvements in artificial intelligence (AI) technologies can provide reliable measures. Way and colleagues (2011) argued that due to the "diversity of problems and responses that are conceivable…in mathematics suggests that the comprehensive use of automated scoring will not be feasible" (p. 24). An analysis of the mechanisms by which current projects utilize external scorers should be conducted, followed by a determination of the degree to which that can occur at scale. External scores are widely used by the Silicon Valley Mathematics Project and have been shown to be an excellent professional development opportunity for them to take a closer look at student work and to recognize, through grading, what a student understands about a given topic (Foster, Noyce, & Spiegel, 2007). Scoring practices should ensure that tasks involving higher level cognitive thinking on related content and practice standards are properly and sufficiently addressed.

Action Items:

A. *Design assessments that reliably work on a variety of technological platforms.*

B. *Build funding into implementation costs for maintenance, hardware, infrastructure, staffing, and data analysis of the assessment system.*

C. *Perform an analysis of existing technology tools for learning, ensuring that these are integrated appropriately and equitably into the new assessments.*

D. *Use human scorers to build towards an accurate and sustainable AI scoring system.*

Recommendation 3.: Design the PARCC through-course assessments to be supportive of teaching and learning by facilitating multiple modes of content delivery.

Discussion: Across grade levels, participants believed through-course assessments would be problematic if they constrain the sequencing of content within a particular grade. Participants were very clear they would resist through-course assessments if they undermine the coherence of well-designed curricular programs. Specific to secondary mathematics, the NSF charged groups to develop three-year comprehensive high school curriculum (Senk & Thompson, 2003), and a through-course assessment risk constraining the mathematical development of ideas over the three-year period. Further, assessments that facilitate natural variation in sequence allow the field to learn more about instruction and the possible learning progressions in the CCSSM and research-based curriculum. Studies should be conducted on the impact of different curricular pathways on student learning.

The CCSSM remain agnostic about either using a subject-specific (Algebra I, Geometry, Algebra II) or an integrated mathematics high school curricular pathway (Common Core State Standards Initiative, 2010). Similarly, it is important the structure of the through-course assessment does not influence or dictate a curriculum. At least two potential approaches to ensuring curricular options are left open to schools were proposed. The first suggestion was for only one summative Common Core high school assessment, to occur at the end of 11^{th} grade. Secondly, end of "domain" exams could be given when students finish work in a CCSSM domain.

Action Items:

A. *Discuss alternative ways to develop common assessment plans that do not limit multiple pathways through the CCSSM.*

B. *DIME should advocate that the common assessments not dictate the pacing of curricula and support multiple pathways through each grade level.*

Recommendation 4.: Assist the SBAC in the creation of scoring categories, sub-scores on constructs, and tagging systems to ensure valid information is being reported to teachers, parents, and students.

Discussion: Assessment design should begin by deciding which major topics should be represented, with a clear articulation for the emphasis that will be placed on each topic, and then followed by determining subtopics (Webb, 2007). These are critical decisions that determine how assessments are scored. There was a request from the SBAC leadership for advice on scoring categories, by which is meant how to communicate the broad areas of results back to users. This is critical to ensure that what is communicated to teachers, parents, and students are

meaningful and actionable. There are too many domains in the CCSSM to use as scoring categories, necessitating the involvement of those with mathematics content expertise.

A major concern voiced to the SBAC was with respect to the degree to which adaptive tests can be designed based on a unidimensional analysis of tasks in the field. This raises the question about the need for sub-scores on constructs, and whether and how such sub-scores can be combined into a single score, if it is necessary for accountability or reported on separately. In the past, teachers have been provided information on sub-scores that are not scaled, and which therefore cannot be considered valid information to guide classroom decision-making. For example, the item difficulty of the groups of items could vary from administration to administration. Some test makers have successfully solved these problems and should be looked to for guidance. One example provided was the New Standards Reference Examination.

Action Items:

A. *Provide scoring category advice to SBAC that they can use to group items with similar content focus.*

B. *Carefully develop valid measures for sub-scoring and the calculation of one summative score or discuss and debate alternative approaches to this problem.*

Recommendation 5.: Utilize research-based strategies to investigate approaches to assessment item development.

Discussion: Item development is a time-intensive process that should utilize scientific methods (National Research Council, 2001). The NRC further argued that grounding item development in empirical research is important to understanding student learning and how they demonstrate what they have learned. Given the time constraints for creating the CCSSM assessments, knowledge of available item databases should be shared with the consortia. These may include items embedded within curricular programs that mathematics educators may be cognizant of, but of which psychometricians are not necessarily aware. An example would be the Mathematics Assessment Resource Service (MARS).

Another significant opportunity is to choose a few target areas in which the research on student learning is most secure and well-developed, and to consider how to build into each assessment clear and careful attention to that topic[5]. Targeted experiments could be conducted into how these areas could be developed within the assessments—as a intentionally designed small experiment. That is, the consortia along with DIME members could choose an area where good conceptual items already exist and be sure to include them within the assessments, with a suitably rigorous design and analysis methodology. This would help us consider what we can learn from these smaller cases and guide us in designing more effective assessments for improved teaching and learning over time.

[5] This could be place value, multiplication and division problem types, transformations of functions, statistical reasoning regarding shape and distribution, to name a few

It is important to discuss reporting decisions during the early stages because those decisions affect how the tasks are designed (NRC, 2002). This is especially important when it comes to tagging items, item clusters, or performance tasks because tagging systems help researchers examine student performance based on a variety of methods of analysis. Tagging options include cognitive difficulty/complexity, mathematical practices, content dimensions, reasoning tasks, chains of reasoning tasks, connections tasks, types of items, etc. A rich and consistent form of tagging incorporated at the front end of the design and development process would aid enormously in assessing the balance in mathematical content and is critical to facilitating subsequent analytics and continuous improvement efforts.

Action Items:

A. *Utilize the field's knowledge of existing item databases created by mathematics educators or embedded within curricular programs.*

B. *Base assessment item development on initial trials with individual and small groups of students.*

C. *Include in the RFP that one requirement for item development is conducting think-aloud interviews with students.*

D. *Generate a consistent tagging system for items and performance tasks to facilitate multiple methods of analysis and continuous improvement efforts.*

Recommendation 6.: Support long-term sustainability of assessments and an evidence-based approach to appropriate revisions of the assessments.

Discussion: Similar to the recommendation that the CCSSM be a living document (Confrey & Krupa, 2010), there needs to structure for the sustainability and revisions of the assessments, especially after funding for the developmental grants end in 2014. A key element of this design should be "Engineering [for] Effectiveness" (Confrey & Maloney, 2011), a process that anticipates the need for future revisions and continuous improvement of educational innovations, including tests, and can assure that all design decisions anticipate subsequent research-based in-depth analytical studies of the impact of these assessments on the educational system.

Action Items:

A. *Using assessment results, conduct research to develop a stronger empirical base for the learning progressions in the CCSSM.*

B. *Create a process to support the review and modification of the standards and assessment, in tandem, based on expert advice and using empirical evidence.*

C. *Provide mechanism for assessment modifications based on verifiable curricular improvements.*

D. *Ensure the maintenance of high reliability and construct validity of the assessments.*

SECTION TWO: NEXT STEPS IN CURRICULUM DEVELOPMENT AND FOR THE CURRICULUM DEVELOPMENT COMMUNITY

Recommendation 7.: Curriculum developers need to be involved in helping the Assessment Consortia create their instructional tools, including content frameworks, model instructional units, formative assessment tools, and resources.

Discussion: Curriculum development should be grounded in empirically-based learning progressions that have been researched, tested, and revised over long periods of time. The current timeline does not support the extensive nature of curriculum development. Hence, DIME should assist the Assessment Consortia in developing model instructional units. They should suggest alternative strategies for the intended purpose of providing instructional supports aligned to the CCSSM for teachers. For example, argue for identification and use of existing high quality instructional units or they might define the concept of model instructional units in a new way.

Action Items:

A. *The curriculum design community should provide consortia with example assessment tasks to contribute to their instructional models.*

B. *DIME should take a position regarding the practice of developing "model instructional units" as a system-initiated strategy for improving instruction aligned with the CCSSM.*

C. *Educate all communities about the nature of curriculum development that produces high quality materials—the importance of expertise and timeframes involved in the process.*

Recommendation 8.: Identify models of the mathematical practices—and content domains that are likely to support the development of the practices.

Discussion: Participants agreed the mathematical practices must take center stage in all facets of the implementation of the CCSSM especially as they can be linked into content standards. There must be clear models of what it means for students to engage in the mathematical practices at different grade levels or for them to show proficiency of a mathematical topic using one or more of the mathematical practices. Such models are important to the Assessment Consortia's task creation, the professional development of teachers, the creation of instructional supports, making administrators and the public aware of what it might look like for students to do mathematics, and for the revision of curriculum that do not currently have supports for the mathematical practices.

DIME members should collaborate together and with professional development designers in the development of a document that elaborates the mathematical practices for teachers and other users. This document should include example tasks, student work and explanation/commentary by curriculum experts. This document will likely be used for professional development as well as curriculum and assessment development. Collaborating on this work cuts across curriculum development projects and will result in a product for a broad audience of teachers, regardless of the particular curriculum materials they are using.

Action Items:

A. *Identify examples of the mathematical practices from existing programs and projects that have been widely used and researched.*

B. *Share video images of students engaging in the mathematical practices as they solve problems.*

C. *Provide formative assessment items that address the mathematical practices and are tied to content in the CCSSM.*

Recommendation 9.: Develop and apply a means of accurately describing curricular emphasis and alignment in existing curricular/instructional materials with regard to the standards for mathematical practice and the content standards. Engage the full range of curriculum developers in alignment discussions, and if materials are not well aligned, revise them.

Discussion: Neither curriculum developers (commercially generated and NSF-sponsored) nor textbook adoption committees can assume curriculum materials are attending to the CCSSM mathematical practices and content standards. Some of the current methods for documenting "correlation" of materials with the CCSSM are not useful to users and of questionable reliability. Districts need tools for discerning, for themselves, high-quality curricular materials that align with the CCSSM, rather than basing textbook adoption on publishers marketing campaigns. One recommendation from the previous conference, still applicable to current work, called for the "organization of a curriculum community to define "alignment to the CCSSM" and develop a system for evaluating alignment of curriculum materials to the CCSSM, including both mathematical practices and content at a deep level." (Confrey & Krupa, 2010, p. 13). Currently the Mathematics Curriculum Analysis Project, led by William Bush, is creating a set of analysis tools for K-12 districts and schools to use to gauge textbook alignment with the CCSSM in regards to content standards, mathematical practices, and their support of equity, assessment, and technology. Such tools need to be widely distributed and results publicly available.

Further, districts and states need to be assured of the existence of curricular programs aligned with the goals of the CCSSM. Given time constraints and research necessary to develop high-quality curricular materials it is ill advised for states and districts to have teachers write local or statewide curriculum.

Collaborations between curriculum developers and the Assessment Consortia are important for necessary curricular revisions, to ensure curricular materials address the CCSSM in the manner in which they will be assessed. If curriculum developers wait until new high stakes tests are developed and then attempt to write curriculum materials that will appropriately prepare students to succeed on those tests, the CCSSM will almost certainly fail and the nation will have missed an important opportunity to strengthen assessments and improve teaching and learning in this country. If districts continue to use current texts, minimally modified by major publishers to 'align' with the CCSSM, then the CCSSM will almost certainly fail. New tests and new curricula must be designed together.

Action Items:

A. *Encourage curriculum developers to analyze the alignment of their materials to the CCSSM content and practice standards and to make necessary revisions.*

B. *Curriculum developers should communicate with assessment and standards developers frequently to ensure that the materials developed not only align with the standards but also address the standards in the way they will be assessed.*

C. *Discourage states and districts from writing their own curriculum materials.*

Recommendation 10.: Focus attention to content changes at the middle grades.

Discussion: An analysis of the middle grades (5-8) CCSSM, particularly Grade 6, should be conducted to document the nature and extent of the changes from previous state standards. This is in response to claims that there is a substantial increase in the number and nature of learning goals outlined in the CCSSM at the upper elementary and middle grades. The resulting analysis should be used to plan professional development for teachers, to inform changes and revisions in future iterations of the CCSSM, as well as revisions to curricular materials. The analysis might also be used to suggest strategies for attending to the standards in an appropriate manner, for example, to provide guidance on the 'weight' of particular topics within a grade.

Action Items:

A. *Conduct an analysis of the middle grades CCSSM to document the nature and extent of the changes from previous state standards.*

B. *Suggest revisions to curricular materials to address the content changes at the middle grades.*

C. *Research the opportunity to learn students are provided in middle grades classrooms, documenting what, and the extent to which, content standards were taught.*

SECTION THREE: IMPLEMENTATION OF THE CCSSM, ASSESSMENTS, AND PROFESSIONAL DEVELOPMENT

Recommendation 11.: Leverage the implementation of the CCSSM as a nationwide systemic change movement.

Discussion: Implementation efforts are underway, some precipitous and others more gradual. However, these efforts should be built upon what has been learned over the past decades with *Standards*-based reform movements (Goertz, 2010). It is important to determine the types of support that are needed for successful implementation of the CCSSM and utilize national resources when possible. There is a need for better mechanisms for sharing existing information. States should not attempt to create or reinvent their own supporting documents. Instead, they

need take advantage of nationally developed materials and resources, modifying them if necessary to meet the needs of their local contexts or share successful materials across state lines.

A reasonable transition plan needs to be devised for the implementation of the CCSSM. Participants suggested several implementation strategies to leverage the national nature of the CCSSM for proper implementation of standards, curriculum, and assessment. One suggestion is to begin implementation with the Race To the Top (RTTT) states, well documenting their strategies, strengths, and weaknesses. The RTTT states could be used as national model, providing insights for the other states to use as they begin their implementation. Another suggestion is to focus on aspects of the K-5 standards that are supported by research[6] and being implementation with curriculum and assessments designed around those content standards. Finally, scale implementation by starting with the mathematical practices and content standards, and wait for the assessments to be fully developed and validated before implementing them.

Action Items:

A. *Developers of assessment, curriculum, professional development, and groups with implementation expertise should collaborate to provide a reasonable transition plan for curriculum and assessment to move from the current state to full implementation of the CCSSM.*

B. *Encourage states to share resources and take advantage of those that are nationally developed, instead of each state creating them in isolated contexts.*

C. *Convene state-level mathematics content leaders to ensure they are informed and have opportunities to share and collaborate within and beyond their own community with regard to implementing the CCSSM.*

Recommendation 12.: Partner in the work of professional development efforts, those directed at both implementation of the CCSSM and assessments.

Discussion: DIME encourages the immediate work on issues related to professional development and the CCSSM and stands ready to be a partner in this work. Immediate work includes identification of needs and strategies for supporting a coordinated effort to address the implementation of standards and assessment. It is also important to ensure that as the Assessment Consortia address professional development needs they not only focus on the new forms of assessment, but also on deepening teacher capacity. Teachers need to know how to monitor and understand student learning, which includes learning how to use data for adapting instruction.

Action Items:

A. *Identify professional development needs and partner in the work of creating high-quality professional development to teachers and administrators.*

B. *Encourage the Assessment Consortia's professional development to move beyond mere technical support of testing and towards helping teachers understand how to interpret and use assessment data.*

[6] Examples include Operations and Algebraic Thinking, Numeration and Base Ten

C. *Partner with the professional organizations, and specifically the AMTE-ASSM-NCSM-NCTM Joint Task Force, on planning for professional development for the implementation of the CCSSM.*

SECTION FOUR: COMMUNICATION AND COLLABORATION

Recommendation 13.: Organize a national public awareness campaign to inform all key stakeholders of the new CCSSM and assessments.

Discussion: It must be very clear that the CCSSM call for radical changes in mathematics education, changes that cannot be accomplished with individual efforts or by continuing with the same instructional practices or modes of assessment. There needs to be a national public call to articulate the rationale for the CCSSM so that all stakeholders understand the need for changes and strategies for supporting these changes. Awareness should target informing and enlisting support of government, business, nonprofits, educators, students, families, and communities. DIME should create a strong vision, set of principles, exemplification, and action plans for the national community.

Action Items:

A. *Encourage national or government agencies to sponsor public awareness campaigns to announce the new CCSSM and assessments and importance of the reform.*

B. *Explain the purpose and use of the assessments in discussions with teachers, administrators, and families.*

C. *Create guidance documents with focused messaging around the mathematical practices, critical areas from K-8, and priority areas at high school.*

D. *Create a strong message for the schools—do not get started on narrow alignment.*

Recommendation 14.: Develop and maintain a clearinghouse of easily accessible information related to the CCSSM.

Discussion: It is vital to foster collaborations and share resources to support consistent implementation efforts. Currently, it can be overwhelming to find a centralized set of resources related to the CCSSM, assessment progress, professional development materials and offerings, curriculum resources, and to get questions answered. It is imperative information is accessible at a common site, with graphics showing the interrelationship between all CCSSM initiatives.

The assessment development process should be as transparent as possible to ensure consistency with other implementation efforts and between the two consortia. Major documents should be available on the shared website and revisions of these documents should be archived to document decisions that were made and that may inform future assessment discussions. One suggestion is to have the two state consortia jointly fund this initiative.

Action Items:

A. *Create an online community with resources related to activities involving the implementation of the CCSSM.*

Recommendation 15.: Meet with university mathematics department representatives to discuss changes in K-12 mathematics education and how these will influence post-secondary mathematics placement.

Discussion: The main goal of the CCSSM is to prepare students to be college and career ready. The PARCC and SBAC assessments will set the cut scores for determining if a student can enroll in a credit-bearing college mathematics course. There needs to be a national call to reexamine the notion of appropriate entry-level credit-bearing college mathematics courses. Further, there needs to be a bridge with university mathematics departments to address the weak alignment between university placement tests and the CCSSM.

Action Items:

A. *Collaborate with university mathematics departments to discuss how the CCSSM assessments impact college placement.*

B. *Discuss the weak alignment between university placement test content and the CCSSM with university mathematics department representatives.*

SECTION FIVE: POLICY AND EQUITY

Recommendation 16.: Request and lobby for policy level changes to slow the timeline and process of implementing the assessments, given the complexity of the task.

Discussion: Given the difficulty, importance, and complexity of developing high quality assessments of the CCSSM, extend the assessment development timeline by a year. Other state and federal mandates may need to be suspended for a period of time to ensure targeted implementation of the CCSSM and in order to prepare all stakeholders for the new standards and assessments.

Action Items:

A. *Extend the assessment development timeline.*

B. *Request an NCLB AYP exam "grace period" to allow for transitioning to the new CCSSM consortia assessments.*

Recommendation 17.: Recommend the Council of Chief State School Officers (CCSSO) create and communicate a governing structure for current and future work on the CCSSM.

Discussion: The CCSSM is a first effort at nationally adopted mathematics standards and there should be a process in place for them to be revised on a consistent basis. The leadership of the CCSSO is essential to the review and modifications of the CCSSM. Guided by information from the assessments, implementation, and from research-based projects, the CCSSM should be a document that is reviewed and revised based on the developmental appropriateness of content and the gaps that may be identified in the current document.

Action Items:

A. *Request clarity on the CCSSO's plans to develop a governing structure to oversee the research-based revision of the CCSSM.*

Recommendation 18.: Equity and access should be a central focus of deliberations and actions related to the CCSSM.

Discussion: Equity is a crucial issue in mathematics education (NCTM, 2000) and should be considered throughout all phases of implementing the CCSSM. It is important for students to be provided with adequate access to learn content in the CCSSM regardless of their background or personal characteristics. As nationwide efforts to implement the CCSSM are underway, issues of equity and access should be considered and resolved at every step of the process.

Action Items:

A. *Ensure that computer-based assessments are equitable for all students.*

B. *Guarantee each school, in states that have adopted the CCSSM, has access to the necessary technology infrastructure to administer the assessments.*

C. *Allocate funding for implementation appropriately.*

SECTION SIX: ORGANIZATION AND STRUCTURE MOVING FORWARD

Recommendation 19.: Coordinate a definitive organization of the curriculum and assessment design and implementation community and seek support for continuing interactions and contact among this community and with outside parties.

Discussion: The time to leverage conference participants' collective expertise in curriculum-related implications of the CCSSM is now. In August, we recommended the group create an organization for Design and Implementation in Mathematics Education—"DIME" (Confrey & Krupa, 2010). The establishment of such a group is pressing if the community intends on be involved with change of the magnitude required by the CCSSM and the Assessment Consortia. As noted in our previous recommendations, a process is needed for this group to interact with Achieve, NGA, CCSSO and the NCTM-NCSM-AMTE-ASSM Joint Task Force on issues regarding assessment design and implementation of the CCSSM. In addition, it is imperative for this group to regularly collaborate with the two Assessment Consortia.

Action Items:

A. *DIME will create a non-profit group or be recognized within an existing group.*

B. *Establish a small task force charged with identifying the mission, goals, membership and administrative structure of the group.*

C. *DIME will prepare an Executive Summary of this report and communicate it to the groups identified above.*

D. *Seek funding to sponsor a working conference focusing on the use of technology in the delivery of curriculum materials and assessments.*

E. *Convene regular meetings for curriculum and assessment developers to continue to share information and collaborate on issues of common interest in support of the CCSSM.*

F. *Create a mechanism for posing questions and obtaining answers to issues related to the work of the Assessment Consortia.*

Recommendation 20.: Create a sub-committee of DIME to collaborate directly with the two Assessment Consortia.

Discussion: It is important that DIME continuously influence and support the work of the Assessment Consortia, which could best be achieved by the establishment of a smaller group of expert members. This subgroup, the Curriculum Research Advisory Committee (CRAC), would be comprised of eight members (two with specialty from each of the three grade bands and two with expertise spanning K-12 with particular experience in task and assessment design). CRAC would be charged with ensuring the integrity of the CCSSM in assessment development and would provide quality assurance that the assessment instruments are testing important aspects of the CCSSM, especially related to the mathematical practices. It is not adequate for these groups to merely review materials after they have been developed, but for their collective content expertise and curriculum development experiences to be involved **in the design** of tasks and assessments. Without this kind of collaboration, the most the new assessments are likely to deliver is a few items that measure specific standards better, and a computer-based testing system which may only facilitate the process of testing and the speed of delivery of the results without making significant contributions to propelling the mathematics learning to higher levels. For greater transparency in the consortia's work and to ensure solicitation of the best possible expertise, CRAC members will be expected to develop a system to communicate with and seek guidance from DIME members.

Action Items:

A. *CRAC should work with the state consortia to develop feedback, review, and quality-control processes to be included in RFPs issued by PARCC and SBAC.*

B. *Conduct reviews to ensure that assessment instruments are jointly assessing the CCSSM fundamental components of the content and practice standards.*

C. *CRAC, a bridging entity between the two consortia, would provide expert advice on content issues, available resources, and concrete recommendations to both consortia to ensure that expertise is efficiently provided to both efforts.*

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