Chapter Two
Trends in Mathematics and Science Course Enrollments

Course Enrollment as Key Indicator

CCSSO has reported indicators of student course-taking in science and mathematics by state since 1990. For educators and education leaders, these indicators are key measures for monitoring the condition of K-12 education in science and math.

- Research on patterns of student achievement in math and science has consistently shown that the number and level of secondary courses completed by students are strongly related to achievement.[3]
- States have an interest in determining the proportion of students who progress through the secondary science and mathematics curricula to higher course levels (i.e., algebra 2, trigonometry, precalculus, chemistry, physics, advanced biology, physical sciences), because they indicate the proportion of students being offered more challenging content, which usually aligns with state content standards for science and math.[4]
- Course-taking patterns can be analyzed in relation to state high school graduation requirements, which have shown significant increases since the mid-1980s.
- Course enrollments by state are useful for tracking how states and schools are progressing in offering opportunities for science and math to students from all race/ethnicity and gender groups.

Mathematics: Students Taking Higher-Level Courses by High School Graduation

- **Four years of higher-level math.** The state data for 2002 indicate that eight states had more than 50 percent of high school students taking trigonometry or precalculus by graduation; nationally, 41 percent of students completed this level of high school math.
- **Three years of higher-level math.** Twenty states had more than 60 percent of students taking algebra 2 or integrated math 3 by graduation, and eight states had more than 75 percent of students at this level.

Policy Issues:

- **What proportion of students take challenging mathematics and science courses by graduation?**
- **What are trends in mathematics and science course-taking for students reported by gender and race/ethnicity?**
- **How are state policies related to course enrollment patterns?**

[3] Many studies show the relationship between course-taking and achievement (Husen, 1967; Jones, L.R., Mullis, Raizen, Weiss, & Weston, 1992; Jones, L.V., Davenport, Bryson, Bekhuis, & Zwick, 1986; Rock, Braun, & Rosenbaum, 1985; Sebring, 1987; Walberg, 1984). Analyses of recent NAEP results show high mathematics proficiency correlates strongly with the levels of mathematics courses completed (Mullis et al., 1993; Shaughnessy, et al., 1998; Wilson & Blank, 1999). Course-taking rates and levels in math and science vary widely across U.S. schools; the levels of courses completed correlate with the socioeconomic status of students (Goodlad, 1984; Horn & Hafner, 1992; McKnight et al., 1987; Oakes, 1990; Lee, Bryk, & Smith, 1993; Weiss, 1994).

[4] Recent analyses by the Education Trust indicate students taking more challenging courses have higher achievement scores regardless of prior scores or students' SES (Barth & Haycock, Education Trust, 2003).

- **Trends over 12 years.** In 2002, 41 percent of graduating high school students nationwide completed four years of challenging high school math, as compared to 29 percent in 1990. As of 2002, 63 percent of students took algebra 2 or integrated math 3 by graduation, as compared to 29 percent in 1990.

Most states have set three years of high school mathematics—and many have set four years—as a requirement for graduation (CCSSO, Key State Education Policies, 2002). However, research on course-taking and achievement indicates that it is critical to specify the *level* of courses completed, which is the approach of the CCSSO course indicators. Figure 2.1 displays the trends for each state in the percent of high school students who took three challenging high school math courses by graduation from 1990 to 2002. According to the data, the percentage of students who reached three years of high school mathematics varied from more than 80 percent (West Virginia, Nebraska, Missouri) to less than 50 percent (three states). Trends are shown for those states reporting consistent data during the period. [See note on state data for 2001-02[5].]

Table 2.1 displays the percentages of high school students who took 4, 3, and 2 years of challenging math courses by graduation, as well as 12-year trends for these courses since 1990 (when the CCSSO state indicators program began). The states are ranked by the percent of students who took 4 years (trigonometry or precalculus). The percentages of students who took algebra 1 or integrated mathematics 1 during high school are shown in table 2.2.

As you study table 2.1 and figure 2.1, consider the following questions about enrollments in math courses:

- What percent of students in your state took algebra 2 or integrated mathematics 3 by the time they graduated, according to the data from states?[6]
- How does the percent of students taking algebra 2 and geometry by graduation in your state compare with national statistics (62 percent and 74 percent)? What are some reasons for the rate of higher-level math enrollments in your state?
- Do you have a reason to question the accuracy or completeness of these data? What would make your state's math course data incomparable to the data for other states in your region?

Students Taking Algebra 1 or Integrated Math 1 in Grade 9

Table 2.2 displays the percentages of students taking algebra 1 or integrated math 1 in grade 9 during the 2001–02 school year. Data are reported disaggregated at this level for those states that collected detailed data by course type. Integrated math 1 is the first high school course in an integrated math series (usually three years) designed to organize curriculum and instructional strategies that bring together key concepts often taught in separate high school courses, such as algebra, geometry, and functions.

[5] Minnesota: data source grade range 7-9 not included; Ohio: Cleveland data not included; Tennessee: 00-01 data.

[6] Eighteen states require students to pass specific math courses including Algebra 1 in order to graduate. (For graduation requirements by subject in each state, see CCSSO, *Key State Education Policies for K-12 Education,* at http://www.ccsso.org/content/pdfs/KeyState2002.pdf.)

Table 2.1 Students Taking Higher-Level Mathematics Courses by Graduation, 2002; Change 1990 to 2002

STATE	Trigonometry/ Precalculus (Level 4) 2002	Change 1992 to '02	Algebra 2/ Integrated Math 3 (Level 3) 2002	Change 1990 to '02	Geometry/ Integrated Math 2 (Level 2) 2002	Change 1992 to '02
West Virginia	71%	+44%	84%	+42%	76%	+21%
North Carolina	68%	+28%	73%	+22%	95+%	+28%
Texas	61%	+35%	76%	+22%	95+%	+30%
Nebraska	60%	+38%	80%	+26%	89%	+22%
Connecticut	59%	+21%	70%	+9%	75%	+12%
Louisiana	52%	—	65%	+1%	79%	—
Wisconsin	51%	+17%	72%	+36%	90%	+9%
Massachusetts	50%	—	79%	—	87%	—
Iowa	47%	+15%	72%	+22%	71%	-5%
South Dakota	46%	—	76%	—	69%	—
North Dakota	45%	-4%	76%	+12%	83%	+2%
Ohio	45%	+10%	47%	0%	80%	+18%
Arkansas	42%	+15%	74%	+26%	95+%	+35%
Missouri	41%	+25%	89%	+31%	78%	+14%
Michigan	41%	—	53%	—	54%	—
Wyoming	41%	+13%	70%	+41%	78%	+15%
NATION	**41%**	**+12%**	**63%**	**+14%**	**78%**	**+17%**
Indiana	39%	+9%	64%	+19%	70%	+12%
Minnesota	38%	+4%	59%	+4%	84%	+13%
New York	38%	+10%	61%	+15%	95+%	+39%
Mississippi	37%	+8%	78%	+20%	87%	+23%
Oklahoma	36%	+13%	71%	+11%	82%	+29%
Tennessee	32%	+3%	77%	+23%	75%	+17%
Vermont	32%	+2%	60%	+7% *	62%	+5%
Florida	28%	+5%	59%	+17%	67%	+14%
California	24%	+3%	43%	-1%	56%	+9%
Idaho	23%	-1%	59%	-5%	66%	+3%
New Mexico	22%	-1%	59%	+12%	53%	-3%
Dist. of Columbia	21%	+4%	68%	+29%	87%	+21%
Nevada	20%	+1%	49%	+17%	60%	+9%

Example: 70% of Connecticut students took Algebra 2 or Integrated Math 3 (3rd year of high school math) prior to graduation, based on data from 2001-02 school year. This represents an increase of nine percentage points since the 1989-90 school year.

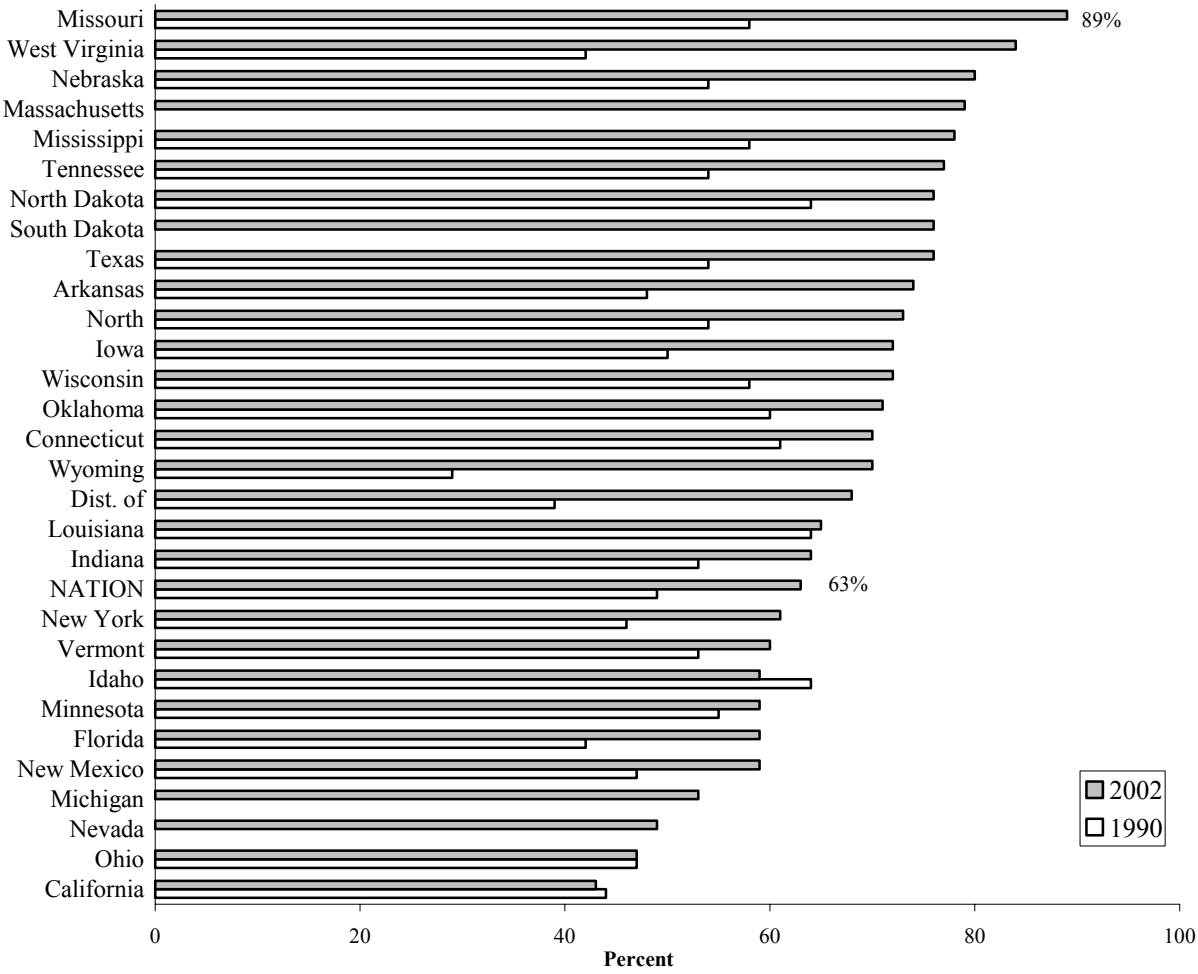
— Data not available. Vermont: data includes imputation.

Note: Each state percent is a statistical estimate of course taking of public high school students by the time they graduate based on the total course enrollment in grades 9-12 in fall 2001 divided by the estimated number of students in a grade cohort during four years of high school. The statistical estimating method is imprecise above 95%. Nation = Percent of all public high school students estimated to take each course, including imputation for nonreporting states (see Appendix C).

Source: State Departments of Education, Data on Public Schools, 2001-02.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Figure 2.1 Percent of High School Students Taking Algebra 2 or Integrated Mathematics 3 by Graduation, 1990 to 2002



(1) see note on percent computation.

Source: State Departments of Education, Data on Public Schools, 2001-02.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.2 Integrated Mathematics and Algebra 1 Course Enrollments as a Percentage of Grade 9 Students, 2002

State	Integrated Math 1 % of Grade 9	Algebra 1 % of Grade 9*
Arkansas	—	85
California	6	67
Connecticut	6	59
District of Columbia	—	177
DoDEA	—	70
Florida	29	29
Idaho	4	81
Indiana	7	73
Iowa	0	113
Massachusetts	12	62
Michigan	—	53
Minnesota	47	47
Mississippi	—	72
Missouri	—	77
Nebraska	—	74
Nevada	0	43
New Mexico	1	67
New York	101	—
North Carolina	0	124
North Dakota	—	89
Ohio	16	89
South Dakota	4	83
Texas	0	85
Vermont	26	56
Wisconsin	21	90
Wyoming	20	76

*Numerator is total algebra 1 enrollment, grades 9–12; denominator is grade 9 enrollment.
Note: Percentages greater than 100 percent indicate students in several high school grades took algebra 1 in 2001–02. Vermont: Data includes imputation.
Source: State Departments of Education, Data on Public Schools, 2001–02.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Science: Students Taking Higher-Level Courses by High School Graduation

- **High school physics.** In 2002, seven states had more than 30 percent of students taking physics by graduation; nationally, 25 percent of students took physics by graduation. In six states, enrollments increased by five or more percentage points from 1990 to 2002; however, during the same period, physics course-taking declined in seven states.
- **High school chemistry.** In 2002, 10 states had more than 60 percent of students taking chemistry by graduation. Chemistry enrollments increased significantly in most states from 1990 to 2002, and enrollments increased more than 10 percentage points in 13 states.
- **Trends over 12 years.** In 2002, 59 percent of students took chemistry by high school graduation as compared to 45 percent in 1990, an increase of 14 percentage points.[7] Twenty-five percent of students nationwide took physics by graduation in 2002, representing a rise of five percentage points from 1990**.**

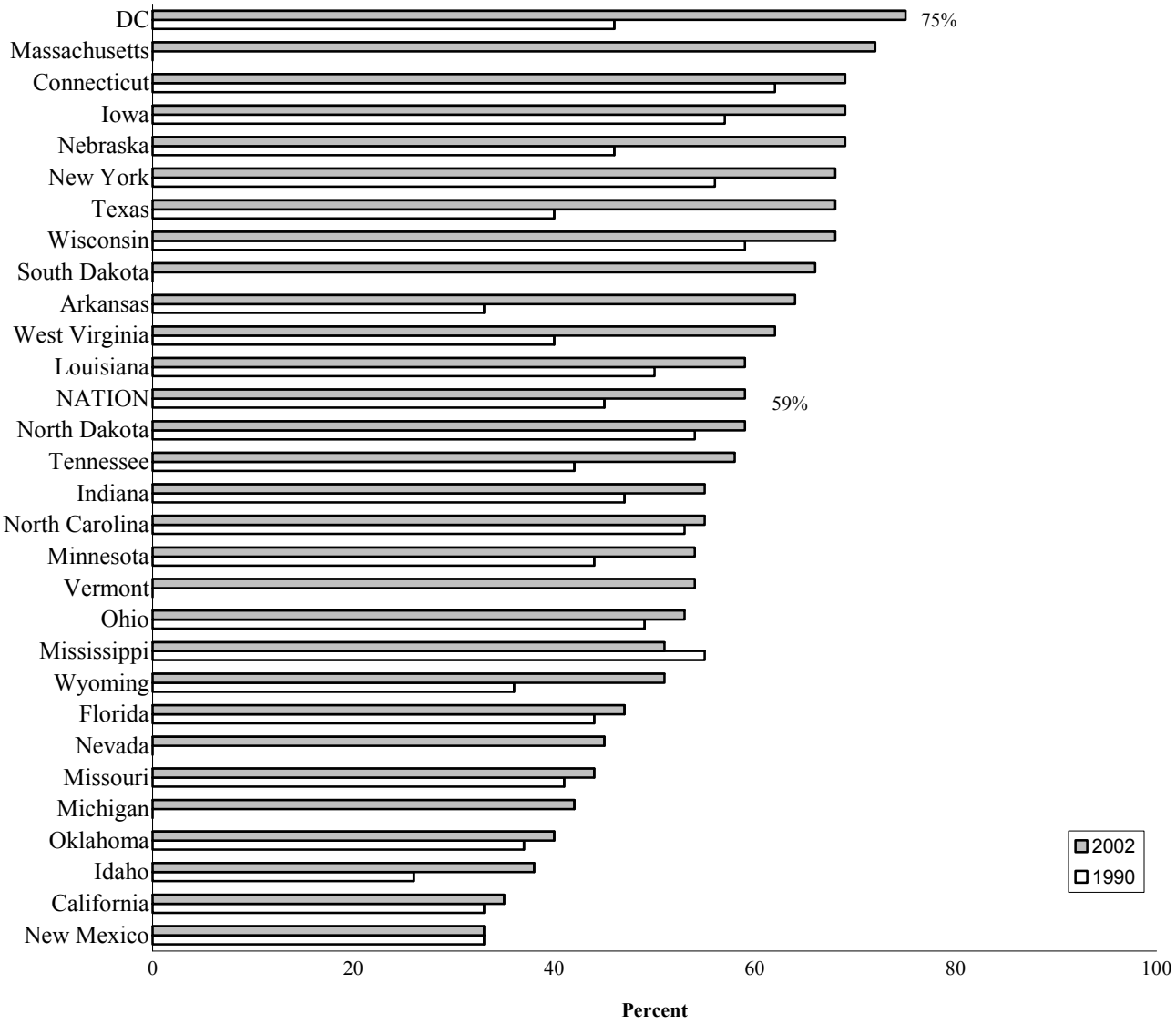
In figure 2.2, states are listed in order by percent of graduating high school students who took chemistry in 2002. The bar graph enables each state to (a) analyze the progress of its schools in chemistry course-taking from 1990 to 2002 and (b) compare each state's improvement in course enrollments to rates for other states and the nation as a whole.

Table 2.3 shows by state the percent of high school students who took courses in chemistry, physics, and biology by graduation. The table also shows the change in percentage points by state and nationally from 1990 (when the CCSSO state indicators program began) to 2002. The 12-year trends for chemistry show major increases in Texas, Nebraska, District of Columbia, Arkansas, Wisconsin, and Tennessee. Nationally, nearly 60 percent of students took chemistry by graduation as compared to 45 percent in 1990.

The trends for physics enrollment demonstrate increased enrollments of more than 10 percentage points in four states, whereas enrollments declined in seven states. Nationally, one-fourth of students took physics by graduation, as compared to 20 percent in 1990. Nearly all high school students took biology by graduation. Nationally, more than 95 percent of students completed a first-year course in biology, and this rate is virtually constant since 1990.

[7] National trends on course-taking based on state data can be compared with results from national sample surveys of high school transcripts from studies conducted by NCES since 1982. In 1982, 33 percent of high school graduates took algebra 2, and results for 1998 graduates show the rate increased to 58 percent. In 1982, 31 percent of high school graduates took chemistry, and results for 1998 graduates show the rate increased to 61 percent (Roey et al., *The 1998 High School Transcript Study Tabulations,* 2001).

Figure 2.2 Percent of High School Students Taking Chemistry by Graduation, 1990 to 2002



(1) see note on percent computation

Source: State Departments of Education, Data on Public Schools, 2001-02.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.3 Students Taking Higher-Level Science Courses by Graduation, 2002; Change 1990 to 2002

	CHEMISTRY		PHYSICS		BIOLOGY	
STATE	2002	Change 1990 to '02	2002	Change 1990 to '02	2002	Change 1990 to '02
Dist. of Columbia	75%	+29%	29%	+16%	95+%	+20%
Massachusetts	72%	—	41%	—	93%	—
Iowa	69%	+12%	30%	+3%	95+%	0%
Nebraska	69%	+23%	32%	+11%	95+%	0%
Connecticut	69%	+7%	34%	-2%	95+%	0%
Texas	68%	+28%	30%	+18%	95+%	0%
Wisconsin	68%	+17%	29%	+4%	95+%	0%
New York	68%	+12%	31%	+3%	95+%	0%
South Dakota	66%	—	23%	—	95+%	—
Arkansas	64%	+31%	25%	+12%	95+%	0%
West Virginia	62%	+22%	48%	+37%	95+%	0%
NATION	**59%**	**+14%**	**25%**	**+5%**	**94%**	**-1%**
Louisiana	59%	+9%	23%	+2%	95+%	+5%
North Dakota	59%	+5%	23%	-1%	95+%	0%
Tennessee	58%	+16%	12%	+1%	90%	+2%
Indiana	55%	+13%	21%	+2%	95+%	0%
North Carolina	55%	+8%	16%	+1%	92%	-3%
Minnesota	54%	+10%	24%	+1%	95+%	0%
Vermont	54%	+2% *	31%	0% *	70%	-12% *
Ohio	53%	+4%	26%	+6%	95+%	0%
Wyoming	51%	+15%	21%	+5%	95+%	+9%
Mississippi	51%	-4%	13%	-4%	93%	-2%
Florida	47%	+3%	17%	-2%	78%	-17%
Nevada	45%	+12%	17%	+4%	61%	-4%
Missouri	44%	+3%	15%	-1%	95+%	+9%
Michigan	42%	—	22%	—	81%	—
Oklahoma	40%	+3%	10%	0%	90%	-3%
Idaho	38%	+12%	13%	-2%	95+%	+15%
California	35%	+2%	16%	0%	66%	-25%
New Mexico	33%	0%	8%	-7%	81%	-14%

Example: 68% of New York students took Chemistry (i.e., three years of high school science) prior to graduation, based on data from 2001-02 school year. This represents an increase of twelve percentage points since the 1989-90 school year.

Note: Each state percent is a statistical estimate of course taking of public high school students by the time they graduate based on the total course enrollment in grades 9-12 in fall 2001 divided by the estimated number of students in a grade cohort during four years of high school. The statistical estimating method is imprecise above 95%. Nation = Percent of all public high school students estimated to take each course, including imputation for nonreporting states (see Appendix C).

— Data not available. Vermont: data includes imputation; West Virginia: Coordinated science includes biology, chemistry, and physics; 62% = 3 years coordinated science.

Source: State Departments of Education, Data on Public Schools, 2001-02.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Advanced/Second-Year Math and Science

Table 2.4 displays by state the percentages of grade 12 students enrolled in advanced mathematics and science courses in 2002. The data show that in the majority of states one to five percent of students took an advanced or second-year biology course; one percent took an advanced chemistry course; one percent took AP biology and AP chemistry; and one to two percent took AP physics or a second-year advanced physics course.

First-Year High School Science

Table 2.5 shows course enrollments in Earth science, physical science, general science, and integrated or coordinated science in 2001–02 and identifies changes in enrollment since 1996. Not all students took these courses at grade 9, but this is a common pattern, and using grade 9 enrollments as the denominator improves state comparisons. These data, which show marked differences in course enrollments by state, are useful to educators interested in tracking the patterns in science course-taking across states.

As you study figure 2.2 and tables 2.3, 2.4, and 2.5, consider the following questions about enrollments in science courses:

- Does the trend in first-year chemistry enrollments provide a useful benchmark of progress of students in the high school science curriculum for your state?
- Do you prefer, instead, to analyze AP or other advanced science course trends?
- How do science enrollments in different course levels for your state compare with those of the states in your region? How do you account for changes and trends?
- What are the trends in first-year high school courses (e.g., Earth science, physical science, and general science)?
- What are the trends for integrated or coordinated science in your state?[8] What accounts for different trends in your region?

Additional Data by Course on the Web

The CCSSO website (http://www.ccsso.org/projects/Science_and_Mathematics_Education_Indicators/) provides additional tables with more detailed data on science and mathematics course enrollments by state, including enrollments in *general* versus *applied* biology, chemistry, and physics; data on review and informal high school mathematics courses; and enrollments by state in advanced/second-year and AP courses. (See appendix D for a complete list of the course categories collected by state.)

[8] Several states now have a substantial percentage of students taking integrated or coordinated science courses, often starting at grade 7 and continuing through grade 9 or 10. A *coordinated* science curriculum treats the disciplines of biology, chemistry, physics, and Earth/space science individually and equitably and focuses on an overarching idea in the sciences that can be explained in terms of all four disciplines. An *integrated* science curriculum intentionally blurs the traditional disciplinary lines and treats science as a whole, under the assumption that the disciplines should not be separated in the secondary curriculum (California Scope, Sequence & Coordination Project, 1995).

Table 2.4 Advanced Mathematics and Science Course Enrollments as a Percent of Students in Grades 9–12, 2002

State	Calculus (Level 5)	Calculus, AP (Level 5)	Biology 2nd-Year AP	Biology 2nd-Year Advanced	Biology 2nd-Year Other	Chemistry 2nd-Year AP	Chemistry 2nd-Year Advanced	Physics 2nd-Year AP	Physics 2nd-Year Advanced
Arkansas	1%	1%	0.5%	2%	1%	1%	—	1%	1%
California	0.4%	2%	1%	3%	0.1%	1%	0.5%	1%	0.3%
Connecticut	1%	3%	1%	4%	5%	1%	0.4%	1%	0.2%
District of Columbia	—	2%	2%	3%	—	0.2%	1%	0.4%	—
DoDEA	—	3%	2%	1%	0%	1%	0.03%	1%	0.01%
Florida	1%	1%	1%	4%	1%	0.4%	0.4%	0.3%	0.1%
Idaho	2%	2%	1%	2%	1%	0.2%	—	0.4%	—
Indiana	2%	1%	1%	3%	3%	1%	1%	1%	0.3%
Iowa	1%	1%	1%	8%	2%	1%	1%	0.2%	1%
Louisiana	1%	1%	0.3%	2%	1%	0.2%	1%	0.2%	0.1%
Massachusetts	4%	2%	1%	3%	3%	1%	1%	1%	1%
Michigan	2%	1%	1%	6%	1%	1%	2%	0.4%	1%
Minnesota	4%	—	2%	3%	2%	2%	1%	0.4%	1%
Mississippi	0.2%	1%	1%	22%	2%	0.2%	1%	0.1%	0.1%
Missouri	4%	—	—	12%	2%	—	4%	—	2%
Nebraska	4%	—	—	13%	—	—	—	—	—
Nevada	0.5%	1%	1%	1%	2%	0.4%	0.3%	0.2%	0.1%
New Mexico	0.3%	1%	1%	4%	1%	0.5%	1%	0.3%	0.3%
New York	1%	3%	1%	1%	4%	1%	1%	1%	1%
North Carolina	0%	2%	1%	6%	0%	1%	1%	0.2%	0.1%
North Dakota	2%	—	—	10%	2%	—	1%	—	—
Ohio	3%	2%	1%	1%	—	1%	0.4%	0.5%	0.2%
Oklahoma	1%	2%	1%	9%	4%	1%	1%	1%	0.02%
South Dakota	6%	—	1%	12%	2%	0.4%	1%	0.3%	0.4%
Tennessee	2%	2%	1%	0%	2%	0.3%	0.5%	0.3%	0.04%
Texas	0.001%	3%	1%	2%	0.03%	1%	0.02%	1%	0.01%
Vermont	1%	2%	1%	3%	1%	1%	1%	0.5%	1%
West Virginia	1%	2%	1%	13%	2%	1%	13%	0.3%	4%
Wisconsin	1%	4%	1%	6%	—	1%	2%	1%	1%
Wyoming	1%	3%	1%	3%	1%	1%	1%	0.4%	0.4%
NATION	**1%**	**2%**	**1%**	**4%**	**2%**	**1%**	**1%**	**1%**	**0.5%**

—Data not available. Vermont: Data includes imputation.

Sources: State Departments of Education, Data on Public Schools, 2001–02; NCES, CCD Fall Membership 2001.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.5 Students Taking Earth Science, Physical Science, General Science and Integrated Science as a Percent of Grade 9 Students, 1996 to 2002

State	Earth Science		Physical Science		General Science		Integrated or Coordinated Science	
	2002	Change 1996 to '02	2002	Change 1996 to '02	2002	Change 1996 to '02	2002	Change 1996 to '02
Arkansas	9%	-74%	98%	+18%	9%	+9%	—	—
California	10%	+1%	21%	-10%	6%	-4%	27%	+9%
Connecticut	36%	-4%	23%	-2%	26%	+2%	12%	+8%
District of Columbia	19%	-3%	0.3%	—	4%	+2%	—	—
DoDEA	20%	+18%	—	—	0.4%	—	10%	-74%
Florida	46%	—	13%	—	0.01%	—	14%	—
Idaho	51%	-12%	39%	+3%	3%	-2%	4%	—
Indiana	39%	+11%	21%	-1%	—	—	4%	+1%
Iowa	35%	+9%	56%	+11%	—	—	27%	—
Louisiana	6%	-6%	1%	-65%	3%	-13%	6%	—
Massachusetts	25%	-3%	33%	+2%	6%	-6%	25%	+18%
Michigan	26%	—	16%	—	9%	—	13%	—
Minnesota	15%	+5%	62%	+22%	—	—	4%	+1%
Mississippi	6%	+4%	44%	+10%	—	—	—	—
Missouri	15%	0%	71%	+7%	12%	-3%	—	—
Nebraska	38%	-5%	48%	-4%	22%	-1%	—	—
Nevada	30%	—	4%	—	15%	—	20%	—
New Mexico	12%	+5%	42%	+1%	9%	-11%	6%	—
New York	70%	+3%	—	—	—	—	2%	-3%
North Carolina	55%	+16%	38%	-39%	—	—	—	—
North Dakota	6%	+3%	109%	+3%	3%	—	—	—
Ohio	21%	0%	29%	+3%	0.1%	-41%	52%	—
Oklahoma	10%	+6%	69%	0%	3%	-3%	—	—
South Dakota	22%	+4%	72%	+11%	15%	+12%	—	—
Tennessee	8%	+1%	81%	+4%	3%	—	—	—
Texas	7%	-1%	0.002%	-62%	—	—	67%	+65%
Vermont	36%	—	19%	—	7%	—	20%	—
West Virginia	21%	+19%	—	—	—	—	99%	+18%
Wisconsin	25%	-1%	49%	-9%	15%	-6%	21%	—
Wyoming	31%	—	47%	—	11%	—	10%	—

—Data not available. Vermont: Data includes imputation. Some students take these courses beyond grade 9. West Virginia students take Integrated Science in grade 9, 10, or 11.

Sources: State Departments of Education, Data on Public Schools, 2001–02; NCES, CCD Fall Membership 2001.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

State Policies and Course Enrollment Trends

Policy Issues:

• Have enrollments in higher-level courses increased since many states raised graduation requirements?

• Do states with policies setting higher course requirements for graduation have higher rates of course-taking in science and mathematics?

Efforts to improve science and math education at the secondary level are currently aimed toward increasing enrollments in challenging courses that are more likely to meet state and national content standards for student learning. One method of analyzing trends at the state level is to track enrollment levels by state course credit requirements for high school graduation and then analyze the question of whether higher requirements do produce increased student enrollments in academically challenging courses.

During the 1980s and the 1990s, more than 40 states raised the number of credits required for graduation, with additional requirements recently added. As of 2002,

- 27 states required three credits of mathematics, and four states required four credits;
- 21 states required three credits of science, and four states required four credits.

Currently, 42 states require at least two years of math and science, whereas in 1980, only nine states had this requirement. In 1992, 13 states required three or more credits of math, and six states required three or more credits in science, compared to 27 and 21 states in 2002. (See CCSSO, Key State Policies for PK-12 Education, 2002; http://www.ccsso.org/content/pdfs/KeyState2002.pdf.)

Enrollment Trends for Higher-Level Courses by State Policies

- In mathematics, from 1990 to 2002, 17 states increased enrollments in higher-level courses by 10 or more percentage points (i.e., 17 of 30 states with complete, reported trend data).
- In science, from 1990 to 2002, 10 (of 30) states increased enrollments in higher-level courses by 10 or more percentage points.
- Nationally, 48 percent of high school students took a higher-level math course during the 2001–02 school year, an increase of 14 points from 1990; 31 percent of high school students took a higher-level science course in 2001–02, an increase of 10 points from 1990.

The state course data provide a measure for assessing change in course enrollments in relation to an individual state's requirements for graduation. Tables 2.6 and 2.7 show the percentages of grade 9–12 students who took higher-level courses in math and science in the 2001–02 school year and identify the change in percentage points from 1990 to 2002. Higher-level math is defined as a course at the level of geometry (level 2), algebra 2, trigonometry, precalculus, or calculus (level 5). Higher-level science is defined as a course in chemistry or physics or an advanced or second-year course.

In table 2.6, among the states requiring 2.5 to four years of math, 12 of 18 states increased higher-level math course enrollments by 11 or more percentage points. The data confirm that states requiring more credits for graduation have produced gains in higher-level course enrollments. In table 2.7, among the states requiring 2.5 to four credits of science, six of 12 states increased higher-level science enrollments by 10 or more percentage points. The third column of each table displays the percent of students in each state who took mathematics at any level in 2002.

Table 2.6 Change in Higher-Level Mathematics Enrollments by State Graduation Requirements, 1990 to 2002

PERCENT OF GRADES 9-12 STUDENTS

State (By Requirements)	Students Taking Math at Level 2, 3, 4, or 5		Students Taking Math (Any Course)
	2002	Change 1990 to 2002	2002
2.5 to 4 Credits (as of 2002)			
Arkansas	56%	+25%	79%
Connecticut	53%	+15%	97%
District of Columbia	46%	+16%	99%
DoDEA	53%	+13%	92%
Florida	38%	+9%	80%
Louisiana	49%	+6%	88%
Minnesota	49%	+8%	81%
Mississippi	50%	+12%	88%
Nevada	32%	+3%	65%
New Mexico	34%	+4%	79%
North Carolina	59%	+22%	99%
Ohio	47%	+11%	84%
Oklahoma	49%	+15%	83%
Tennessee	49%	+21%	81%
Texas	59%	+24%	86%
Vermont	41%	+4%	79%
West Virginia	59%	+29%	99%
Wyoming	51%	+26%	89%
2 Credits (as of 2002)			
California	33%	+4%	66%
Idaho	40%	+2%	73%
Indiana	46%	+13%	82%
Missouri	55%	+19%	95%
New York	55%	+21%	90%
South Dakota	54%	—	86%
Wisconsin	58%	+11%	93%
1 Credit or Local Board Policies			
Iowa	50%	+7%	99%
Massachusetts	59%	—	99%
Michigan	40%	—	77%
Nebraska	61%	+25%	99%
No Requirement			
North Dakota	53%	+9%	93%
NATION	**48%**	**+14%**	**89%**

Math Level 2–5: Geometry, algebra 2, trigonometry, precalculus, or calculus.
— Data not available. Vermont: Data includes imputation.
DoDEA, Nevada, Vermont, Wisconsin: Change from 1992 to 2002.
Source: State Departments of Education, Data on Public Schools, 2001–02.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.7 Change in Higher-Level Science Enrollments by State Graduation Requirements, 1990 to 2002

	PERCENT OF GRADES 9-12 STUDENTS		
	Students Taking Chemistry, Physics, or Advanced Science		Students Taking Science (Any Course)
State (By Requirements)	2002	Change 1990 to 2002	2002
2.5 to 4 Credits (as of 2002)			
Arkansas	28%	+17%	94%
District of Columbia	32%	+16%	82%
DoDEA	37%	+16%	92%
Florida	26%	-2%	73%
Louisiana	24%	+6%	70%
Mississippi	43%	+8%	91%
North Carolina	26%	+10%	88%
Oklahoma	28%	+15%	84%
Tennessee	20%	+4%	75%
Vermont	29%	+3%	77%
West Virginia	44%	+23%	99%
Wyoming	25%	+7%	85%
2 Credits (as of 2002)			
California	18%	+3%	56%
Connecticut	38%	+8%	94%
Idaho	18%	+1%	71%
Indiana	30%	+6%	74%
Minnesota	30%	+7%	78%
Missouri	34%	+7%	92%
Nevada	20%	+6%	59%
New Mexico	19%	+5%	63%
New York	34%	+10%	96%
Ohio	23%	+3%	80%
South Dakota	41%	—	93%
Texas	29%	+12%	80%
Wisconsin	36%	+6%	99%
1 Credit or Local Board Policies			
Iowa	39%	+16%	99%
Massachusetts	38%	—	99%
Michigan	27%	—	72%
Nebraska	38%	+22%	99%
No Requirement			
North Dakota	35%	+10%	90%
NATION	**31%**	**+10%**	**90%**

— Data not available. Vermont: Data includes imputation.
DoDEA, Vermont, Wisconsin: Change from 1992 to 2002.
Source: State Departments of Education, Data on Public Schools, 2001–02.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Middle Grades Mathematics and Science Course Enrollments

- In 14 states, more than 20 percent of grade 8 students took algebra 1 in 2002, and grade 8 enrollments in algebra 1 increased by 10 or more percentage points in 9 states.
- Nationally, 21 percent of grade 8 students took algebra 1 in 2002, an increase of 10 percentage points since 1990.

The **mathematics** curriculum for middle school students is highly varied among states and within states. Many states and districts are moving toward a grade 8 curriculum with greater emphasis on algebra. Table 2.8 shows that the percentage of grade 8 students who took algebra in 2002 varied from 4 percent in Louisiana and Oklahoma to 39 percent in California. The national total of grade 8 students who took algebra is 21 percent (which includes imputation for missing states). Accelerated or pre-algebra courses were taken by 18 percent of grade 8 students in 2002.

The course titles provide only a rough estimation of the content students received. Content analyses show wide content variation in courses of algebra, pre-algebra, and regular grade 8 math, but these categories do provide useful distinctions in the general level of math content that is taught (McKnight, et al., 1987; Shaughnessy, 1998).

The **science** courses and curriculum taught in grades 7 and 8 varied widely across states, as shown in table 2.9. Nationally, 40 percent of grades 7 and 8 students took a general science course in 2002, an increase of 14 percent since 1990. Nineteen percent of students took life science, which was a decline of 14 percent. Earth science enrollment declined to 11 percent; physical science increased slightly to 13 percent. Integrated or coordinated science had the highest enrollment percent of grades 7 and 8 in five states.

Table 2.8 Grade 8 Mathematics Course Enrollments, 2002; Change 1990 to 2002

State	Algebra Grade 8 2002	Algebra Grade 8 Change 1990 to 2002	Accelerated/ Pre-Algebra 2002	Regular Math 2002
Arkansas	21%	+18%	35%	43%
California	39%	+26%	20%	16%
Connecticut	25%	+9%	28%	37%
District of Columbia	31%	+2% *	94%	—
DoDEA	34%	+16% *	6%	60%
Florida	19%	+8%	5%	62%
Idaho	27%	+15%	38%	28%
Indiana	12%	+3% *	15%	68%
Louisiana	4%	-1%	25%	15%
Massachusetts	35%	—	13%	43%
Michigan	14%	—	12%	41%
Minnesota	17%	+11%	8%	64%
Mississippi	13%	+6%	6%	42%
Missouri	23%	+13%	—	36%
Nebraska	27%	—	—	—
Nevada	13%	+6%	16%	67%
New Mexico	15%	+7%	31%	49%
New York	—	—	—	71%
North Carolina	19%	+1% *	—	—
North Dakota	16%	-4% *	26%	53%
Ohio	22%	+13%	2%	61%
Oklahoma	9%	+2%	37%	36%
South Dakota	13%	—	0.1%	78%
Tennessee	14%	—	—	84%
Vermont	20%	—	9%	64%
West Virginia	25%	+17%	1%	76%
Wisconsin	22%	+10% *	—	78%
Wyoming	23%	-1% *	37%	23%
NATION	**22%**	**+11%**	**19%**	**45%**

State totals may not sum to 100% because self-contained classrooms are not included in course data.
— Data not available.
*Change 1992 to 2002. Vermont: Data includes imputation.
Source: State Departments of Education, Data on Public Schools, 2001–02.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.9 Students Taking General Science, Life Science, Earth Science, Physical Science, and Integrated Science as a Percent of Grades 7-8 Students, 2002; Change 1990 to 2002

State	GENERAL SCIENCE		LIFE SCIENCE		EARTH SCIENCE		PHYSICAL SCIENCE		INTEGRATED OR COORDINATED SCIENCE
	2002	Change 1990 to 2002	2002	Change 1990 to 2002	2002	Change 1990 to 2002	2002	Change 1990 to 2002	2002
Arkansas	28%	+12%	34%	-2%	38%	+3%	1%	-1%	—
California	50%	+3%	13%	-1%	1%	-4%	13%	+4%	—
Connecticut	24%	+5%	21%	-13%	7%	-2%	19%	-9%	22%
District of Columbia	6%	-79%	70%	—	0.1%	—	59%	—	—
DoDEA	17%	—	2%	—	1%	—	—	—	77%
Florida	72%	+49%	6%	-27%	2%	-9%	7%	-16%	0.2%
Idaho	8%	-4%	38%	0%	26%	+16%	17%	-5%	2%
Indiana	95%	—	0.1%	—	0.1%	—	0.1%	—	1%
Louisiana	17%	+4%	20%	-3%	16%	-2%	22%	—	8%
Massachusetts	30%	—	17%	—	10%	—	13%	—	32%
Michigan	35%	—	8%	—	5%	—	9%	—	18%
Minnesota	—	—	45%	+11%	29%	+5%	6%	-1%	4%
Mississippi	—	—	—	—	—	—	—	—	95%
Missouri	48%	+15%	24%	-8%	18%	-7%	4%	-1%	—
Nebraska	62%	+52%	12%	-1%	13%	+6%	8%	0%	—
Nevada	14%	+12%	11%	-12%	36%	+29%	41%	+26%	1%
New Mexico	6%	-42%	16%	-14%	32%	+9%	17%	+6%	17%
New York	10%	-5%	21%	-20%	11%	-4%	28%	-1%	12%
North Carolina	—	—	0.02%	—	1%	0%	0.3%	-1%	87%
North Dakota	—	—	48%	-3%	50%	+1%	—	—	—
Ohio	63%	+29%	3%	-4%	2%	-13%	2%	-3%	8%
Oklahoma	8%	-21%	—	—	12%	—	3%	-1%	65%
South Dakota	61%	—	11%	—	17%	—	2%	—	4%
Tennessee	97%	+3%	—	—	—	—	—	—	—
Vermont	31%	—	21%	—	9%	—	13%	—	28%
West Virginia	—	—	—	—	—	—	—	—	100%
Wisconsin	44%	+20%	19%	-24%	17%	+3%	8%	-5%	3%
Wyoming	18%	+2%	29%	-2%	20%	+4%	14%	-4%	10%
NATION	**40%**	**+14%**	**19%**	**-14%**	**11%**	**-4%**	**13%**	**+5%**	**27%**

State totals may not sum to 100 percent because self-contained classrooms are not included in course data.

— Data not available. Vermont: Data includes imputation.

Source: State Departments of Education, Data on Public Schools, 2001–02.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Course Enrollments by Race/Ethnicity and Gender

Policy Issues:

- **Are minority students increasing their participation in higher-level science and mathematics?**
- **Is the gender gap closing in higher-level science and mathematics?**

Reforms in science and mathematics education aim to increase opportunities among female and male students, and among minority and white students. States are trying to improve the knowledge and skills of all students in math and science and raise student confidence by helping them reach challenging levels of course work. The goal of efforts toward equity is to prepare students for further study or to apply knowledge in careers. Course achievement is a strong predictor of student learning in math and science and an important indicator of progress by minority students.

Higher-Level Mathematics and Science by Race/Ethnicity

- **Seventeen states reported enrollments by student race/ethnicity group for the 2001–02 school year.** States reported growth in higher-level math and science enrollments for all race/ethnicity groups; however, African American and Hispanic enrollments continued to lag behind enrollments for whites and Asians in most states.
- **National trends show high growth in math and science for all race/ethnicity groups.** From 1982 to 1998, enrollments in chemistry and algebra 2 doubled for Hispanic, African American, and American Indian high school students, although these rates were still 20 percentage points lower than those of white or Asian students.

Tables 2.10 and 2.11 focus on two courses, chemistry and algebra 2, as key indicators and display enrollments by race/ethnicity for 17 states. When CCSSO requested data by race/ethnicity from states in 1993–94, fewer than five states were able to report.

The chemistry enrollment data in table 2.10 show significant gains from 1996 to 2002 for African American students in Arkansas, Massachusetts, and Texas. The rates of enrollment in 2002 were within 10 percentage points of white students in the District of Columbia, Massachusetts, Michigan, Mississippi, and Vermont. Gains for Hispanic students were highest in Massachusetts and Texas, and rates were comparable to whites in the District of Columbia.

The data on algebra 2 in table 2.11 show that African American students made significant gains in Massachusetts, Connecticut, and Arkansas; and Hispanic enrollments gained significantly in the District of Columbia, Massachusetts, and Texas.

Another approach to analyzing race/ethnicity enrollments is to compare the state percentages with the overall composition of enrollments by race/ethnicity group in each state. Students taking chemistry and algebra 2 or integrated math 3 in 2002 can be compared with the percent of each group in the K-12 enrollment in Appendix B.2.

Table 2.10 Race/Ethnicity Differences of Students Taking Chemistry by Graduation, 1996 to 2002

State	White		African American		Hispanic		Asian		American Indian	
	2002	Change 1996 to 2002	2002	Change 1996 to 2002	2002	Change 1996 to 2002	2002	Change 1996 to 2002	2002	Change 1996 to 2002
Arkansas	69%	-1%	55%	+6%	30%	-35% *	71%	+6% *	51%	+2% *
Connecticut	83%	+13%	40%	0%	25%	-7%	69%	-26% *	69%	-26% *
District of Columbia	65%	-13%	76%	0%	64%	-14%	99%	0%	—	—
Florida	53%	—	36%	—	39%	—	74%	—	47%	—
Idaho	41%	-2%	19%	-22% *	17%	-1%	58%	+17% *	15%	-6% *
Massachusetts	75%	+3%	67%	+22%	47%	+10%	80%	-9%	48%	+14% *
Michigan	44%	—	38%	—	23%	—	63%	—	42%	—
Mississippi	54%	—	48%	—	28%	—	73%	—	26%	—
Nevada	59%	—	26%	—	20%	—	59%	—	26%	—
New Mexico	48%	—	28%	—	25%	—	60%	—	20%	—
North Carolina	64%	-4%	42%	-4%	21%	-41% *	87%	-12% *	37%	-25% *
Ohio	58%	-2%	32%	-14%	28%	-30% *	88%	-11% *	53%	-5% *
South Dakota	70%	—	51%	—	47%	—	66%	—	32%	—
Texas	83%	+18%	57%	+11%	55%	+16%	97%	-2% *	45%	-10% *
Vermont	54%	—	45%	—	22%	—	72%	—	22%	—
Wyoming	55%	—	36%	—	21%	—	57%	—	16%	—

Note: — Data not available. *Small enrollment—interpret change with caution.

Sources: State Departments of Education, Data on Public Schools, 2001–02 school year; NCES, CCD, Fall 2001.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.11 Race/Ethnicity Differences of Students Taking Algebra 2/Integrated Math 3 by Graduation, 1996 to 2002

	White		African American			Hispanic			Asian			Am. Indian		
State	2002	Change 1996 to 2002	2002	Change 1996 to 2002		2002	Change 1996 to 2002		2002	Change 1996 to 2002		2002	Change 1996 to 2002	
Arkansas	79%	+8%	64%	+8%		35%	-32%	*	82%	+15%	*	74%	+24%	*
Connecticut	81%	+10%	46%	+9%		36%	-5%		70%	-28%	*	93%	+28%	*
District of Columbia	89%	-10%	64%	-3%		80%	+23%		99%	0%		—	—	
Florida	66%	—	43%	—		52%	—		93%	—		39%	—	
Idaho	64%	+1%	30%	-70%	*	26%	-9%		91%	+30%	*	45%	+14%	*
Massachusetts	82%	+8%	73%	+19%		51%	+12%		88%	-5%		99%	+64%	*
Michigan	53%	—	58%	—		29%	—		53%	—		53%	—	
Mississippi	89%	—	67%	—		87%	—		99%	—		39%	—	
Nevada	65%	—	33%	—		21%	—		64%	—		29%	—	
New Mexico	76%	—	49%	—		49%	—		54%	—		47%	—	
North Carolina	84%	+8%	58%	+4%		28%	-42%	*	77%	-22%	*	49%	-21%	*
Ohio	50%	—	34%	—		25%	—		78%	—		47%	—	
South Dakota	83%	—	58%	—		54%	—		76%	—		22%	—	
Texas	93%	+11%	63%	-9%		62%	+9%		99%	+0%		51%	-21%	*
Vermont	59%	—	50%	—		60%	—		99%	—		48%	—	
West Virginia	84%	—	57%	—		99%	—		99%	—		84%	—	
Wyoming	74%	—	50%	—		39%	—		78%	—		22%	—	

Note: — Data not available. *Small enrollment—interpret change with caution.

Sources: State Departments of Education, Data on Public Schools, 2001–02 school year; NCES, CCD, Fall 2001.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

National Trends for Race/Ethnicity

Data from national high school transcript studies conducted by NCES are useful for analyzing long-term national trends in mathematics and science course-taking by student race/ethnicity and gender (Roey, et al., 2001). Transcripts for high school seniors were reviewed from a nationally representative sample of high schools. The national averages for course enrollments showed that minority students have made progress in participation in higher-level math and science courses since the 1980s. Algebra 2 and chemistry were selected for this report to trace minority student progress, as compared to that of white students.

The enrollment of African American students taking algebra 2 increased significantly from 1982 to 1998—from 26 to 52 percent of graduates. The gap in participation between whites and African Americans narrowed by 5 percentage points over the 16 year period (to 10 points). Hispanic, African American, and American Indian students made the largest increases in algebra 2 enrollments, with each group's enrollment doubling over the 16 years.

In science, chemistry enrollments increased significantly from 1982 to 1998 for all groups. African American and Hispanic enrollments in chemistry more than doubled over the 16 year period—from 23 to 53 percent for African Americans and from 17 to 44 percent for Hispanics; white enrollments increased by 28 percentage points; and Asian enrollments increased by 22 points.

As you study tables 2.10 and 2.11, consider the following questions about state and national data on course enrollment differences by race/ethnicity:

- What are the recent trends in course enrollments among minority groups in your state?
- How does your state compare with national trends?
- If you do not have these data by race/ethnicity, how could the data be obtained? Are these statistics important for your own work and for communicating where policy change is needed?

National Race/Ethnic Trends for Students Taking Algebra 2 and Chemistry, 1982 to 1998

STUDENTS TAKING ALGEBRA 2

Race/Ethnicity	1982	1998
White	41	62
African American	26	52
Hispanic	23	45
Asian	55	62
American Indian	20	41

STUDENTS TAKING CHEMISTRY

Race/Ethnicity	1982	1998
White	35	63
African American	23	53
Hispanic	17	44
Asian	52	74
American Indian	34	47

SOURCE: High School Transcripts Studies (national representative sample)

Course Enrollments by Gender

- From 1992 to 2002, female student enrollment in algebra 2 and chemistry (indicating three years of high school math and science) increased in all 22 states reporting by gender.
- In 12 of 15 states with trend data, female student enrollments in trigonometry and precalculus increased, and enrollments increased in physics in most states.

In analyzing course-taking trends by student gender, focus is placed on the higher-level, more advanced courses of high school math and science. The data in tables 2.12 and 2.13 show trends by state of the percentages of female students taking higher-level math and science. Contrary to some current views and the patterns of the mid-1980s, more high school girls took higher-level math and science courses as of 2002 than did boys in all of the reporting states.

Table 2.12 Gender Differences (Percent Female) of Students Taking Higher-Level Mathematics, 1990 to 2002

	Alegbra 2/Integrated Math 3		Trigonometry/Precalculus		Algebra 1/ Integrated Math 1	Geometry/ Integrated Math 2
State	2002	Change 1990 to 2002	2002	Change 1990 to 2002	2002	2002
Arkansas	53%	-1%	57%	+8%	49%	50%
California	53%	+2%	53%	+4%	49%	52%
Connecticut	51%	0%	52%	+4%	50%	51%
District of Columbia	56%	-3%	59%	-3%	51%	51%
DoDEA	50%	-1%	51%	+5%	50%	52%
Florida	54%	0%	55%	+2%	48%	52%
Idaho	53%	+6%	51%	+3%	49%	52%
Iowa	52%	0%	50%	+3%	50%	51%
Massachusetts	51%	—	53%	—	48%	50%
Michigan	52%	—	52%	—	49%	51%
Mississippi	56%	—	56%	—	50%	54%
Nevada	53%	+1%	52%	+8%	52%	52%
New Mexico	51%	—	55%	—	49%	51%
North Carolina	54%	-2%	54%	0%	48%	51%
North Dakota	50%	—	51%	—	46%	48%
Ohio	51%	0%	51%	+1%	49%	51%
South Dakota	52%	—	52%	—	48%	50%
Texas	52%	—	50%	—	47%	50%
Vermont	52%	+3%	48%	-2%	49%	51%
West Virginia	54%	-1%	52%	+2%	50%	53%
Wisconsin	53%	+2%	52%	+6%	48%	51%
Wyoming	51%	-1%	50%	+3%	49%	50%

— Data not available. Vermont: Data includes imputation.

DoDEA, Florida, North Carolina, Ohio, Vermont: Change from 1992 to 2002.

Source: State Departments of Education, Data on Public Schools, 2001–02.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.13 Gender Differences (Percent Female) of Students Taking Higher-Level Science, 1990 to 2002

	Chemistry		Physics	
State	2002	Change 1990 to 2002	2002	Change 1990 to 2002
Arkansas	54%	+2%	46%	+3%
California	54%	+3%	48%	+6%
Connecticut	52%	+3%	42%	+6%
District of Columbia	56%	-1%	56%	-7%
DoDEA	51%	0%	45%	+5%
Florida	54%	+1%	49%	-1%
Idaho	52%	+1%	39%	+8%
Iowa	54%	+3%	46%	+6%
Massachusetts	53%	—	45%	—
Michigan	52%	—	46%	—
Mississippi	57%	—	52%	—
Nevada	52%	+1%	48%	+8%
New Mexico	53%	—	42%	—
North Carolina	55%	-1%	44%	-1%
North Dakota	53%	—	41%	—
Ohio	53%	+1%	43%	+1%
South Dakota	53%	—	44%	—
Texas	53%	—	51%	—
Vermont	52%	+1%	44%	+1%
West Virginia	50%	-4%	27%	-15%
Wisconsin	55%	+3%	45%	+5%
Wyoming	51%	+3%	40%	+4%

— Data not available. Vermont: Data includes imputation.
DoDEA, Florida, North Carolina, Ohio, Vermont: Change from 1992 to 2002.
Source: State Departments of Education, Data on Public Schools, 2001–02.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Other Indicators of Curriculum and Instruction

Elementary Class Time Spent on Mathematics and Science

A basic indicator on curriculum and instruction is the amount of time that teachers spend teaching a subject. At the elementary level, there is wide variation by school, district, and state on how time is used in teaching various subjects. Sample surveys with teachers, such as the SASS conducted by NCES, can provide basic data on differences in time devoted to mathematics and science and to other subjects. (For data related to elementary class time in core academic subjects, see "Elementary Class Time" tables at http://www.ccsso.org/projects/State_Education_Indicators/.)

Instructional Practices in Mathematics and Science Classrooms

State-level statistics based on data from the teacher and student questionnaires which accompany the NAEP mathematics and science assessments can be used to analyze instructional practices by state and by characteristics of teachers, students, and classrooms in each state (Reese, et al., 1997; Shaughnessy, et al., 1998). NAEP survey data are available on classroom use of calculators and math manipulatives as well as on different instructional strategies, such as student work in small groups and average time homework is assigned. These variables and data can be analyzed by school size or teacher qualifications.

Aggregate statistics on practices at the state level can be useful in tracking a specific practice that has strong policy interest, such as use of calculators. In prior reports on state indicators, CCSSO reported on specific instructional practices in math and science that appeared to indicate the kinds of teaching recommended in state and national content standards (Blank & Langesen, 1997, 1999, 2001). Additional measures of instruction at grades 4 and 8 are available from the "NAEP Data Tool" at the NCES website, http://www.nces.ed.gov/nationsreportcard/naepdata/search.asp.

Indicators of Subject Content or Enacted Curriculum

Reliable, comparable data on content of specific science and math courses or grades are not available at the state level. Several states and districts have participated in efforts to study subject content through large data collection projects, including the TIMSS 1995 and 1999 studies (NCES, 1996, 1997, 1998; Beaton, et al., 1996, 1997, 1998; Martin, et al, 2001; Mullis, et al., 2001).

A methodology and set of survey tools for measuring, analyzing, and reporting subject content and instructional practices in mathematics and science, called the Survey of Enacted Curriculum (SEC), have been developed by CCSSO in partnership with states and with the Wisconsin Center for Education Research. Through grants from NSF, the SEC tools are now available to produce reliable analysis of the enacted curriculum through the survey data collected at the classroom level and compared across schools, districts, and states (Blank, 2002; Blank, Porter, & Smithson, 2001; Porter, 2002). The SEC data assist educators in conducting analyses of classroom-level instructional practices, subject content (by topics and by expectations for students), teacher preparation, professional development, and classroom resources. For examples of survey data formats, go to the CCSSO website, http://www.ccsso.org/projects/Surveys_of_Enacted_Curriculum/.

Table 2.14 Students Taking Algebra 1/Integrated Math 1 and Algebra 2/Integrated Math 3 as a Percent of Students in Each High School Grade, 2002

	ALGEBRA 1 OR INTEGRATED MATH 1				ALGEBRA 2 OR INTEGRATED MATH 3			
State	**Grade 9**	**Grade 10**	**Grade 11**	**Grade 12**	**Grade 9**	**Grade 10**	**Grade 11**	**Grade 12**
Arkansas	57%	13%	4%	2%	3%	19%	38%	14%
California	46%	23%	5%	2%	2%	11%	25%	4%
Connecticut	43%	16%	7%	2%	3%	19%	36%	13%
District of Columbia	89%	64%	28%	14%	2%	13%	39%	15%
DoDEA	46%	20%	9%	3%	2%	24%	35%	17%
Florida	40%	18%	6%	3%	2%	15%	27%	16%
Idaho	56%	22%	7%	2%	5%	16%	35%	3%
Indiana	65%	15%	1%	1%	3%	21%	39%	1%
Massachusetts	55%	14%	7%	2%	4%	21%	40%	14%
Michigan	36%	12%	6%	2%	10%	15%	21%	6%
Mississippi	30%	38%	10%	2%	2%	17%	37%	25%
New Mexico	39%	21%	10%	5%	5%	25%	19%	8%
North Carolina	82%	37%	13%	4%	2%	24%	33%	15%
North Dakota	61%	17%	5%	6%	1%	22%	41%	12%
Ohio	56%	28%	21%	8%	3%	12%	24%	9%
South Dakota	64%	16%	7%	2%	4%	23%	41%	8%
Texas	70%	14%	4%	2%	3%	22%	40%	12%
Vermont	52%	22%	8%	3%	3%	21%	26%	10%
West Virginia	44%	17%	5%	1%	3%	31%	35%	14%
Wisconsin	76%	25%	9%	3%	4%	20%	36%	12%
Wyoming	51%	25%	15%	5%	6%	23%	31%	10%

Vermont: Data includes imputation.

Source: State Departments of Education, Data on Public Schools, 2001–02; NCES, CCD Fall Membership 2001.

Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.

Table 2.15 Students Taking First-Year Biology as a Percent of Students in Each High School Grade, 2002

State	Grade 9	Grade 10	Grade 11	Grade 12
Arkansas	9%	83%	9%	3%
California	17%	42%	5%	1%
Connecticut	19%	66%	10%	7%
District of Columbia	75%	21%	8%	4%
DoDEA	29%	57%	7%	2%
Florida	30%	40%	5%	2%
Idaho	8%	80%	12%	3%
Indiana	66%	23%	3%	1%
Massachusetts	23%	59%	8%	3%
Michigan	28%	44%	7%	3%
Mississippi	57%	25%	5%	1%
New Mexico	21%	46%	9%	3%
North Carolina	21%	61%	10%	3%
North Dakota	2%	88%	7%	7%
Ohio	21%	52%	16%	11%
South Dakota	10%	76%	7%	3%
Texas	45%	39%	7%	2%
Vermont	17%	48%	4%	2%
West Virginia	0.004%	0.1%	0.1%	0.3%
Wisconsin	27%	71%	10%	3%
Wyoming	14%	67%	10%	3%

Vermont: Data includes imputation.
Source: State Departments of Education, Data on Public Schools, 2001–02; NCES, CCD Fall Membership 2001.
Council of Chief State School Officers, State Services and Technical Assistance, Washington, DC, 2003.