

Chapter Three

Indicators of Teacher Quality: State Trends in Supply of Science and Mathematics Teachers

Policy Issues:

- **What proportion of current public school teachers have knowledge and teaching skills in their fields as required to meet professional and state standards?**
- **Is the current supply of math and science teachers in each state sufficient to meet the increasing demands for well-prepared teachers?**
- **What are the trends in supply of math and science teachers by race/ethnicity, gender, and age?**

Importance of Teacher Quality Indicators in Science and Mathematics Education

National professional standards in mathematics and science, as well as many states' standards, call for change in teaching and classroom practices to emphasize active learning by students, deep understanding of concepts, and development of skills in problem solving and reasoning (NCTM, 1989, 1991; AAAS, 1993; NRC, 1995; Blank, et al., 1997). The standards for teaching in math and science de-emphasize teacher lectures and encourage use of multiple strategies for teaching and learning.

One implication of challenging state and local standards of learning is the need for teachers with in-depth knowledge and understanding of their assigned fields and skills in effective instructional methods for math and science at their assigned grade levels. Research confirms that investments in teacher preparation pay off. Recent studies consistently show a strong positive relationship between the amount of teacher course preparation in math and science and the level of student achievement in these subjects (Darling-Hammond, 2000; Ferguson, et al., 1993; Fetler, 1999; Monk, 1994; National Commission on Teaching and America's Future, 1996).

Current federal policy has moved in the direction of defining a "highly qualified teacher" and requiring states to ensure that all teachers in core subjects are highly qualified. NCLB requires states to report on (a) the professional qualifications of all teachers as defined by the state, (b) the percentage of classes taught by teachers who are highly qualified, and (c) the percentage of classes taught by teachers who are not highly qualified (see Section 1111(h) of NCLB). In the September 2003 Consolidated Performance Application, each state reported to the U.S. Department of Education on its definition of a highly qualified teacher and its plans for collecting and reporting on the status of its teachers (U.S. Department of Education, 2003). By the 2005–06 school year, states must guarantee that all teachers of core subjects (math, science, language arts, social studies, foreign language, special education, etc.) meet the definition of highly qualified.

To meet the standard of highly qualified under NCLB, all teachers must

- have completed a bachelor's degree;
- hold full state certification;
- pass rigorous subject content and pedagogy tests to demonstrate competence in assigned subjects.

However, middle and high school teachers may demonstrate competence in their assigned subjects by holding degrees (or equivalent course work) in the assigned subjects. *For current*

Teachers

teachers only, a state may propose another method of evaluating and reporting on competence of teachers in their assigned subjects (NCLB, Section 1111(h); CCSSO, 2002, pp. 44–45).

Issues of teacher preparation and teacher supply are critical to education quality in every state. The recent National Commission on Mathematics and Science Teaching for the 21st Century highlighted the needs in schools and outlined proposals for changes to improve the quality of teachers and teaching (USED, 2000). The commission's report set three main goals to guide action strategies: (a) establish an ongoing system to improve the quality of mathematics and science teaching in grades K-12; (b) increase significantly the number of math and science teachers and improve the quality of their preparation; and (c) improve the working environment and make the teaching profession more attractive for K-12 math and science teachers.

CCSSO's state science and mathematics indicators system provides state-level biennial measures and trends in the numbers of math and science teachers in relation to school and student needs (i.e., trends of supply and demand), and the indicators address by state trends in the quality of teacher preparation. [See note on state data for 2001-02⁹.]

State Totals: Teachers Assigned in Mathematics and Science, Grades 9–12 and Grades 7–8

The analyses in this chapter are based on state data on all math and science teachers, which are compiled by CCSSO every two years through the cooperation of the state departments of education and the managers of state education. Current state information systems are based on data collected from schools and districts, and they provide basic data on all current teachers by subject and grade. The state systems vary in capacity for reporting current data on state certification, degrees, and teacher demographics (CCSSO, Data Quality and Standards Project). See appendix A for a recent analysis by CCSSO of the quality of teacher preparation (based on SASS results).

One of the first questions about the quality of mathematics and science teachers in the nation's public schools is whether current supply is meeting demand. Results in chapter 2 show that secondary school course enrollments in science and math increased significantly over the past 12 years (1990 to 2002), with more than half of 2001–02 high school students taking challenging higher-level courses in math and science, and more than 90 percent of students taking a high school math and science course of any level. Understanding the current status of the supply of teachers and the recent data trends is essential for states to meet this demand.

Trends for High School Teachers with Main Assignments in Math or Science

Nationally, the numbers of high school teachers with main assignments (more than 50 percent of time) in mathematics or science increased rapidly during the 12-year period. The number of high school teachers with main assignments in math increased from 61,000 in 1990 to 72,000 in 2002; the number of high school teachers with main assignments in science increased from 51,000 to 61,000.

Table 3.1 and figures 3.1 and 3.2 show by state the change in the numbers of high school teachers with main or primary assignments in mathematics or science, with several states in particular demonstrating notable increases. Texas increased its math teacher force by 1,300

⁹ Alaska: partial data reported; Georgia: certification and assignment tables differ; Minnesota: data source grade range 7-9 not included; Ohio: Cleveland data not included.

teachers, New York by 2,800, and California by 3,800. Smaller states, such as Wisconsin, Minnesota, Colorado, Mississippi, and Nevada, added significant numbers of math teachers.

In science, the large states of California, Illinois, and Texas increased the numbers of science teachers over the 12-year period, whereas New York and North Carolina had declines in their numbers. Other states with significant increases in numbers of science teachers were Wisconsin, Connecticut, Nevada, Missouri, and Oklahoma.

Trends for All High School Math and Science Teachers

Nationally, the number of high school teachers with *main or secondary* assignments in mathematics increased to 148,000, a rise of 37,000 from 1990 to 2002; the number of teachers with main or secondary assignments in science increased to 111,000, an increase of 22,000. (Secondary assignment includes at least one period assigned to the subject.)

The trend data for all teachers show the effect of a rapid increase in demand by student enrollments, which resulted in an increase in the use of part-time teachers or teachers with more than one subject assignment, particularly in mathematics.

Table 3.2 shows by state the change in total numbers of teachers of high school math and science, including main and secondary assignment teachers. In high school science nationwide, the numbers of teachers increased in all four fields reported: from 1990 to 2002, the number of biology teachers increased by 7,900; chemistry teachers by 6,800; physics teachers by 2,900; and Earth science teachers by 4,000.

Several states demonstrated significant increases in the numbers of part-time assignment or multiple assignment teachers. For example, in Texas only 9,000 of its 26,000 high school math teachers had main assignments in math (about one third). Nationally, 48 percent of high school math teachers had main assignments in math, and 55 percent of all science teachers had main assignments in a science field.

Teachers

**Table 3.1 High School Teachers with Main Assignments in Mathematics or Science, 2002;
Change 1990 to 2002**

State	MAIN ASSIGNMENT TEACHERS			
	Number 9-12 Math		Number 9-12 Science	
	2002	Change 1990 to '02	2002	Change 1990 to '02
Alaska	214	—	186	—
California	10,364	+3,779	7,062	+2,751
Colorado	1,700	+533	1,590	—
Connecticut	1,468	+88	1,578	+323
Delaware	275	+35	272	+127
District of Columbia	272	—	206	—
Florida	4,573	—	2,383	—
Georgia	3,104	—	2,819	—
Idaho	387	-67	339	+79
Illinois	4,354	—	3,816	+806
Indiana	2,261	—	1,933	—
Louisiana	1,135	—	635	—
Maine	691	—	745	—
Massachusetts	2,963	—	2,701	—
Minnesota	1,825	+521	1,513	+472
Mississippi	1,222	+575	1,992	+1,548
Missouri	2,055	+336	1,836	+427
Nebraska	1,046	—	712	—
Nevada	853	+342	702	+390
New Mexico	598	+58	389	+26
New York	8,620	+2,887	7,595	-1,354
North Carolina	1,233	-1,436	2,055	-776
North Dakota	339	+28	202	+61
Ohio	3,866	+37	3,136	+23
Oklahoma	1,942	+452	1,373	+302
South Dakota	325	-127	172	-9
Tennessee	1,368	-111	1,002	-223
Texas	8,792	+1,318	7,255	+2,120
Utah	603	-166	484	-77
Vermont	305	—	311	—
West Virginia	1,081	—	1,501	—
Wisconsin	2,294	+628	2,179	+833
Wyoming	243	-96	224	-74
NATION	72,371	+11,476	60,898	+9,521

—Data not available. Main Assignment = 50% or more time assigned to subject.

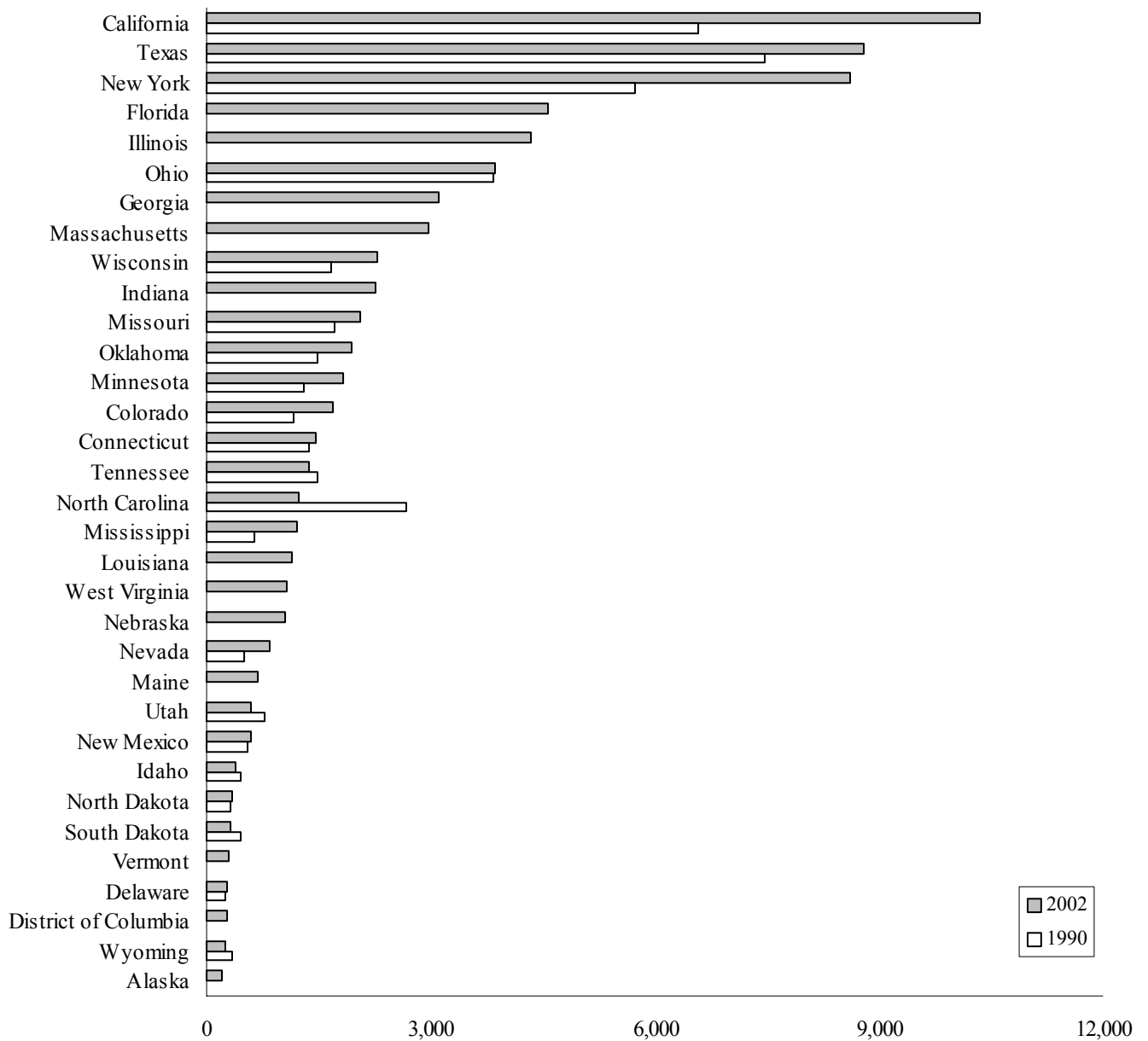
Science = sum biology, chemistry, physics, earth science, physical science, general science, integrated science (2002).

Vermont: 2002 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.

Figure 3.1 High School Teachers with Main Assignment in Mathematics, 1990 to 2002



Main Assignment = 50 percent or more time assigned to subject.

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.

Teachers

Table 3.2 High School Teachers (All) in Mathematics and Science, 2002; Change 1990 to 2002

State	MATH		BIOLOGY		CHEMISTRY		PHYSICS		EARTH SCIENCE	
	# 2002	Change 1990 to '02	# 2002	Change 1990 to '02	# 2002	Change 1990 to '02	# 2002	Change 1990 to '02	# 2002	Change 1990 to '02
Alaska	276	—	81	—	26	—	16	—	30	—
Arkansas	1,412	+762	580	+62	224	-59	96	-124	20	-71
California	11,924	+2,240	4,214	+481	1,997	+689	1,264	+396	767	+151
Colorado	1,768	+471	1,643	+482	—	—	—	—	—	—
Connecticut	1,519	+66	738	+118	405	+32	220	-23	187	-71
Delaware	277	+37	67	+12	41	+24	33	-8	15	+2
District of Columbia	272	—	89	—	44	—	24	—	49	—
Florida	7,752	—	2,742	-1,090	918	-178	451	-181	2,029	+21
Georgia	3,200	—	1,318	—	—	—	—	—	—	—
Idaho	843	+194	319	+49	139	+10	108	+4	161	+56
Illinois	4,540	+795	1,513	+201	863	+209	420	+127	205	+20
Indiana	2,534	+236	1,141	+138	632	+141	390	+22	425	+142
Iowa	1,412	-75	645	-55	438	+11	353	-37	170	-164
Kansas	1,541	+362	653	0	446	+76	325	+63	61	-21
Kentucky	1,890	+231	773	+84	475	+130	296	+76	317	+274
Louisiana	1,235	-2,330	520	-296	199	-243	87	-154	22	-86
Maine	752	-44	361	+4	232	+29	180	+7	149	-25
Massachusetts	3,303	-210	1,214	+450	756	+290	499	+230	274	-49
Minnesota	2,118	+307	939	+224	550	+75	345	-21	166	+44
Mississippi	1,233	+514	779	+381	315	+174	215	+169	339	+338
Missouri	2,388	+389	1,349	+363	665	+91	415	+54	196	+29
Nebraska	1,205	—	554	—	339	—	277	—	243	—
Nevada	871	+198	308	+95	124	+55	79	+38	114	+26
New Hampshire	602	+2	335	+107	90	+31	47	+15	40	+6
New Mexico	844	+201	384	+83	157	+36	81	+3	81	+26
New York	10,832	+2,979	4,356	-824	2,228	+364	1,309	+151	2,840	-91
North Carolina	4,004	+1,038	1,419	+238	651	+98	347	+16	919	+748
North Dakota	444	-27	267	+5	181	+7	114	-11	19	+10
Ohio	4,180	-74	1,659	-36	949	-36	686	-65	424	+30
Oklahoma	2,098	+424	1,128	+227	515	+34	230	-10	118	+32
South Dakota	461	-246	271	+41	175	+24	124	-1	45	+19
Tennessee	1,797	-75	688	-21	412	+55	233	-5	107	+68
Texas	26,339	+16,505	6,291	+2,340	3,312	+1,750	1,938	+1,029	659	+293
Utah	702	-412	334	-171	187	+82	129	+60	104	-5
Vermont	342	+64 *	148	+21 *	108	+28 *	70	-3 *	70	-7
West Virginia	1,081	+175	237	-149	161	-21	115	-7	171	+104
Wisconsin	2,410	+450	1,087	+249	618	+96	388	+14	145	+32
Wyoming	269	-195	117	-63	65	-60	41	-57	34	-60
NATION	148,290	+37,106	54,178	+7,901	28,011	+6,815	17,006	+2,936	17,429	+4,004

— Data not available. All Teachers = one or more period assigned to subject.

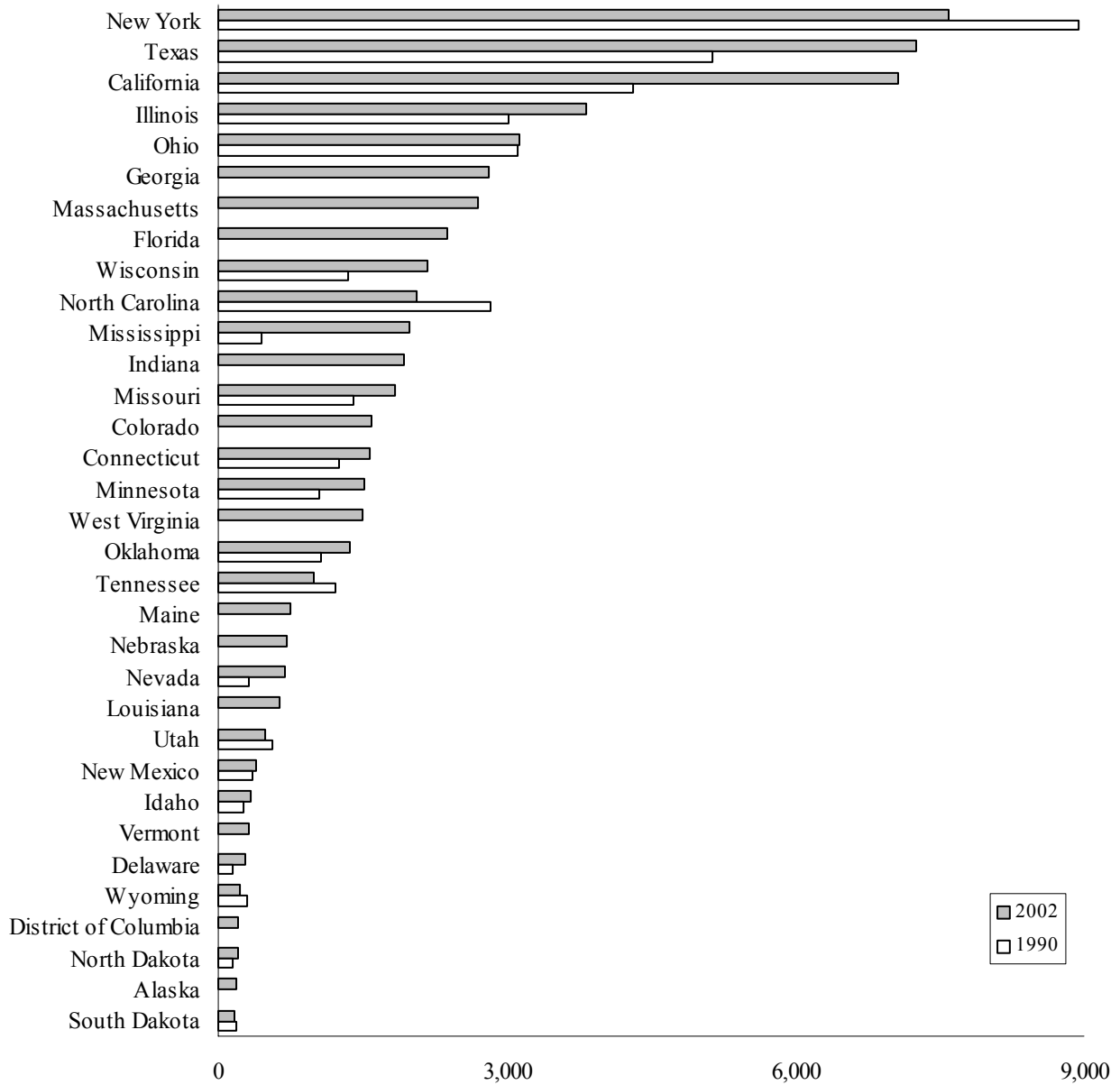
* = change 1992 to 2000.

Arkansas: 1990 math = main assignment only; Colorado: 1990, 2002 biology = all science; Delaware: 1990 = main assignment only; 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.

**Figure 3.2 High School Teachers with Main Assignment in Science, Grades 9-12
1990 to 2002**



Main Assignment = 50 percent or more time assigned to subject.

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.

Teachers

Trends for Middle School Teachers of Math and Science

From 1994 to 2002, the numbers of math and science teachers in grades 7–8 increased significantly nationwide. The number of teachers with main or secondary assignments in math increased from 81,000 in 1994 to more than 91,000 in 2002, and the number of science teachers increased from 65,000 to 79,000.

Table 3.3 displays trends by state for math and science teachers in grades 7–8. Several states realized major increases in the numbers of middle school math teachers including Florida, New York, North Carolina, Ohio, and Utah. States with significant increases in the numbers of science teachers were Ohio, North Carolina, Utah, and West Virginia, whereas Florida experienced a significant decrease. Details on math and science teachers by assignment are available at http://www.ccsso.org/projects/Science_and_Mathematics_Education_Indicators/.

As you study the state data on teacher indicators, consider the following questions:

- What are the trends for your state in numbers of math and science teachers versus teachers with main assignments in the field? How do trends compare with other states in your region?
- Do you know what accounts for trends in current numbers of teachers in your state?
- What is the extent of unmet need for teachers? Do you have any other data indicating the demand for teachers versus current teacher numbers (i.e., data on positions not filled or courses not offered due to teacher shortages)?
- Are there problems in data collection for your state that prevent having reliable, consistent data on math and science teachers?

Table 3.3 Middle Grades Teachers (All) in Mathematics and Science, 2002; Change 1994 to 2002

State	Number 7-8 Math		Number 7-8 Science	
	2002	Change 1994 to '02	2002	Change 1994 to '02
Arkansas	790	—	684	—
Colorado	1,228	+157	1,063	+62
Connecticut	966	+38	923	+100
Delaware	142	+6	61	-64
District of Columbia	198	-74	146	+16
Florida	5,960	—	4,560	—
Georgia	1,769	—	1,386	—
Idaho	483	+87	401	+55
Illinois	1,528	-1,220	1,419	-1,168
Indiana	1,518	-17	1,374	-56
Kansas	1,052	—	1,008	—
Kentucky	1,415	+256	1,148	+141
Louisiana	443	-79	657	+164
Maine	471	+8 *	376	+98 *
Massachusetts	2,502	+932	2,063	+585
Minnesota	1,251	+455	998	+266
Mississippi	906	-45	816	-20
Missouri	1,490	+156	1,401	+113
Nebraska	150	-62	140	-54
Nevada	487	+177	382	+150
New Hampshire	296	+193	200	—
New Mexico	787	+350	729	+306
New York	7,628	+664	6,091	+610
North Carolina	3,719	+940	2,882	+390
North Dakota	456	-14	357	-24
Ohio	3,224	+437	5,095	+2720
Oklahoma	1,289	+104	1,223	+123
South Dakota	502	+164	412	+93
Utah	659	+366	533	+282
Vermont	309	+43	277	+42
West Virginia	845	+44	644	+108
Wisconsin	1,322	+272	1,195	+196
Wyoming	146	-85	141	-58
NATION	91,262	+10,296	79,338	+14,315

— Data not available. Delaware: 1994 main assignment only; Vermont: grades 5-8; data includes imputation. All Teachers = one or more period assigned to subject.

* = change 1996 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.

State-Certified Teachers in Science and Mathematics

State certification in the assigned teaching field indicates that a teacher has met the core state requirements for preparation in the subject. CCSSO requested that states refer to teacher personnel files and current assignment data for all teachers in order to determine which current teachers had full certification in each of the subjects of science and math to which they were assigned.

The proportion of teachers who are certified in the subjects they are teaching is an important policy indicator for state and local educators, because state certification is often used as a basic but essential measure of teacher qualification, as well as an indicator of teacher supply (e.g., shortage). It is not, however, a wholly adequate measure of the quality of teacher preparation, particularly in cross-state comparisons, because of differing state standards for certification. Now, NCLB requires states to report on the proportion of teachers who meet a separate criterion of subject knowledge in the assigned field/subject (by passing a teacher assessment in the field or by holding a degree in the field). State certification requirements are tracked by CCSSO every two years for secondary, middle grades, and elementary teachers and are reported in *Key State Education Policies on K-12 Education* (<http://www.ccsso.org/content/pdfs/KeyState2002.pdf>).

In the following analysis, “certification” means the teacher holds a state’s regular, standard, advanced, or probationary certificate in the assigned field/subject. In science, the teacher holds a “specific-field certification” (e.g., biology) or a “broad-field certification” (multiple fields of science). “Not certified” means the teacher holds an emergency or temporary certificate or holds a certification in a field other than the assigned field.

High School Teachers Certified in Field, 2001–02

- **Mathematics:** The state statistics for the 2001–02 school year show widely divergent patterns of teacher certification in math across the states. For example, in mathematics, 11 of 30 reporting states had more than 95 percent of high school math teachers certified in their assigned fields, whereas six states had less than 75 percent certified.
- **Science:** Certification rates in science were likewise divergent across the states, with 20 of the reporting states showing more than 90 percent of biology and chemistry teachers certified in the subjects, and with five states showing less than 80 percent certified. Thirteen states had less than 80 percent of teachers in physics and Earth science certified in the subjects.

Table 3.4 displays the percentages of subject-certified high school teachers and reveals several problems with the supply of teachers. One problem is that **shortages of teachers vary by region**. For example, states in the Midwest reported higher rates of certified teachers than did other regions, and states with high enrollment growth such as California and Texas had relatively lower rates of certified teachers. High student enrollment growth signifies rapid increases in the numbers of students taking high school math and science courses, resulting in increased demand for growth in the teacher force. As a result, the numbers of certified teachers in some states are insufficient to meet the demand.

Table 3.4 Certification of High School Mathematics and Science Teachers, 2002; Change 1994 to 2002

State	MATH		BIOLOGY		CHEMISTRY		PHYSICS		EARTH SCIENCE	
	Cert. 2002	Change 1994 to 2002	Cert. 2002	Change 1994 to 2002	Cert. 2002	Change 1994 to 2002	Cert. 2002	Change 1994 to 2002	Cert. 2002	Change 1994 to 2002
Alaska	63%	—	79%	—	42%	—	63%	—	50%	—
California	85%	+3%	87%	+1%	84%	-1%	86%	0%	63%	-23%
Connecticut	96%	-2%	97%	-1%	93%	-2%	93%	+4%	90%	+10%
Delaware	70%	-20%	72%	-21%	78%	-17%	42%	-47%	60%	-40%
Georgia	90%	—	91%	—	—	—	—	—	—	—
Idaho	93%	-2%	100%	+1%	100%	+22%	81%	+4%	96%	+1%
Illinois	65%	-30%	64%	-31%	60%	-35%	64%	-32%	42%	-52%
Indiana	94%	-2%	97%	+1%	98%	+1%	96%	+12%	93%	+19%
Kansas	98%	—	96%	—	96%	—	92%	—	82%	—
Louisiana	80%	-12%	84%	-2%	75%	-10%	63%	-6%	50%	-10%
Maine	93%	—	93%	—	91%	—	91%	—	91%	—
Massachusetts	82%	-9%	89%	-4%	90%	-6%	89%	-8%	92%	+5%
Minnesota	98%	+1%	97%	+1%	94%	+8%	94%	+6%	81%	+5%
Mississippi	94%	+3%	95%	+16%	91%	+23%	67%	+15%	89%	+34%
Missouri	93%	-6%	92%	-4%	91%	-5%	84%	+3%	86%	+19%
Nebraska	91%	+3%	90%	-1%	76%	0%	67%	-3%	67%	+1%
Nevada	98%	+2%	97%	-2%	92%	-8%	96%	+2%	82%	-2%
New Mexico	97%	+4%	98%	+6%	97%	+9%	99%	+9%	95%	+14%
New York	88%	-5%	83%	-9%	80%	-12%	76%	-12%	72%	-7%
North Carolina	74%	-14%	78%	-13%	82%	-14%	77%	-13%	70%	-16%
North Dakota	100%	0%	100%	0%	100%	0%	100%	0%	100%	0%
Ohio	99%	+5%	93%	+4%	98%	+4%	99%	+6%	88%	+10%
Oklahoma	100%	+5%	99%	+2%	99%	+2%	97%	+17%	96%	+11%
South Dakota	98%	+2%	98%	+2%	98%	+5%	97%	+7%	93%	-4%
Tennessee	89%	-1%	93%	-2%	84%	-12%	69%	-20%	80%	+46%
Texas	65%	-9%	68%	-7%	74%	-12%	53%	-26%	0.3%	-64%
Utah	89%	0%	90%	0%	90%	+7%	88%	+4%	58%	-11%
Vermont	91%	—	95%	—	94%	—	94%	—	99%	—
Wisconsin	100%	0%	100%	0%	100%	0%	100%	0%	100%	0%
Wyoming	99%	+7%	100%	+4%	100%	+6%	100%	+7%	100%	+3%
NATION	80%	-8%	83%	-7%	82%	-10%	75%	-11%	72%	-9%

— Data not available. Certified = Teacher assigned to subject one or more period and has state certification in subject.

Science Certified = Specific-field or broad-field certification.

Delaware: Certification tables differ from teacher assignments. Oklahoma: Gen. Sec. = Alternative schools.

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.

Teachers

In addition, the data in table 3.4 highlight the problem that some **states have limited information systems capacity**. For example, 20 of 50 states did not report on current teacher certification in math and science; yet all 50 states maintain personnel files containing records of the preparation and certification of K-12 teachers, and all states count the numbers of teachers in K-12 education. The analysis shows that only 30 of 50 states have data systems and resources that allow them to identify and report the proportion of teachers who meet state policies for certification in a given grade and subject. States do have differences in teacher licensure policies concerning the requirements for subject-certification and the hiring and use of emergency or temporary certified teachers. State policies are detailed in an annual 50-state analysis (NASDTEC, 2002), and summary information is reported by CCSSO (<http://www.ccsso.org/content/pdfs/KeyState2002.pdf>).

Trends Show Increasing Demand for Certified Teachers

In 2001–02, 80 percent of all high school math teachers (main and secondary assignments in math) were certified, compared to 88 percent in 1994—representing a significant decline. In particular, the states of Alaska, Delaware, Illinois, Missouri, North Carolina, and Texas experienced substantial shortages of certified math teachers.

A major factor contributing to the decrease in rates of certified teachers is the problem of increased demand and insufficient supply. In the past 12 years, the number of high school math teachers rose to more than 37,000 (a gain of 33 percent), and the number of high school science teachers rose to 22,000 (a gain of 20 percent). Enrollment data reported in chapter 2 indicate that increased student course-taking in high school science and math has increased the demand for teachers. Although many states increased their numbers of certified teachers, the overall demand for teachers nationwide has, since 1990, pushed down the national ratio of highly qualified teachers (based on state certification).

In science, 14 of the reporting states shown in table 3.4 had more than 95 percent of teachers certified in biology and chemistry in 2002. The certification rate includes combined numbers of teachers with specific-field and broad-field certification in science. According to the data, Delaware, Illinois, Missouri, North Carolina, and Texas had the greatest shortages of certified high school science teachers.

In 2002, 83 percent of biology teachers and 82 percent of chemistry teachers were certified, compared to 90 percent in biology and 92 percent in chemistry in 1994. The certification rate in physics declined to 75 percent from 86 percent in 1994, and Earth science certification likewise declined eight points to 72 percent. Rates of certified teachers in high school science have experienced overall a slightly greater decline than those in math by about 10 percentage points from 1990 to 2002.

Percentage of High School Teachers Certified in Assigned Fields, 1990 to 2002

	Math	Biology	Chemistry	Physics	Earth Science
1990	90%	92%	92%	88%	n/a
1994	88	90	92	86	81
1998	88	86	89	86	68
2000	86	88	88	85	82
2002	80	83	82	75	72

Source: State Departments of Education, 1990–2002.

Two-thirds of the states reported having a certification for broad-field secondary science that covered teaching in biology, chemistry, physics, and other science subjects. Most states also had

policies for specific-field certification in biology, chemistry, physics, etc. (see <http://www.ccsso.org/content/pdfs/KeyState2002.pdf>).

The analysis of state data by type of science certification revealed that nearly one-third of all high school science teachers were certified through broad-field certification. Many schools were required to hire teachers to teach two or three science subjects, and they tended to hire teachers who had received state certification through a broad-field, or non-specialist, method of science certification.

Middle-Grades Teachers Certified in Field

- **Mathematics:** In 2002, 60 percent of middle grades math teachers nationwide were certified in math. Although this percentage of certification improved slightly since 1994, a national shortage of certified math teachers remained as of 2002. Nationally, 23 percent of middle grades math teachers held elementary certification, and 17 percent were not certified.
- **Science:** Among grades 7–8 science teachers, 58 percent were certified in science as of 2002, representing a slight decline over the previous eight years. Twenty-one percent of all science teachers held elementary certification, and 21 percent were not certified.

Many states find that trends on the certification of middle grades science and math teachers, as shown in table 3.5, represent a key indicator for gauging teacher preparation and supply. Middle school is often the point where students develop strong interests and aspirations in science and math, or where interests fall off, and well-prepared teachers are likely to be the key to building interest in these subjects. In addition, middle school is often the point where states, districts, and schools find it difficult to fill positions with well-qualified science and math teachers, thus making the statistical trend analysis a critical resource. It is important to differentiate between teachers with elementary certification and teachers certified in the specific subjects at the middle grades level of teaching. NCLB now requires that middle grades teachers be “highly qualified” in their assigned subjects of teaching.

States have widely differing levels of certified teachers in middle grades math and science. Table 3.5 shows that, of the 26 states reporting certification data for grades 7–8 teachers, 8 states had 90 percent or more of their middle grades teachers certified in math, whereas 12 states had less than 60 percent certified in math. The national average, based on reported state data, is 60 percent certified in math, a slight increase since 1994, and 58 percent certified in science, a decline since 1994.

Six of the 28 states reporting data on middle grades science teachers had a certification rate of 90 percent or more in science, whereas 13 states had a certification rate of less than 60 percent. States with high numbers of elementary certified teachers were Georgia, Idaho, Nevada, New Mexico, Ohio, North Dakota, and Oklahoma.

Percentage of Grades 7–8 Teachers Certified in Assigned Fields, 1994 to 2002

	Math	Science
1994	54%	63%
1998	72	73
2000	66	68
2002	60	58

Source: State Departments of Education, 1990–2002.

As you study middle grades indicators on teacher certification, consider the following questions:

- Do the data accurately reflect what you know about the rate of science and math teacher certification in your state?
- If your state is not reported, would these be important data for your state, either as a trend or as a one-time status figure?
- What are some reasons that state data on teacher certification may not be available or may not be reported?
- How do the rates of teacher certification differ across school districts—central city vs. suburb vs. rural? Large schools vs. small schools?
- Is the rate of certification a valid indicator of the quality of teacher preparation for your state?

**Table 3.5 Certification of Middle Grades Mathematics and Science Teachers, 2002;
Change 1994 to 2002**

State	MATHEMATICS				SCIENCE			
	Certified Math	Change Certified Math 1994 to 2002	Certified Elementary	Not Certified	Certified Science	Change Certified Science 1994 to 2002	Certified Elementary	Not Certified
Connecticut	55%	+7%	41%	5%	55%	-4%	37%	8%
Delaware	41%	-33%	27%	27%	51%	-28%	25%	25%
Georgia	14%	—	76%	—	16%	—	68%	—
Idaho	44%	-8%	55%	1%	60%	-14%	34%	6%
Illinois	50%	+50%	27%	23%	47%	+47%	23%	29%
Indiana	88%	+1%	8%	4%	92%	0%	4%	4%
Kansas	60%	—	39%	1%	62%	—	31%	1%
Louisiana	80%	-6%	0%	20%	70%	-9%	0%	30%
Maine	96%	—	0%	4%	96%	—	0%	4%
Massachusetts	47%	-20%	34%	19%	59%	-11%	28%	13%
Minnesota	98%	+2%	0%	2%	93%	+13%	0%	7%
Mississippi	95%	+58%	0%	5%	92%	+40%	0%	8%
Missouri	89%	+1%	0%	11%	89%	+8%	0%	11%
Nebraska	91%	-1%	—	—	70%	-6%	—	—
Nevada	97%	+41%	1%	2%	55%	+7%	41%	4%
New Mexico	20%	-19%	62%	22%	31%	-31%	49%	22%
New York	83%	-9%	0%	17%	80%	-7%	0%	20%
North Carolina	59%	-9%	1%	41%	51%	-17%	1%	48%
North Dakota	49%	-9%	51%	0%	34%	-36%	74%	0%
Ohio	36%	-15%	53%	10%	20%	-18%	58%	22%
Oklahoma	54%	0%	45%	0.2%	59%	-8%	41%	0%
South Dakota	92%	-5%	6%	2%	84%	-8%	11%	5%
Utah	85%	+2%	15%	0.2%	80%	+8%	19%	1%
Vermont	69%	—	24%	7%	71%	—	17%	6%
Wisconsin	99%	—	0%	—	100%	—	0%	—
Wyoming	90%	+16%	10%	0%	96%	+21%	4%	0%
NATION	60%	+6%	23%	17%	58%	-5%	21%	21%

— Data not available. Certified Math/Science = Teacher assigned to subject one or more period and has state certification in secondary math/science or middle grades math/science. Certified Elementary = Certification in elementary education, general secondary/middle education, or subject not assigned.

Oklahoma: Gen. Sec. = Alternative schools; some grades 7–8 teachers not included. Vermont: Grades 5–8; data includes imputation.

National totals include imputation for nonreporting states.

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

Council of Chief State School Officers, State Services and Technical Assistance, Washington, D

Demographics of Mathematics and Science Teachers by State

The state-by-state trends and distributions of science and math teachers across categories of race/ethnicity, gender, and age provide useful indicators for states, professional organizations, and national policymakers in analyzing the current supply and demand of teachers. These data are analyzed and reported from state education information systems.

Race/Ethnicity of Science and Mathematics Teachers

- **Minority teachers low in relation to students.** Nationally, the minority enrollment among K-12 students increased 8 percentage points from 1990 to 2002, whereas the number of minority teachers in math and science increased only 4 percentage points during the same period.
- The highest percentages of minority teachers in math and science were reported in California, Texas, New Mexico, and Mississippi, but even in these states the total of minority teachers compared to only one-third of the student total.

National survey data (Weiss, et al., 2001; NCES/SASS, 1996a) show that minority teachers in math and science are vastly under-represented, considering the national student population. Oakes' (1990) analysis of teacher characteristics and student opportunity and participation in science and math demonstrated that the rate of participation of minority and female students in science and math was related to the characteristics of their teachers.

Table 3.6 ranks the states by percent of increase in minority students from 1990 to 2002 and compares the percentages of minority teachers in math, biology, and chemistry. The highest percentages of minority teachers ranged from 20 to 26 percent in mathematics, whereas minority students made up more than 50 percent of the student populations in California, Texas, New Mexico, and Mississippi. There were no major percentage differences among the subjects/fields of minority teachers, although chemistry reflected a slightly lower proportion of minority teachers in most states. A complete state-by-state disaggregation of teacher race/ethnicity by group (African American, Hispanic, Asian, American Indian, white) for each teaching field is available online at http://www.ccsso.org/projects/Science_and_Mathematics_Education_Indicators.

The national trends in four high school fields, shown below, reveal only small increases since 1990 in the percentages of teachers in these fields who are from minority groups.

Minority Teachers in High School Math and Science: 1990 to 2002

Field	1990	1994	1998	2002
Math	11%	14%	12%	15%
Biology	10	13	12	12
Chemistry	7	9	8	11
Physics	5	6	6	7

Source: State Education Information Systems and CCSSO.

Table 3.6 Minority Teachers in Mathematics and Science by Minority Students in State, 1990 to 2002

State	MINORITY STUDENTS		MINORITY TEACHERS MATH		MINORITY TEACHERS BIOLOGY		MINORITY TEACHERS CHEMISTRY	
	2002	Change 1990 to 2002	2002	Change 1990 to 2002	2002	Change 1990 to 2002	2002	Change 1990 to 2002
	Nevada	46%	+22%	8%	-1%	6%	-1%	4%
California	65%	+12%	26%	+8%	22%	+6%	21%	+9%
Oklahoma	36%	+11%	6%	+1%	6%	+1%	5%	+1%
Florida	48%	+11%	22%	—	20%	—	19%	—
Delaware	40%	+9%	8%	0%	9%	+5%	7%	+7%
Colorado	33%	+9%	7%	+2%	8%	+2%	—	—
Texas	59%	+9%	23%	+5%	22%	+5%	21%	+10%
Minnesota	18%	+9%	2%	—	2%	—	2%	—
Nebraska	18%	+8%	1%	—	1%	—	2%	—
Utah	15%	+8%	3%	+1%	2%	0%	1%	0%
New Mexico	66%	+8%	25%	+5%	20%	+1%	17%	-2%
Alaska	40%	+8%	8%	—	6%	—	4%	—
NATION	40%	+8%	15%	+4%	12%	+2%	11%	+4%
Idaho	15%	+8%	1%	-1%	2%	+1%	1%	+1%
Georgia	46%	+7%	20%	—	19%	—	—	—
Kansas	22%	+7%	2%	-1%	2%	0%	2%	-4%
Illinois	41%	+7%	11%	0%	12%	0%	10%	+3%
North Carolina	40%	+7%	16%	+2%	16%	0%	10%	-1%
Connecticut	31%	+7%	6%	+3%	6%	+3%	7%	+5%
Massachusetts	24%	+6%	10%	—	9%	—	9%	—
Wisconsin	20%	+6%	3%	+1%	2%	0%	2%	+1%
South Dakota	14%	+5%	0%	—	0.4%	—	1%	—
Iowa	10%	+4%	1%	+0.6%	2%	+2%	1%	0%
Missouri	21%	+4%	6%	—	4%	—	5%	—
Ohio	20%	+4%	5%	+2%	5%	0%	3%	+1%
Arkansas	29%	+4%	10%	0%	10%	0%	3%	-3%
Wyoming	13%	+4%	1%	—	0%	—	5%	—
North Dakota	11%	+3%	0%	-0.2%	2%	+1%	2%	+1%
Indiana	17%	+3%	3%	0%	3%	0%	3%	+1%
Kentucky	12%	+2%	2%	0%	3%	0%	1%	0%
Vermont	4%	+2%	0.3%	—	0%	—	0%	—
Mississippi	53%	+2%	23%	-3%	24%	-6%	25%	-2%
Maine	4%	+2%	1%	1%	0.3%	+0.3%	1%	+1%
West Virginia	6%	+1%	2%	—	3%	—	1%	—

— Data not available.

Colorado: Biology = All science. Vermont: Data includes imputation.

Grades 9–12 teachers assigned to subject one or more period.

Minority Teachers = Asian/Pacific Islander, African American, Hispanic, and American Indian teachers.

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.

Teachers

Gender of Science and Mathematics Teachers

Female teachers gain in all high school fields. The numbers and percentages of female high school math and science teachers increased significantly from 1990 to 2002. As of 2002, more than half of grades 9–12 math teachers were women, half of all biology teachers were women, and nearly half of all chemistry teachers were women. In physics, one-third of all teachers were women.

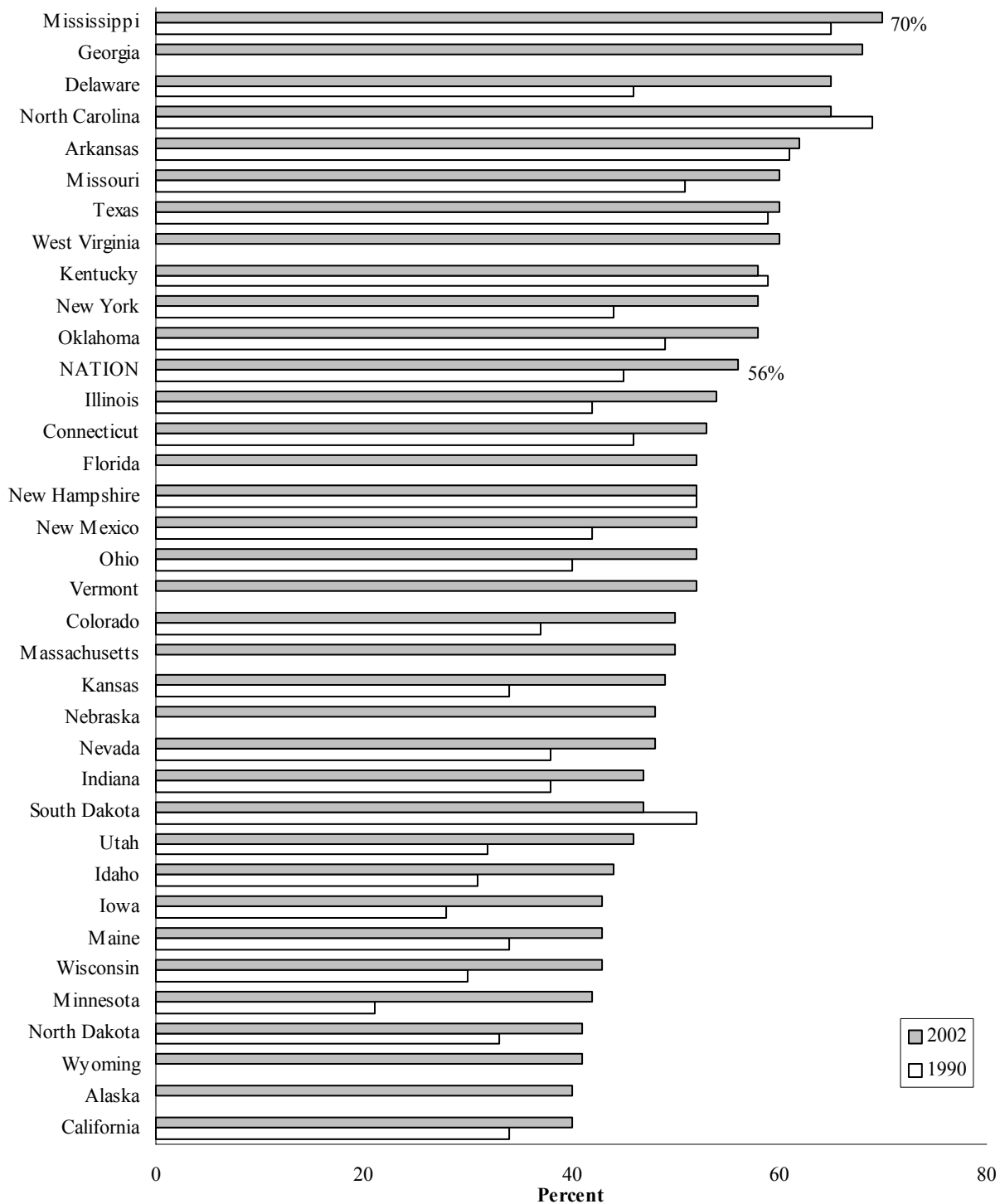
Trends for Female Teachers in High School Math and Science, 1990 to 2002

Field	1990	1994	1998	2002
Mathematics	45%	50%	56%	56 %
Biology	37	45	50	52
Chemistry	34	40	44	47
Physics	22	25	29	28

Source: State Education Information Systems and CCSSO.

The bar graph in figure 3.3 shows that the numbers of female math teachers have increased in nearly every state since 1990, and half the states now have more female than male high school math teachers. The gender distribution for high school math and science shows that geographic region is associated with the proportion of teachers who are women. In figure 3.4, the map showing percentages of female chemistry teachers by state indicates a regional pattern. Four states reporting more than 55 percent female chemistry teachers are in the Southeast, and the lower percentages of female chemistry teachers appear in Midwest states.

Figure 3.3 Gender of Mathematics Teachers (Percent Female), 1990 to 2002



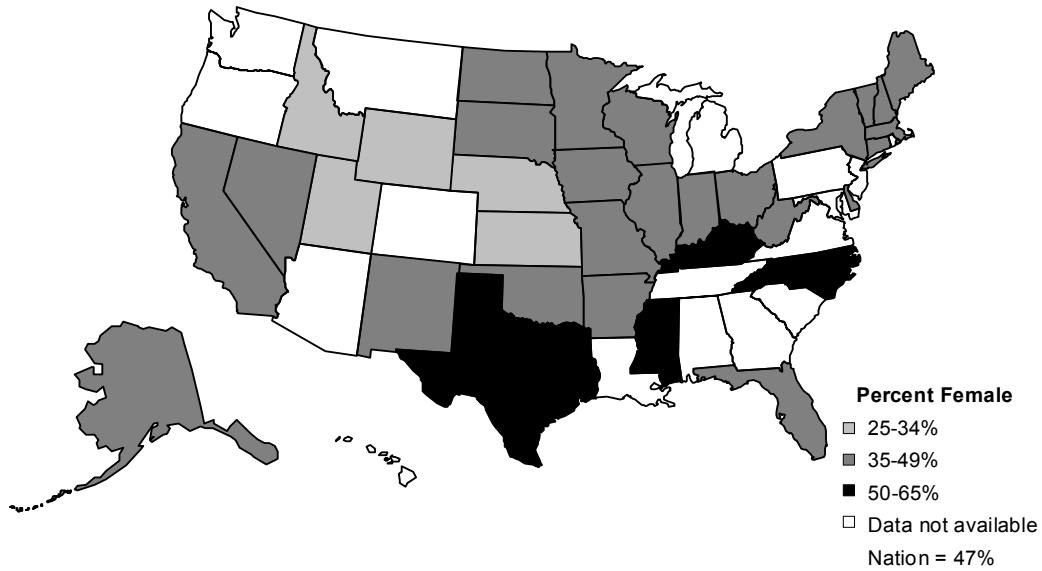
Note: Grades 9–12 teachers assigned one or more period to subject.

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.

Teachers

Figure 3.4 Gender of Chemistry Teachers, Percent Female by State, 2002



DoDEA, Guam, Puerto Rico, Virgin Islands, Washington, DC = n/a; Vermont: data includes imputation. Grades 9-12 teachers assigned one or more period to chemistry.

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.

Age Distribution of Science and Mathematics Teachers

Nearly one-third of math and science teachers over age 50 in 2002. From 1990 to 2002, the percent of high school math teachers over the age of 50 increased nine percentage points, with a similar aging trend evident in three science fields.

CCSSO has collected and reported data on the age distribution of science and mathematics teachers since the 1989–90 school year. Age distributions of teachers now can be compared for the nation and by state to reflect trends over the 12-year period.

Teachers over Age 50 in High School Math and Science

Field	1990	1994	1998	2002
Math	19%	23%	24%	28%
Biology	20	24	25	28
Chemistry	22	26	28	31
Physics	23	27	28	33

The map in figure 3.5 shows by state the percent of high school math teachers over the age of 50. The analysis shows that states in the Northeast and Midwest have an older teacher population than do other regions. Eight states had 36 percent or more of teachers over the age of 50: New York, Nebraska,

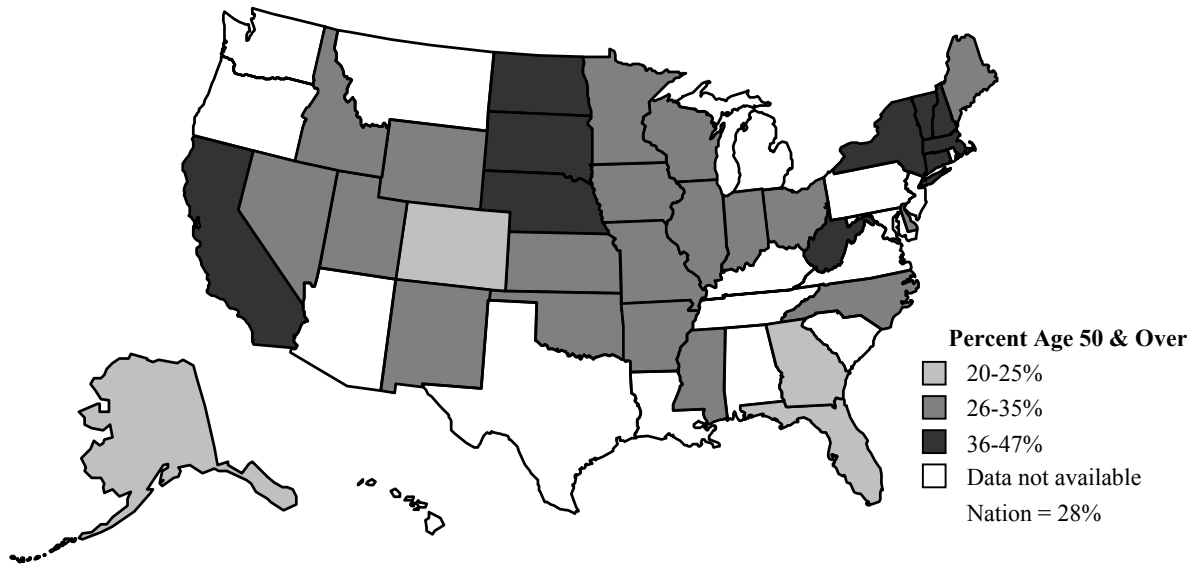
Connecticut, Massachusetts, California, South Dakota, North Dakota, New Hampshire, and West Virginia. At the other end of the spectrum, North Carolina had the highest percent of younger teachers, at 31 percent under the age of 30. The 12-year trends shown in table 3.7 indicate that the percent of teachers over the age of 50 had risen in 15 states by more than 10 points since 1990, with the highest rates of increase evident in Maine, Connecticut, and North Dakota.

Nationally, one-third of all physics teachers were aged 50 or older. In table 3.8, the data show that 13 states had more than 36 percent of teachers over the age of 50, and six states had more than 40 percent: Vermont, Connecticut, Utah, North Dakota, New Hampshire, and Massachusetts. The percent of physics teachers over the age of 50 rose by more than 10 points since 1990 in all but six of the reporting states. The highest increases were evident in North Dakota, South Dakota, and Ohio—states which are facing shortages of physics teachers due to the impending retirement of many of their teachers.

As you study the demographic data of math and science teachers, consider the following questions:

- What are the key issues concerning teacher recruitment and hiring in your state (i.e., attracting more minority teachers, increasing the balance of female and male teachers, how to offset the loss of a large group of teachers in the next five years)?
- What variables other than those reported here are critical for providing an adequate, well-prepared science and math teaching force in your state?
- How have increased requirements for licensure, including teacher assessment, affected the hiring of minority teachers in your state?
- What is being done to educate and hire more qualified math and science teachers in your state?

Figure 3.5 Mathematics Teachers Age 50 and Over, by State, 2002



DoDEA, Guam, Puerto Rico, Virgin Islands, District of Columbia = n/a. Vermont: Data includes imputation.
 Grades 9–12 teachers assigned to mathematics one or more period.
 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 3.7 Age of Math Teachers by State, 1990 to 2002

State	UNDER AGE 30		AGE 50 & OVER	
	2002	Change 1990 to 2002	2002	Change 1990 to 2002
North Carolina	31%	+11%	26%	+16%
Ohio	23%	+7%	27%	+14%
Iowa	22%	+7%	26%	+8%
Georgia	22%	—	25%	—
Illinois	20%	+9%	34%	+11%
Colorado	20%	+11%	24%	+2%
Delaware	20%	+11%	32%	+4%
New York	18%	+9%	36%	+16%
Missouri	18%	-1%	30%	+15%
Indiana	18%	+3%	33%	+16%
Minnesota	17%	+7%	30%	+1%
Nebraska	17%	—	36%	—
Arkansas	16%	+2%	33%	+18%
Massachusetts	16%	—	43%	—
Utah	16%	0%	29%	+7%
California	16%	+3%	36%	+10%
NATION	16%	+3%	28%	+9%
Mississippi	15%	+1%	31%	+14%
Florida	15%	—	25%	—
South Dakota	15%	-3%	37%	+15%
Kansas	15%	-7%	35%	+14%
Wisconsin	15%	+2%	33%	+12%
Nevada	14%	+3%	30%	+8%
Wyoming	14%	—	28%	—
Vermont	14%	—	34%	—
Maine	14%	0%	35%	+20%
Connecticut	13%	+7%	44%	+24%
Idaho	12%	-5%	31%	+12%
Oklahoma	11%	-6%	26%	+15%
Alaska	11%	—	22%	—
New Mexico	10%	-2%	32%	+12%
New Hampshire	10%	—	45%	—
North Dakota	9%	-13%	41%	+28%
West Virginia	7%	—	38%	—

— Data not available. Vermont: Data includes imputation.

Grades 9–12 teachers assigned to subject one or more period.

National totals include imputation for nonreporting states.

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.

Teachers

Table 3.8 Age of Physics Teachers by State, 1990 to 2002

State	% Under Age 30		% Age 50 & Over	
	2002	Change 1990 to '02	2002	Change 1990 to '02
Delaware	21%	+4%	33%	+4%
North Carolina	21%	+6%	31%	+14%
Iowa	18%	+2%	31%	+10%
Mississippi	17%	+8%	32%	+12%
Ohio	15%	+2%	34%	+20%
Missouri	15%	+1%	31%	+10%
Wyoming	15%	—	34%	—
Illinois	14%	+2%	31%	-1%
Nevada	14%	+7%	25%	+5%
Kansas	14%	0%	38%	+15%
California	14%	0%	33%	+11%
Arkansas	14%	+1%	36%	+14%
Maine	13%	0%	37%	+16%
New York	13%	+6%	36%	+9%
Indiana	13%	0%	36%	+11%
Nebraska	13%	—	36%	—
Massachusetts	13%	—	45%	—
New Hampshire	13%	—	51%	—
NATION	13%	+2%	33%	+10%
North Dakota	12%	-2%	46%	+30%
Wisconsin	12%	+3%	33%	+3%
Florida	12%	—	30%	—
Utah	12%	+2%	40%	+21%
Minnesota	11%	+3%	32%	-1%
South Dakota	11%	-11%	38%	+20%
Oklahoma	11%	+4%	34%	+16%
Idaho	7%	-6%	36%	+5%
West Virginia	7%	—	30%	—
Alaska	6%	—	25%	—
Connecticut	5%	-2%	46%	+17%
Vermont	4%	—	46%	—
New Mexico	4%	-6%	33%	+16%

—Data not available. Vermont: data includes imputation.

Grades 9-12 teachers assigned one or more period to subject.

National totals include imputation for nonreporting states.

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.

New Teachers in High School Math and Science

- In 2002, more than 10 percent of high school math teachers for five states were new and inexperienced; only one state had more than 10 percent new teachers in high school science.
- For the nation, 8 percent of math and 7 percent of science high school teachers were new to teaching in the 2001–02 school year.

Table 3.9 displays data on new teachers for the 30 states reporting for 2001–02. The totals by state reflect the numbers of newly hired, first-year teachers with no teaching experience. The new teacher total per year is an important indicator of math and science teacher supply, as it represents new entrants to the teaching profession.

The data on the age of the current teacher force, described above, show that nearly half of the states will see one-third or more of their high school science and math teachers retire in the next few years, and many states reported having relatively few teachers under the age of 30. With the current increases in student enrollments experienced by most states, it is certain that additional teachers in science and mathematics soon will be needed.

Several of the states with higher rates of new teachers (more than 10 percent) experienced sharp increases in their teacher forces in the 1990s, including Florida, Illinois, Massachusetts, North Carolina, California, and Texas. In 2002, Texas and California had more 1,000 new math and science teachers, and North Carolina had more than 500 new math teachers.

Teachers

Table 3.9 New Teachers in High School Science and Mathematics, 1996 to 2002

State	NEW FIRST-YEAR TEACHERS					
	MATH			SCIENCE		
	2002	% New	% Change 1996 to 2002	2002	% New	% Change 1996 to 2002
Alaska	17	6%	—	4	3%	—
California	958	8%	+2%	509	6%	+2%
Colorado	206	12%	+7%	142	9%	+5%
Connecticut	85	6%	+4%	60	4%	+2%
Delaware	15	5%	+3%	10	6%	+1%
Florida	1,376	18%	—	838	14%	—
Georgia	208	7%	—	58	4%	—
Idaho	81	10%	-5%	65	9%	-3%
Illinois	308	7%	+2%	168	6%	+4%
Indiana	64	3%	-1%	97	4%	+1%
Iowa	63	4%	0%	53	3%	0%
Kansas	76	5%	—	40	3%	—
Maine	27	4%	+1%	28	3%	+2%
Massachusetts	322	10%	+6%	155	6%	+3%
Minnesota	102	5%	+1%	68	3%	-1%
Mississippi	106	9%	-5%	88	5%	-1%
Nevada	40	5%	—	12	2%	—
New Mexico	72	9%	+4%	45	6%	+4%
North Carolina	513	13%	-1%	236	7%	-3%
North Dakota	6	1%	0%	12	2%	-1%
Ohio	341	8%	+4%	222	6%	+3%
Oklahoma	116	6%	0%	77	4%	0%
South Dakota	18	4%	-14%	22	4%	-1%
Texas	2,005	8%	0%	722	6%	-1%
Utah	46	7%	-7%	39	5%	-8%
Vermont	31	9%	—	32	8%	—
Wisconsin	122	5%	+2%	92	4%	+1%
Wyoming	7	3%	—	7	3%	—
NATION		8%	+1%		7%	+2%

— Data not available.

New = No experience; Vermont: data includes imputation. National totals include imputation for nonreporting states.

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.

Teacher Professional Development in Science and Math

Professional standards for teaching mathematics (NCTM, 2000) and standards for teaching science (NRC, 1995) recommend that teachers have adequate course-work preparation in the content areas they will be teaching. Professional organizations recommend ongoing professional development in subject content and methods of teaching in the assigned field and grade level. Research has demonstrated that key factors of effective professional development in math and science are content focus, active learning by teachers, learning with colleagues, duration, and coherence with curriculum (Loucks-Horsley, 1998; Garet, et al, 2001).

Until 2000, both the periodic teacher surveys accompanying NAEP mathematics and science assessments and the SASS asked teachers to report on the amount of time (hours or days) spent in professional development for the previous 12 months. NAEP has discontinued questions for teachers about professional development or in-service. In 2000, the SASS included questions for teachers about time spent (at least one day) in professional development in several major categories. The data on the following categories are reported by state by NCES (SASS, 1999-00, Overview of the Data, 2002) but cannot be disaggregated by teacher field.

Topics of Professional Development Activities Reported by K-12 Public School Teachers, Schools and Staffing Survey, 1994 and 2000

	Percent of Participating Teachers	
	1994	2000
In-depth study of content in main teaching field	34%	59%
Methods of teaching in field	72	73
Use of computers in instruction	54	71
Content and performance standards	n/a	73
Student assessment	57	64
Student discipline/management	n/a	41













Source: NCES, Schools and Staffing Survey, 2000 (<http://nces.ed.gov>).

Other Sources of Data on Professional Development

The Surveys of Enacted Curriculum (available for math, science, and English/language arts) include a more extensive set of questions for teachers about professional development. Questions relate to types of activities in the subject/field, time spent, and measures of the quality of activities, such as coherence with curriculum, cooperation with other school staff, follow-up activity, and content focus (Blank, et al., 2001). The surveys also cover instructional practices and content taught, which allows for evaluation of change in teaching over time in relation to professional development activities. Table 3.10 provides an example of the data that can be reported; the example is based on surveys with middle school teachers in four urban districts which participated in an instructional improvement project using the Surveys of Enacted Curriculum from 2001 to 2004 (see http://www.ccsso.org/projects/Surveys_of_Enacted_Curriculum/).

Teachers

Table 3.10 Professional Development of Middle Grades Math Teachers by Topic
(N = 197 Teachers in Sample of Schools)

Topic	Time on Topic		Percentage of Teachers				
	Low	High	None	1-5 hours	6-15	16-35	> 35
Implement Content Standards			23	22	28	18	9
Implement New Curriculum or Instructional Materials			27	23	27	16	7
New Methods of Teaching			31	17	29	16	7
In-Depth Study of Math Content			45	15	12	16	12
Meet Needs of All Students			26	22	27	14	18
Strategies for Student Assessment			31	22	22	14	18
Educational Technology			31	35	18	12	4
Teacher Network or Study Group on Improving			53	20	12	11	3
Portfolio Assessment Training			63	21	9	4	3
Extended Institute or Professional Development			61	9	9	6	16
Mentoring Program			58	10	10	9	13
Committee of Task Force			69	9	11	4	7

Source: CCSSO, Surveys of Enacted Curriculum, 40 urban middle schools, Spring 2003