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QUALIFICATIONS OF PUBLIC SCHOOL TEACHERS FOR SCIENCE, MATHEMATICS, AND HISTORY

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OVERVIEW

Studies since the mid-1990s of the relationship between teachers' qualifications and student achievement have produced mixed results (see Wayne and Youngs 2003 for a review of the research). One of the more robust findings has been that student achievement is higher when teachers are trained in the specific subject matter taught. This training is frequently measured in terms of postsecondary majors and certification (although research on the value of certification has produced inconsistent results). Teachers are described as "in field" if their training matches the field taught and "out of field" if their training does not match the field taught (Seastrom et al. 2004).

Recent analyses have examined out-of-field teachers more closely to explore how far out of field they are in terms of their subject-matter training and how out-of-field teaching varies among schools serving relatively more or fewer poor children (McGrath, Holt, and Seastrom, 2005; 2006). However, no national-level research on teacher qualifications has studied data more recent than those from the 1999–2000 school year. Nor has the recent research explored potential differences between newer teachers and more experienced teachers.

This Research Brief *focuses on the qualifications of teachers in science and mathematics as well as history, in grades 7–12 for the 2003–04 school year. The subjects of science and mathematics were selected because of continuing concerns in the United States over the high need for individuals with advanced knowledge and skills in these subjects (Jacobs and Simpkins 2005). Due to the current interests in the science and mathematics field, all subjects that fall under science and mathematics were grouped together in this brief in order to examine the overall patterns in teachers' qualifications in these subjects.*[i] *Research about teacher qualifications is just one component in ongoing investigations into science and mathematics education and career attainment. History was selected because of its high enrollment rates—in 2005, 94 percent of high school graduates had taken at least 1 year of history at the secondary level (Shettle et al. 2007).*

Our analysis found that 45 percent of secondary–level science and mathematics students as well as 53 percent of history students were taught by teachers with the highest qualification (with both an in-field[ii] *major and an in-field regular state certification) in the 2003–04 school year. On the other hand, 26 percent of science or mathematics students and 12 percent of history students were taught by teachers with neither qualification. Students in lower poverty schools as well as students taught by veteran teachers were more likely to be taught by in-field teachers with an in-field major or certification. However, among students with teachers with the lowest qualifications (i.e., those with neither an in-field major nor certification), our analyses suggest that newer teachers' qualifications may be less far out-of-field than veteran teachers'. This may suggest some possible improvement in teachers' qualifications among the least qualified newer teachers, although further research is needed on this topic.*

SCIENCE AND MATHEMATICS TEACHERS

In the 2003–04 school year, 58 percent of secondary-level science and mathematics students had a teacher with a in-field major, 61 percent had a teacher with an in-field regular state certification, 45 percent had a teacher with both an in-field major and a state certification qualification, and 26 percent had a teacher with neither qualification. Results are discussed below for each type of qualification.

What proportion of science and mathematics students had a teacher with a major in the specific science or mathematics field?

In 2003–04, 58 percent of science and mathematics students at the secondary level were taught by teachers with a postsecondary major in the specific science or mathematics field that they were teaching (table 1). A higher percentage of students in lower poverty schools than in higher poverty schools were taught by teachers with an in-field major (61 vs. 50 percent). No measurable difference was detected by teachers' experience.

Of the 58 percent of students taught by teachers with an in-field major, a higher percentage of students had teachers who received their degrees from an education school or department (36 percent) than from a subject-matter department (22 percent). Students taught by teachers with an in-field major in lower poverty schools and with veteran teachers more often had teachers with degrees from education schools or departments than with degrees from subject-matter departments.

Among the 42 percent of science and mathematics secondary students taught by teachers without an in-field postsecondary major, their teachers' most common majors were another science or mathematics field (35 percent), secondary education (25 percent), and elementary education (24 percent). Among the students whose teachers lacked an in-field major, a higher percentage of students in lower poverty schools than in higher poverty schools were taught by teachers with a major in secondary education (28 vs. 16 percent) and a higher percentage of students with veteran teachers than with newer teachers were taught by teachers with a major in elementary education (26 vs. 18 percent).

What proportion of science and mathematics students had a teacher with a regular state certification in the specific science or mathematics field?

In 2003–04, approximately 61 percent of secondary-level science and mathematics students were taught by a teacher with a regular state certification in the specific science or mathematics field. Among the 39 percent of students with a teacher lacking an in-field regular state certification, 28 percent had a teacher with a regular state certification in another science or mathematics field, 29 percent had a teacher with no regular certification in any subject, and 20 percent had a teacher with an "other certification"[ix] in the specific science or mathematics field.

Differences by poverty: The percentage of science and mathematics students taught by teachers with a regular state certification in the specific science or mathematics field was higher among students in lower poverty schools than in higher poverty schools (64 vs. 53 percent). Among those whose teachers lacked an in-field regular state certification, the percentage of students taught by teachers without a regular certification in any subject was higher among students in higher poverty schools than in lower poverty schools (35 vs. 26 percent).

Differences by teaching experience: The percentage of science and mathematics students taught

ABOUT THE DATA AND METHODOLOGY FOR THIS BRIEF

This *Research Brief* employs a similar methodology as that used in McGrath, Holt, and Seastrom (2005).[iii] Teachers are grouped first by postsecondary major and certification separately (table 1) and then by combinations of their postsecondary majors and certification (table 2). For each qualification—postsecondary major and regular state certification[iv]—teachers are grouped first by whether or not they have the qualification in their respective subject. Science and mathematics teachers must have a major or certification in the specific science or mathematics field of the class taught in order to be categorized as having an "in-field" major or certification. Then, teachers lacking the qualification in the subject are grouped by their field of study or field of certification.[v] Each field comprises subjects grouped by their similarity to each other in terms of subject matter and skills.[vi] Science and mathematics teachers with a major or certification in "other subject in the field" have a major or certification in a science or mathematics field, but not in the specific field of the class taught. For history teachers, this category refers to those with a major in other social science. Teachers who reported more than one non-subject qualification are included in each subject reported. Thus, the groups of teachers lacking the subject's qualifications are not mutually exclusive.

Results are reported separately for each subject matter. Within each subject, findings are reported in terms of the percentage of public school students in grades 7–12 taking the subject matter taught by teachers with various qualifications. Estimates are reported separately for students in schools where fewer than 50 percent of students were eligible for free or reduced-price lunch (lower poverty schools) and schools where 50 percent or more of students were eligible (higher poverty schools), as well as for students of teachers with 5 or fewer years of teaching experience (newer teachers) and teachers with 6 or more years of experience (veteran teachers).

Data are drawn from the National Center for Education Statistics (NCES) 2003–04 Schools and Staffing Survey (SASS) Public Teacher Questionnaire and Public School Questionnaire data files.[vii] The sample used in the analysis includes teachers who taught the subject for classes in grades 7–12.[viii]

Table 1. Percentage of public secondary school students in science, mathematics and history classes, by free or reduced-price lunch eligibility, teachers' years of experience, and subject field of teachers' postsecondary major and certification: School year 2003–04

	Percentage of students in science/mathematics classes						Percentage of students in history classes					
		By percentage of students eligible for free or reduced-price lunch			By teachers' years of experience			By percentage of students eligible for free or reduced-price lunch			By teachers' years of experience	
	TOTAL	LOWER POVERTY (Less than 50%)		HIGHER POVERTY (50% or higher)	NEWER TEACHER (5 years or less)	VETERAN TEACHER (6 years or more)	TOTAL	LOWER POVERTY (Less than 50%)		HIGHER POVERTY (50% or higher)	NEWER TEACHER (5 years or less)	VETERAN TEACHER (6 years or more)
Subject field of major or certification												
Major in subject	58	61	>	50	55	60	62	64		54	60	62
Degree from education school or department	36	39		28	25	40	42	43		36	40	43!
Degree from subject-matter department	22	23		21	30	19	20	21		18	20	19
No major in subject	42	39		50	45	40	38	36		46	40	38
Among those with no major in subject, major in another subject:												
Other subject in the field[1]	35	34		36	33	35	56	52		66	62	55
Elementary education	24	24		24	18	< 26	9	9		7	6	9
Secondary education	25	28	>	16	24	26	35	37		29	41	33
Regular state certification in subject[2]	61	64	>	53	45	< 67	79	82	>	67	68	< 82
No regular state certification in subject	39	36		47	55	33	21	18		33	32	18
Among those with no regular certificate in subject:												
Regular state certification in another subject	71	74		65	42	89	60	65		48	34	75
Regular state certification in other subject in the field[3]	28	30		24	19	< 34	9	7!		14!	6!	11
No regular state certification	29	26	<	35	58	> 11	40	35	<	52	66	> 25
Other certification in any subject	28	25		32	51	12	34	27		50	54	23
Other certification in subject	20	19		20	39	> 8	33	25	<	49	51	> 22!
No other certification	72	75		68	49	88	66	73		50	46	77

! Interpret data with caution.
< & > indicate the comparisons of the percentages between the two groups where the difference is statistically significant at the 0.05 level.

[1]For science and mathematics, this category refers to teachers with a major in science or mathematics other than the subject taught. The subjects of science include biology/life science, chemistry, earth science, general science, integrated science, physical science, and physics. Mathematics includes basic mathematics, business and applied mathematics, computer science, pre-algebra, algebra, geometry, statistics and probability, trigonometry, pre-calculus, and calculus. For history, this category refers to teachers with a major in any subject in social science other than history. "Other social science" includes anthropology, area/ethnic studies, criminal justice, cultural studies, economics, geography, government/civics, international studies, law, Native American studies, political science, psychology, and sociology.

[2]For history, this category includes teachers with regular state certification in history or general social studies.

[3]For science and mathematics, this category refers to teachers with a regular certification in science and mathematics other than the subject taught. For history, it refers to those with a regular certification in any subject in social science other than history. See footnote 1 for the list of subjects included in the category, other subject in the field.

NOTE: Secondary-level students are those in grades 7–12. "Regular state certification" includes regular or standard state certificates, advanced professional certificates, and probationary certificates (issued after satisfying all requirements except the completion of a probationary period). Major in "Other social science" includes majors in anthropology, area/ethnic studies, criminal justice, cultural studies, economics, geography, government/civics, international studies, law, Native American studies, political science, psychology, sociology, and other social sciences. "Other certification" includes provisional or other types of certificates given to teachers who are still participating in what the state calls an "alternative certification program," temporary certificates, and waivers or emergency certificates. Detail may not sum to totals because of rounding. Detail below "Major in another subject" an "Regular certification in another subject" may not sum to totals, because teachers could report majors or certifications in multiple subjects and some of the subjects are not listed in this table. Not all apparent differences in this table are statistically significant. Standard errors are available upon request from the authors.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Questionnaire" and "Public Teacher Questionnaire," 2003–04.

by teachers with a regular state certification in the specific science or mathematics field was higher for students taught by veteran teachers than those taught by newer teachers (67 vs. 45 percent). Among students whose teachers lacked an in-field regular state certification, the percentage of students taught by teachers with a regular state certification in another science or mathematics field was higher among students of veteran teachers than of newer teachers (34 vs. 19 percent). Conversely, the percentage of students taught by teachers without a regular certification in any subject was higher among students of newer teachers than those of veteran teachers (58 vs. 11 percent). However, among students of newer teachers who lacked an in-field regular state certification, 39 percent had a teacher

Table 2. Percentage of public secondary school students in science, mathematics and history classes, by free or reduced-price lunch eligibility, teachers' years of experience, and combinations of teachers' postsecondary majors and certification subject fields: School year 2003-04

	Percentage of students in science/mathematics classes							Percentage of students in history classes						
		By percentage of students eligible for free or reduced-price lunch			By teachers' years of experience				By percentage of students eligible for free or reduced-price lunch			By teachers' years of experience		
	TOTAL	LOWER POVERTY (Less than 50%)		HIGHER POVERTY (50% or higher)	NEWER TEACHER (5 years or less)		VETERAN TEACHER (6 years or more)	TOTAL	LOWER POVERTY (Less than 50%)		HIGHER POVERTY (50% or higher)	NEWER TEACHER (5 years or less)		VETERAN TEACHER (6 years or more)
Subject field of major or certification														
Regular certification in subject field[1]	61	64	>	53	45	<	67	79	82	>	67	68	<	82
and major in subject field	45	48	>	37	33	<	50	53	55	>	43	45		55
and no major in subject field	16	16		16	12		17	26	27		24	23		27
Among those with regular certification but no major in subject, major in another subject:														
Other subject in the field[2]	36	38		31	30		37	59	58		57	64		57
Secondary education	32	33		26	45	>	29	41	41		39	53		38
No regular certification in subject field	39	36		47	55		33	21	18		33	32		18
and major in subject field	13	13		12	22	>	10	9	9		11	15	>	7
and no major in subject field	26	23	<	35	33	>	23	12	9	<	22	16		11
Among those with neither regular certification nor major in subject field, major in another subject:														
Other subject in the field[2]	34	32		38	34		34	52	33	<	76	60		48
Elementary education	27	27		27	19	<	31	20	30	>	7!	10!	<	25
Secondary education	21	25	>	11	17		23	21	25		18!	23!		21

! Interpret data with caution.

< & > indicate the comparisons of the percentages between the two groups where the difference is statistically significant at the 0.05 level.

[1]For history, this category includes teachers with regular state certification in history or general social studies.

[2]For science and mathematics, this category refers to teachers with a major in science or mathematics other than the subject taught. For history, this category refers to teachers with a major in any subject in social science other than history.

NOTE: Secondary level students are those in grades 7–12. "Regular certification" includes regular or standard state certificates, advanced professional certificates, and probationary certificates (issued after satisfying all requirements except the completion of a probationary period). Detail may not sum to totals because of rounding. Detail below "Major in another subject" may not sum to totals, because teachers could report majors in multiple subjects and not all of the subjects are listed in this table. Major in "Other social science" includes majors in anthropology, area/ethnic studies, criminal justice, cultural studies, economics, geography, government/civics, international studies, law, Native American studies, political science, psychology, sociology, and other social sciences. Not all apparent differences in this table are statistically significant. Standard errors are available upon request from the authors.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Questionnaire" and "Public Teacher Questionnaire," 2003–04.

with an "other certification"[ix] in the specific science or mathematics field, compared with 8 percent of students of veteran teachers.

Majors and certifications reported in combinations: teachers with a regular state certification in science or mathematics

In 2003–04, 45 percent of secondary-level science and mathematics students had teachers with both a regular state certification and a postsecondary major in the specific science or mathematics field (table 2). The percentage of students taught by teachers with both qualifications was higher among students in lower poverty schools than in higher poverty schools (48 vs. 37 percent) and among students taught by veteran teachers than by newer teachers (50 vs. 33 percent).

Approximately 16 percent of science and mathematics students had a teacher with an in-field regular state certification but no in-field postsecondary major. Of these students, their teachers' two most common majors were another science or mathematics field (36 percent) and secondary education (32 percent). The percentage of students taught by a teacher with a major in secondary education was higher among students of newer teachers than of veteran teachers (45 vs. 29 percent).

Majors and certifications reported in combinations: teachers with no *regular state certification in science or mathematics*

In 2003–04, 13 percent of science and mathematics students at the secondary level had teachers who *did not* have an in-field regular state certification but

did have a postsecondary major in the specific science or mathematics field. A higher percentage of students taught by newer teachers than by veteran teachers had teachers with this combination of qualifications (22 vs. 10 percent).

Some 26 percent of science and mathematics students had teachers with neither an in-field regular state certification nor an in-field postsecondary major. The percentage of students having teachers with neither qualification was higher among students in higher poverty schools than in lower poverty schools (35 vs. 23 percent) and among students of newer teachers than of veteran teachers (33 vs. 23 percent).

Among science and mathematics students whose teachers had neither qualification, 34 percent were taught by teachers with a major in another science or mathematics field, 27 percent by teachers with a major in elementary education, and 21 percent by teachers with a major in secondary education. Among the same group of students, the percentage of those taught by teachers with a major in elementary education was lower among students of newer teachers than of veteran teachers (19 vs. 31 percent).

HISTORY TEACHERS

In the 2003–04 school year, 62 percent of secondary-level history students had a teacher with a postsecondary major in history, 79 percent had a teacher with a regular state certification in history or general social studies, 53 percent had a teacher with both qualifications, and 12 percent had a teacher with neither qualification. Results are discussed below for each type of qualification.

What proportion of history students had a teacher with a major in history?

In the 2003–04 school year, 62 percent of history students at the secondary level were taught by teachers with a postsecondary major in history (table 1). There were no measurable differences between students in higher or lower poverty schools or in the classrooms of newer or veteran teachers. In all cases, estimates ranged between 54 and 64 percent. Forty-two percent of history students had a teacher with a history major from an education school or department, and 20 percent had a teacher with a history major from a subject-matter department.

Among the 38 percent of history students taught by a teacher without a postsecondary major in history, 56 percent were taught by a teacher with a major in another social science[x] and 35 percent were taught by a teacher with a major in secondary education. For all students, regardless of their school's poverty level or teacher's years of experience, these majors (i.e., another social science and secondary education) were the most common among their teachers without a postsecondary major in history.

What proportion of history students had a teacher with a regular state certification in history or general social studies?

In the 2003–04 school year, 79 percent of secondary school history students were taught by a teacher with a regular state certification in history or general social studies. Among history students with a teacher lacking this certification, 40 percent had a teacher with no regular state certification in any subject and 33 percent had a teacher with an "other certification"[ix] in history or general social studies.

Differences by poverty: A higher percentage of students in lower poverty schools than in higher poverty schools had teachers with a regular state certification in history or general social studies (82 vs. 67 percent). Among students whose teachers lacked an in-field regular state certification, a higher percentage in higher poverty schools than in lower poverty schools had a teacher with no regular certification in any subject (52 vs. 35 percent). Among the same group of students, a higher percentage had teachers with an in-field "other certification" in higher poverty schools than in lower poverty schools (49 vs. 25 percent).

Differences by teaching experience: A higher percentage of students taught by veteran teachers than by newer teachers had teachers with an in-field regular state certification (82 vs. 68 percent). Among students whose teachers lacked an in-field regular state certification, a higher percentage of students with newer teachers than with veteran teachers had a teacher with no regular state certification in any subject (66 vs. 25 percent) and a teacher with an in-field "other certification" (51 vs. 22 percent).

Majors and certifications reported in combinations: teachers with a regular state certification in history or general social studies

In the 2003–04 school year, 53 percent of secondary-level history students had teachers with both a regular state certification and a postsecondary major in history (table 2). Students in lower poverty schools more often than those in higher poverty schools had a teacher with both qualifications (55 vs. 43 percent).

Twenty-six percent of history students had a teacher with a regular state certification in history or general social studies, but no major in history. Of these

students, more than half (59 percent) were taught by a teacher with a major in another social science and 41 percent were taught by a teacher with a secondary education major. For all students, regardless of their school's poverty level or teacher's years of experience, these were the two most common majors among their teachers with a regular state certification but no major in history.

Majors and certifications reported in combinations: teachers with no *regular state certification in history or general social studies*

In 2003–04, 9 percent of secondary-level history students had teachers who *did not* have a regular state certification in history or general social studies but *did* have a major in history and 12 percent of students had a teacher with neither qualification. Of those students whose teachers had neither qualification, about half (52 percent) had a teacher with a major in another social science.

Differences by poverty: A higher percentage of students in higher poverty schools than in lower poverty schools had a teacher with neither a major in history nor a regular state certification in history or general social studies (22 vs. 9 percent). Among these students, 76 percent in higher poverty schools had a teacher with a major in another social science, compared with 33 percent in lower poverty schools. On the other hand, 30 percent in lower poverty schools had a teacher with an elementary education major, compared with 7 percent in higher poverty schools.

Differences by teaching experience: Students of newer teachers more often than those of veteran teachers had a teacher with a history major, but no regular state history or general social studies certification (15 vs. 7 percent). Among students of both newer and veteran teachers with neither qualification, their teachers' most common major was another social science (60 percent of students with newer teachers and 48 percent of students with veteran teachers had a teacher with this major). Among the same group of students, the percentage of those taught by teachers with a major in elementary education was lower among students of newer teachers than of veteran teachers (10 vs. 25 percent).

SUMMARY

While 45 percent of secondary–level science and mathematics students as well as 53 percent of history students were taught by teachers with both an in-field major and an in-field state certification, 26 percent of science or mathematics students and 12 percent of history students were taught by teachers with neither qualification during the 2003-04 school year.

Among secondary-level science and mathematics students:

- 58 percent had a teacher with an in-field major, 61 percent had a teacher with an in-field regular state certification, 45 percent had a teacher with both qualifications, and 26 percent had a teacher with neither qualification.
- Among the students taught by teachers without an in-field major (42 percent), their teachers' most common majors were another science or mathematics field (35 percent), followed by secondary education (25 percent) and elementary education (24 percent).
- Among the students with a teacher lacking an in-field regular state certification (39 percent), 28 percent had a teacher with a regular state certification in another science or mathematics field, 29 percent had a teacher with no regular certification in any subject, and 20 percent had a teacher with an "other certification" (e.g., provisional, temporary, or emergency certification or waiver) in the specific science or mathematics field.

Among secondary-level history students:

- 62 percent had a teacher with a major in history, 79 percent had a teacher with a regular state certification in history or general social studies, 53 percent had a teacher with both qualifications, and 12 percent had a teacher with neither qualification.
- Among those students whose teachers did not have a regular state certification in history or general social studies, 40 percent had a teacher with no regular state certification in any subject and 33 percent had a teacher with some "other certification" in history or general social studies.

Students in lower poverty schools were more likely to be taught by teachers with in-field qualifications than their counterparts in both subjects.

Among science and mathematics students, higher percentages of students in lower poverty schools than in higher poverty schools had teachers with an in-field postsecondary major, an in-field regular state certification, and the combination of both qualifications. Conversely, a higher percentage of students in higher poverty schools than in lower poverty schools had teachers with neither qualification. Similar patterns were found among history students.

In both subjects, students with veteran teachers were more likely to be taught by teachers with an in-field certification compared to

students with newer teachers; however, when students taught by teachers with the lowest qualifications (i.e., with neither an in-field major nor an in-field state certification) were examined, those with newer teachers were less likely to be taught by teachers with a major in elementary education.

Compared to students with newer teachers, students with veteran teachers were more likely to be taught by teachers with a regular certification in their field, and less likely to be taught by teachers who have "other certification" in their subject. Students with newer teachers were more likely to be taught by teachers with an in-field major but no regular state certification in their subject. However, among students with teachers with neither qualification, those with newer teachers were less likely to be taught by teachers with a major in elementary education compared to those with veteran teachers (19 vs. 31 percent for science and mathematics students and 10 vs. 25 percent for history students). Compared to teachers with a major in another subject in the field or a major in secondary education, those with a major in elementary education can be considered as farther out-of-field in their qualification. Therefore, this finding may suggest a possible improvement in teachers' qualification in both subjects among the least qualified newer teachers, although further research is necessary on this topic.

REFERENCES

Jacobs, J. E., and Simpkins, S. D. (2005). Mapping Leaks in the Math, Science, and Technology Pipeline. New Directions for Child and Adolescent Development, 110, 3-6.

McGrath, D.J., Holt, E.W., and Seastrom, M.M. (2005). *Qualifications of Public Secondary School Biology Teachers, 1999–2000* (NCES 2005-081). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

McGrath, D.J., Holt, E.W., and Seastrom, M.M. (2006). *Qualifications of Public Secondary School History Teachers, 1999–2000* (NCES 2006-004). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Seastrom, M.M., Gruber, K.J., Henke, R., McGrath, D.J., and Cohen, B.A. (2004). *Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-Field Teaching: 1987–88 to 1999–2000* (NCES 2002-603 Revised). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Shettle, C., Roey, S., Mordica, J., Perkins, R., Nord, C., Teodorovic, J., Brown, J., Lyons, M., Averett, C., and Kastberg, D. (2007). *America's High School Graduates: Results From the 2005 NAEP High School Transcript Study* (NCES 2007-467). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Wayne, A.J., and Youngs, P. (2003). Teacher Characteristics and Student Achievement Gains: A Review. *Review of Educational Research, 73*(1): 89–122.

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[i] Science includes biology/life science, chemistry, earth science, general science, integrated science, physical science, and physics. Mathematics includes basic mathematics, business and applied mathematics, computer science, pre-algebra, algebra, geometry, statistics and probability, trigonometry, pre-calculus, and calculus.

[ii] "In-field" qualification in this brief refers to a major or certification in the specific subject matter taught.

[iii] Although the analytic methodology employed here and in the previous studies analyzing data from SASS administered in 1999-2000 is similar, the data may not be comparable because of changes in the questionnaire between SASS administrations.

[iv] Regular state certification includes regular or standard state or advanced certificates, as well as probationary certificates issued after satisfying all requirements except completion of a probationary period.

[v] After a review of state teacher certification websites showed that many states do not grant certification specifically in history, certifications in either history or general social studies were accepted as "in field" for this analysis (see https://title2.ed.gov/StateCertOffices.asp for links to state teacher certification websites). A similar "in field" definition was not necessary for postsecondary majors since teachers could report a major in history, but not a major in general social studies.

[vi] See tables 2 and 3 in the SASS Public Teacher Questionnaire, available at http://nces.ed.gov/surveys/sass/pdf/0304/sass4a.pdf, for the grouping of subjects.

[vii] Information on teachers' qualifications, years of experience, class assignments, and numbers of students taught is drawn from teachers' reports. Information on the percentage of students eligible for free or reduced-price lunch is drawn from school reports.

[viii] The sample includes 2,498 public school teachers. Estimates of students were derived using the Proc Ratio procedure in SUDAAN. The analysis weighted cases using the TFNLWGT weighting variable.

[ix] "Other certification" includes (1) provisional or other types of certificates given to persons who are still participating in what the state calls an "alternative certification program, (2) temporary certificates, and (3) waivers or emergency certificates.

[x] Major in "other social science" includes majors in anthropology, area/ethnic studies, criminal justice, cultural studies, economics, geography, government/civics, international studies, law, Native American studies, political science, psychology, sociology, and other social sciences.