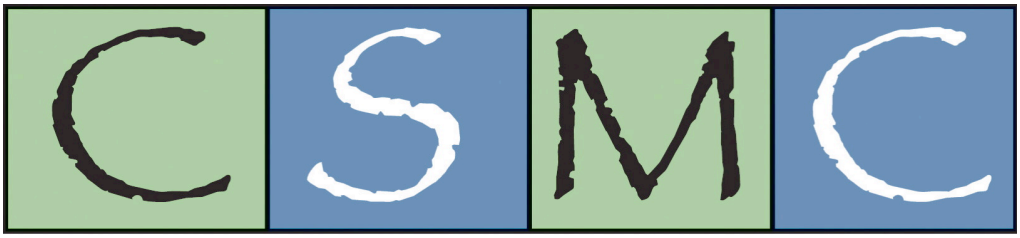

Center for the Study of Mathematics Curriculum

Development of State-Level Mathematics Curriculum Documents:

Report of a Survey

Prepared By:

Barbara J. Reys
Shannon Dingman
Angela Sutter
Dawn Teuscher

Center for the Study of Mathematics Curriculum
an NSF Center for Learning and Teaching

March 2005

This paper was supported by funds from the National Science Foundation (NSF). The paper does not necessarily represent the official positions of NSF. The contents are the sole responsibility of the authors.

121 Townsend Hall | University of Missouri | Columbia, MO 65211

Development of State-Level Mathematics Curriculum Documents: Report of a Survey

Recent federal initiatives, most notably the *No Child Left Behind* (NCLB) legislation, have exerted substantial influence on state and local decision-making. One element of the educational system that has been affected most directly and dramatically is curriculum articulation, particularly as it relates to holding school systems accountable for what students learn.

The term "curriculum" is used here to describe the set of learning expectations for students in grades K-12 in a subject such as mathematics. A central question that occupies state and local educators is, *what mathematics should be the focus of instruction and student learning at particular grades/levels of the K-12 educational system?* For most of the history of our country the authority to answer this question has resided either at the local school district level, or in some cases, at the school or classroom level. School administrators have generally trusted teachers to make appropriate decisions and then to select curriculum materials to enact those decisions. As schools grew larger, the authority for curriculum decisions was centralized at the district level with committees of teachers, community representatives, and parents working together to articulate the broad goals and outcomes of mathematics instruction within a district.

This system of local control has its advantages – most notably that schools can tailor the curriculum to the needs of the local community. However, as more students have chosen post-secondary education (colleges or technical schools), there has been an increased call to centralize curriculum decisions so that students are prepared for further education, regardless of where they receive their K-12 education. Increased mobility of students in the K-12 school years is another factor that has focused attention on the need for more centralized curriculum articulation. Most recently, comparisons of student performance in mathematics in the U. S. with students in other countries have highlighted differences in what students have an opportunity to learn, both in comparison to their international counterparts as well as among students residing in different parts of the U. S. or different parts of the same state.

Momentum for Central Control of Curriculum Articulation

In the 1980s the role of state government in articulating mathematics curriculum standards grew. This coincided with their increasing role in measuring student learning for the purpose of public accountability. Prompted by national concerns such as those described in *A Nation at Risk* (National Commission on Excellence in Education, 1983) and international comparisons of student performance such as the Second International Mathematics and Science Study (Crosswhite, et al, 1985), many states passed legislation raising standards – developing more rigorous expectations for teacher certification, initiating new curriculum and assessment programs, and increasing graduation requirements (Long, 2003). In fact, "the state role has expanded considerably as state standards, curriculum frameworks, and accountability measures have emerged as key strategies in the search for educational improvements" (National Research Council, 2002, p. 39).

The publication of *Curriculum and Evaluation Standards for School Mathematics* in 1989 by the National Council of Teachers of Mathematics (NCTM) had a dramatic impact on states that were in the process of specifying mathematics curriculum standards (Martin, 2002). However, the set of state level mathematics curriculum documents produced in the early 1990s, like the NCTM *Standards*, were often general – specifying broad goals organized by grade bands rather than grade-by-grade description of learning goals. In the past 15 years these documents have been reviewed and revised on regular cycles, tending to greater specificity with each new version. This trend toward more specificity in mathematics curriculum documents is driven, in part, by increased accountability in the form of state-mandated testing and, not coincidentally, by a call from teachers asking for more guidance in what mathematics to focus on at particular grades.

Since the passage of NCLB in 2002, state departments of education as well as local school districts have been scrambling to address many of the law's requirements. One major area of focus has been on articulation of mathematics content standards - or what is commonly referred to as grade level expectations. Grade level expectations (GLEs) are statements that convey the specific mathematics content that students at particular grades are expected to learn (and teachers are expected to teach). NCLB requires that states adopt "challenging academic content standards" in mathematics, reading/language arts and science that, (a) specify what children are expected to know and be able to do; (b) contain coherent and rigorous content; and (c) encourage the teaching of advanced skills. Furthermore, states are required, beginning no later than school year 2005-2006, to measure the achievement of students against the state standards in grades 3 through 8 (NCLB, 2001). Since 2002, 35 states, the District of Columbia, and the Department of Defense Educational Agency have revised, replaced, or created new mathematics curriculum documents that include GLEs, and at least half dozen other states have new drafts in progress (see Appendix A for a listing of the most recent state mathematics curriculum documents).

CSMC Curriculum Analysis Initiatives

In an effort to better understand the nature and role of state-level mathematics curriculum documents, the Center for the Study of Mathematics Curriculum (CSMC) has initiated a series of activities and studies to organize, disseminate, and describe the current status of mathematics curriculum articulation in the United States. For example, CSMC has developed an online database that provides links to each of the state mathematics curriculum documents (see http://mathcurriculumcenter.org/statestandards). The Center is also doing an analysis of GLE documents to describe similarities and differences in grade level expectations. One of the questions being investigated is: "To what extent do states differ regarding the grade level where particular learning expectations such as fluency with basic number combinations (basic facts) or computational proficiency are expected?"

The third initiative and the main purpose of this paper is a survey of state curriculum specialists (generally employees of state departments of education) designed to describe the process of development of the newest mathematics curriculum documents. In particular, the goals of the survey reported here were to:

- Describe the most current set of state mathematics curriculum documents and the processes used to develop them.
- Describe conditions and resources that influenced the development of the newly created curriculum documents.
- Identify major changes between the most recent mathematics curriculum document and prior documents.
- Gauge respondents' interest in assistance with future mathematics curriculum articulation from professional organizations or other national entities.

Procedures

The Survey

CSMC researchers developed a 30-item online survey organized around the broad goals described in the previous section. In particular, respondents were asked, among other things, to describe the process used to develop their states' most recent mathematics curriculum document, outline its role and influence, and provide their perspective on whether national leadership is needed for future curriculum articulation efforts.

Items from previous surveys with similar goals were considered in developing this survey. In particular, a survey developed by the NCTM Standards Impact Research Group was reviewed and some questions were adapted for use in the present survey. Other items were developed and reviewed by the project staff and consultants. Some items provided a choice of responses while others were open-ended, allowing respondents to write in a narrative response.

Respondents

The goal was to learn about state-level curriculum articulation in each of the 50 states as well as the Department of Defense Education Agency (DoDEA) and the District of Columbia (DC) (DoDEA and DC were treated as "states" due to the nature of their responsibilities and size). We contacted a member of the Association of State Supervisors of Mathematics (ASSM) representing each state, asking this representative to identify the person within their state who was most knowledgeable about the development of the most recent mathematics curriculum document. In most cases, the ASSM representative responded to the survey. In a few cases, the ASSM member recommended another individual who worked closely on the development of the state document and they were invited to respond to the survey.

To provide as complete a picture as possible, our goal was for participation by 52 representatives, and non-respondents were contacted several times to encourage participation. In one case (Iowa), no state mathematics curriculum document exists and thus no data are reported. In three cases (NY, NH, and IL) representatives replied that their newest state mathematics curriculum document was currently under development, and therefore it was premature to respond to the survey. In one case (DC) we received no response to our invitation to participate. In all, we collected surveys from respondents representing 46 states and DoDEA. Thus, this report represents responses from 47 different geographical educational agencies. All responses were organized by category and question. A summary of responses is included in the following section.

Results

Identifying State Mathematics Curriculum Documents

Prior to the survey, CSMC researchers compiled a list of current state mathematics curriculum documents, including those that articulate grade-level learning expectations (GLE) or course-level learning expectations (CLE). See Appendix A for a list of the publication date and title of the most recently developed state-level K-8 mathematics GLE documents (as of January 2005). See http://mathcuriculumcenter.org/statestandards for the list as well as links to the documents. The compilation was based on a careful review of state department of education websites and conversations with state education officials. The search confirmed that multiple mathematics curriculum documents exist in many states, most developed over the past 15 years. The documents are referred to by different names such as *Content Standards, Curriculum Frameworks, Performance Standards/Indicators, Core Curriculum Standards,* or *Grade Level Expectations*. They vary in their level of specificity, legal status (mandatory or voluntary) and they serve different purposes. Some documents outline general learning goals across multiple subjects. Others describe specific curricular emphasis in subjects such as mathematics, and some summarize the focus of state assessments. For example, the Missouri Department of Elementary and Secondary Education currently posts three curriculum documents on its website:

> The *Show-Me Standards,* published in 1996, is a set of 73 curriculum standards intended to define what students should know and be able to do in six content areas (mathematics, literacy, social studies, science, health and fine arts) by the time they graduate from Missouri's public high schools. School districts are required by state law to adopt these standards and build their curriculum around them.
>
> *Missouri's Frameworks for Curriculum Development: Mathematics***,** first published in 1996, is intended to provide districts with a structure for building local curricula using the *Show-Me Standards* as a foundation. The mathematics framework is not required but instead considered a resource.
>
> The *Missouri Mathematics Grade Level Expectations* document, developed to respond to NCLB legislation and published in 2004, is intended as a resource to strengthen alignment of local district curricula to the *Show-Me Standards* and to provide more specific achievement targets for state assessments. State department staff and a committee of Missouri teachers are currently utilizing this document to build a "state model curriculum" which will include a set of lesson plans and other resources connected to the GLEs.

Although different types of curriculum documents have been produced and carry different status within states, most states have documents that specify grade-level learning expectations (GLE) for mathematics and some specify high school mathematics course learning expectations (CLE). These documents represent new levels of curriculum authority and articulation for most states. Table 1 provides a summary of the organization of GLE and CLE documents and Table 2 summarizes the publication dates of these documents.

As noted in the Tables 1 and 2, 44 states have GLE documents that span K-8, K-7, 3-8, 4-8, or 3-10 and most of these documents (31) have been published within the last two years. States that did not have a GLE document at the time of the survey included Delaware, Illinois, Iowa, Massachusetts, Montana, Nebraska, Pennsylvania, and Wisconsin, although some of these states have recently developed grade-by-grade "assessment" frameworks.

Table 1. Organization of mathematics GLE[1] and CLE[2] curriculum documents by state and level (as of 3/31/05)

Elementary/Middle School			High School		
States with K-8 GLE documents	States with other GLE documents	States with Grade-band LE documents	States with CLE documents	States with GLE or Grade-band documents	States with no high school GLE or CLE documents
AL, AZ, AR, CO, CT, DoDEA, DC, FL, GA, HI, ID, IN, KS, LA, MD, MI, MN, MS, MO, NV, NH, NM, NY, NC, ND, OH, OK, OR, RI, SC, SD, TN, TX, VT, VA, WA, WV, WY	AK – 3-10 CA – K-7 ME – 3-8 NJ[4] – 3–8 UT – K-7 KY – 4-8	DE: K-3, 4-5, 6-8, 9-10 IL[5]: Early elem., Late elem., middle/junior high, early HS, late HS IA: None MA: 1-2,3,3-4,5, 5-6,7, 7-8 MT: K-4, 5-8, 9-12 NE: K-1, 2-4, 5-8, 9-12 PA[6]: K-3, 4-5, 6-8, 9-10 WI[7]: K-4, 5-8, 9-12	AL, AR, CA, DC, GA, HI, IN, KY, MA[3], MD, MS, NY, NC, OK, TN, TX, UT, VA, WV	MO, OH (9, 10, 11, 12) AK (9, 10) LA (9,10,11-12) DE, KS, NH, WA (9-10) CT, ND, MA[3] (9-10, 11-12) MN (9-11, 11-12) PA (11) AZ, CO, DoDEA, FL, ID, MT, NE, NV, NJ, NM, OR, SC, SD, VT, WI, WY (9-12) IL (Early HS, Late HS)	IA, ME, MI
38	6	8	19	31	3
52			52*		

[1] Grade-level Learning Expectations (Learning expectations organized by grade)
[2] Course Learning Expectations (Learning expectations for high school courses such as algebra I, geometry, etc.)
[3] MA has both Course and Grade Band expectations for high school.
[4] NJ has Grade Band Expectations for Grades K-2.
[5] IL has Assessment Frameworks for Grades 3-8.
[6] PA has Assessment Anchors for Grades 3-8 & 11.
[7] WI has Assessment Frameworks for Grades 3-8 & 10.

Table 2: Publication dates for most recent state curriculum documents.

Year	Number	States
2005	2	ID, NY
2004	20	AK, AR, CA*, CT*, DoD, GA, HI, KY*, LA, ME, MD, MA, MI, MO, NH*, ND*, RI*, SD, VT, WA
2003	9	AL, AZ, KS, MN, NV, NC, UT, WV, WY
2002	6	DC, NJ, NM, OK, OR, VA
2001	3	OH, SC, TN
2000	3	CO, IN, NE
Pre-2000	8	DE, FL, IL, MS, MT, PA, TX, WI
None	1	IA
Total:	52	

* Draft document

Because multiple state mathematics curriculum documents exist, we asked respondents of the survey to:

> "…focus on the document which provides the most detailed mathematics curriculum specifications (e.g., grade level learning expectations) to guide K-12 teachers in focusing their instruction. If there are separate documents for different grades or grade ranges, please consider the K-12 set as a single document when answering these questions."

In addition to identifying the documents, respondents were asked whether their most recent curriculum document includes "performance (or assessment)" expectations (i.e., specific learning expectations that are tested in a state level assessment). If not, then does another document exist which specifies this information? Seventy-five percent of respondents indicated that the curriculum document includes performance expectations. Of those, 37 percent indicated that performance expectations are a subset of the curriculum document while the remainder indicated that the entire set of learning expectations in the curriculum document are meant to convey performance expectations. Of the twelve respondents who responded "no" to this item, seven indicated that their state publishes a separate document to convey specific performance/assessment expectations. The titles of these separate documents include *Performance Indicators, Test Item Specifications, Core Content for Assessment, and Blueprint for Learning*.

Influences on the Development of Mathematics Curriculum Documents

Respondents were asked to identify the reasons the most recent mathematics curriculum document was developed. See Table 3 for a summary of responses. The three most common responses were: to provide direction to teachers (81 percent); to

guide state assessment development (70 percent); and to respond to NCLB legislation or other federal mandate (55 percent). About half of the respondents indicated that the new document was developed to meet the normal timelines within the state for curriculum review. Fewer respondents (less than 20 percent) indicated that the state curriculum document was developed to influence textbook adoption at district level or state levels.

Table 3. Responses to, *"Why was the most recent state mathematics curriculum document developed?"* (N=47)

Response	Percent of Respondents
To provide direction to teachers	81
To guide state assessment development	70
To respond to NCLB legislation or another federal mandate	55
To meet the normal timelines within the state for curriculum review	53
To meet a particular state mandate	49
To influence textbook selection at the school/district level	19
To influence state textbook adoption	15

In 2001 the Standards Impact Research Group (SIRG), a committee appointed by NCTM, conducted a survey of Association of State Supervisors of Mathematics. The survey was intended to document the impact of national standards such as NCTM's *Curriculum and Evaluation Standards for School Mathematics* (1989) and the *Principles and Standards for School Mathematics* (PSSM) (2000) on the development of state standards and other state-level policies and practices. Respondents representing about half of the states indicated that PSSM had a strong influence on the development of state standards. (Martin, 2002)

Respondents in the current survey were asked to indicate on a Likert scale to what extent each of the following documents influenced the development of their state document: NCTM PSSM (2000), *Achieve Foundations* (2002), the NAEP framework, curriculum documents from other states or countries, and reports of research on student learning. Table 4 contains a summary of the responses of those states that published curriculum documents since 2002 (the first year all of the listed resources was available). PSSM was most frequently cited as having had a major influence, with 80 percent of respondents reporting that it had a great or strong influence. The NAEP frameworks and reports of research on student learning were each cited by 30-40 percent of respondents as having had a great or strong influence. Nineteen respondents (40 percent) indicated that the newest document utilized earlier documents as a foundation, refining some areas and adding specificity in terms of grade level identification of learning goals.

Table 4. Percent of responses to, "*To what extent did each of the following influence the development of the new curriculum document?"* (based on responses from representatives of 35 states that published new documents 2002-present)

Choices	Great extent	Strong	Somewhat	Minor	Not at all
NCTM PSSM (2000)	54	26	17	-	3
Achieve Foundations (2002)	12	9	15	21	42
NAEP Framework	23	17	26	17	17
Curriculum documents from other states	13	13	25	19	31
Curriculum documents from other countries	7	-	7	10	77
Research on student learning	19	13	31	25	13
Other	24	24	12	18	24

Respondents who indicated that curriculum documents from other states were influential in the development of their document were asked to specify the state(s). A total of 17 respondents cited other states' documents as having an influence with CA, CO, CT, IN, MN, MA, ME, NC, NH-VT-RI[1], OH, TX, and VA each listed by between two and five respondents. Three respondents indicated that one or more curriculum documents from other countries (e.g., Japan, Singapore, Netherlands) influenced the development of their document.

Documents summarizing research on student learning noted to be influential were papers and publications from the Third International Mathematics and Science Study, *Adding It Up* (2001), and *EdThoughts* (2002). Other documents noted by respondents as influential included mathematics methods textbooks, and the Fordham Foundation analysis of state standards.

Respondents were asked, "In what ways did the development of the state curriculum document explicitly involve attention to PSSM?" Twenty-four respondents indicated that members of the curriculum writing group were provided copies of PSSM for reference purposes. Other common responses included:

- The organizational structure of PSSM (common content strands and goals across multiple grades) was replicated in the state document.

[1] The New Hampshire Department of Education, Rhode Island Department of Education, and Vermont Department of Education collaborated in the development of a common set of Grade-Level Expectations, known as the New England Common Assessment Program Grade-Level Expectations (NECAP GLEs), and test specifications in Mathematics, Reading, and Writing.

- The five content strands of PSSM served as the headings for the state GLE document.
- The inclusion of a "representation" strand in the state document was a direct result of the prioritization of "representation" in PSSM.
- Drafts of the state document were cross-referenced with PSSM expectations to look for gaps and gauge alignment.
- Some of the language of PSSM (e.g., computational fluency) was adopted within the state document.
- PSSM was used to identify the content that was developmentally appropriate at particular grade bands.

Respondents were asked whether NCLB legislation influenced the timing, organization, and content of the most recent state curriculum document. Fifty-five percent of the respondents indicated that NCLB did influence the timing of the development of their state document, 38 percent indicated it influenced the organization of the state document, and 36 percent indicated that NCLB influenced the content of the document.

Process of Development of Mathematics Curriculum Documents

State representatives were asked to describe the process used to develop the most recent mathematics curriculum document and the types of people who contributed to its development. Respondents representing 28 states (60 percent) indicated that a committee comprised of people from within the state developed the document (see Table 5). Thirteen percent of respondents indicated that in addition to people from within the state some consultants from outside the state contributed to the work of the committee. Respondents from two states indicated that a company or organization was contracted by the state to develop the document. Four state documents were developed by an individual or small group of individuals working under the supervision of state department personnel. Seven other respondents indicated that more than one committee developed their state document. For example, one state indicated that twenty teachers developed a draft document with the final version crafted by seven “master teachers.”

Committee members for writing groups/committees were identified through nominations by a principal or superintendent or through an application process. The mean number of members on the development committee was 35 with the “typical” committee consisting of state or district mathematics specialists, district or school administrators, teachers (representing elementary, middle and secondary levels), university mathematicians and mathematics educators, parents, and business/community representatives.

Twenty-one percent of respondents indicated that the curriculum document was developed in less than a year, 43 percent indicated about one year, 28 percent about two years, and 9 percent more than two years. This time frame generally included opportunities for feedback and public comment.

Table 5. Responses to, *"The mathematics curriculum document was developed by: (select appropriate response)"* (N=47)

RESPONSE	Percent of Respondents
A committee comprised of people from within the state.	60
A committee comprised of people from within and outside the state.	13
An individual, or small group of individuals, developed the document under the supervision of the state education department.	9
A company or organization that was contracted by the state to develop the document, *specify name of company or organization*.	4
Other:	15

Role of State Mathematics Curriculum Documents

State representatives were asked to comment on the role the curriculum document plays within their state. See Table 6 for a summary of responses. Seventy- nine percent of the respondents indicated that the most recent mathematics curriculum document communicates to district personnel and teachers what will be assessed in the state-mandated testing program in mathematics. Half of the 47 respondents indicated that the document serves as the official mathematics curriculum document and all districts within the state must utilize it in formulating their own district mathematics curriculum. Twelve respondents (26 percent) indicated that the document serves as a "model" or "sample" curriculum that school districts could adopt or modify for their own purposes.

Table 6. Responses to, *"What role does the curriculum document serve in the state? (Select all that apply.)"* (N=47)

RESPONSE	Percent of respondents
It communicates to district personnel and teachers what will be assessed in the state-mandated testing program in mathematics.	79
It serves as the official mathematics curriculum document and all districts within the state must utilize it in formulating their own district mathematics curriculum.	49
It serves as a "model" or "sample" curriculum that school districts can adopt or modify for their own purposes.	26
Other, *specify*:	26

Although many of the state curriculum documents are new, respondents were asked to predict the extent to which their most recent GLE document will likely influence state or district assessments, the selection of textbooks, classroom practice or professional development. Over half of the respondents indicated that their GLE document will likely influence "to a great extent" each of the areas noted above, with the largest group (89 percent) indicating that the document will have a great influence on state assessments. See Table 7 for a summary of responses.

Table 7. Percent of responses to: *"To what extent will the document likely influence each of the following?"* (N=47)

Activity	Great extent	Strong	Somewhat	Minor	Not at all
State assessments	89	6	-	4	-
Classroom practice	54	11	33	2	-
District assessments	53	27	16	4	-
Selection of textbooks at the school/district level	53	26	15	4	2
Professional development	52	28	13	7	-

Respondents were asked to estimate the percentage of various groups within the state who are familiar with the GLE document and also to predict each group's general opinion of the document. Tables 8 and 9 summarize their responses. Not surprisingly, respondents predicted that teachers and school administrators are the groups most familiar with the GLE document (most estimated that at least half of these groups are familiar with the document). A number of respondents, ranging from 38 to 47 percent, were unsure about the extent to which university mathematicians, parents, or the business community are aware of the document. Respondents estimated that most teachers, school administrators, and college/university mathematics educators are somewhat or highly favorable regarding the content of the document. Again, they were less sure about the opinions of other subgroups.

Table 8. Percent of responses to: "*Approximately what percent of each of the following groups in the state is familiar with the most recent state mathematics curriculum document?"* (N=47)

Group	Do not know	Less than 10%	11-25%	26-50%	51-75%	More than 75%
Elementary teachers	11	4	13	13	15	45
Middle grades mathematics teachers	11	2	13	6	23	45
High school mathematics teachers	11	4	11	4	22	48
District/school administrators	15	4	6	15	23	36
College/university mathematicians	38	19	25	6	13	-
College/university mathematics educators	17	9	15	17	22	20
Parents	47	19	17	11	4	2
Business community	47	29	11	13	-	-

Table 9. Percent of responses to: "*Sometimes people have opinions about a document based on what they have heard, whether or not they have actually seen it. How would you characterize the general perceptions of each of the following groups about the content of the most recent state mathematics curriculum documents?"* (N=47)

Group	Do not know	Highly unfavorable	Somewhat unfavorable	Neutral/ Mixed	Somewhat favorable	Highly favorable
Classroom teachers	9	-	9	16	40	27
District/school administrators	11	-	9	16	31	33
College/university mathematicians	58	-	4	16	16	7
College/university mathematics educators	33	-	7	11	29	20
Parents	60	-	-	18	18	4
Business community	64	-	-	2	24	9

Relationship of Mathematics Curriculum Document to the State Testing Program

As noted in previous sections, for most states the new GLE document serves the role of communicating the focus of state assessments, particularly in states that are implementing new grade level assessments in response to NCLB. Respondents were asked how well they felt the current assessment tools match the content in the new

curriculum documents. Fifty-one percent of the respondents indicated that the curriculum and assessment tools align "extremely well." When asked how well the new curriculum document aligns with assessments that will be used in 2005-06 (the first year of NCLB-mandated grades 3-8 assessment), 71 percent of respondents indicated that the tools align "extremely well." Based on the responses, it appears that grade level curriculum articulation and state assessment development are proceeding in tandem in most states.

Comparison with Prior Documents

Respondents were asked to characterize the differences between the newest state mathematics curriculum document and previously developed documents. Specifically, they were asked about differences in the development process, content, organization, philosophical orientation, and likely influence.

With regard to the development of the document, about a fourth of the respondents indicated that the process utilized for developing previous mathematics curriculum documents was utilized for the newest document. About a third indicated that the process was different with several attributing this change to the shorter timeline dictated by NCLB requirements.

Two themes emerged to describe the nature of the change in document development. One group of respondents indicated that a smaller writing group worked on the newest document whereas previous documents incorporated a wider representation of constituents (and generally longer timeline). Another group indicated that a larger writing group with fuller representation of constituents including teachers, administrators, community leaders, parents and university faculty developed the new curriculum document.

Regarding differences in the content of the new documents, a common response (noted by 15 respondents) was that the new document provided increased specificity, particularly with regard to grade specific learning expectations. Other differences, each noted by at least four respondents included: the new document is "more rigorous"; the new document is more closely aligned with PSSM; the new document pays greater attention to vertical alignment; the new document places more emphasis on topics such as algebra, geometry, and probability in the middle grades. Another theme in the responses is that GLE documents tend to be more focused on student learning expectations with less attention to pedagogy than in previous documents.

Several differences were noted related to the organization of the new documents, most notably utilization of a smaller number of content strands to organize the GLEs. Eleven respondents indicated their states had adopted the content strands used in PSSM or NAEP and this represented fewer strands than their previous document. Another major change for many states was specifying learning expectations by grades rather than by grade bands. Several states reported adding format features (e.g., numbering system) to make more visible either vertical alignment of ideas or assessment standards.

Regarding changes in the philosophical orientation of the new document, five respondents indicated that more attention is paid to constructing a set of learning

expectations that ALL students can attain. One respondent indicated that this shift was dramatic and that the new curriculum document "contained little to support college-bound students' needs." A few respondents indicated that many of the changes in the document were a direct result of NCLB. One state mathematics supervisor said, "The original document involved many people and there was a great discussion about what we wanted. NCLB and state tests changed that discussion to discussions about accountability rather than instructional philosophies."

Echoing this theme, five respondents indicated that the newest curriculum document focused less on instructional strategies than did previous documents. One respondent commented, "Earlier documents were directed to both content and teacher. This document is directed toward content." Another said, "It allows the teacher to use any method. Our old document was specific in how the teacher was to teach each objective."

Other comments indicated that the new documents include the introduction of some content earlier in the grades than in previous curriculum documents and there is less emphasis on "real-world" problems and greater emphasis on procedural learning expectations in the newer documents. Some respondents also indicated an effort to condense the content so that it was more focused at each grade level. One respondent stated, "We tried to narrow the focus of each course, have the courses taught with deep understanding, incorporate the NCTM process standards as well as the content standards." Another respondent indicated that, whereas the "first document was written as 'standards to strive for,' the second document was written as more 'achievable goals'."

About half (23) of the respondents indicated that the new document would likely have a greater influence than the previous mathematics curriculum document (six indicated the same influence and eight did not provide a judgment of relative change in influence). For example, one respondent said, "Due to the increased testing and pressure on testing the standards are widely used and have become the driving force in most classrooms." Another indicated, "This document has already influenced what is taught in classrooms. State standards are no longer viewed as the document on the shelf. NCLB and the accountability requirement had a tremendous influence on this change." In fact, most respondents attributed the increased influence of the state mathematics curriculum document to factors associated with NCLB.

Role of National Organizations in Mathematics Curriculum Articulation

Recall that most of the respondents of the survey are state department of education employees – people who are responsible for curriculum and instructional improvement within the state. In an effort to learn whether they felt national leadership is needed for mathematics curriculum articulation, the final section of the survey asked the following questions: *In your opinion, is national leadership for mathematics articulation needed? If yes, why do you think national leadership would be helpful?* Eighty-five percent of respondents answered "yes" - national leadership is needed. Table 10 summarizes the reasons offered by these respondents. The two most prominent reasons offered were to increase the level of expertise and resources in developing a well-articulated mathematics curriculum and to promote higher, yet appropriate, curriculum standards.

Table 10. Responses to question, *"Why do you think national leadership would be helpful?"* (N=40)

Response	Percent of Respondents
To increase the level of expertise and resources in developing a well-articulated mathematics curriculum.	80
To help promote higher, yet appropriate, curriculum standards.	80
To increase the alignment of curriculum standards from state to state.	68
To reduce duplication of efforts.	60
To provide clearer guidance for textbook publishers.	53
Other, *specify*:	23

The final question of the survey asked, *In your view, what role, if any, should national professional mathematics organizations such as the National Council of Teachers of Mathematics (NCTM), Association of State Supervisors of Mathematics (ASSM), National Council of Supervisors of Mathematics (NCSM), American Mathematical Association of Two Year Colleges (AMATYC), Mathematical Association of America (MAA), or American Mathematical Society (AMS) play in mathematics curriculum articulation at the national level?*

Respondents described several important roles for professional organizations including contributions of expertise, e.g., for mathematics content, pedagogical advice, understanding of student learning patterns. Another suggested role was assistance in articulation (or vertical alignment) between K-12 and higher education. One respondent noted, "These organizations have the needed expertise to develop standards that provide a national vision toward which to work." Another respondent felt that professional organizations could help provide a "rallying influence" and a "common voice" to help coordinate curriculum articulation. For example, "They should collaborate to articulate comparable, compatible standards. Eliminate unwarranted or insignificant differences in order to advance a common agenda." Another respondent called for assistance from professional organizations to advocate nationally for mathematics education, "These groups should work with politicians to help them understand why teaching students using mathematical modeling, problem solving and application is critical to future learning." Another said, "They should help advocate for reasonable expectations with respect to accountability."

Summary

Results of this survey indicate that over the past 3 years there has been a concerted and widespread effort at the state level to describe grade-by-grade mathematics curriculum expectations, particularly for the elementary and middle grades. In developing these grade-level learning expectations, some states followed processes used for earlier iterations, involving a diverse group including teachers, administrators, community leaders and parents and providing substantial opportunities for public comment and input. A few states circumvented their normal process in producing the new set of learning expectations for mathematics, either because of the need to meet tight timelines or because they sought specialized expertise.

In most cases, respondents indicated that the new documents carry greater weight than previous documents, primarily because of their tie to new or expanded state-mandated assessments in mathematics. This survey suggests that NCLB requirements have prompted considerable work on articulation of mathematics learning goals for students, particularly in grades K-8. However, few states are collaborating on this work although national documents such as those produced by NCTM have served as a common reference document. Most respondents also indicate that national leadership is needed to assist in future articulation of learning expectations in mathematics, particularly from national professional organizations of mathematics teachers (K-12 and university) and mathematicians.

As mentioned at the outset of this report, this survey is part of a series of activities organized by researchers at the Center for the Study of Mathematics Curriculum. Another phase of the work is an analysis of the content of the state mathematics GLE documents noted in Appendix A. This analysis will provide information on when particular learning goals are emphasized and the extent to which this varies by states. For more information about this and other initiatives of CSMC, see: http://mathcurriculumcenter.org.

References

Achieve, Inc. (2002). *Foundations for success: Mathematics Expectations for the middle grades*. http://www.achieve.org

American Institutes for Research. (2005). *What the United States Can Learn From Singapore's World-Class Mathematics System (and what Singapore can learn from the United States): An Exploratory Study. http://www.air.org/*

Crosswhite, F. J., Dossey, J.A., Swafford, J.O., McKnight, C.C., and Cooney, T.J. (1985). *Second International Mathematics Study: Summary Report for the United States.* Champaign, Ill.: Stipes Publishing Co.

Kilpatrick, J., Swafford, J., & Findell, B. (Eds.) 2001. *Adding it up: Helping children learn mathematics.* Washington, D.C.: National Academy Press.

Long, V.M. (2003). The role of state government in the custody battle over mathematics education. In Stanic, G. and Kilpatrick, J. (Eds). *A History of Mathematics Education*. Reston, VA: National Council of Teachers of Mathematics. (pages 931-954).

Martin, W.G. (2002). Measuring the impact of *Principles and Standards for School Mathematics* on state policies and practices. Unpublished paper.

National Commission on Excellence in Education. (1983). *A Nation at Risk: The Imperative for Educational Reform*. United States Department of Education.

National Council of Teachers of Mathematics. (1989) *Curriculum and Evaluation Standards for School Mathematics*. Reston, VA: NCTM.

National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.

National Research Council. (2002). *Curriculum as a channel of influence: What shapes what is taught to whom?* In Weiss, I.R., Knapp, M.S., Hollweg, K.S, and Burrill, G. (Eds). Investigating the Influence of Standards: A Framework for Research in Mathematics, Science, and Technology Education. (pages 39-47).

The No Child Left Behind Act. (2001). Public Law No. 107-110. Retrieved January 13, 2005, from http://www.ed.gov/policy/elsec/leg/esea02/index.html

Schmidt, W.H. (2004). A Vision for Mathematics. *Educational Leadership*, 61(5), 6-11.

Sutton, J. & Krueger, A. (Eds.) 2002. *EdThoughts: What we know about mathematics teaching and learning*. Aurora, CO: Mid-Continent Research for Education and Learning.

Appendix A. Names and publication dates for the most recent state-level mathematics curriculum documents (as identified by a search of state education department websites as of Jan. 2005).

State	Document Title	Year
AK	Grade Level Expectations	2004
AL	Alabama Course of Study: Mathematics	2003
AR	Arkansas Mathematics Curriculum Frameworks K-12	1998
AZ	Grade Level Expectations	2003
CA	Mathematics Framework for California Public Schools: K-12 (Draft)	2004
CO	Grade Level Expectations (Examples)	2000
CT	Frameworks for Mathematics (Draft)	2004
DC	Standards for Teaching and Learning	2002
DE	Mathematics Curriculum Framework	1995
DoDEA	Mathematics Curriculum Content Standards	2004
FL	Sunshine State Standards	1996
GA	Georgia Performance Standards	2004
HI	Framework and Instructional Guides--Grade Level Performance Indicators	2004
IA	(no state document exists)	---
ID	Idaho Mathematics Achievement Standards	2005
IL	Illinois Learning Standards for Mathematics	1997
IN	Indiana's Academic Standards for Mathematics	2000
KS	Kansas Curricular Standards for Mathematics	2003
KY	Combined Curriculum Documents (Draft)	2004
LA	Grade Level Expectations	2003
MA	Supplement to the 2001 Math Curriculum Framework	2004
MD	Maryland Voluntary State Curriculum	2004
ME	Grade Level Expectations for Mathematics	2004
MI	Michigan Grade Level Content Expectations (GLCE)	2004
MN	Minnesota Academic Standards--Mathematics	2003
MO	Mathematics Grade Level Expectations	2004
MS	Mississippi Mathematics Framework 2000	1999
MT	Montana Grade Level Learning Expectations (Draft)	2003
NC	Mathematics Standard Course of Study and Grade Level Competencies	2003
ND	Mathematics Content Standards (Draft)	2004
NE	Nebraska Mathematics Standards	2000
NH	Local Grade Level Expectations K-8 (Draft)	2004
NJ	New Jersey Core Curriculum Content Standards for Mathematics	2002
NM	Mathematics Content Standards, Benchmarks, and Performance Standards	2002
NV	Nevada Content & Performance Standards	2003
NY	New York Learning Standards for Mathematics	2005
OH	Academic Content Standards K-12 Mathematics	2001
OK	Priority Academic Student Skills	2002
OR	Oregon Grade Level Standards and K-2 Foundations	2002
PA	Academic Standards for Mathematics	1999
RI	Local Mathematics Grade Level Expectations (Draft)	2004
SC	South Carolina Mathematics Curriculum Standards 2000	2001
SD	South Dakota Revised Mathematics Content Standards	2004
TN	Mathematics Curriculum Standards	2002
TX	Texas Essential Knowledge and Skills for Mathematics	1998
UT	Mathematics Core Curriculum	2003
VA	Virginia Mathematics Standards of Learning Curriculum Framework	2002
VT	Grade Expectations for Vermont's Framework of Standards and Learning Opportunities	2004
WA	Mathematics K-10 Grade Level Expectations: A New Level of Specificity	2004
WI	Wisconsin Model Academic Standards for Mathematics	1998
WV	Mathematics Content Standards and Objectives for West Virginia Schools	2003
WY	Wyoming Mathematics Content and Performance Standards	2003