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Purpose Statement

The purpose of the National Journal of Mathematics Education Leadership is to advance the mission and vision of the National Council of Supervisors of Mathematics by:

- Strengthening mathematics education leadership through the dissemination of knowledge related to research, issues, trends, programs, policy, and practice in mathematics education
- Fostering inquiry into key challenges of mathematics education leadership
- Raising awareness about key challenges of mathematics education leadership, in order to influence research, programs, policy, and practice
- Engaging the attention and support of other education stakeholders, and business and government, in order to broaden as well as strengthen mathematics education leadership

Curriculum Standards, Course Requirements, and Mandated Assessments for High School Mathematics: A Status Report of State Policies

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High schools across the country are under pressure to improve graduation rates, prepare students for an increasingly technical workforce, and raise student achievement outcomes as measured by college entrance, state-mandated, and international test scores. Unlike some school improvement initiatives sparked at the local level, current efforts are driven by changes in state policy that are responses to national policies (e.g. NCLB). In fact, many state departments of education are redefining what students are expected to learn, when and how students will be assessed on that knowledge, and the number of years students are required to study mathematics. This article summarizes current state policies regarding curriculum standards, course-taking requirements, and mandated assessments for high school mathematics. Specifically, we address the following questions:

- How many years of mathematics are required for high school graduation?
- Are specific high school mathematics courses required for graduation?
- How are state-level high school mathematics learning expectations (standards) organized?
- What is the nature of state-mandated high school mathematics assessments and how are they related to graduation requirements?

The information reported was gathered through searches of state[1] Departments of Education websites as of December 2006 (Reys, Dingman, Nevels, & Teuscher, 2007). Due to ongoing work of states, some changes may have occurred since this material was compiled. In fact, at the time of this study, at least six states were reviewing plans for updating or changing state standards, graduation requirements or state-mandated assessments. We recommend that those interested in particular state requirements consult the appropriate website for the latest and most complete set of information.[2]

How many years of mathematics are required for high school graduation?

A recent change by many states is to increase the number of years of mathematics required to graduate from high school (Achieve, 2004). In the United States, high school credit is earned during grades 9 through 12; however, current credit requirements vary across states (see Table 1). As noted in Table 1, five states do not mandate a minimum number of

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[1] In this report, the word "state" refers to the 50 states, as well as the District of Columbia (DC) and the Department of Defense Education Activity (DoDEA)

[2] Links to relevant information about state standards can be found at: http://mathcurriculumcenter.org/states.php

Table 1: Number of Years of High School Mathematics Courses/Credits Required for Graduation*

Specified at Local Level (5)	Colorado, Iowa, Maine, Massachusetts, Nebraska
1 year (0)	None
2 years (7)	Alaska, Arizona, California, Idaho, Montana, North Dakota, Wisconsin
3 years (24)	Connecticut, District of Columbia, DoDEA*, Hawaii, Illinois, Kansas, Kentucky, Louisiana, Maryland, Minnesota, Missouri*, Nevada, New Hampshire*, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon*, Pennsylvania, Tennessee, Utah*, Vermont, Wyoming
4 years (11)	Alabama, Arkansas*, Delaware*, Florida*, Michigan, Mississippi*, Rhode Island, South Carolina, Texas*, Washington, West Virginia
Varies by Diploma (5)	Indiana (2-4 yrs), Georgia (3-4 yrs), North Carolina (3-4 yrs), South Dakota (3-4 yrs), Virginia (3-4 yrs)

* This information includes requirements that have been approved and are being phased in with a particular freshman class.

mathematics credits for high school graduation. Rather, the decision in these states is made at the district level. Seven states require two years of high school mathematics and the majority of states (24) require three years of mathematics for high school graduation. As of 2006, 11 states required students to take four years of mathematics.

Five states offer different graduation diplomas that are dependent, in part, on the number of years of mathematics students complete. For example, high school students in the state of Georgia who earn a "Technology/Career-Preparatory" diploma are required to complete three years of mathematics, while students receiving a "College Preparatory" diploma are required to complete four years of mathematics.

Table 1 reflects some changes that are being phased in over the next five years. For example, five states (Missouri, New Hampshire, Oregon and Utah, plus the DoDEA) are phasing in an increase in mathematics credits from two years of mathematics to three years. Five other states (Arkansas, Delaware, Florida, Mississippi and Texas) are increasing the requirement to four years of mathematics, up from the current requirement of three years.

Are specific high school mathematics courses required for graduation?

Twenty-five states (see Table 2) require students to complete at least Algebra I for high school graduation. Four of these states (Delaware, Louisiana, Michigan and Tennessee)

Table 2: Mathematics Courses Required for High School Graduation/Diploma

Required Courses	States	Number of States
Algebra I	California, District of Columbia*, Florida*, Georgia*, Indiana*, Louisiana, Mississippi, North Carolina*, North Dakota, New Hampshire, New Mexico*, Oklahoma*, South Dakota	13
Algebra I and Geometry	Alabama, DoDEA, Illinois, Kentucky, Maryland, Tennessee*	6
Algebra I and II	Minnesota	1
Algebra I, Geometry and Algebra II	Arkansas, Delaware*, Michigan, Texas, Virginia	5

* An equivalent course is permissible.

Table 3: Organization of State High School Mathematics Learning Expectations (as of Dec. 1, 2006)

Organization	States	Number of States
Grade-Band	Arizona, Colorado, Connecticut, DoDEA, Florida, Illinois, Iowa, Kansas, Maine, Michigan, Minnesota, Montana, Nebraska, Nevada, North Dakota, New Hampshire, New Jersey, New Mexico, Pennsylvania, Rhode Island, South Dakota, Vermont, Washington, Wisconsin, Wyoming	25
Grade-Level	Alaska, Delaware, Idaho, Louisiana[3], Missouri, Ohio	6
Course-Based	Alabama, Arkansas, California, District of Columbia, Georgia, Hawaii, Indiana, Louisiana, Maryland, Mississippi, North Carolina, New York, Oklahoma, South Carolina, Tennessee, Texas, Utah, Virginia, West Virginia	19
Grade-Band and Course-Based	Kentucky, Massachusetts	2
None	Oregon	1

specify Integrated Mathematics I as an appropriate substitute for Algebra I. Six states (Arkansas, Delaware, Michigan, Minnesota, Texas and Virginia) require courses equivalent in rigor to Algebra II for graduation. In addition to specifying a required number of high school mathematics courses, two states (Delaware and Michigan) require that students take a mathematics course in the senior year of high school.

How are state-level high school mathematics learning expectations (standards) organized?

Two approaches — course-based and grade-band/level — are used by states to organize and communicate high school mathematics curriculum standards. Course-based learning expectations define what students are expected to learn when taking a specific course (e.g., Algebra 1, Geometry, Algebra II, Integrated Mathematics I, II, III). Grade-band or grade-level expectations define what students across a set of grades (9-10, 11-12) or at a particular grade level (9, 10, 11, 12) are expected to learn. As noted in Table 3, 25 states organize learning expectations by grade-band, six by grade-level, and 19 by course. As noted, Kentucky and Massachusetts publish both course-based and grade-level learning expectations at the secondary level. Oregon is the only state that does not specify learning goals by course, grade-level or grade-band. Instead, it publishes a document called the *Certificate of Initial Mastery*. This document specifies content to be learned after eighth grade and before a student graduates but does not relate this content to specific courses or grades.

While Table 3 notes differences in the ways states organize high school mathematics standards, it does not specify differences in the learning expectations themselves. We encourage readers who are interested in particular state standards to review the source documents (see http://mathcurriculumcenter.org/states.php for links to these documents).

How do states assess high school students in mathematics?

NCLB requires that every student participate in assessments based upon state standards at least once during high school; however, some states require more than a single exam of all students. Three different types of mathematics exams (*end-of-course examinations, general high school examinations, and graduation exams)* are used by states at the secondary level, one of which is designated as fulfilling the NCLB requirement. *End-of-course exams* are generally state-developed assessments administered to students at the end of a specific mathematics course. In some states students take more than one end-of-course exam (one for each course designated by the state). *General high school examinations* are administered to students at a specific grade level, generally grade 10 or 11. *Graduation exams* are named as such and are required for a high school diploma. These three types of exams vary in content focus, the grade at which the exam is administered to students, and the stakes for students (e.g., some states require a passing grade on

[3] *Louisiana has grade-band standards for grades 9-10 and grade-level standards for grade 11.*

the graduation exam while others require only that students take the exam).

Table 4 summarizes, by state, mathematics assessments required at the high school level. Some of the state exams fulfill more than one purpose. For example, in Mississippi students are required to take and pass an end-of-course exam in Algebra 1. This exam satisfies NCLB requirements and students must pass it to receive a diploma. As noted in Table 4, 43 states administer a general high school exam, 15 states administer end-of-course exams, and 12 states administer a graduation exam. Eight states (Alabama, Alaska, Arizona, California, Florida, Louisiana, Nevada and New Mexico) administer both a general high school exam and a graduation exam to high school students. Eight states (Arkansas, DoDEA, Hawaii, Indiana, North Carolina, Tennessee, Utah and Washington) administer both end-of-course and general high school exams to high school students. Two states (Georgia and South Carolina) administer both end-of-course and a graduation exam to high school students.

The state-mandated assessments vary as to the level of consequence for individual students. In some states, students are required to pass the assessment(s) in order to receive a high school diploma (we classify these as *high stakes assessments*). In other states, while students are required to complete the state assessment, if they do not pass the exam they can receive a high school diploma by meeting alternative requirements. In some of these cases, the assessment score is factored into a course grade (we classify these as *low stakes assessments*). Finally, some states require students to complete the assessment, but the score does not have consequences for the student in their course grade and/or graduation eligibility (we classify these as *no stakes assessments*).

Table 5 provides a summary of our classification of the stakes of the state high school mathematics assessments. As noted, some states are included in more than one cell because they require students to take multiple exams. As shown, 24 states require high stakes assessments (students must pass an exam in order to receive a high school diploma). Six states mandate a low stakes form of assessment for high school students, whereas 40 states require a high school exam, but students are not required to take or pass this exam (no stakes).

Summary

States have initiated major changes since the passage of NCLB with regard to specifying standards for high school mathematics, increasing mathematics requirements for high school graduation, and developing assessments for accountability purposes. Although standards, course requirements, and assessments differ across states, efforts are directed at a common goal, namely to strengthen mathematics programs at the secondary level in order to provide opportunities for all students to learn important

Table 4: Types of High School Assessments Required in Mathematics

Type of State-Required Exam	States	Number of States
End-of-Course Exam(s)	Arkansas, DoDEA, Georgia, Hawaii[4], Indiana, Maryland, Mississippi North Carolina, New York, Oklahoma, South Carolina, Tennessee, Utah, Virginia, Washington[5]	15
General High School Exam	Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, DoDEA, District of Columbia, Florida, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Carolina, North Dakota, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, Wyoming	43
Graduation Exam	Alabama, Alaska, Arizona, California, Florida, Georgia, Louisiana, Nevada, New Jersey, New Mexico, Ohio, South Carolina	12

[4] An Algebra I exam is under development as of April 2007.
[5] An End-of-Course exam has been proposed and may be implemented April 2007.

mathematics and to be prepared for continued study of mathematics as it relates to their future endeavors.

The variance of current state policy regarding high school curriculum standards, course requirements, and mandated assessments raises some interesting questions:

- What impact will raising course standards and graduation requirements have on student learning and graduate rates?
- Should all high school students study a common core of mathematics?
- Should high schools provide alternative mathematics course sequences beyond the core in order to prepare students for particular interests and career options?

Although answers to these questions are difficult to agree upon, preparing all high school students for an increasingly mathematics-intensive work environment requires rethinking traditional methods, exploring alternative course sequences and materials, and increasing the supply of "highly qualified" high school mathematics teachers and curriculum leaders (Steen, 2007).

Table 5: Summary of Level of Stakes and Type of Assessment for High School Students by State

	No Stakes	Low Stakes	High Stakes	Number of States
End-of-Course Exam(s)	DoDEA, Hawaii[6], Georgia, Indiana, North Carolina, South Carolina, Tennessee, Utah, Washington[7] (9)	Arkansas (1)	Maryland, Mississippi, New York, Oklahoma, Virginia (5)	15
General High School Exam	Alabama, Alaska, Arizona, Arkansas, California, Colorado, DoDEA, District of Columbia, Florida, Hawaii, Illinois, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oregon, Rhode Island, South Dakota, Vermont, West Virginia, Wisconsin, Wyoming (31)	Connecticut, Indiana, Pennsylvania (3)	Delaware, Idaho, Massachusetts, Minnesota, N. Carolina, Tennessee, Texas, Utah, Washington (9)	43
Graduation Exam		Arizona, Ohio (2)	Alabama, Alaska, California, Florida, Georgia, Louisiana, Nevada, New Mexico, New Jersey, S. Carolina (10)	12
Totals	40	6	24	

[6] *An Algebra I exam is under development as of April 2007.*
[7] *An End-of-Course exam has been proposed and may be implemented April 2007.*

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