Education and certification of full-time, secondary mathematics and science teachers

Concern about the quality of education in the United States has focused interest on teacher qualifications and student exposure to well-qualified teachers, especially in mathematics and science. Educational background is one measure of teachers' qualifications. Whether they had majored or minored or are certified in the fields they teach is an indication of their substantive and academic qualifications in those subjects.

- In school year 1993–94, about 90 percent of public and private secondary students in science classes were taught by teachers who had majored or minored in science at the undergraduate or graduate level. In mathematics classes, 70 to 80 percent of students were taught by teachers who had majored or minored in mathematics.
- Students in mathematics classes in public secondary schools with a high student poverty level (more than 40 percent of students eligible for free or reduced-price lunch) were less likely to be taught by teachers who had majored or minored in mathematics than were students in public schools with a low poverty level (5 percent or less of students eligible for free or reduced-price lunch) (see supplemental table 57-1).
- Secondary students in public schools with high minority enrollment (20 percent or more of students) were less likely to be taught mathematics or science by a teacher who had majored or minored in the class subject than were students at public schools with low minority enrollment (less than 20 percent of students).
- Students in mathematics classes at large public schools (750 or more students) were more likely to be taught by a teacher who had majored or minored in mathematics than students at small public schools (less than 150 students). Students in science classes at large and small public schools had similar chances of being taught by a teacher who had majored or minored in science (90 and 86 percent, respectively) (see supplemental table 57-2).

Percentage of secondary mathematics and science students taught by teachers with selected qualifications, by control of school, percentage of minority enrollment, and class subject: School year 1993–94

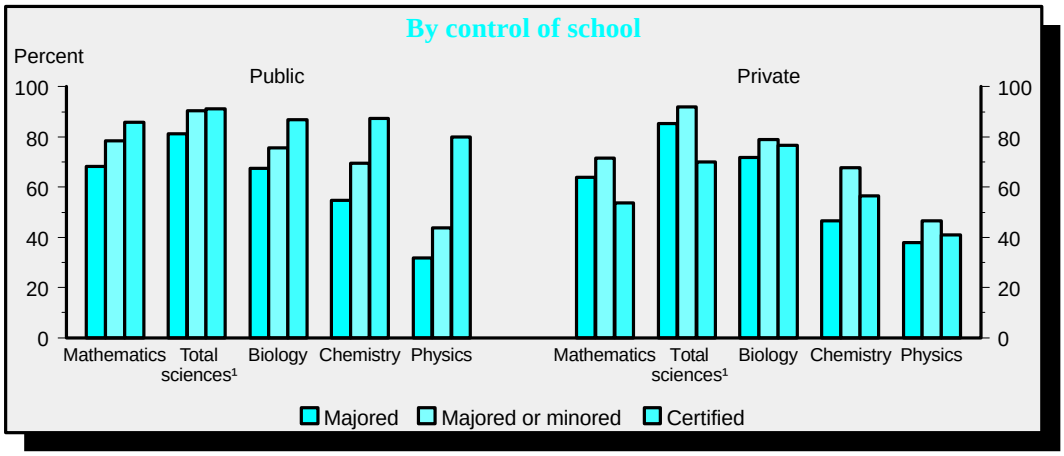
	Public			Private		
Class subject	Total	Less than 20 percent minority students	20 percent or more minority students	Total	Less than 20 percent minority students	20 percent or more minority students
Majored in class subject						
Mathematics	68.3	73.0	63.3	63.8	64.9	61.7
Science*	81.1	84.2	77.5	85.4	86.3	83.5
Biology	67.4	70.0	64.3	71.7	67.3	81.5
Chemistry	54.7	54.6	54.9	46.5	48.4	43.6
Physics	31.8	29.7	33.9	38.0	38.6	—
Majored or minored in class subject						
Mathematics	78.3	81.3	75.1	71.4	73.2	68.2
Science*	90.3	91.9	88.3	91.8	93.0	89.2
Biology	75.6	75.6	75.6	78.9	77.8	81.5
Chemistry	69.6	69.0	70.3	67.7	61.0	78.2
Physics	43.8	41.7	45.9	46.6	47.4	—
Certified in class subject						
Mathematics	85.8	88.6	82.7	53.6	57.8	45.8
Science*	91.1	92.6	89.4	70.1	79.3	49.7
Biology	86.8	89.4	83.6	76.6	77.9	73.7
Chemistry	87.4	87.4	87.4	56.4	76.9	24.2
Physics	80.1	79.3	80.8	40.8	49.0	—

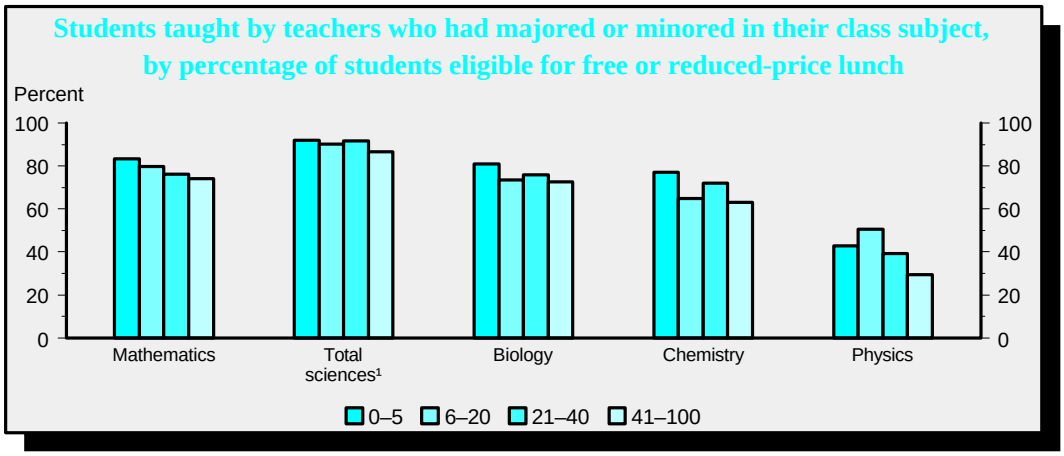
— Too few sample observations for a reliable estimate.

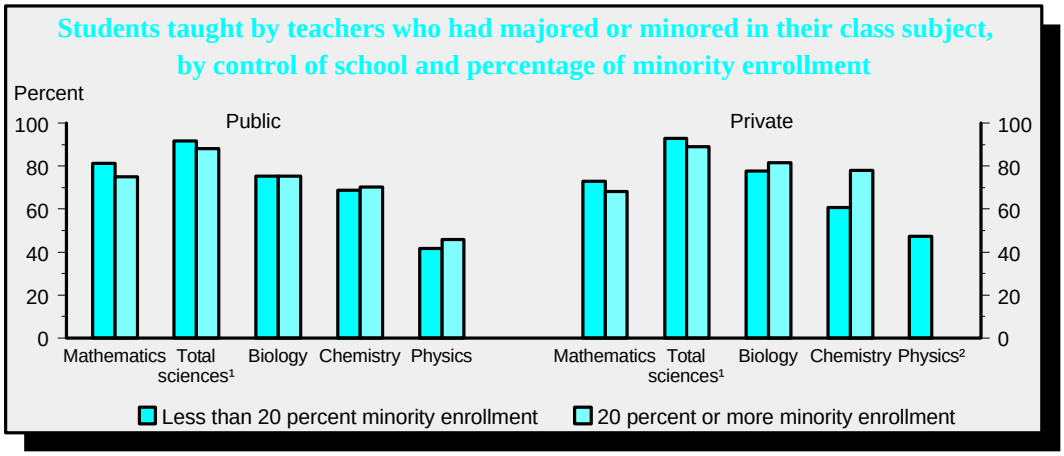
*It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter. See the supplemental note to this indicator for further discussion.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Percentage of secondary mathematics and science students taught by teachers with selected qualifications: School year 1993–94







¹ It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter.

² Too few sample observations for a reliable estimate of the number of physics students in schools with 20 percent or more minority enrollment.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Note to Indicator 57: Definition of student percentages and major/minor and certification in class subject

Definition of student percentages

Indicator 57 reports the percentages of students who were taught by full-time teachers with different qualifications. These values were calculated from Schools and Staffing Survey (SASS) information on the number of classes taught, the number of students in each class, the subject matter taught in each class, and the teachers' education and certification levels. The data collected from the teachers were weighted to properly represent national levels.

The following procedure was used to calculate the percentage of mathematics students taught by certified mathematics teachers: First, for each full-time teacher who reported teaching a mathematics class, the sum of the weighted number of students in each mathematics class taught by that teacher was used to estimate the total number of mathematics students. Next, for each full-time teacher certified to teach mathematics, the sum of the weighted number of students in each mathematics class taught by that teacher was used to estimate the number of mathematics students taught by certified teachers. Finally, the estimate of the number of mathematics students taught by certified teachers was divided by the estimate of the total number of mathematics students in order to obtain the estimated percentage of mathematics students taught by a full-time teacher certified in mathematics. The percentages reported in each of the tables in this analysis were calculated by limiting the selection to specific class subjects and school and teacher characteristics.

Classes excluded from the text table and tables 57-1 through 57-4

Computer science was excluded from the tables in this analysis because the computer science major has existed only for a limited number of years.

Matching class subject to major/minor and certification field

There are many ways to match a major / minor field of study or certification in a teaching assignment field to a class subject. One method is to include both the general or specific field and the education major / minor parallel field as a match for a specific class subject. For example, a teacher who majored or minored or who was certified in mathematics or mathematics education could be defined as having majored or minored or having become certified in the subject of mathematics. A stricter definition would exclude the mathematics teachers who majored or minored or who were certified in mathematics education. The more general definition was used for mathematics and science in all the tables in this analysis. The stricter definition was used for the specific science disciplines (biology, chemistry, and physics) in all tables.

For alternative classifications of fields see *Out-of-Field Teaching and Education Equality* (NCES 96-040).

Majored or minored in class subject

Teachers were classified as having majored or minored in a class subject if they had majored or minored in a field (shown in the right-hand column) that corresponds to the class subject listed in the left-hand column. Both undergraduate- and graduate-level degrees were considered in identifying major / minor matches to class subjects.

Class subject(s)	Major / minor field(s)
Mathematics	Mathematics, mathematics education, engineering, physics
Natural sciences	Geology / earth science, science education, other natural sciences and majors listed below
Biology / life science	Biology / life science
Chemistry	Chemistry
Physics	Physics

Certification in class subject

Certification refers to a teacher's advanced, standard, or probationary certification by a state or full certification by an accrediting body other than a state. Teachers with a temporary or emergency certification were not included as certified teachers in this analysis.

The table below shows teacher certifications classified by class subject. Teachers were classified as being certified in a class subject if they were certified in a teaching assignment field (shown in the right-hand column) that corresponds to the subject matter listed in the left-hand column. Only certifi-

cations as defined above were considered when matching subject matter.

Class subject(s)	Certification in assignment field(s)
Mathematics	Mathematics
Natural sciences	Geology / earth science, space science education, physical science, general science and all other sciences
Biology / life science	Biology / life science
Chemistry	Chemistry
Physics	Physics

Percentage of secondary mathematics and science students taught by teachers with selected qualifications, by control of school, percentage of minority enrollment, and class subject : School year 1993–94

	Public			Private		
Class subject	Total	Less than 20 percent minority students	20 percent or more minority students	Total	Less than 20 percent minority students	20 percent or more minority students
			Majored in class subject			
Mathematics	68.3	73.0	63.3	63.8	64.9	61.7
Science*	81.1	84.2	77.5	85.4	86.3	83.5
Biology	67.4	70.0	64.3	71.7	67.3	81.5
Chemistry	54.7	54.6	54.9	46.5	48.4	43.6
Physics	31.8	29.7	33.9	38.0	38.6	—
			Majored or minored in class subject			
Mathematics	78.3	81.3	75.1	71.4	73.2	68.2
Science*	90.3	91.9	88.3	91.8	93.0	89.2
Biology	75.6	75.6	75.6	78.9	77.8	81.5
Chemistry	69.6	69.0	70.3	67.7	61.0	78.2
Physics	43.8	41.7	45.9	46.6	47.4	—
			Certified in class subject			
Mathematics	85.8	88.6	82.7	53.6	57.8	45.8
Science*	91.1	92.6	89.4	70.1	79.3	49.7
Biology	86.8	89.4	83.6	76.6	77.9	73.7
Chemistry	87.4	87.4	87.4	56.4	76.9	24.2
Physics	80.1	79.3	80.8	40.8	49.0	—

— Too few sample observations for a reliable estimate.

* It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter. See the supplemental note to this indicator for further discussion.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table 57-1 Percentage of public school secondary mathematics and science students taught by teachers with selected qualifications, by percentage of students eligible for free or reduced-price lunch and class subject: School year 1993–94

Class subject	Percentage of students eligible for free or reduced-price lunch			
	0–5	6–20	21–40	41–100
		Majored in class subject		
Mathematics	73.3	71.6	65.3	60.1
Science*	83.7	82.0	82.0	73.8
Biology	74.8	66.0	70.2	57.4
Chemistry	57.5	52.7	50.2	54.6
Physics	36.3	33.0	26.2	26.7
		Majored or minored in class subject		
Mathematics	83.3	79.7	76.1	74.1
Science*	92.0	90.1	91.5	86.5
Biology	80.9	73.5	75.7	72.7
Chemistry	77.2	64.8	72.1	62.9
Physics	42.8	50.5	39.3	29.3
		Certified in class subject		
Mathematics	89.3	87.6	86.0	78.8
Science*	93.1	94.3	88.8	86.6
Biology	93.2	92.2	83.3	74.8
Chemistry	92.2	90.9	85.6	80.2
Physics	88.4	88.0	68.1	65.0

* It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter. See the supplemental note to this indicator for further discussion.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table 57-2 Percentage of secondary mathematics and science students taught by teachers with selected qualifications, by control of school, school size, and class subject: School year 1993–94

	Public				Private			
Class subject	Less than 150	150–499	500–749	750 or more	Less than 150	150–499	500–749	750 or more
				Majored in class subject				
Mathematics	57.7	66.3	62.0	70.5	60.8	61.8	68.0	63.4
Science*	77.1	74.6	83.5	82.0	83.4	88.4	72.7	90.0
Biology	57.0	63.5	64.1	69.2	—	80.1	—	—
Chemistry	19.9	35.2	55.6	57.9	—	27.9	—	—
Physics	—	21.3	26.3	34.7	—	33.1	—	—
				Majored or minored in class subject				
Mathematics	66.0	75.1	75.1	80.0	66.3	72.9	73.7	69.3
Science*	86.3	89.4	92.8	90.0	90.5	93.0	87.5	93.4
Biology	64.7	73.4	71.2	77.3	—	80.8	—	—
Chemistry	40.1	48.6	65.4	73.7	—	45.9	—	—
Physics	—	26.9	35.4	48.4	—	42.4	—	—
				Certified in class subject				
Mathematics	81.3	83.6	85.2	86.4	42.4	58.3	47.2	54.6
Science*	92.5	91.1	91.1	91.1	25.9	74.5	75.2	70.6
Biology	69.5	85.2	88.5	87.4	—	77.5	—	—
Chemistry	44.5	79.3	81.4	90.0	—	61.4	—	—
Physics	25.3	55.7	60.0	88.1	—	23.0	—	—

— Too few sample observations for a reliable estimate.

* It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter. See the supplemental note to this indicator for further discussion.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table 57-3 Percentage of secondary mathematics and science students taught by teachers with selected qualifications, by control of school, urbanicity, and class subject: School year 1993–94

Class subject	Public: Central city	Public: Urban fringe/ large town	Public: Rural/ small town	Private: Central city	Private: Urban fringe/ large town	Private: Rural/ small town
			Majored in class subject			
Mathematics	62.8	69.6	71.3	64.0	61.9	69.0
Science*	80.8	79.5	82.4	81.2	88.4	91.5
Biology	65.6	67.8	68.4	62.4	76.3	—
Chemistry	57.7	60.8	47.7	56.2	39.4	—
Physics	41.7	34.0	17.1	—	—	—
			Majored or minored in class subject			
Mathematics	74.3	78.8	80.9	74.0	68.4	70.6
Science*	91.9	88.3	90.7	90.5	92.6	94.3
Biology	74.3	77.9	74.9	72.7	83.2	—
Chemistry	67.7	77.3	65.0	87.9	52.9	—
Physics	53.5	49.5	24.4	—	—	—
			Certified in class subject			
Mathematics	83.8	87.8	85.5	55.7	53.8	43.7
Science*	89.6	91.4	91.9	59.1	83.2	70.3
Biology	83.1	90.2	86.9	71.6	85.3	—
Chemistry	85.2	89.7	87.2	38.0	79.9	—
Physics	81.7	87.9	66.9	—	—	—

— Too few sample observations for a reliable estimate.

* It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter. See the supplemental note to this indicator for further discussion.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table 57-4 Percentage of public school secondary mathematics and science students taught by teachers with selected qualifications, by urbanicity, percentage of students eligible for free or reduced-price lunch, and class subject: School year 1993–94

	Central city				Urban fringe/large town				Rural/small town			
Class subject	0–5	6–20	21–40	41–100	0–5	6–20	21–40	41–100	0–5	6–20	21–40	41–100
Majored in class subject												
Mathematics	61.6	67.7	65.0	55.9	71.1	74.6	63.9	53.4	82.8	71.2	66.4	68.4
Science*	72.4	86.9	82.3	73.9	85.2	74.6	80.8	74.1	85.8	85.0	82.5	73.5
Biology	—	69.5	71.0	53.4	81.6	59.5	64.7	62.3	70.7	68.9	72.6	59.8
Chemistry	—	56.1	—	60.9	67.8	58.3	—	—	44.8	45.7	43.7	51.8
Physics	—	—	—	—	—	24.7	—	—	—	34.9	11.5	—
Majored or minored in class subject												
Mathematics	71.8	79.2	72.3	71.8	83.4	80.7	76.0	63.8	88.1	79.2	79.0	81.3
Science*	99.7	93.5	90.8	88.7	91.0	85.4	91.0	81.7	90.3	92.0	92.3	85.5
Biology	—	72.1	75.7	70.8	87.6	72.3	74.6	78.6	73.8	74.9	76.3	73.1
Chemistry	—	71.7	—	66.8	88.2	66.6	—	—	67.1	60.6	67.0	65.1
Physics	—	—	—	—	—	53.5	—	—	—	39.5	18.2	4.5
Certified in class subject												
Mathematics	89.1	87.8	86.1	77.7	86.0	90.8	86.3	75.3	95.7	84.7	85.7	81.6
Science*	92.8	97.1	90.1	80.7	94.4	91.6	89.3	83.0	90.9	94.8	87.5	93.8
Biology	—	91.8	87.6	62.4	96.1	89.5	88.3	70.1	86.5	94.3	76.6	86.1
Chemistry	—	95.4	—	81.3	93.0	86.9	—	—	93.4	90.5	85.1	80.5
Physics	—	—	—	—	—	90.1	—	—	—	75.0	58.6	72.9

— Too few sample observations for a reliable estimate.

* It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter. See the supplemental note to this indicator for further discussion.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table S57 Standard errors for the text table in *Indicator 57*

Class subject	Public: Total	Public: Less than 20 percent minority students	Public: 20 percent or more minority students	Private: Total	Private: Less than 20 percent minority students	Private: 20 percent or more minority students
Majored in class subject						
Mathematics	0.9	1.0	1.8	2.6	2.8	5.3
Science	1.0	1.0	1.8	1.6	2.3	3.4
Biology	1.6	1.9	2.7	3.7	5.1	5.0
Chemistry	2.3	2.8	3.7	6.2	7.3	10.0
Physics	3.5	4.1	5.7	5.7	6.5	—
Majored or minored in class subject						
Mathematics	1.0	1.0	1.9	2.5	2.5	5.5
Science	0.6	0.6	1.1	1.1	1.2	2.9
Biology	1.2	1.7	1.9	3.2	4.0	5.0
Chemistry	2.2	2.6	3.2	5.1	7.9	6.7
Physics	3.6	3.7	6.2	6.3	7.1	—
Certified in class subject						
Mathematics	0.8	0.8	1.3	2.6	2.8	5.2
Science	0.7	0.7	1.2	2.3	2.4	5.7
Biology	1.1	1.5	1.8	2.7	4.0	7.4
Chemistry	1.6	1.8	3.0	6.3	4.7	7.6
Physics	2.1	2.3	3.2	6.6	7.9	—

— Not available.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table S57-1 Standard errors for table 57-1

Class subject	Percentage of students eligible for free or reduced-price lunch			
	0–5	6–20	21–40	41–100
		Majored in class subject		
Mathematics	2.5	1.5	2.4	2.9
Science	2.8	1.6	1.6	2.0
Biology	3.2	2.9	3.2	3.8
Chemistry	5.3	4.0	5.3	5.6
Physics	10.2	4.7	5.8	10.3
		Majored or minored in class subject		
Mathematics	2.1	1.5	2.0	2.7
Science	2.3	1.1	0.9	1.2
Biology	2.8	2.3	2.5	2.8
Chemistry	5.1	3.4	4.3	5.8
Physics	10.4	5.9	5.6	10.0
		Certified in class subject		
Mathematics	1.3	1.4	1.1	2.5
Science	1.2	0.8	1.2	2.0
Biology	1.6	1.0	2.3	3.2
Chemistry	2.5	1.9	2.7	4.1
Physics	2.9	2.0	5.5	8.0

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table S57-2 Standard errors for table 57-2

Class subject	Public: Less than 150	Public: 150–499	Public: 500–749	Public: 750 or more	Private: Less than 150	Private: 150–499	Private: 500–749	Private: 750 or more
Majored in class subject								
Mathematics	3.8	2.2	3.2	1.3	8.2	4.4	5.5	5.6
Science	3.5	2.2	1.6	1.3	6.6	2.5	5.7	3.0
Biology	6.0	3.2	3.8	2.0	—	4.9	—	—
Chemistry	7.2	4.4	7.0	2.7	—	9.1	—	—
Physics	—	4.5	8.1	4.4	—	8.3	—	—
Majored or minored in class subject								
Mathematics	3.6	1.9	2.7	1.2	8.4	3.9	5.1	5.5
Science	2.4	1.1	0.9	0.8	6.6	1.7	2.8	2.6
Biology	5.2	3.1	3.5	1.3	—	4.9	—	—
Chemistry	11.4	4.3	6.7	2.4	—	11.8	—	—
Physics	—	4.3	8.4	4.7	—	9.9	—	—
Certified in class subject								
Mathematics	2.6	1.9	1.8	1.0	7.2	4.0	5.5	5.5
Science	1.6	1.1	1.1	0.9	9.6	4.0	4.5	4.0
Biology	3.8	2.7	2.5	1.3	—	4.3	—	—
Chemistry	13.1	3.0	4.6	1.7	—	11.0	—	—
Physics	5.9	5.0	8.0	2.0	—	7.7	—	—

— Not available.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table S57-3 Standard errors for table 57-3

Class subject	Public: Central city	Public: Urban fringe/ large town	Public: Rural/ small town	Private: Central city	Private: Urban fringe/ large town	Private: Rural/ small town
Majored in class subject						
Mathematics	2.7	1.8	1.6	4.1	3.9	7.4
Science	2.2	2.1	0.9	2.7	2.9	2.9
Biology	3.4	3.2	1.9	6.1	6.3	—
Chemistry	4.1	4.3	3.3	8.1	8.9	—
Physics	6.7	6.3	2.7	—	—	—
Majored or minored in class subject						
Mathematics	2.3	1.8	1.2	3.9	3.5	7.3
Science	0.9	1.5	0.6	2.0	1.7	2.5
Biology	2.6	2.3	1.6	5.7	5.1	—
Chemistry	4.7	3.4	3.1	3.7	10.5	—
Physics	7.0	7.1	2.7	—	—	—
Certified in class subject						
Mathematics	1.7	1.2	1.1	3.7	3.8	6.8
Science	1.5	0.9	0.9	4.0	2.9	5.6
Biology	2.4	1.6	1.6	5.0	3.5	—
Chemistry	3.6	2.7	1.5	5.9	8.5	—
Physics	4.3	3.3	3.2	—	—	—

— Not available.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

Table S57-4 Standard errors for table 57-4

Class subject	Central city				Urban fringe/large town				Rural/small town			
	0–5	6–20	21–40	41–100	0–5	6–20	21–40	41–100	0–5	6–20	21–40	41–100
Majored in class subject												
Mathematics	6.0	3.8	5.8	4.9	3.3	2.2	3.5	8.6	3.5	2.5	3.6	2.6
Science	9.6	3.0	3.3	3.8	3.1	3.4	4.0	5.0	3.3	1.6	1.9	3.0
Biology	—	5.9	4.9	7.2	3.5	5.5	6.8	9.8	4.8	3.8	3.4	4.9
Chemistry	—	8.0	—	8.0	7.6	6.0	—	—	8.7	6.3	5.1	7.4
Physics	—	—	—	—	—	6.8	—	—	—	5.4	4.0	—
Majored or minored in class subject												
Mathematics	6.7	3.0	5.6	4.3	2.8	2.3	2.7	10.2	2.9	2.2	2.0	2.0
Science	0.2	1.8	2.3	2.0	3.0	2.4	2.3	4.9	2.9	1.4	1.0	1.7
Biology	—	5.8	4.5	4.6	2.9	4.2	5.2	6.2	4.8	3.3	3.2	3.7
Chemistry	—	7.6	—	7.8	6.5	5.7	—	—	8.5	5.9	5.5	7.6
Physics	—	—	—	—	—	11.2	—	—	—	5.4	4.8	2.0
Certified in class subject												
Mathematics	3.0	2.4	2.8	4.0	2.0	2.4	1.7	6.8	1.2	2.0	1.7	2.3
Science	4.1	1.2	2.7	3.5	1.2	1.4	2.0	5.6	2.7	1.3	2.1	1.1
Biology	—	3.5	4.7	5.4	1.4	2.0	4.0	10.8	4.3	1.1	4.1	2.9
Chemistry	—	3.2	—	5.3	3.5	4.0	—	—	2.7	2.1	3.3	5.9
Physics	—	—	—	—	—	3.2	—	—	—	3.3	7.5	8.5

— Not available.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).