Education and Certification Qualifications of Departmentalized Public High School-Level Teachers of Core Subjects:
Evidence from the 2003–04 Schools and Staffing Survey

Statistical Analysis Report

NCES 2008-338
U.S. DEPARTMENT OF EDUCATION

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Institute of Education Sciences

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Statistical Analysis Report

AUGUST 2008

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Executive Summary

This report examines the postsecondary majors and teaching certifications of public high school-level teachers of departmentalized classes[1] in a selection of subject areas. This report uses data from the 2003–04 Schools and Staffing Survey (SASS), a sample survey of elementary and secondary schools in the United States. SASS collects data on American public, private, and Bureau of Indian Affairs (BIA)-funded elementary and secondary schools and their related components (teachers, principals, libraries, and districts, where applicable).

SASS provides information on a range of teacher qualifications in the United States. Prior research in the field of education has examined the correlation between teacher education (postsecondary major) and certification and student outcomes (Ferguson 1991, 1998; Goldhaber and Brewer 1997, 1999, 2000; Mayer, Mullens, and Moore 2000; Sanders, Wright, and Horn 1997). While this report does not link teacher qualifications to student outcomes, it does examine the qualifications of high school-level teachers of departmentalized classes in three ways.

First, the report examines the percentage of public high school-level teachers who held either an in-field postsecondary major, in-field certification, or both, in a selection of main assignment fields—the subject in which teachers reported teaching the most classes.[2] Second, the report looks at the percentages of high school-level classes taught and students taught by a teacher with one or both in-field qualifications. While the teacher-level analyses pair qualifications against the teacher's main assignment, the class- and student-level analyses consider all subjects taught by a teacher. Finally, the report examines the percentage of teachers in selected subfields of science and social science who held a major and/or certification in that specific subfield in relation to the percentage of teachers who held qualifications in any field within science and social science. In other words, the report provides some insight into whether teachers of the subfields hold in-field qualifications in the specific subfield (e.g., chemistry) or at least in another subject within the broad field (e.g., any science).

Teachers' qualifications were considered in relation to a selection of 11 broad subject areas including 6 subfields of science and social science (biology/life science, physical science, economics, geography, government/civics, and history) and 3 further subfields of physical science (chemistry, Earth sciences, and physics). Teachers of these subjects were considered in-field majors if they held a major that they had earned at the bachelor's

[1] High school-level teachers taught students in any of grades 10–12, or grade 9 and no grade lower. Teachers of departmentalized classrooms instruct several classes of different students all or most of the day in one or more subjects. Departmentalized teachers were included because they represent a majority of teachers at the high school level and allow for analyses that tie specific teachers to specific classes and students.

[2] Teacher main assignment was taken from question 17 of the SASS Teacher Questionnaire, which asks, "This school year, what is your MAIN teaching assignment field at this school? (Your main assignment is the field in which you teach the most classes.)."

degree level or higher in the subject(s) that they taught. To be fully certified, the analysis required teachers to hold a regular or probationary[3] secondary-level certification in the subject(s) taught. Additionally, teachers of art/arts or crafts, music, and dance/theater were considered certified if they held an ungraded certification.[4]

The selected teacher sample and analytical decisions were motivated by current federal education legislation, the No Child Left Behind Act (2001), and state teaching certification requirements. First, No Child Left Behind (NCLB) only pertains to schools in the public sector. Since the SASS sample of teachers in BIA-funded schools is too small to support stable estimates, this report only includes teachers in public schools (traditional and charter). Second, the subjects that were selected are defined as core academic subjects under NCLB. These include: English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography. Lastly, the broad field of social studies was added because not all states separately certify the aforementioned subfields (civics and government, economics, history, and geography). The subfields of science (biology/life science, physical science, and three further subfields of physical science—chemistry, Earth sciences, and physics) were added because, while the law does not break out the subfields, some states might require that teachers are separately certified in those subfields (U.S. Department of Education, Office of the Deputy Secretary 2004, p. 23). The subfields of science and social science were also added because teacher supply and demand literature has reported on subfields of both science and social science (U.S. Department of Education 1996; Murnane and Schwinden 1989). Both subjects cover broad fields of multiple disciplinary fields relative to certification subject areas, and both are recognized as having a number of subfields that are used to frame teacher demand and quality. Although NCLB guided the structure of the analyses, the authors caution that this report is not meant to report percentages of Highly Qualified Teachers, nor be a commentary on any part of the law in general.

The findings are reported at the teacher, class, and student levels in order to provide a complete picture of teacher qualifications. Estimates were produced from crosstabulations of the data. T-tests were performed to test for differences between estimates. All differences cited in the text of this report are statistically significant at the $p < .05$ level. No corrections were made for multiple comparisons. As a result, an increase in Type I error is possible. Type I error is the observation of a statistical difference when, in fact, there is none. Readers are cautioned not to make causal inferences about the data presented here.

[3] A probationary certification is issued after satisfying all certification requirements except the completion of a probationary period.

[4] This exception in the analysis was made after an examination of state requirements showed that, in a majority of states, teachers of the arts were considered fully certified if they held an ungraded certification in the arts. In the analysis, teachers of dance and theater classes were also allowed reciprocation in qualifications requirements (i.e., teachers were certified to teach dance classes if they held a theater certification and vice versa).

Some of the major findings from the teacher-, class-, and student-level analyses are presented below. These represent the overall patterns that were found in the data.

High School-Level Teacher Qualifications

- Among teachers with a main assignment of English or mathematics, 71 percent and 65 percent, respectively, held both a major and certification in their main assignment. The percentages of these teachers who held neither qualification were 6 percent in English and 11 percent in mathematics.

- Among teachers with a main assignment of science, 87 percent held a major in science, 80 percent held a certification in science, and 72 percent held both a major and certification in science. In comparison, 50 percent of teachers with a main assignment of chemistry held a major in chemistry, 62 percent held a certification in chemistry, and 33 percent held both qualifications in chemistry.

- Among teachers with a main assignment in social science, 84 percent held a major in social science, 82 percent held a certification in social science, and 71 percent held both qualifications. In comparison, among teachers with a main assignment in the social science subfield of history, 67 percent held a major in history, 37 percent held a certification in history, and 30 percent held both qualifications in history.

- Some of the highest reported rates of qualifications were seen among teachers with a main assignment of art or music. In art, 92 percent of teachers held a major in art, 84 percent held a certification in art, and 78 percent held both qualifications. In music, 97 percent held a major in music, 82 percent held a certification in music, and 81 percent held both qualifications.

- A higher percentage of teachers whose main assignments were English or mathematics, and who instructed at least half of their classes in their main assignment, held a major and certification in that main assignment than did their colleagues assigned to teach less than half of their classes in those main assignments. For example, 73 percent of teachers with a main assignment in English who taught all of their classes in English held both a major and certification in English. However, 34 percent of teachers with a main assignment in English who taught less than half of their classes in English held both qualifications. Similarly, 67 percent of teachers with a main assignment in mathematics who taught all of their classes in mathematics held both a major and certification in mathematics. However, 14 percent of teachers with a main assignment in mathematics who taught less than half of their classes in mathematics held both qualifications.

- A higher percentage of teachers with a main assignment of science and who taught all science classes held dual qualifications in science (73 percent) than their counterparts who did not teach all of their classes in science (teachers who were 50–99 percent in-field—62 percent, teachers who were 0–49 percent in field—52 percent).

- In social science, a higher percentage of teachers with a main assignment of social science and who taught all social science classes held dual qualifications in social science (73 percent) than did their counterparts who taught 50 to 99 percent of their classes in social science (60 percent).

Qualifications of Teachers of High School-Level Classes and the Students Enrolled

- At the 9th- through 12th-grade class level, 82 percent of high school-level social science classes were taught by a teacher with a major in social science; in comparison, 12 percent of high school-level economics classes were taught by a teacher with an economics major.

- Among students in 9th- through 12th-grade science classes, 85 percent were taught by a teacher with a major in science, 79 percent were taught by a teacher with a certification in science, and 70 percent were taught by a teacher with both qualifications.

- Percentages of classes taught and students taught, by teachers with either an in-field major, in-field certification, or both, were compared across comparable subject areas. Overall, no significant differences were found between the comparable percentages of classes and students taught by teachers with either an in-field major, in-field certification, or both.

Limitations

One limitation of the findings is that certification rates in the science and social science subfields might be artificially low because some states do not offer specific certifications in those subfields. Therefore, an analytical match between certification and subject taught could not be made at the subfield level. For this reason, estimates are provided at the broad-field level.

Another limitation of the study is that it is restricted to public high schools and teachers who teach in departmentalized classes. Hence, one should be careful not to generalize beyond this population.

The authors also caution against comparing the estimates in this report to previously published reports on the topic of teacher qualifications that used prior administrations of the Schools and Staffing Survey (SASS) data. This is because the way in which teachers were asked to report their main assignment and their certification(s) changed in the 2003-04 SASS Teacher Questionnaire.

Furthermore, teacher qualifications can be measured in many ways. This report offers one way of using SASS data to measure teacher qualification, but the authors acknowledge that it is not the only method for doing so.

Acknowledgments

Many people contributed to the production of *Teacher Education and Certification: Qualifications of Public High School-Level Teachers in 2003–04* and the authors would like to thank several in particular.

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Introduction

The Schools and Staffing Survey (SASS) is a sample survey of elementary and secondary schools in the United States. Sponsored by the National Center for Education Statistics (NCES), the statistical agency of the U.S. Department of Education, SASS has been conducted six times: in school years 1987–88, 1990–91, 1993–94, 1999–2000, 2003–04, and 2007–08. As of this writing, the 2007–08 data are not yet released, making the 2003–04 data the most recent available. SASS contains data on the characteristics and qualifications of teachers and principals, teacher hiring practices, professional development, and other conditions in schools across the nation. As a result, SASS is one of the best sources of data on teacher qualifications in the United States.

Findings from the 2003–04 SASS are presented on the prevalence of public high school-level teachers of departmentalized classes[1] with various qualifications—postsecondary education (major) and certification—in relation to their reported main assignment. A teacher's main assignment is the field in which he or she reports teaching the most classes.[2] The report also presents findings on the percentages of classes taught and students taught by teachers with various qualifications in the respective subjects. Collectively, these analyses provide a measure of public high school-level teacher qualifications. NCES has published several reports on this topic (U.S. Department of Education 2004; McGrath, Holt and Seastrom 2005; and Holt, McGrath, and Seastrom 2006), but due to changes in the SASS questionnaires, differences in the teacher populations that were analyzed, and the criteria for matching teacher qualifications to subjects taught, data in this report are not directly comparable to data in the previously published reports.

Analytical decisions were motivated by current federal education legislation. In this report, teachers' postsecondary education qualifications were measured by the correspondence between the major(s) they earned and the subject(s) they taught. The SASS Teacher Questionnaire asks whether each major was awarded within or outside a department, college, or school of education. Analyses presented in the body of the report considered all in-field majors regardless of where the major was earned. For all analyses, teachers' in-field majors must have been earned at the bachelor's degree level or higher.

Teacher certification status was determined by three criteria—the certification type, content area(s), and grade level(s). To meet these certification requirements, teachers must have held a regular or standard state certification, advanced professional certificate, or probationary certification,[3] recognized by the state in which they currently teach. The content area and grade level covered by teachers' regular or probationary certification

[1] Teachers of departmentalized classrooms instruct several classes of different students all or most of the day in one or more subjects.
[2] Teacher main assignment was taken from question 17 of the SASS Teacher Questionnaire which asks, "This school year, what is your MAIN teaching assignment field at this school? (Your main assignment is the field in which you teach the most classes.)."
[3] A probationary certification is issued after satisfying all certification requirements except the completion of a probationary period.

must also have been at the secondary level and in the subject they taught. Additionally, teachers of art/arts or crafts, music, and dance/theater were considered certified if they held an ungraded certification in the respective subject area.

This report examines teacher qualifications in a selection of 20 subjects,[4] including subfields within science and social science.[5] In order to report on the match between teachers' assignments and college major or certification subject, a determination had to be made as to which typology of subject-matter specialties to use. In this analysis, the subject matter specialty categories are based on the core subjects in NCLB and state teaching certification requirements (see *Measures Used in This Report* section for further discussion). Within the tables of this report, there are two measures of the subject fields that teachers instruct: *main assignment* and *all course subject areas taught*. Each teacher had one main assignment, the field in which they reported teaching the most classes (tables 1, 2, and 3). Some teachers also instructed classes outside their main assignment. Tables 4 and 5 include all course subject areas taught—both the teacher's main assignment and any subjects taught outside their main assignment (and within the selection of 20 broad fields and subfields). For a detailed description of the subjects and their corresponding major and certification requirements, please see Appendix D: Description of Variables Used in the Report.

The selected teacher sample and analytical decisions were motivated by current federal education legislation, the No Child Left Behind Act (2001). First, No Child Left Behind (NCLB) only pertains to schools in the public sector. Since the SASS sample of teachers in BIA-funded schools is too small to support stable estimates, this report only includes teachers in public schools (traditional and charter). Second, the subjects that were selected are defined as core academic subjects under NCLB. These include: English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography. Lastly, the broad field of social studies was added because not all states separately certify the aforementioned subfields (civics and government, economics, history, and geography). The subfields of science (biology/life science, physical science, and three further subfields of physical science—chemistry, Earth sciences, and physics) were added because, while the law does not break out the subfields, some states might require teachers to be separately certified in those subfields (U.S. Department of Education, Office of the Deputy Secretary 2004, p. 23). Although NCLB guided the structure of the analyses, the authors caution that this report is not meant to report percentages of Highly Qualified Teachers, nor be a commentary on any part of the law in general.

The findings of the report open with a discussion of teachers' *main assignments* and the frequency with which they taught in their main assignment (table 1). Next, the findings

[4] The population of teachers analyzed in this report includes departmentalized public teachers of high-school level students in core subjects. Overall, this population represents 63 percent of the total public high school-level teacher population.

[5] Under science and social science, several subfields are examined in detail. These subfields are not inclusive of all subfields in the science and social science and therefore, do not add to the broad field totals.

examine the percentage of high school-level departmentalized teachers in public schools with varying combinations of majors and certifications in relation to their main assignment. Table 2 provides a detailed report of the percentage of teachers who hold an in-field major, in-field certification, or both, within a selection of main assignments. Table 3 combines components from tables 1 and 2 by examining three combinations of qualifications (both an in-field major and in-field certification, only an in-field major or only an in-field certification, and neither qualification) by the percentage of classes taught within teachers' main assignments.

Finally, the report considers teacher qualifications in *all course subject areas taught* (within a selection of 20 broad fields and subfields). This is achieved by examining the percentage of 9th- through 12th-grade classes (table 4) and students (table 5) taught by departmentalized teachers with varying combinations of majors and certifications in relation to all course subject areas taught. Since teachers may instruct subjects outside of their main assignment field, the class- and student-level analyses shed light on the qualifications of teachers in relation to these "other" assignments. Reporting findings at three levels of measurement—teacher, class, and student—is also important for exploring the prevalence of teachers' qualifications while considering variation in the number of classes they teach and the number of students in those classes.

At all three levels, a closer examination is made of teachers, classes, and students in the subfields of science and social science. Specifically, are teachers of the subfields likely to hold in-field qualifications in the specific subfield (e.g., chemistry) or at least in another subject within the broader field (e.g., any science)? In sum, the report addresses three main areas:

- the percentage of high school-level teachers who held either an in-field postsecondary major, in-field certification, or both, in a selection of main assignment fields—the subject in which they reported teaching the most classes;

- the percentage of high school-level classes and students that were taught by a teacher with one or both in-field qualifications—in a selection of course subject areas that include both main assignment and other assignments (where applicable); and

- the percentage of teachers in selected subfields of science and social science who held a major and/or certification in that specific subfield in relation to the percentage of teachers who held qualifications in any field within science and social science.

Estimates were produced from crosstabulations of the data. T-tests were performed to test for differences between estimates. All differences cited in the text of this report are statistically significant at the $p < .05$ level. No corrections were made for multiple comparisons. As a result, an increase in Type I error is possible. Type I error is the observation of a statistical difference when, in fact, there is none. Readers are cautioned not to make causal inferences about the data presented here.

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Background

Much of the research on teacher qualifications has examined teachers' majors and certifications. This research has largely focused on the relationship between these two measures and the subjects and grade levels teachers instruct (Goldhaber and Brewer 2000; U.S. Department of Education 2004; McGrath, Holt, and Seastrom 2005; Holt, McGrath, and Seastrom 2006). Further, this research often links this match between teacher qualifications and teaching assignments to student-level outcomes (Goldhaber and Brewer 1997, 1999, 2000). For example, prior research has generally linked improved student performance with teachers who have a formal postsecondary degree or certification in the field of their assigned subject (Ferguson 1991; Goldhaber and Brewer 1997, 1999, 2000; Mayer, Mullens, and Moore 2000; Wenglinksy 2002). However, results vary by subject (e.g., more evidence of a correlation in mathematics and science than in other subjects) and in strength (e.g., generally positive, but not always statistically significant). Other research that has confirmed findings on the importance of teachers—e.g., their training, experience, and qualifications—on student outcomes includes Darling-Hammond (1999); Goldhaber and Brewer (1999, 2000); Mayer, Mullens, and Moore (2000); Rivkin, Hanushek, and Kain (2005); and Sanders, Wright, and Horn (1997). The Schools and Staffing Survey does not provide data on individual student outcomes and, therefore, this report does not examine teacher qualifications in relation to their students' levels of achievement. However, this background section provides support for this report's choice of particular measures of teacher qualifications, because they have been found in other studies to be associated with student achievement.

Postsecondary Majors

The research on teachers' majors has largely examined the relationship between majors and student test scores (Goldhaber and Brewer 1997, 1999, 2000). Goldhaber and Brewer (1997) found a significant positive relationship between teacher education (i.e., holding a postsecondary major or advanced degree in the subject) and students' 10^{th}-grade achievement in mathematics and science. Goldhaber and Brewer (1999, 2000) also examined National Education Longitudinal Study of 1988 (NELS) data and found that students whose teachers held a mathematics major had higher 12^{th}-grade test scores in mathematics. Specifically, students whose teachers held both bachelor's and master's degrees in mathematics showed an increase in mathematics scores of "more than a third of a year of schooling" compared to students whose teachers did not hold the same credentials (Goldhaber and Brewer 1999, p. 94).

Although their findings in mathematics were consistent, Goldhaber and Brewer (1997, 1999, and 2000) did not find a consistent, positive relationship between a teacher's major and students' 10^{th}- and 12^{th}-grade test scores in science. Their 1997 study of 10^{th}-grade test scores showed a positive relationship between teachers with a bachelor's degree in science and their students' test scores (relative to teachers without a degree or a degree in another subject). However, their studies of 12^{th}-grade test scores showed no relationship between teachers who held a science major, or had taken postsecondary classes in

science, and the 12th-grade achievement of those teachers' students (Goldhaber and Brewer 1999, 2000).

Research by Goldhaber and Brewer (1997) showed that having a teacher with an in-subject major was not related to student achievement in English and history. Though they admit there are limitations to the data and research available, they conclude that there appears to be some value, measured in student achievement, when teachers of the "technical subject" (mathematics and science) hold subject-specific degrees (Goldhaber and Brewer 1997, p. 208).

Certification

Literature supporting teacher certification requirements contends that teaching is a profession requiring specialized skills and that certification ensures at least minimal standards in teacher quality (Goldhaber and Brewer 2000). However, there is another side to the debate, one that believes certification is a barrier to entering the profession. This side also notes that the research on the positive benefits of teacher certification on educational outcomes is limited (Walsh 2001).

Given this debate, it is not surprising that much of the teacher qualifications research focuses on the correlation that certification has with student achievement outcomes. When examining the teacher certification literature, the focus of the research is generally on whether the teacher holds a certification and, if so, the certification type and content areas it covers. While many teachers hold regular certifications, some hold other certifications, such as emergency, provisional, temporary, or probationary certifications. The latter certification types are usually awarded to novice teachers, teachers who are still completing requirements for a full certification, or teachers who were given emergency credentials to teach. Teachers are also certified in various content areas such as mathematics, science, special education, and many others.

Certification Type and Content Area

The body of research on teacher certification that examines the correlation between the teacher's certification and student outcomes typically focuses on the correlation between the certification *type* (e.g., regular, probationary, emergency) and *content area* (e.g., the subject areas covered). Using the 12th-grade wave of NELS, Goldhaber and Brewer (1999, 2000) found that students whose teachers held a standard, probationary, or emergency certification in mathematics scored significantly higher on a 12th-grade mathematics achievement test than did students who were taught by a teacher with no certification or a certification in another subject. Students who were taught by a teacher with a mathematics certification recorded a two-point increase on the NELS mathematics test; about three-quarters of a year of schooling. This was about twice the size of the association that Goldhaber and Brewer (1999, 2000) found among students whose teachers had a mathematics major. Goldhaber and Brewer (1999, 2000) found similarly positive, but small and statistically nonsignificant findings in science.

Measuring Postsecondary Education (Major) and Certification in Combination

Two recent NCES publications used the 1999-2000 Schools and Staffing Survey (SASS) data to examine the major and certification qualifications of secondary-level teachers in two subfields: biology and history.[1] McGrath, Holt, and Seastrom (2005) found that about 39 percent of biology students were taught by teachers without a postsecondary major or minor in biology. Among these students, about 49 percent were taught by a teacher with a major in another natural science. Regarding certification, about 25 percent of biology students were taught by a teacher without a certification in biology; however, about 37 percent of these students were taught by a teacher with a certification in another natural science.

Results from similar analyses of secondary-level history teachers showed that about 55 percent of history students were taught by a teacher without a major or minor in history; however, 73 percent of these students were taught by a teacher with a major or minor in another field of social science (Holt, McGrath, and Seastrom 2006). Certification rates were higher, with 86 percent of students taught by a teacher with a certification in a field of social science (including history). Only about 40 percent of students were taught by a teacher with dual qualifications—a major or minor in history and a certification in a field of social science. However, including all social science majors and minors, about 80 percent of students were taught by a teacher who held a major or minor and certification in some field of social science.

[1] These reports also address school characteristics related to teacher qualifications; specifically, how teacher qualifications vary by the level of school poverty. The tables in the body of this report do not examine teacher- or school-level characteristics that may relate to teacher qualifications. See Ingersoll (1999), McGrath, Holt, and Seastrom (2005), and Holt, McGrath, and Seastrom (2006) for more information.

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Data and Measures

The data for this report come from the 2003–04 Schools and Staffing Survey (SASS) Restricted-Use Public School Teacher Data File, a data file generated from teacher responses to the SASS Teacher Questionnaire (Form SASS-4A).

Levels of Analysis and Report Subpopulation

Levels of Analysis

This report employs findings at three levels of analysis to provide a more complete picture of teacher qualifications. Findings are presented at the teacher, class, and student levels. The teacher level is important as it relates to current federal education legislation. The additional benefit of the three levels is the ability to see not only teacher qualifications, but to account for the variation in the number of classes and students each teacher instructs. In other words, if all teachers taught an identical number of students and an identical number of classes, the teacher-level measure, class-level measure, and student-level measure would be identical across the levels.

The following scenario provides an example of the relationship between the 3 levels: a teacher teaches 4 mathematics classes and 1 English class, has a major and certification in mathematics, and reports mathematics as her main assignment. At the teacher level, this teacher would be considered "qualified" in her main assignment. At the class level, the teacher would be "qualified" in her mathematics classes, but "unqualified" in her English class. This would result in a class-level measure of 80 percent of her classes being taught by a "qualified" teacher. If all 5 of these classes had identical numbers of students, the student-level measure would be the same (e.g., if the enrollment of the 4 mathematics classes totaled to 80 students and the English class had 20 students, the student-level measure would also be 80 percent). However, if a total of 60 students were enrolled in the 4 mathematics classes and the 1 English class had 40 students, the student-level measure would indicate 60 percent of this teacher's students were taught by a "qualified" teacher.

Teachers' majors and certifications are examined with respect to their main assignment—the one subject in which they reported teaching the most classes (tables 1–3). However, even if all teachers were to hold qualifications in their main assignment, it is hypothesized that some teachers instruct additional classes outside their main assignment. It is further hypothesized that a lower percentage of teachers may hold in-field qualifications in these other subjects. The class-level table (table 4) takes into account teachers' qualifications with respect to all of the subjects they teach—both main assignment and other assignments (within the selection of the 20 broad fields and

subfields examined in the report).[1] The extent to which teachers lack qualifications in all of their assignments can be seen if the percentage of *classes* taught by teachers with in-field qualifications is significantly higher or lower than the percentage of *teachers* within main assignment who hold in-field qualifications. The class-level measure also accounts for variation in the number of classes that teachers teach. If teachers with in-field qualifications are assigned to teach more classes in a particular subject than are teachers who lack qualifications, the proportion of classes taught by "qualified" teachers should be higher than if teachers taught an equal number of classes.

Like the class-level analyses, the student-level analyses (table 5) take into account all of the subjects taught by a teacher—both main and other assignments. Additionally, the student-level analyses compensate for differences in both the number of classes taught by a teacher and the student enrollments in those classes. As with the variation in classes taught, differences in student enrollments can affect the findings on teacher qualifications. For example, if teachers instruct an equal number of classes, but a higher percentage of teachers who lack in-field qualifications are assigned classes with higher student enrollments, the proportion of students taught by teachers with in-field qualifications would be lower than if those classes had equal enrollments.

Report Subpopulation

Teacher level. Since the No Child Left Behind Act (2001) pertains to public education, the teacher-level analyses in this report include public school teachers of high school-level students in departmentalized classes. Public school teachers include those in both traditional public schools and public charter schools. Teachers in BIA-funded schools were not included because the sample size is too small to support stable estimates, High school-level teachers were defined using items from question 11 in the Teacher Questionnaire: "In which grades are the STUDENTS you currently teach at THIS school?" Teachers were included if they instructed students in any of grades 10 through 12, or grade 9 and no grade lower. Finally, departmentalized teachers were included because they represent a majority of teachers at the high school level and allow for analyses that tie specific teachers to specific classes and students.[2] Teachers of departmentalized classrooms instruct several classes of different students all or most of the day in one or more subjects. At the high school level, there were 964,000 public school teachers. Of these teachers, 87 percent (837,000) taught in departmentalized classrooms. Of the public high school-level teachers of departmentalized classrooms, 72 percent (606,000) taught one of the 20 broad fields or subfields examined in the report. Overall, this represents 63 percent of all of the public high school-level teachers.[3]

[1] Teachers who instruct classes in more than one subject appear in multiple rows (subjects) of the class- and student-level tables. In each subject, their major(s) and certification(s) are tested for correspondence.
[2] Team teachers, elementary enrichment teachers, pull-out teachers, and teachers of self-contained classrooms were not included in the report because they either 1) appeared in very low numbers at the high school level or 2) a substantive match between their classes and their qualifications was difficult.
[3]The stated percentages are based on calculations of unrounded counts of teachers.

The findings presented in tables 1, 2, and 3 provide context on the frequency with which teachers instruct classes in their reported main assignment and the qualifications of these teachers in relation to that main assignment.

Class and student levels. In question 19 of the Teacher Questionnaire, teachers of departmentalized classes were asked to report the subject area, number of students, and grade level of the classes they teach (up to 10 classes could be reported).[4] These items were used to define the class- and student-level measures in this report.

At the class level (table 4), this report examines the percentage of high school-level classes (grades 9–12) taught by public school teachers of departmentalized classes who held various combinations of majors and certifications. The class-level analysis accounts for the variation in the number of classes taught. The class-level measure takes into account all subjects taught by the teacher, not just classes within the teacher's reported main assignment.

The student-level measure (table 5) examines the percentage of students in high school-level classes taught by public school teachers of departmentalized classes who held various combinations of majors and certifications. Like the class-level measure, all subjects are taken into account, not just those in the teacher's main assignment.

Therefore, it is important to recognize that the teachers included in the teacher-level tables differ in several ways from the teachers included in the class- and student-level tables. First, in the teacher-level tables the unit of analysis is the teacher's main assignment area. However, for the class- and student-level tables, the unit of analysis is the classes taught and students taught by the teacher. The subpopulation also differs due to slight differences in the grade levels considered at each level. For example, a teacher of eighth- and ninth-graders is not included in the teacher-level tables because teachers of ninth-grade students are only included when they teach no lower grades. However, if they report an individual class taught at the ninth-grade level, that class, and the students enrolled, are included in the class- and student-level tables.

The authors caution readers to remember these differences when examining the results of analyses in the teacher-, class-, and student-level tables. While each level is provided so that a more complete picture of teacher qualifications can be examined, readers should take caution in making direct comparisons between tables.

[4] Less than .1 percent of the teachers in this report taught more than 10 classes. However, teachers were only given space on the questionnaire to report the subject area of up to 10 classes. Since the subject area was used to match teacher qualifications, it is not possible to say whether these teachers have in-field qualifications for classes beyond the 10 that were reported. Given the small fraction of teachers who reported more than 10 classes, examining only the first 10 classes reported should not introduce bias into the findings.

Measures Used in This Report

Subjects Taught

Teacher qualifications were considered as they related to one of two measures of the subjects teachers instruct: *main assignment* and *course subject area taught*. Each teacher had one main assignment, the field in which he or she reported teaching the most classes (tables 1–3). Main assignment was taken from question 17 of the Teacher Questionnaire, which asks, "This school year, what is your MAIN teaching assignment field at this school? (Your main assignment is the field in which you teach the most classes.)."

Course subject area taught included all of the subjects taught by a teacher (both main and other assignments) (tables 4 and 5). Some teachers only instructed classes within their main assignment, while others may also have instructed one or more classes outside that assignment. In question 19 of the Teacher Questionnaire, teachers reported up to 10 of the courses they taught. This question served as the basis for tables 4 and 5.

A selection of 20 main assignment fields and course subject areas were examined, including some subfields within subjects: English, mathematics, science (including the subfields of biology/life sciences and physical science—including chemistry, Earth sciences, and physics), social science (including the subfields of economics, geography, government/civics, and history), French, German, Latin, Spanish, art/arts or crafts, music, and dance/theater. These 20 broad fields and subfields represent academic subjects for which clear matches could be made between teacher assignment and qualifications. These also include fields in which there are a sufficient number of sampled teachers to support accurate estimates.[5]

In order to report on the match between teachers' assignments (either main assignment or by other subject matter courses) and college major or certification subject, a determination had to be made as to which typology of subject-matter specialties to use in classifying the teachers' assignment fields. Studies that have examined the match between teachers' college major, their area of subject matter certification, and the teaching assignment field often report on subfields of both science and social science (U.S. Department of Education 1996; Murnane and Schwinden 1989), as both cover broad fields of multiple disciplinary fields relative to certification subject areas, and both are recognized as having a number of teaching fields that are used to frame teacher demand and quality. It is generally the certification field that drives the subject-matter fields being reported. English and mathematics, though, are not typically reported with

[5] Teachers of elementary education, special education, English as a Second Language, health education, physical education, vocational and technical education, driver's education, library/information science, military science (ROTC), philosophy, religious studies (theology and divinity), and "other" or "other foreign language" were not examined in this report due to analytical constraints. For more information, see "Specific Report Subpopulation" in Appendix B: Methodology and Technical Notes.

any subfields, probably due to a lack of comparability of possible subfields for certification purposes.

NCLB also informed the analytic decisions to include certain subjects in the report. First, the core subjects of NCLB were included; English, mathematics, science, social science, economics, geography, government/civics, history, foreign language, and arts. The law allows states to decide on the specific fields under arts and foreign language. In this report, the subjects of art/arts or crafts, music, dance/theatre, French, German, Latin, and Spanish are commonly defined by states as specific fields of "arts" and "foreign language." States also require teachers to pass a Praxis II test in these art and foreign language subjects in order to qualify for a state education license in these specific subjects.[6] In addition to being one of the core subjects of NCLB, it was important to include the broad field of social science because not all states separately certify the aforementioned social science subfields. The subfields of science (biology/life science, physical science, and three further subfields of physical science—chemistry, Earth sciences, and physics) were added because, while the law does not break out the subfields, many states require teachers to be separately certified in those subfields (Office of the Deputy Secretary 2004, p. 23). Other researchers have also subdivided science and social science because they are broad multidisciplinary fields (e.g., U.S. Department of Education 1996; Murnane and Schwinden 1989). Finally, the NCLB list of the core subjects does not include subfields for English or mathematics and states do not typically require teachers to be certified in any subfields of English or mathematics. In the Praxis II test, there is typically only one general mathematics test and one English/language arts test that teachers have to pass in order to obtain state certification.

Teacher Qualifications

This report addresses two primary measures of teacher qualifications—*teacher education* and *teacher certification*—as they relate to the main assignment and course subject area(s) taught. In general, the subjects and corresponding "in-field" qualifications included in this report are closely aligned with the prior publication, *Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-Field Teaching, 1987–88 to 1999–2000* (NCES 2002-603 revised). However, due to differences in the analyses, readers are strongly cautioned against making comparisons of estimates in this report and the previously published report. See appendix D and exhibit D-1 for information on how the matches between subjects taught and teacher qualifications were determined.

Teacher education. A teacher's level of education was measured using the educational background items in the Teacher Questionnaire. Teachers of all academic backgrounds are included in the analyses, but categorization within the tables is determined using two components of teachers' academic majors: the major field of study and level at which the postsecondary major was earned. Teachers satisfied the analytical requirements if they

[6] The Praxis test information was retrieved July 22, 2008, from http://www.ets.org/portal/site/ets/menuitem.fab2360b1645a1de9b3a0779f1751509.

held an in-field majors regardless of whether it was earned within or outside a college, department, or school of education. Academic minors are not included in the analysis. Teachers were considered to have a major in the subject area(s) they taught if they held a bachelor's degree or higher with a major corresponding to the subject(s) they taught (main assignment or course subject area taught). Degrees that were considered to be at the bachelor's degree level or higher included a first or second bachelor's degree, a first or second master's degree, an educational specialist or professional diploma, a Certificate of Advanced Graduate Studies, or a doctorate or first professional degree. Teachers who did not hold a major in the subject(s) they taught included those with majors in another subject and those whose highest degree is a vocational certificate or associate's degree. By this definition, teachers who reported a main assignment in English did not hold a major in the main assignment if they (1) received a degree with a major in any field other than English, (2) held a vocational certificate or an associate's degree with a major in English or any other subject, or (3) held no degree.

In order for teachers to have an in-field major, their major must have also matched the subject(s) they teach (main assignment or course subject area taught). However, teachers may instruct many different subjects and may earn postsecondary majors in a variety of fields; therefore, matches were made between the subject(s) taught and the major(s) held. In some subjects, the match was a strict one (e.g., to be considered as having in-field majors, a chemistry teacher must hold a major in chemistry and a French teacher must hold a major in French). In other subjects, teachers were considered in-field if they held one of several majors. For example, a mathematics teacher was considered a mathematics major if he or she reported any of the following majors: mathematics, computer science, engineering, or physics. See appendix D and exhibit D-1 for information on how the matches between subjects taught and teacher qualifications were determined.

It is especially important to keep these matching criteria in mind (exhibit D-1) when examining the qualifications of teachers within the science and social science subfields and making comparisons to the broad fields under which they fall. Teachers who appear in the science or social science rows are *not* mutually exclusive from teachers who appear in the subfield rows within those subjects; however, the analysis allowed more lenient requirements in the broad field. In table 2, for example, a teacher with a main assignment of history appears in the social science row. At this level, he is considered to hold an in-field major if he earned a major in any of anthropology, area/ethnic studies, criminal justice, cultural studies, economics, geography, government/civics, history, international studies, law, Native American studies, political science, psychology, sociology, or other social sciences. However, this same teacher also appears in the history row, where he must have earned a major in history to be counted as in-field.

The reported science and social science subfields represent only a selection of the subjects within the broad field.[7] For example, the social sciences subfields of social

[7] Some subfields of science and social science are excluded from the analyses because a substantive match between subject matter, major field of study, and certification area is not possible. This is because

studies (general), anthropology, Native American studies, psychology, and sociology are *not* reported as subfields, but *are* included in the broad field category of "social science." Since all subfields are not reported, the subfield levels do not sum to the totals reported at the broad field level. For example, a teacher with a main assignment of sociology appears in the social science row and was in-field with any of the same social science majors (anthropology, area/ethnic studies, criminal justice, cultural studies, economics, geography, government/civics, history, international studies, law, Native American studies, political science, psychology, sociology, or other social sciences). However, unlike her counterpart in the history example, above, sociology is not examined in detail and, therefore, she is not reported in any of the social science subfields.

Teacher certification. Teacher certification was measured using three criteria: the type of certification as well as the content area(s) and the grade level(s) of students to which it applied. Both the teacher's first and, if applicable, second certification were taken into consideration.[8] To be considered certified, teachers must have reported a regular or standard state certification or advanced professional certificate, or a probationary certification. A probationary certification is issued after satisfying all certification requirements except the completion of a probationary period. The certification must also have been granted or recognized by the state in which they currently teach. Teachers who reported a provisional certificate, temporary certificate, waiver or emergency certificate, or no certification in the state in which they teach were not considered certified. Second, in order for the certification to count as an exact match, its content area must have matched the subject taught according to the table of allowable codes (exhibit D-1). As with a major, some certification matches were more strict than others. Finally, in most subjects, the certification must have applied to the secondary grades. This analytical requirement was set because of the report's focus on high school-level teachers. Additionally, teachers of art/arts or crafts, music, and dance/theater were considered certified if they held an ungraded certification.[9] One limitation is that some states do not grant secondary-level certifications in all of the subfields examined in this report. Therefore, an analytical match between certification and subject taught cannot be made at the subfield level. As a result, the percentage of in-field certifications in the subfield subject might be underestimated. For this reason, it is importation to take both the broad-field and subfield level findings into account.

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comparable codes are not available in each of the three areas. For example, while integrated science is a subject assignment, it is not available as a major or certification. Also, teachers of many of the subfields represent too small of a population to achieve stable estimates of teacher qualifications.

[8] Since SASS collects information on two certifications, it is not known how many teachers have three or more certifications or the additional fields in which they may be certified. About 8 percent of teachers in this report held a second certification. Given this finding, it can be surmised that few teachers hold three or more certifications. The findings of the report should be minimally impacted and, if anything, very slightly underestimate the rates of teachers with in-field certifications.

[9] This exception in the analysis was made after an examination of state requirements showed that teachers of the arts were considered fully certified if they had an ungraded certification in the arts. In the analysis, teachers of dance and theater classes were also allowed reciprocation in qualifications requirements (i.e., teachers were certified to teach dance classes if they held a theater certification and vice versa).

Teachers' majors and certifications were considered in several combinations. Taken collectively, the following combinations of qualifications were examined in relation to the subjects that teachers taught (both main assignment and course subject area taught). In all cases, the numerator is the number of teachers meeting the specified criteria (in-field major and/or in-field certification) divided by all teachers of that subject. Results in tables 2, 4, and 5 are presented as follows:

- the percentage of teachers with a major in the subject area taught:
    - the percentage of teachers with a major in the subject area taught and a certification in the subject area taught;
    - the percentage of teachers with a major in the subject area taught, but no certification in the subject area taught;
- the percentage of teachers without a major in the subject area taught:
    - the percentage of teachers without a major in the subject area taught, but with a certification in the subject area taught;
    - the percentage of teachers without a major in the subject area taught and without a certification in the subject area taught; and
- the percentage of teachers with a certification in the subject area taught.

Findings

Presented below are findings from teacher qualifications analyses using the 2003–04 Schools and Staffing Survey (SASS) Restricted-Use Public School Teacher Data File. Henceforth, when referring to teacher-level findings (tables 1, 2, and 3), the term "teacher" is used in reference to *traditional public and public charter school teachers of departmentalized classes who instruct students in any of grades 10–12, or grade 9 and no grade lower.* When referencing class- and student-level findings (tables 4 and 5, respectively), "teacher" refers to *traditional public and public charter school teachers of departmentalized classes taught at the 9th- through 12th-grade levels.*

At all levels, the term "major" refers to any major that is *in-field and earned at the bachelor's degree level or higher*. The term "certification" refers to a *regular or standard state certification or advanced professional certificate, or a probationary certification that is in-field and applies to secondary-level grades.* For the subjects of art/arts or crafts, music, and dance/theater, an ungraded certification was also accepted.

Estimates were produced from crosstabulations of the data. T-tests were performed to test for differences between estimates. All differences cited in the text of this report are statistically significant at the $p < .05$ level. No corrections were made for multiple comparisons. As a result, an increase in Type I error is possible. Type I error is the observation of a statistical difference when, in fact, there is none. Readers are cautioned not to make causal inferences about the data presented here.

Teacher-Level Findings: Main Assignments

In SASS, teachers were asked to report their main teaching assignment, the field in which they reported teaching the most classes. In tables 1 through 3, teachers are examined in relation to their main assignment. Specifically, table 1 examines the number of teachers in selected main assignments and the percentage of classes they taught within their main assignment field. Table 2 reports the percentage of teachers who held various combinations of qualifications (major and certification) with respect to their main assignment field. Table 3 combines elements from both tables 1 and 2, examining the qualifications of teachers in four selected main assignments by the proportion of classes they taught in their main assignment area.

Percentage of Classes Taught in Main Assignment

The results from table 1 show that many teachers only instructed classes within their main assignment. The four most frequently reported main assignments were English, mathematics, science, and social science. The majority of teachers with these main assignments instructed all of their classes within their respective main assignment. For example, of the approximately 134,900 teachers with an English main assignment, 84 percent taught all of their classes in English and an additional 15 percent taught 50 to 99.9 percent of their classes in English. The majority of teachers with main assignments

in mathematics (86 percent), science (or one of it subcategories)[10] (88 percent), and social science (or one of it subcategories)[11] (82 percent) taught all of their classes within their respective main assignment. With the exception of Latin, the majority of teachers with main assignments in the foreign languages and the arts also taught all of their classes in their respective field: 70 percent of French and German teachers, 84 percent of Spanish teachers, 86 percent of art/arts or crafts teachers, 87 percent of music teachers, and 60 percent of dance/theater teachers reported that all of their classes were taught in-field. The SASS Teacher Questionnaire defines main assignment as the subject in which the teacher instructs the most classes and asks teachers to report their main assignment with that definition in mind. By definition, these findings are expected.

Table 1. Number of public high school-level teachers who reported a particular main assignment and the percentage of teachers who taught various proportions of classes within that main assignment, by selected main assignments: 2003-04

		Among teachers of a particular main assignment, the percentage who teach		
Selected main assignment	Number of teachers	0 to 49.9 percent of their classes in their main assignment	50 to 99.9 percent of their classes in their main assignment	100 percent of their classes in their main assignment
English	134,900	1.9	14.6	83.6
Mathematics	128,500	2.0	11.6	86.4
Science	106,100	1.5	10.8	87.7
Biology/life sciences	42,600	9.3	31.7	59.0
Physical science	57,400	3.5	28.0	68.5
Chemistry	21,700	10.9	43.3	45.9
Earth sciences	10,900	5.6	44.0	50.4
Physics	9,200	15.5	47.8	36.7
Social science	111,600	1.9	15.9	82.2
Economics	5,200	23.2	40.5	36.4
Geography	8,400	10.0	51.4	38.5
Government/civics	14,700	17.1	54.3	28.7
History	57,200	7.3	40.7	52.0
French	9,800	5.6	24.6	69.8
German	3,400	1.6 !	28.3	70.1
Latin	2,000	6.3 !	30.4	63.3
Spanish	37,000	1.9 !	14.3	83.8
Art/Arts or crafts	29,700	2.1	11.6	86.3
Music	36,300	0.6	12.0	87.4
Dance/theater	6,800	6.0 !	33.7	60.3

! Interpret data with caution. The standard error for this estimate is equal to 50 percent or more of the estimate's value.
NOTE: Teachers include traditional public and public charter teachers who taught departmentalized classes to students in any of grades 10-12, or grade 9 and no grade lower. The denominator used (all classes taught) is the sum of all subjects reported by the teacher, not the sum of classes taught within the selected 20 subjects. Each broad main assignment includes several subfields. Under science and social science, several subfields are examined in detail. These subfields are not inclusive of all subfields in the subject and, therefore, do not add to the broad field total. See appendixes for technical notes and definitions of specific subjects within main assignment fields. Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Teacher Data File," 2003-04.

Compared to the subfields within science and social science, the rates of in-field teaching appear higher at the broad field level for science and social science because teachers were credited as being in-field if they reported a main assignment of any science or social

[10] The broad field of science includes teachers with a main assignment of science (general), biology/life sciences, chemistry, Earth sciences, integrated science, physical science, and physics.
[11] The broad field of social science includes teachers with a main assignment of social studies (general), anthropology, economics, geography, government/civics, history, Native American studies, psychology, and sociology.

science subfields *and* instructed courses within any of those same respective subfields.[12] For example, a teacher with a main assignment of history was teaching in-field in both her history and geography course. At the subfield level, the analysis only considered her history course to be in-field.

Among teachers with a main assignment in chemistry, 46 percent taught only chemistry classes, another 43 percent taught 50 to 99 percent of their classes in chemistry, and the remaining 11 percent taught less than 50 percent of their classes in chemistry. Also, among the approximately 57,200 teachers with a main assignment of history, about half (52 percent) taught only history classes, 41 percent taught 50 to 99 percent of their classes in history, and 7 percent taught less than 50 percent of their classes in history.

For an example of this subfield versus broad field relationship, consider a hypothetical teacher with a main assignment of biology/life sciences who taught two biology/life sciences classes, two science (general) classes, and one geometry class. With these classes, she would appear in both the "science" row and the "biology/life sciences" row of table 1. In "science" she would fall under the 50–99.9 percent column, because four of her five classes fall under the broader umbrella of science. However, for "biology/life sciences" she would appear in the 0–49.9 percent column, because only two of her five classes are specifically in biology/life sciences. In other words, she appears in both the general and specific subject rows, but her classes appear better matched to her main assignment in the general row due to more relaxed matching requirements.

Teacher Qualifications by Main Assignment

At the teacher level, the results from table 2 generally show that the majority of teachers held a major, certification, or both in their main assignment field.

Major in main assignment. More than three-quarters of teachers with a main assignment in English (84 percent), science (87 percent), social science (84 percent), French (90 percent), and German (91 percent) held a major in the respective field. With the exception of dance/theater teachers, teachers of the arts had some of the highest percentages of in-field majors; 92 percent of teachers with a main assignment in art/arts or crafts and 97 percent of teachers with a main assignment in music held majors in their respective field. In comparison, a lower percentage of teachers with a main assignment of dance/theater (63 percent) held a major in the respective main assignment.

Compared to the broad field level, a lower percentage of teachers with main assignments in the science and social science subfields held a major in those specific subfields. Again, this is due in part to the analytical conditions where any science or social science major was considered to be in-field, respectively, for any science or social science assignment.

[12] Within science, only five subfields are explored in detail: biology/life sciences and physical science, which includes chemistry, Earth sciences, and physics. Within social science, only four subfields are explored in detail: economics, geography, government/civics, and history.

With the exception of biology/life sciences, in which 81 percent of teachers had an in-field major, fewer than two-thirds of teachers with a main assignment in physical science (54 percent) and two of its subfields—chemistry (50 percent) and Earth sciences (40 percent)—held an in-field major. About two-thirds of teachers with a main assignment of physics (57 percent) held a major in that subfield. In the social science subfields, https://webmail.air.org/exchange/BMorton/Inbox/RE: OOF findings Table 2.EML/ -_ftn1#_ftn1 22 percent of teachers with a main assignment of economics and 10 percent of teachers within the geography and government/civics main assignments held an in-field major. Finally, 67 percent of teachers with a main assignment in history held majors in their respective fields.

Certification in main assignment. The data in the last column of table 2 also show that the percentages of teachers who were certified to teach in their main assignment field were close to the percentages of teachers with a major in their main assignment field. Among teachers with a main assignment in mathematics, no measurable difference could be detected between the percentage of teachers with a certification in mathematics (77 percent) and the percentage of teachers with a major in mathematics (76 percent). Similarly, no difference was detected between the percentage of teachers with a main assignment in social science who held a certification in social science (82 percent) and a major in social science (84 percent). However, a higher percentage of teachers with a main assignment in science or English held a major in their main assignment than were certified in their main assignment (87 vs. 80 percent in science, 84 vs. 80 percent in English).

Examination of certifications among teachers in the science and social science subfields revealed differences in the percentage of teachers who reported a main assignment and certification in specific subfields. The majority of teachers who reported a main assignment in biology/life sciences (69 percent), physical science (60 percent), and chemistry (62 percent) had a certification in those assignments. Conversely, less than a majority of teachers with main assignments in each of the four social science subfields of economics (17 percent), geography (18 percent), government (20 percent), and history (37 percent) were separately certified in their respective subfields.

Table 2. Number of public high school-level teachers who reported a particular main assignment and the percentage with a major and certification in that main assignment, by selected main assignments: 2003-04

Selected main assignment	Number of teachers	Major in main assignment			No major in main assignment			Total certified
		Total	Certified	Not certified	Total	Certified	Not certified	
English	134,900	84.5	71.1	13.4	15.5	9.1	6.4	80.2
Mathematics	128,500	76.0	64.5	11.5	24.0	12.7	11.3	77.2
Science	106,100	87.2	71.7	15.5	12.8	8.3	4.5	80.0
Biology/life sciences	42,600	81.2	59.1	22.1	18.8	9.9	8.9	69.0
Physical science	57,400	54.3	38.1	16.2	45.7	22.0	23.6	60.1
Chemistry	21,700	49.9	33.3	16.7	50.1	28.6	21.4	61.9
Earth sciences	10,900	39.8	32.5	7.3	60.2	19.1	41.1	51.6
Physics	9,200	57.2	39.3	17.9	42.8	21.7	21.1	61.0
Social science	111,600	83.6	70.7	12.9	16.4	11.1	5.2	81.8
Economics	5,200	21.8	9.7	12.1	78.2	7.7	70.5	17.4
Geography	8,400	10.0	3.0	7.0	90.0	15.1	74.9	18.1
Government/civics	14,700	9.7	4.6	5.1	90.3	15.7	74.6	20.3
History	57,200	67.4	30.2	37.2	32.6	6.5	26.1	36.7
French	9,800	89.5	74.5	15.0	10.5	8.0	2.5 !	82.5
German	3,400	90.6	73.0	17.5	9.4	7.6	1.8 !	80.6
Latin	2,000	69.3	58.4	10.8	30.7	12.9 !	17.8	71.4
Spanish	37,000	79.2	62.9	16.3	20.8	12.8	8.0	75.7
Art/Arts or crafts[1]	29,700	91.6	78.0	13.5	8.4	5.6	2.8	83.6
Music[1]	36,300	97.2	80.7	16.5	2.8	1.6	1.2 !	82.3
Dance/theater[1]	6,800	63.5	53.4	10.0	36.5	18.7	17.8	72.1

! Interpret data with caution. The standard error for this estimate is equal to 50 percent or more of the estimate's value.

[1] Teachers of art/arts or crafts, music, and dance/theater were allowed to report an ungraded or secondary-level certification.

NOTE: Teachers include traditional public and public charter teachers who taught departmentalized classes to students in any of grades 10-12, or grade 9 and no grade lower. Each main assignment includes several subfields. Under science and social science, several subfields are examined in detail. These subfields are not inclusive of all subfields in the subject and, therefore, do not add to the broad field total. See appendixes for technical notes and definitions of specific subjects within main assignment fields. "Major in main assignment" include all teachers, regardless of whether the major was earned within or outside the school/college of education. Majors in main assignment are credited if they were earned at the bachelor's degree level or higher. "Certified" columns contain teachers with a regular/probationary certification in-subject and at the secondary level. Detail may not sum to totals because of rounding.

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

A lower percentage of teachers in the subfield subjects held a certification in the respective subfield compared to the broad fields under which they fall. For example, among teachers with a main assignment in history, only 37 percent reported a certification in history, significantly fewer than the 82 percent who held a certification in any social science. Again, this is due in part to stricter analytical requirements at the subfield levels.

It is important to note that rates of certification in the subfields might be lower because some states do not grant secondary-level certifications in all of the subfields examined in this report. Therefore, an analytical match between certification and subject taught could not be made at the subfield level.

Major and certification in main assignment. Of teachers with main assignments in English, mathematics, science, and social science, the majority reported both a major and certification in their respective main assignments. Seventy-one percent of teachers with a main assignment in English reported holding both a major and certification in English. Similarly, 72 percent of teachers with a main assignment in science, 71 percent of teachers with a main assignment in social science, and 65 percent of teachers with a main assignment in mathematics reported both a major and certification in their respective assignment. The percentage of teachers with a main assignment of English who held a major and certification in English was not significantly different from the percentages of science and social science teachers with comparable in-field qualifications; however, compared to these teachers, significantly fewer teachers with a main assignment in mathematics reported dual qualifications.

Among teachers with a main assignment in French, German, or Spanish, a majority held both a certification and major in their respective foreign language (75 percent, 73 percent, and 63 percent, respectively). Given the rates of in-field majors and certifications among teachers of art/arts or crafts and music, it was not surprising that these teachers were among the most likely to hold dual qualifications. For example, among high school-level teachers with a main assignment in music, 81 percent reported both a major and certification in music. There was no measurable difference between the percentages of teachers with a main assignment in music and teachers with a main assignment in art/arts or crafts (78 percent) who held both a major and certification in their respective subjects.

Compared with the broad field level, a lower percentage of teachers with a main assignment in the science and social science subfields held both a major and certification in their respective field. In the subfields of science, dual-qualification rates ranged from 59 percent of biology/life science teachers to 32 percent of Earth science teachers. The range in the percentages of teachers with in-field majors and certifications in the subfields of social science varied from 30 percent of teachers with a main assignment of history to 3 percent of teachers with a main assignment of geography.

Next, the report moves to table 3, where teacher qualifications relative to the main assignment and the percentage of classes taught in the main assignment are examined jointly.

Teacher Qualifications by Main Assignment and Percentage of Classes Taught in Main Assignment

Table 3 combines elements from tables 1 and 2, examining the qualifications of teachers by the percentage of classes taught within their main assignment. In order to preserve stable estimates of teacher qualifications, table 3 only examines the four largest main assignment areas: English, mathematics, science, and social studies. The results show that a higher percentage of teachers whose main assignments were either English or mathematics, and who instructed at least half of their classes in their main assignment, held both a major and certification in that main assignment than did their colleagues assigned to teach less than half of their classes in their main assignment (table 3). Among teachers with a main assignment in English who taught all of their classes in English, 73 percent held both an in-field major and certification and two-thirds (64 percent) of those who taught 50 to 99 percent of their classes in English held both qualifications. But among teachers with a main assignment in English who taught less than half of their classes in English, 34 percent held both qualifications and 29 percent held neither qualification. Among teachers with a main assignment in mathematics who taught all of their classes in math, 67 percent held both an in-field major and certification in mathematics and 52 percent of those who taught 50 to 99 percent of their classes in mathematics held both qualifications. Finally, 14 percent of teachers who taught less than half of their classes in mathematics had both a major and certification in mathematics, while 54 percent had neither.

Seventy-three percent of teachers with a main assignment of science and who taught all science classes held dual qualifications in that subject. This was greater than the percentage of their dually-qualified counterparts who taught 0 to 49 percent or 50 to 99 percent of their classes in science (52 percent and 62 percent respectively). In social studies, 73 percent of teachers who taught all social science classes held dual qualifications in that field, a higher percentage than among their counterparts who taught 50 to 99 percent of their classes in science (60 percent).

In sum, data from the teacher-level tables demonstrate that teachers in most subjects taught within their main assignment field. The data also support a common finding in the literature on teacher qualifications: a higher percentage of teachers are qualified in their main assignments, especially those who instruct most of their classes in their main assignment, than teachers who have been assigned to teach most of their classes outside their main assignment (Ingersoll 1999).

Table 3. Number of public high school-level teachers who reported a particular main assignment and the percentage of teachers with various qualifications who taught various proportions of classes within that main assignment, by selected main assignments: 2003-04

Selected main assignment	Number of teachers	Percent with a major **and** certification in their main assignment	Percent with **only** a major **or only** a certification in their main assignment	Percent with **neither** a major **nor** a certification in their main assignment
English	134,900	71.1	22.5	6.4
Percentage of classes taught in English				
0 to 49.9	2,600	33.8	36.8	29.4
50 to 99.9	19,600	63.7	23.2	13.1
100	112,700	73.2	22.0	4.7
Mathematics	128,500	64.5	24.2	11.3
Percentage of classes taught in mathematics				
0 to 49.9	2,600	14.3 !	31.5	54.2
50 to 99.9	14,900	52.1	24.9	23.0
100	111,000	67.4	23.9	8.7
Science	106,100	71.7	23.8	4.5
Percentage of classes taught in science				
0 to 49.9	1,600	51.8	24.6	23.6
50 to 99.9	11,400	61.6	24.2	14.2
100	93,100	73.3	23.7	3.0
Social science	111,600	70.7	24.1	5.2
Percentage of classes taught in social science				
0 to 49.9	2,200	53.0	25.2	21.7
50 to 99.9	17,800	59.5	29.1	11.4
100	91,600	73.3	23.1	3.7

! Interpret data with caution. The standard error for this estimate is equal to 50 percent or more of the estimate's value.

NOTE: Teachers include traditional public and public charter teachers who taught departmentalized classes to students in any of grades 10-12, or grade 9 and no grade lower. Each main assignment includes several subfields. See appendixes for technical notes and definitions of specific subjects within main assignment fields. Majors are included regardless of whether they were earned within or outside the school/college of education. Majors in main assignment are credited if they were earned at the bachelor's degree level or higher. A certification is credited if it is a regular or standard state certificate or a probationary certification in-subject and at the secondary level. Detail may not sum to totals because of rounding.

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

Class- and Student-Level Findings

Table 4 includes the percentage of high school-level classes (grades 9–12) of various subjects taught by teachers who hold various combinations of majors and certifications. Table 5 displays the percentage of students in those high school-level classes who are taught by teachers with various combinations of qualifications. Both tables take into account all classes taught within the selected subjects, not just the teacher's main assignment.

High School-Level Classes and the Students Enrolled: Taught by a Teacher With an In-Field Major

In general, a majority of high school-level classes, and the students enrolled in these classes, were taught by teachers who held a major in the subject area.

Class level. A majority of classes in English (81 percent), mathematics (75 percent), science (85 percent) (including the subfield of biology/life sciences—77 percent), social science (82 percent) (including the subfield of history—64 percent), all four foreign languages (French—88 percent, German—87 percent, Latin—70 percent, and Spanish—80 percent), and art/arts or crafts (91 percent) and music (97 percent) were taught by teachers with a major in the respective subject area (table 4).

Table 4. Percentage of public high school-level classes of various subjects taught by a teacher with a major and certification in that subject area, by selected subject areas: 2003-04

Selected subject area	Major in subject area			No major in subject area			
	Total	Certified	Not certified	Total	Certified	Not certified	Total certified
English	81.1	68.3	12.8	18.9	9.0	9.9	77.3
Mathematics	74.5	63.6	10.9	25.5	11.9	13.6	75.5
Science	84.7	69.3	15.4	15.3	8.4	6.9	77.7
Biology/life sciences	77.4	56.4	21.0	22.6	10.1	12.5	66.4
Physical science	50.3	34.3	16.0	49.7	21.6	28.1	55.9
Chemistry	47.9	31.2	16.7	52.1	28.7	23.4	59.9
Earth sciences	33.8	27.5	6.3	66.2	16.0	50.2	43.5
Physics	47.9	29.0	18.9	52.1	23.8	28.4	52.7
Social science	81.9	68.8	13.1	18.1	10.6	7.4	79.4
Economics	12.1	5.1	7.0	87.9	8.0	79.9	13.1
Geography	8.0	2.0	6.0	92.0	12.4	79.5	14.4
Government/civics	8.2	3.0	5.2	91.8	13.7	78.2	16.7
History	64.0	27.5	36.6	36.0	6.4	29.6	33.9
French	88.4	75.0	13.5	11.6	8.8	2.7	83.8
German	86.7	68.5	18.1	13.3	8.2	5.1 !	76.8
Latin	70.3	61.5	8.9 !	29.7	10.0 !	19.7	71.4
Spanish	80.3	63.9	16.4	19.7	11.3	8.4	75.2
Art/Arts or crafts[1]	90.7	78.3	12.4	9.3	4.9	4.3	83.3
Music[1]	97.1	82.5	14.6	2.9	1.6	1.4	84.1
Dance/theater[1]	53.5	46.3	7.2	46.5	15.6	30.9	61.9

! Interpret data with caution. The standard error for this estimate is equal to 50 percent or more of the estimate's value.

[1] Teachers of art/arts or crafts, music, and dance/theater were allowed to report an ungraded or secondary-level certification.

NOTE: Teachers of high school-level classes include traditional public and public charter teachers who taught departmentalized classes to students in any of grades 9-12. Each subject area includes several subfields. Under science and social science, several subfields are examined in detail. These subfields are not inclusive of all subfields in the subject and, therefore, do not add to the broad field total. See appendixes for technical notes and definitions of specific subjects within each subject area. "Major in subject area" columns include all teachers, regardless of whether the major was earned within or outside the school/college of education. Majors in subject area are credited if they were earned at the bachelor's degree level or higher. "Certified" columns contain teachers with a regular/probationary certification in-subject and at the secondary level. For teachers with eight or more classes, the variables reporting subject matter codes, grade-level codes, and student enrollments do not meet reporting standards. Their weighted item response rates are less than 70 percent. These data might appear in any row or column of the table depending on the subject(s) taught and qualifications of the teacher. Detail may not sum to totals because of rounding.

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

However, in the science and social science subfields of Earth sciences (34 percent), economics (12 percent), geography (8 percent), and government/civics (8 percent), a lower percentage of classes were taught by a teacher who held a major in the respective subfield.

Student level. The findings at the student level parallel those at the class level. The majority of students in English (83 percent); mathematics (76 percent); science (85 percent), including biology/life sciences (79 percent); social science (84 percent), including history (66 percent); French (87 percent); German (84 percent); Spanish (80 percent); and art/arts or crafts (91 percent) and music (98 percent) were taught by teachers who held a major in their respective subject areas (table 5).

Although students in science and social science classes tended to be taught by teachers with majors that broadly match the subject they are teaching, fewer students were taught by teachers with majors in the science and social science subfields. About half of the students in high school-level physics (51 percent) and chemistry (48 percent) classes were taught by teachers with majors in their respective subfield. Among students in high school-level economics classes, 12 percent were taught by a teacher with a major in economics.

High School-Level Classes and the Students Enrolled: Taught by a Teacher With an In-Field Certification

Next, findings are presented in tables 4 and 5 on the percentages of 9th- through 12th-grade classes and students taught by a teacher with a certification in the subject area.

Class level. For example, 77 percent of English classes, 75 percent of mathematics classes, 78 percent of science classes, and 79 percent of social science classes were taught by teachers holding a certification in the respective field. French, art/arts or crafts, and music were among the classes with the highest percentage of teachers certified in the respective subject. Eighty-three percent of art classes and 84 percent of music and French classes were taught by teachers with an in-field certification (table 4).

Student level. No measurable difference existed between the percentages of high school-level classes and students taught by a teacher with an in-field certification. The majority of students in English (80 percent), mathematics (77 percent), science (79 percent) (including biology/life sciences—68 percent, physical science—56 percent, and chemistry—61 percent), social science (81 percent), the four foreign languages (French—84 percent, German—77 percent, Latin—72 percent, and Spanish—75 percent), and art/arts or crafts (83 percent), music (84 percent), and dance/theater (64 percent) were taught by a teacher with an in-field certification (table 5).

Table 5. Percentage of students in public high school-level classes of various subjects taught by a teacher with a major and certification in that subject area, by selected subject areas: 2003-04

Selected subject area	Major in subject area			No major in subject area			Total certified
	Total	Certified	Not certified	Total	Certified	Not certified	
English	83.1	70.4	12.8	16.9	9.4	7.4	79.8
Mathematics	76.3	65.0	11.3	23.7	11.5	12.1	76.6
Science	85.3	69.8	15.5	14.7	9.4	5.2	79.2
Biology/life sciences	78.5	57.2	21.3	21.5	10.8	10.7	68.0
Physical science	50.4	33.9	16.5	49.6	22.3	27.3	56.2
Chemistry	47.6	30.7	16.9	52.4	30.0	22.4	60.7
Earth sciences	32.5	26.8	5.7	67.5	15.8	51.7	42.6
Physics	51.0	30.4	20.6	49.0	20.9	28.1	51.3
Social science	84.1	71.2	12.9	15.9	10.3	5.6	81.5
Economics	11.6	5.1	6.5	88.4	8.2	80.1	13.4
Geography	7.8	2.1	5.8	92.2	13.5	78.7	15.6
Government/civics	8.2	2.9	5.3	91.8	14.6	77.2	17.4
History	65.8	26.5	39.3	34.2	6.0	28.2	32.5
French	87.1	74.7	12.4	12.9	9.5	3.4 !	84.2
German	84.0	67.9	16.2	16.0	9.1	6.9 !	76.9
Latin	68.0	60.3	7.7 !	32.0	11.8 !	20.2	72.1
Spanish	80.2	63.1	17.1	19.8	11.5	8.3	74.6
Art/Arts or crafts[1]	91.0	77.7	13.4	9.0	5.0	4.0	82.7
Music[1]	98.4	83.3	15.1	1.6	1.0 !	0.7	84.2
Dance/theater[1]	59.3	51.1	8.1	40.7	12.8	27.9	64.0

! Interpret data with caution. The standard error for this estimate is equal to 50 percent or more of the estimate's value.

[1] Teachers of art/arts or crafts, music, and dance/theater were allowed to report an ungraded or secondary-level certification.

NOTE: Teachers of high school-level classes include traditional public and public charter teachers who taught departmentalized classes to students in any of grades 9-12. Each Subject area includes several subfields. Under science and social science, several subfields are examined in detail. These subfields are not inclusive of all subfields in the subject and, therefore, do not add to the broad field total. See appendixes for technical notes and definitions of specific subjects within each subject area. "Major in subject area" columns include all teachers, regardless of whether the major was earned within or outside the school/college of education. Majors in subject area were credited if they are earned at the bachelor's degree level or higher. "Certified" columns contain teachers with a regular/probationary certification in-subject and at the secondary level. For teachers with eight or more classes, the variables reporting subject matter codes, grade-level codes, and student enrollments do not meet reporting standards. Their weighted item response rates are less than 70 percent. These data might appear in any row or column of the table depending on the subject(s) taught and qualifications of the teacher. Detail may not sum to totals because of rounding.

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

In each of the science and social science subcategories, relatively fewer students in high school-level classes were taught by a teacher with a certification in the subfield than by a teacher with a certification in the broader subject area. For example, while 79 percent of science students were taught by a high school-level teacher with a certification in any science field, 61 percent of chemistry students were taught by a teacher with a certification in chemistry. This finding suggests that students might have been taught by a teacher who was certified in the broader subject area (i.e., science), but did not hold a certification that matched the specific subject (i.e., chemistry). These findings are similar to those in McGrath, Holt, and Seastrom (2005) and Holt, McGrath, and Seastrom (2006).

High School-Level Classes and the Students Enrolled: Taught by a Teacher With an In-Field Major and Certification

Class level. The majority of classes in English (68 percent), mathematics (64 percent), science (69 percent), social science (69 percent), French (75 percent), German (69 percent), Spanish (64 percent), art/arts or crafts (78 percent), and music (83 percent) were taught by teachers holding both a major and certification in the respective subject (table 4). About half (46 percent) of high school-level dance/theater classes were taught by a teacher with an in-field major and certification.

Classes in the subfields of social science were among the least likely to be taught by a teacher with a major and certification in the specific field: 5 percent of economics classes, 2 percent of geography classes, and 3 percent of government/civics classes were taught by teachers with a major *and* certification in the specified subfield (table 4).

Student level. More than two-thirds of students in English, science, social science, art/arts or crafts, and music classes were taught by teachers who held a major and certification in the respective subject (70, 70, 71, 78, and 83 percent, respectively). About two-thirds of students in mathematics and foreign language (French, German, Latin, and Spanish) classes were taught by a teacher with a major and certification in the respective field (65, 75, 68, 60, and 63 percent, respectively) (table 5). Finally, about half (51 percent) of students in dance/theater classes were taught by a teacher with a major and certification in one of those fields.

Among students in the subfields of science, only in biology/life sciences were a majority of students taught by a teacher who was dually qualified in biology/life sciences (57 percent) (table 5). Compared to students in biology/life sciences, relatively fewer students in physical science (34 percent) and its further subdivisions (chemistry—31 percent, Earth sciences—27 percent, and physics—30 percent) were taught by a teacher with both a major and certification in the specific subfield.

In sum, patterns of teacher qualifications were comparable across the class- and student-level findings. In many of the broad field subjects, the majority of classes and students were taught by a teacher with one or both in-field qualifications. However, when examining the specific subfields of science and social science, a lower percentage of

classes and students were taught by a teacher with in-field qualifications specific to that subfield. Overall, there were no statistically significant differences between the percentages of classes and the percentages of students taught by teachers who held an in-field major, an in-field certification, or both qualifications.

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Summary and Limitations

Teachers

Within the teacher population,[19] the most frequently reported main assignments were the fields of English, mathematics, science, and social science. Within these four main assignments, the majority of teachers instructed all of their classes within their respective field. When examining the subfields of science and social science, fewer teachers taught all of their classes within the exact subfield; however, a majority taught at least 50 percent of their classes in that subfield.

Teachers of the broad subject areas generally held a major, certification, or both in their respective main assignment. For example, among teachers with a main assignment in social science, 84 percent held a major in social science, 82 percent held a certification in social science, and 71 percent held both qualifications. Teachers with reported main assignments in art or music reported some of the highest rates of dual qualifications, with 78 percent of art/arts or crafts teachers and 81 percent of music teachers holding a major and certification in their main assignment. Among teachers of the four most frequently reported main assignments, the percentage of teachers who held dual qualifications in their respective main assignment ranged from 65 percent (mathematics) to 72 percent (science).

Compared with the broad field level, a lower percentage of teachers with a main assignment in the science and social science subfields held the dual qualifications of both a major and certification in their respective field. In the subfields of science, dual-qualification rates ranged from 59 percent of biology/life science teachers to 32 percent of Earth science teachers. The range in the percentages of teachers with in-field majors and certifications in the subfields of social science varied from 30 percent of teachers with a main assignment of history to 3 percent of teachers with a main assignment of geography. Some states might not grant secondary-level certifications in all of the subfields examined in this report. It is possible that this is one reason that a lower percentage of teachers with main assignments in some of the subfields hold in-field certifications.

Teachers' qualifications were examined in combination with the percentage of classes they taught within the main assignment. Results show that a majority of teachers who instructed at least half of their classes in their main assignment held both a major and certification in that main assignment. For example, among teachers who taught less than half of their classes within their reported main assignment, 22 percent (social science) to 54 percent (mathematics) held neither qualification in the respective main assignment field.

[19] The population of teachers analyzed in this report includes departmentalized public teachers of high-school level students in core subjects. Overall, this population represents 63 percent of the total public high school-level teacher population.

Classes

At the class level, a majority of 9th- through 12th-grade classes were taught by teachers with either an in-field major, an in-field certification, or both. A majority of classes in English (81 percent), mathematics (75 percent), science (85 percent) (including the subfield of biology/life sciences—77 percent), social science (82 percent) (including the subfield of history—64 percent), all four foreign languages (French—88 percent, German—87 percent, Latin—70 percent, and Spanish—80 percent), and art/arts or crafts (91 percent) and music (97 percent) were taught by teachers with a major in the respective subject area. However, in classes taught in the science and social science subfields of Earth sciences, economics, geography, and government/civics, fewer than 50 percent of classes were taught by a teacher who held a major in the respective subfield.

High school-level classes were also likely to be taught by a teacher with an in-field certification. Seventy-seven percent of English classes, 75 percent of mathematics classes, 78 percent of science classes, and 79 percent of social science classes were taught by teachers holding a certification in the respective field. Art/arts or crafts and music classes were among the most likely to be taught by a teacher who was certified in the respective subject. Eighty-three percent of art classes and 84 percent of music classes were taught by teachers with an in-field certification.

The majority of classes in English (68 percent), mathematics (64 percent), science (69 percent), social science (69 percent), French (75 percent), German (69 percent), Spanish (64 percent), art/arts or crafts (78 percent), and music (83 percent) were taught by teachers holding both a major and certification in the respective subject. Again, classes within the subfields of social science and physical science were among the least likely to be taught by a teacher with a major and certification in the specific field.

Students

The findings at the student level parallel those at the class level. In fact, no statistically significant differences were found when testing corresponding estimates of the percentages of 9th- through 12th-grade classes and students taught by a teacher with an in-field major. The majority of students in English (83 percent), mathematics (76 percent), science (85 percent) (including biology/life sciences—79 percent), social science (84 percent) (including history—66 percent), French (87 percent), German (84 percent), Spanish (80 percent), art/arts or crafts (91 percent), and music (98 percent) were taught by teachers who held a major in the respective subject areas. Although students in science and social science classes tended to be taught by teachers with majors that broadly matched the subject they were teaching, fewer students were taught by teachers with majors in the specific science and social science subfields.

The majority of students in English (80 percent), mathematics (77 percent), science (79 percent) (including biology/life sciences—68 percent, physical science—56 percent, and chemistry—61 percent), social science (81 percent), the four foreign languages (French—

84 percent, German—77 percent, Latin—72 percent, and Spanish—75 percent), art/arts or crafts (83 percent), music (84 percent), and dance/theater (64 percent) were taught by a teacher with an in-field certification. In each of the science and social science subcategories, a lower percentage of students in high school-level classes were taught by a teacher with a certification in the subfield than by a teacher with a certification in the broader subject area.

More than two-thirds of students in English, science, social science, art/arts or crafts, and music classes were taught by teachers who held a major and certification in the respective subject. In mathematics and foreign language (French, German, Latin, and Spanish) classes, about two-thirds of students were taught by a teacher with a major and certification in the respective subject. Finally, about half of the students in dance/theater classes were taught by a teacher with a major and certification in one of those fields. Among students in the subfields of science, only a majority of students in biology/life sciences classes were taught by teachers who were dually qualified in biology/life sciences (57 percent). A lower percentage of students in physical science (34 percent) and its further subdivisions (chemistry—31 percent, Earth sciences—27 percent, and physics—30 percent) were taught by a teacher with both a major and certification in the specific subfield.

Limitations

One limitation of the findings is that certification rates in the science and social science subfields might be artificially low because some states do not offer specific certifications in those subfields. Therefore, an analytical match between certification and subject taught could not be made at the subfield level. For this reason, estimates are provided at the broad-field level.

Another limitation of the study is that it is restricted to public high schools and teachers who teach in departmentalized classes. Hence, one should be careful not to generalize beyond this population.

The authors also caution against comparing the estimates in this report to previously published reports on the topic of teacher qualifications that used prior administrations of the Schools and Staffing Survey (SASS) data. This is because the way in which teachers were asked to report their main assignment and their certification(s) changed in the 2003-04 SASS Teacher Questionnaire. Where earlier administrations relied on teachers to self-report whether they were certified in their main assignment, the 2003-04 Teacher Questionnaire asks for these data separately. Thus, it allows the analyst to make the substantive match between main assignment and certification. For more information on this topic, see Appendix C: Caution Concerning Changes in Estimates Over Time.

Finally, teacher qualifications can be measured in many ways. The tables in the body of this report offer one way of using SASS data to measure teacher qualifications; the

authors acknowledge that it is not the only method for doing so. Researchers are encouraged to use SASS data to explore other measures.

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Appendix A: Standard Error Tables

Table A-1. Standard errors for Table 1: Number of public high school-level teachers who reported a particular main assignment and the percentage of teachers who taught various proportions of classes within that main assignment, by selected main assignments: 2003-04

Selected main assignment	Number of teachers	Among teachers of a particular main assignment, the percentage who teach: 0 to 49.9 percent of their classes in their main assignment	50 to 99.9 percent of their classes in their main assignment	100 percent of their classes in their main assignment
English	4,830.4	0.33	0.93	0.87
Mathematics	3,592.9	0.42	0.83	0.98
Science	4,291.1	0.30	0.83	0.89
Biology/life sciences	2,275.1	1.34	1.91	2.10
Physical science	3,090.7	0.63	2.06	2.07
Chemistry	1,400.8	1.66	3.23	3.43
Earth sciences	1,347.8	1.59	4.69	4.69
Physics	1,084.1	3.32	4.94	5.25
Social science	3,391.9	0.43	1.30	1.38
Economics	660.7	6.57	6.11	6.43
Geography	986.7	3.35	5.56	5.15
Government/civics	1,157.5	2.98	4.33	3.50
History	2,603.7	1.11	2.24	2.48
French	844.8	1.88	3.21	3.28
German	492.4	0.96	6.72	6.71
Latin	374.2	5.42	8.54	9.67
Spanish	2,003.1	1.00	1.95	2.16
Art/Arts or crafts	1,977.3	0.73	1.67	1.80
Music	2,020.4	0.27	2.17	2.20
Dance/theater	809.7	3.04	5.17	5.13

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

Table A-2. Standard errors for Table 2: Number of public high school-level teachers who reported a particular main assignment and the percentage with a major and certification in that main assignment, by selected main assignments: 2003-04

Selected main assignment	Number of teachers	Major in main assignment			No major in main assignment			Total certified
		Total	Certified	Not certified	Total	Certified	Not certified	
English	4,830.4	0.86	1.12	0.86	0.86	0.64	0.59	1.06
Mathematics	3,592.9	1.22	1.44	0.89	1.22	0.87	0.85	1.27
Science	4,291.1	1.02	1.12	1.05	1.02	0.75	0.68	1.13
Biology/life sciences	2,275.1	1.99	2.13	1.89	1.99	1.27	1.48	2.02
Physical science	3,090.7	2.17	2.19	1.56	2.17	1.72	1.80	1.96
Chemistry	1,400.8	3.25	2.80	2.42	3.25	2.92	2.75	3.24
Earth sciences	1,347.8	5.12	5.36	2.35	5.12	3.48	4.86	4.93
Physics	1,084.1	5.14	4.96	4.33	5.14	3.88	4.98	5.93
Social science	3,391.9	0.97	1.39	1.08	0.97	0.86	0.64	1.15
Economics	660.7	5.24	3.46	3.61	5.24	2.46	5.38	3.95
Geography	986.7	3.07	1.44	2.99	3.07	3.11	4.33	3.51
Government/civics	1,157.5	2.06	1.57	1.53	2.06	2.48	3.10	2.87
History	2,603.7	2.11	1.93	2.21	2.11	0.89	2.08	2.03
French	844.8	2.64	4.26	3.51	2.64	2.38	1.25	3.51
German	492.4	3.34	6.75	5.70	3.34	3.19	1.24	5.81
Latin	374.2	8.68	9.60	4.93	8.68	6.79	6.05	7.66
Spanish	2,003.1	2.58	2.96	1.79	2.58	2.25	1.43	2.28
Art/Arts or crafts[1]	1,977.3	1.51	2.44	2.15	1.51	1.24	0.81	2.18
Music[1]	2,020.4	0.88	2.56	2.58	0.88	0.45	0.69	2.49
Dance/theater[1]	809.7	5.91	5.93	2.33	5.91	4.44	4.71	4.97

[1] Teachers of art/arts or crafts, music, and dance/theater were allowed to report an ungraded or secondary-level certification.

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

Table A-3. Standard errors for Table 3: Number of public high school-level teachers who reported a particular main assignment and the percentage of teachers with various qualifications who taught various proportions of classes within that main assignment, by selected main assignments: 2003-04

Selected main assignment	Number of teachers	Percent with a major **and** certification in their main assignment	Percent with **only** a major **or only** a certification in their main assignment	Percent with **neither** a major **nor** a certification in their main assignment
English	4,830.4	1.12	0.95	0.59
Percentage of classes taught in English				
0 to 49.9	452.8	7.75	8.57	7.19
50 to 99.9	1,483.4	3.30	2.64	2.49
100	4,221.0	1.15	1.06	0.63
Mathematics	3,592.9	1.44	1.12	0.85
Percentage of classes taught in mathematics				
0 to 49.9	549.6	10.19	9.93	11.12
50 to 99.9	1,190.1	4.46	3.46	3.13
100	3,167.9	1.68	1.32	0.82
Science	4,291.1	1.12	1.03	0.68
Percentage of classes taught in science				
0 to 49.9	331.0	9.87	7.25	8.81
50 to 99.9	869.5	3.85	3.49	3.10
100	4,195.7	1.10	1.10	0.54
Social science	3,391.9	1.39	1.41	0.64
Percentage of classes taught in social science				
0 to 49.9	481.9	10.73	8.45	7.54
50 to 99.9	1,625.4	3.84	3.81	2.45
100	3,058.1	1.61	1.59	0.53

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

Table A-4. Standard errors for Table 4: Percentage of public high school-level classes of various subjects taught by a teacher with a major and certification in that subject area, by selected subject areas: 2003-04

Selected subject area	Major in subject area			No major in subject area			
	Total	Certified	Not certified	Total	Certified	Not certified	Total certified
English	1.08	1.22	0.86	1.08	0.67	0.87	1.13
Mathematics	1.25	1.49	0.91	1.25	0.90	0.89	1.30
Science	1.23	1.24	1.14	1.23	0.80	0.91	1.24
Biology/life sciences	2.12	1.80	2.00	2.12	1.14	1.63	1.72
Physical science	1.88	1.86	1.47	1.88	1.61	1.58	1.63
Chemistry	3.10	2.48	2.23	3.10	2.50	2.62	2.85
Earth sciences	4.29	4.40	1.78	4.29	2.65	4.42	4.34
Physics	4.01	3.36	4.01	4.01	3.10	3.95	4.54
Social science	1.05	1.49	1.17	1.05	0.84	0.85	1.33
Economics	2.74	1.76	1.84	2.74	1.67	3.06	2.21
Geography	2.28	0.89	2.23	2.28	2.42	3.32	2.56
Government/civics	1.44	1.00	1.20	1.44	1.58	2.05	1.90
History	2.10	1.71	1.97	2.10	0.75	2.09	1.77
French	2.78	4.48	3.61	2.78	2.62	1.17	3.81
German	4.78	7.87	6.18	4.78	3.59	3.24	6.68
Latin	10.15	11.31	5.23	10.15	6.08	7.71	9.20
Spanish	2.39	2.86	2.07	2.39	1.89	1.50	2.48
Art/Arts or crafts[1]	1.48	2.64	2.21	1.48	1.17	0.93	2.44
Music[1]	0.77	2.04	1.96	0.77	0.64	0.42	1.95
Dance/theater[1]	5.97	5.83	1.80	5.97	3.91	4.54	4.56

[1] Teachers of art/arts or crafts, music, and dance/theater were allowed to report an ungraded or secondary-level certification.

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

Table A-5. Standard errors for Table 5: Percentage of students in public high school-level classes of various subjects taught by a teacher with a major and certification in that subject area, by selected subject areas: 2003-04

Selected subject area	Major in subject area			No major in subject area			
	Total	Certified	Not certified	Total	Certified	Not certified	Total certified
English	1.05	1.32	0.91	1.05	0.71	0.71	1.13
Mathematics	1.48	1.75	1.02	1.48	1.07	0.93	1.46
Science	1.29	1.30	1.25	1.29	1.06	0.70	1.25
Biology/life sciences	2.04	2.09	2.32	2.04	1.31	1.53	2.06
Physical science	2.04	2.00	1.59	2.04	1.80	1.85	1.81
Chemistry	3.33	2.95	2.53	3.33	2.66	2.75	3.04
Earth sciences	4.37	4.44	1.70	4.37	2.64	4.42	4.34
Physics	4.78	3.77	4.67	4.78	3.19	4.77	5.09
Social science	0.98	1.49	1.16	0.98	0.91	0.67	1.23
Economics	2.71	1.79	1.70	2.71	1.90	3.24	2.46
Geography	2.38	0.93	2.29	2.38	3.67	4.13	3.75
Government/civics	1.41	0.97	1.20	1.41	2.11	2.47	2.46
History	2.40	1.85	2.58	2.40	0.82	2.33	1.98
French	3.77	4.92	3.67	3.77	3.32	1.90	4.05
German	5.58	8.08	5.76	5.58	4.00	4.12	6.81
Latin	11.09	11.96	4.52	11.09	7.28	8.26	9.47
Spanish	2.73	3.14	2.32	2.73	2.19	1.54	2.73
Art/Arts or crafts[1]	1.59	3.24	2.90	1.59	1.21	0.98	3.07
Music[1]	0.56	2.91	2.89	0.56	0.51	0.24	2.85
Dance/theater[1]	6.32	6.31	2.22	6.32	3.31	5.02	5.06

[1] Teachers of art/arts or crafts, music, and dance/theater were allowed to report an ungraded or secondary-level certification.

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

Appendix B: Methodology and Technical Notes

The data used in this report come from the 2003–04 Schools and Staffing Survey (SASS) Restricted-Use Public School Teacher Data File. Therefore, the information provided in this appendix opens with a description of the full SASS, but applies largely to the Teacher components of SASS used in the analyses in the report. For general information on SASS, please visit the SASS homepage at http://nces.ed.gov/surveys/sass.

For specific information on SASS planning and administration, please see the following: *Documentation for the 2003–04 Schools and Staffing Survey* (Tourkin et al. 2007) and *Characteristics of Schools, Districts, Teachers, Principals, and School Libraries in the United States: 2003–04 Schools and Staffing Survey* (Strizek et al. 2006).

Overview of SASS

SASS is sponsored by the National Center for Education Statistics (NCES), the statistical agency of the U.S. Department of Education, and conducted by the U.S. Census Bureau. SASS has been conducted five times: in the 1987–88, 1990–91, 1993–94, 1999–2000, and 2003–04 school years. The next data collection will take place in the 2007–08 school year. SASS includes data from traditional public, public charter, private, and Bureau of Indian Affairs (BIA)-funded sectors. SASS is a sample survey of elementary and secondary schools, teachers, and principals in the United States. SASS also collects data from public and BIA library media centers and public school districts. As a result, SASS provides data on the characteristics and qualifications of teachers and principals, professional development, class size, library holdings, district hiring practices, and other conditions in schools across the nation.

For each administration of SASS, NCES has reviewed the content of the questionnaires to expand, retain, or eliminate topics covered in the previous administration. Through these reviews, the survey's capability for trend analysis is maintained, yet new topics are added to address current concerns. The fifth administration of SASS, completed during the 2003–04 school year, consisted of 10 survey components: the School District Questionnaire (public only), Principal Questionnaire, Private School Principal Questionnaire, School Questionnaire, Private School Questionnaire, Unified School Questionnaire, Teacher Questionnaire, Private School Teacher Questionnaire, School Library Media Center Questionnaire, and the Teacher Listing Form. These 10 questionnaires translated into 12 data files. In 2003–04, public charter school data were included with the traditional public school data, rather than in a separate data file.

Teacher Questionnaire Content

Teacher Questionnaire (Form SASS-4A)

The data for this report come from the Teacher Questionnaire (Form SASS-4A). The purpose of the 2003–04 Teacher Questionnaire was to obtain information on topics such as education and training, teaching assignment, certification, workload, and perceptions and attitudes about teaching.

Information on the other SASS questionnaires can be found in Tourkin et al. (2007) and Strizek et al. (2006). Questionnaires from all SASS administrations are available online at http://nces.ed.gov/surveys/sass/questionnaire.asp.

Data Collection

The data collection procedures for all questionnaires administered at the selected schools changed substantially for the 2003–04 SASS. In previous administrations of SASS, self-administered questionnaires were mailed to the selected schools. Nonrespondents were contacted by telephone, using a computer-assisted telephone interviewing (CATI) instrument. Finally, the remaining nonrespondents were assigned to field representatives, who contacted them by telephone and/or by personal visits. Under that methodology, most respondents completed self-administered questionnaires, while some were interviewed by telephone. During the 2003–04 SASS, field representatives were responsible for all of the SASS data collection for each of the sampled schools, and nearly all questionnaires were completed directly by respondents as opposed to telephone interviews. The field representatives' work was coordinated by staff at 12 regional offices. The regional office staff was responsible for making assignments, supervising fieldwork, checking in completed questionnaires, editing questionnaires, and implementing quality control procedures. Data collection for the 2003–04 SASS began in September 2003, with most of the data collection completed by February 2004. Collection of district and BIA questionnaires was extended into early May 2004 due to low response rates.

SASS Teacher-Level Estimates and Target Population

SASS is designed to produce national, regional, and state estimates for public elementary and secondary schools and their related components (i.e., teachers, principals, school districts, and school library media centers). Data from the SASS teacher questionnaires are designed to support comparisons between new and experienced teachers (3 years or less of experience vs. more than 3 years of experience) at the state level and between teachers by race and full- or part-time status at the national level.

2003–04 SASS Public School and Public School Teacher Sample Selection

Full SASS public school sample selection

The foundation of the public school SASS sampling frame is the Common Core of Data (CCD) Public Elementary/Secondary School Universe Data File. The CCD file is based on data collected annually by NCES from each state education agency, and it is the most comprehensive list of public schools at the time of sample selection. Because of its scale, planning for SASS begins 2 years prior to data collection. Therefore, SASS uses the most recent CCD file available at the time for the sampling frame: the CCD file released 2 years prior to the SASS school year (e.g., the 2003–04 SASS used the 2001–02 CCD file).

Schools were added and deleted from the CCD file in order to fit the definition of a school that is used in SASS. In SASS, a school is defined as an institution or part of an institution that provides classroom instruction to students, has one or more teachers to provide instruction, serves students in one or more of grades 1–12 or the ungraded equivalent, and is located in one or more buildings. SASS is confined to the 50 states plus the District of Columbia and excludes territories and overseas schools. The SASS public school sample is a stratified probability-proportionate-to-size (PPS) sample. All BIA-funded schools are automatically included in the SASS sample. Non-BIA-funded schools are stratified by type, then state or state group, and, finally, grade level. Non-BIA-funded schools are systematically selected for the sample from a hierarchically sorted list using the PPS algorithm within each stratum. In 2003–04, this produced a non-BIA-funded sample of about 10,200 public schools and a BIA-funded sample of about 170 schools.

Full SASS public school teacher sample selection

The sample of SASS teachers was selected from all of the SASS schools that provide teacher data on the Teacher Listing Form. Teachers were selected if they met the definition of staff who teach a regularly scheduled class to students in grades K–12. Teachers of prekindergarten only, adult education or postsecondary education only, short-term substitutes, student teachers, teacher aides, day care aides, and librarians who only teach library skills were excluded from SASS. Teachers were stratified by minority status (Asian or Pacific Islander, American Indian or Alaska Native) and teaching experience (3 or fewer years or more than 3 years). The goals of the teacher sampling were to select at least 1,600 Asian or Pacific Islander teachers, at least 1,600 American Indian or Alaska Native teachers, and a minimum of 2,300 new teachers by sector. No oversampling of new teachers in public schools was needed because of the large number of sampled schools with new teachers.

On average, three to eight teachers were selected from each school. The maximum number of teachers selected per school was set at 20. The teacher sample size was limited in this way to avoid overburdening the schools, while allowing for a large enough teacher sample to meet the reliability requirements. As a result of these sampling procedures, approximately 53,000 public school teachers were selected. From this public school teacher sample, approximately 43,000 responded. For more information on the SASS sample selection, see Strizek et al. (2006) and Tourkin et al. (2007).

Unit and Item Response Rates

Unit response rates

Unit response rates are the rates at which the sampled units respond by substantially completing the questionnaire. The base-weighted unit response rates are the base-weighted number of interviewed cases divided by the base-weighted number of eligible cases. The base weight for each sampled unit is the inverse of the probability of selection; see NCES Standard 1-3 for guidance on how to compute different types of response rates (U.S. Department of Education 2003). Unit response rates can either be calculated

unweighted or weighted. Table B-1 provides the unweighted and base-weighted response rates for public school teachers who received the Teacher Questionnaire.

Table B-1. Unweighted and weighted response rates and weighted overall response rate for the public school teacher survey population: 2003–04

Survey population	Unweighted response rate	Weighted response rate	Weighted overall response rate[1]
Public school teacher	84.0	84.8	75.7

[1] Weighted questionnaire response rate times the weighted response rate for the Teacher Listing Form.
NOTE: Response rates were weighted using the inverse of the probability of selection (base weight).
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, special tabulations from the Public School Teacher Documentation Data File.

Item response rates

The weighted item response rates are the final-weighted number of sample cases responding to an item divided by the final-weighted number of sample cases eligible to answer the item. Of the items used in this report, nine have a weighted response rate of less than 70 percent. These are the subject codes, grade-level codes, and student enrollments for the 8th, 9th, and 10th class (or section) taught by teachers of departmentalized classes (T0098 through T0106, where applicable). These items were used in tables 4 and 5, but were reported by only a small percentage of the subpopulation of teachers in this report. Of the teachers in this report, about 4 percent reported data on an 8th class and about 2 percent reported data on a 9th and 10th class.

Nonresponse Bias Analysis

A comprehensive nonresponse bias analysis was conducted for each of the components of the 2003–04 SASS. The analysis evaluated the extent of potential bias introduced by school district nonresponse, school nonresponse, school principal nonresponse, teacher nonresponse, and school library nonresponse at both the unit and item levels. Results of the bias analysis are discussed in detail in *Documentation for the 2003–04 Schools and Staffing Survey* (Tourkin et al. 2007). Evidence of substantial bias due to unit-level nonresponse was not found in the Public School Teacher Data File.

At the item level, all questionnaire items with response rates below 85 percent were examined for nonresponse bias. No evidence of substantial nonresponse bias was found at the item level in the data files.

Data Cleaning and Quality Assurance

Primary Data Review and Preliminary Interview Status Recode Classification

During data review, Census Bureau analysts examined frequencies of each data item in order to identify any suspicious values (e.g., if an item's response was outside the range of possible answer choices, or if an answer seemed unlikely given the respondent's other responses in the survey). Analysts also reviewed questionnaires to ensure that key items were answered and that enough of the questionnaire items were completed. When analysts identified a potential problem, they verified that data were keyed correctly by reviewing an electronic image of the questionnaire. If data were missing, analysts attempted to recontact the school or use nonintrusive means of obtaining the data (e.g., school website, intraquestionnaire imputation).

The next step in data processing was the preliminary determination of each case's interview status recode (ISR); that is, whether each case was an interview, a noninterview, or out-of-scope for SASS. In general, cases with an "out-of-scope" outcome code that had been assigned by the SASS Teacher Listing instrument were classified as out-of-scope (ISR = 3) for the preliminary ISR. Otherwise, cases with data entries were classified as completed interviews (ISR = 1). Cases with no data, cases lacking critical items, and cases where the district or school had refused for all respondents were classified as noninterviews (ISR = 2).

Computer Edits

After primary data review and the preliminary ISR classification, all files were submitted to a series of computer edits. These edits consisted of a range check, a consistency edit, and a blanking edit. The first of the computer edits was the range check. The range check was used to delete entries that were outside the range of acceptable values that were set prior to the administration of SASS. Actual changes to the data were made during the consistency edit. The consistency edits identified inconsistent entries within each case and, whenever possible, corrected them. If the inconsistencies could not be corrected, the entries were deleted. In addition, the consistency edit filled in some items where data were missing or incomplete by using other information from the same data record. The blanking edits deleted extraneous entries (e.g., in situations where skip patterns were not followed correctly) and assigned the "not answered" (.N) code to items that should have been answered, but were not. The only records that were put through the series of edits were those classified as interviews in the preliminary ISR.

Final Interview Status Edit

After the range checks, consistency edits, and blanking edits were completed, the records were put through an edit to make a final determination of whether the case was eligible for the survey and, if so, whether sufficient data had been collected for the case to be

classified as a completed interview. A final ISR value was assigned to each case as a result of this edit.

Imputation Procedures

SASS is a fully imputed dataset. In general, missing values (i.e., items that should have been answered but were not) are filled during one of three stages of imputation: (1) survey data are imputed with a valid response using data from other items in the same questionnaire or from other related sources, (2) data are imputed from items found in the questionnaires of respondents who have certain characteristics in common or from the aggregated answers of similar questionnaires, and (3) the remaining unanswered items are imputed clerically by Census Bureau analysts. A numerical flag is assigned to each imputed item so that it is possible for data users to identify which items were imputed, how the imputations were performed, and whether or not to include the imputed data in their analysis.

Weighting, Variance Estimation, and Tests of Significance

Each SASS data file contains a final weight and a set of replicate weights. The final weights are needed so that the sample estimates reflect the target survey population when the data are analyzed. For these analyses, the final teacher weight was used so that sample estimates reflected the target teacher population. The final weight variable was TFNLWGT.

In surveys with complex sample designs, such as SASS, direct estimates of sampling errors that assume a simple random sample will typically underestimate the variability in the estimates. The SASS sample design and estimation include procedures that deviate from the assumption of simple random sampling. For this reason, the preferred method of calculating sampling errors is replication. Each SASS data file includes a set of replicate weights designed to produce variance estimates (e.g., the teacher replicate weights TREPWT1-TREPWT88).

The tests of significance used in this analysis are based on Student's *t* statistics. The formula used to compute Student's *t* statistic is as follows:

$$t = \frac{E_1 - E_2}{\sqrt{se_1^2 + se_2^2}}$$

where E_1 and E_2 are the first and second estimates being compared, and se_1 and se_2 are the corresponding standard errors. The computation of sampling errors can be done easily with one of the following software programs: WesVar Complex Sample Software,

SUDAAN (SUDAAN programs can be written within a SAS statistical package), Stata 9, or AM Statistical Software.[1]

All differences cited in the text of this report are statistically significant at the $p < .05$ level.

Reliability of Data

SASS estimates are based on samples. The sample estimates may differ somewhat from the values that would be obtained from administering a complete census using the same questionnaire, instructions, and enumerators. The difference occurs because a sample survey estimate is subject to two types of errors: nonsampling and sampling. Estimates of the magnitude of the SASS sampling error, but not the nonsampling error, can be derived or calculated. Nonsampling errors are attributed to many sources, including definitional difficulties, the inability or unwillingness of respondents to provide correct information, differences in the interpretation of questions, an inability to recall information, errors made in collection (e.g., in recording or coding the data), errors made in processing the data, and errors made in estimating values for missing data. Quality control and edit procedures were used to reduce errors made by respondents, coders, and interviewers.

Specific Report Subpopulation

General report subpopulation

This report includes

- traditional public and public charter school teachers;
- teachers of departmentalized classes; and
- teachers of selected main assignments and subject areas.

Subpopulation at each unit of measure

By unit of measure, this report also includes

- public school teachers of students in any of grades 10–12, or grade 9 and no grade lower;
- classes taught at the 9th- through 12th-grade level; and
- students in classes taught at the 9th- through 12th-grade level.

Readers should be aware of these differences when making comparisons across tables in this report. For example, a teacher of eighth- and ninth-graders would not be included in

[1] For information on each of these software programs, please see their respective websites: www.westat.com/wesvar, www.rti.org/SUDAAN/, www.stata.com, and am.air.org.

the teacher-level tables. However, if that teacher reported an individual class taught at the ninth-grade level, that class, and the students enrolled in it, were included in tables 4 and 5. For more detailed information on the variables used to define teacher-, class-, and student-level tables, please see Appendix D: Description of Variables Used in the Report.

It is important to point out that not all public high school-level departmentalized teachers were included in the tables of this report. Teachers of, and classes and students in, selected subjects were not analyzed due to various reasons. The following subjects were not examined in the report: elementary education, special education, English as a Second Language, health, physical education, vocational and technical education, driver's education, library/information science, military science (ROTC), philosophy, and religious studies (theology and divinity). Also, teachers who reported "other" or "other foreign language" as their main assignment or subject area taught were not examined in the report. These exclusions were made for various reasons, including small sample sizes and difficulties in matching subject areas to qualifications.

As a result of these decisions, the teacher-level tables in this report address a portion of high school-level teachers. At the high school level, there were 964,000 public school teachers. Of these teachers, 87 percent (837,000) taught in departmentalized classrooms. Of these public high school-level teachers of departmentalized classrooms, 72 percent (606,000) taught one of the 20 broad fields or subfields. Overall, this subpopulation of teachers represents 63 percent of all public high school-level teachers.[2]

Also note that within science and social science, some subfields are excluded from the analyses because a substantive match between subject, major, and certification is not possible. This is because comparable topical areas are not available in each of the three areas. For example, while integrated science is a subject assignment, it is not available as a major or certification. Also, many of the subfields represent too small a population to achieve stable estimates of teacher qualifications.

For a full list of the subjects included in the tables, and the majors and certifications with which they are associated, please see Appendix D: Description of Variables Used in the Report.

[2] The stated percentages are based on calculations of unrounded counts of teachers.

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Appendix C: Caution Concerning Changes in Estimates Over Time

Change Over Time

Care must be taken in estimating change over time in a SASS data element, because some of the measured change may not be attributable to a change in the education system. It may be due to changes in the sampling frame, changes in questionnaire item wording, or other changes. This appendix describes two particular areas of change.

Changes in the Definitions and Measurement of Locales

The definitions of locale codes based on the U.S. Census were revised in 2000 and again in 2003. This revision impacts the urbanicity variable included in tables A-2, A-3, A-4, A-5, and A-6 of the report, which is based on the 2000 Census definitions for locale codes.

The definitions of locale codes changed between the 1999–2000 and 2003–04 administrations of SASS. To facilitate the transition, locale codes based on geographic concepts from both the 1990 and 2000 Decennial Census are included in the 2003–04 SASS data files. SLOCP_99 uses the 1990 Census metropolitan areas, and SLOCP_03 and URBANS03 use the 2000 Census metropolitan areas. The specific categories reported in the locale codes are based, respectively, upon the 1990 or 2000 definitions for central city, urban fringe of large or medium-sized central city, large or small town, and rural areas either inside a metropolitan area or outside a metropolitan area. The 1990 Decennial Census geographic areas were based upon countywide definitions of metropolitan or nonmetropolitan areas. By the 2000 Census, urban and rural classifications were based on a subcounty level.

In 2003, the Office of Management and Budget changed the geographic classifications, replacing "central city" with "principal city" and "Standardized Metropolitan Statistical Area" (SMSA) with "Core-Based Statistical Area" (CBSA). However, these newer terms and locale codes could not be used in the 2003–04 SASS, because the 2003 geographic classification of schools and school districts had not been completely implemented in the Common Core of Data (CCD) or the Private School Universe Survey (PSS)—which serve as the sampling frames for SASS—by the time the 2003–04 SASS data were collected. Since then, the 2003–04 CCD and 2003–04 PSS have incorporated a new set of 12-level locale codes.

Changes in the Teacher Certification Portion of the SASS Teacher Questionnaire

In 2002 (revised 2004), NCES released *Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-Field Teaching, 1987–88 to 1999–2000* (U.S. Department of Education 2004). While the current report is similar in spirit, enough analytical changes were made in 2003–04 that readers should not compare estimates on teacher qualifications from the prior report with data in the current report. More generally, analysts should take note of the structural changes that were made to the certification items in the 2003–04 Teacher Questionnaire. These changes also impact the data and, therefore, are another reason why year-to-year comparisons are discouraged.

In the early stages of the report, comparisons of the certification data from 1999–2000 and 2003–04 were run. These preliminary analyses revealed a decline in the percentage of certified high school-level teachers in many subject areas. This discrepancy is particularly noticeable when looking at the subfields of subjects. For instance, the percentage of students taught by a high school-level teacher with a certification in science declined by 4.8 percent, while the decline was 14.5 percent for biology/life sciences, 17.6 percent for physical science, and 20.5 percent for chemistry students.

Table C-1 compares 1999–2000 data with 2003–04 data on the percentage of students taught by high school-level teachers who were certified in the subject being taught. Note that unlike the tables in the body of the report, table C-1 does not include the secondary-level certification requirement, as those items were not available in 1999–2000. It also includes only a subset of those subjects reported in the body of the text.

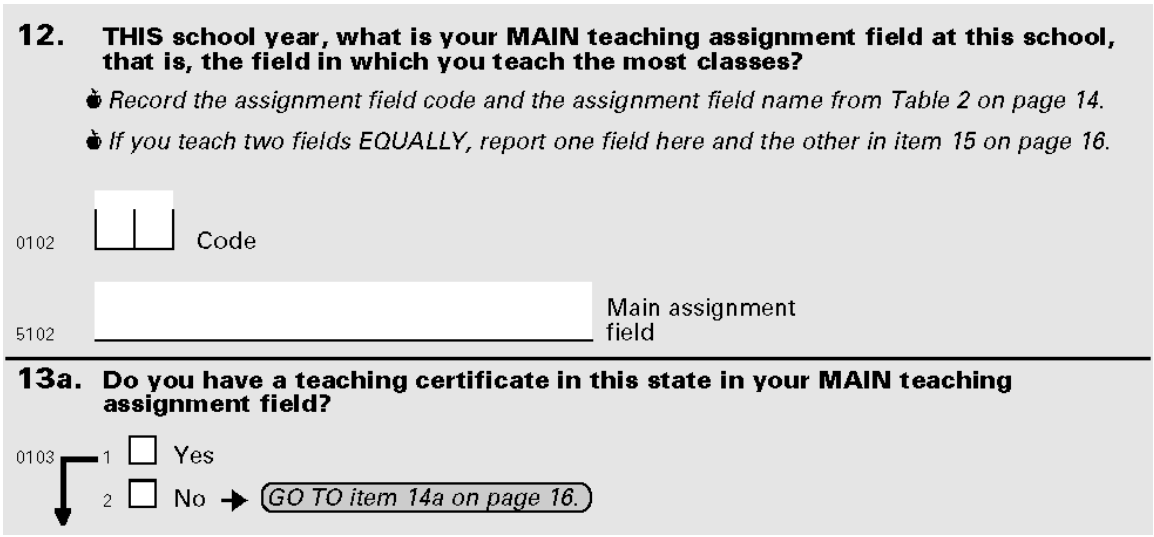
Table C-1. Among public school students taught by a high school-level teacher, the percentage of students taught by a teacher certified in that subject area, by school year and course subject area: 1999–2000 and 2003–04

Course subject area	Total certified (1999–2000)[1]	Total certified (2003–04)[1]	Difference between 1999–2000 and 2003–04
English	85.7	79.5	-6.2
Mathematics	83.1	76.8	-6.3
Science	84.8	80.0	-4.8
Biology/life sciences	81.9	67.4	-14.5
Physical science	77.4	59.8	-17.6
Chemistry	81.7	61.2	-20.5
Earth sciences	59.4	45.5	-13.9
Physics	73.7	51.6	-22.1
Social science	84.5	81.9	-2.6

[1] For each course subject area, certifications are in-subject, but not necessarily at the secondary level.
NOTE: Analyses present in this table are not comparable to those in the body of this report.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Teacher Data File," 2003–04; and *Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-Field Teaching, 1987–88 to 1999–2000* (NCES 2002-603 REVISED).

It is likely that some of the change in certification rates from 1999–2000 to 2003–04 was due to changes in how the data were collected in the survey. The format of the items in the 1999–2000 questionnaire may have resulted in the overreporting of certification in the teacher's main assignment. The structure of the items concerning certification was revised in the 2003–04 questionnaire. In 1999–2000, respondents reported whether or not they were certified in their main teaching assignment (see items 12 and 13a below). This method relied on teachers' self-reports of the match between their main assignment (and other assignments) and their certification(s) held. There was evidence that allowing teachers to self-report their certification status led to the over-reporting of in-field certifications.

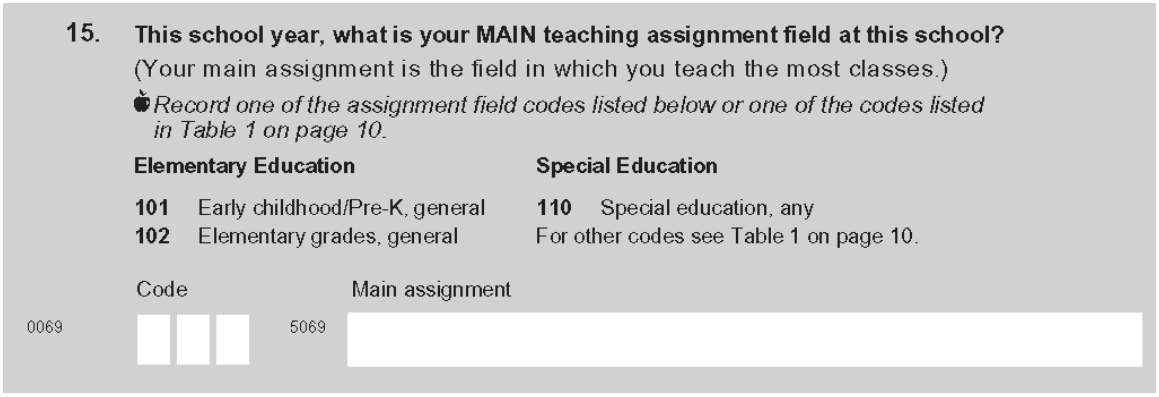
Exhibit C-1. Main assignment and certification items from the 1999–2000 Teacher Questionnaire



SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), Public School Teacher Questionnaire, 1999–2000.

As a result, the certification items were changed on the 2003–04 Teacher Questionnaire. In an effort to improve the reliability of the items, separate questions were used to ask about main teaching assignment and certification. Respondents were first asked to identify the subject code for their main assignment and then, in a later section of the survey, to identify subject codes for all subjects covered by the certification(s) they held. A determination of whether or not teachers were certified in their main assignment is up to the analyst; the analyst is able to match the course taught with certification areas, rather than rely on teacher self-reports.

Exhibit C-2. Departmentalized teacher main assignment item from the 2003–04 Teacher Questionnaire



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

Exhibit C-3. Departmentalized teacher subjects taught item from the 2003–04 Teacher Questionnaire

19. For each class (or section) that you currently teach at THIS school, complete a row/line of information.

- *Record the subject name, subject matter code, and the grade level code from Table 1 on page 10.*
- *For classes with mixed grades, list the grade with the most number of students.*
- *The number of lines filled should equal the number of classes (or sections) reported in item 18.*

A. Subject Name	B. Subject Matter Code	C. Grade Level Code	D. Number of Students
Example: English	153	11	33
5077 (1)	0077	0078	0079
5080 (2)	0080	0081	0082
5083 (3)	0083	0084	0085
5086 (4)	0086	0087	0088
5089 (5)	0089	0090	0091
5092 (6)	0092	0093	0094
5095 (7)	0095	0096	0097
5098 (8)	0098	0099	0100
5101 (9)	0101	0102	0103
5104 (10)	0104	0105	0106

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

Exhibit C-4. Teaching assignment and subject matter codes from the 2003–04 Teacher Questionnaire

Table 1. Teaching Assignment and Subject Matter Codes
For questions 15, 17, and 19

General Education

Elementary Education
101 Early childhood/Pre-K, general
102 Elementary grades, general

Special Education
110 Special education, any

Subject Matter Specific

Arts & Music
141 Art/Arts or crafts
143 Dance
144 Drama/Theater
145 Music

English and Language Arts
151 Communications
152 Composition
153 English
154 Journalism
155 Language arts
158 Reading
159 Speech

English as a Second Language
160 ESL/Bilingual education: General
161 ESL/Bilingual education: Spanish
162 ESL/Bilingual education: Other languages

Foreign Languages
171 French
172 German
173 Latin
174 Spanish
175 Other foreign language

Health Education
181 Health education
182 Physical education

Mathematics and Computer Science
191 Algebra, elementary
192 Algebra, intermediate
193 Algebra, advanced
194 Basic and general mathematics
195 Business and applied math
196 Calculus and pre-calculus
197 Computer science
198 Geometry
199 Pre-algebra
200 Statistics and probability
201 Trigonometry

Natural Sciences
210 Science, general
211 Biology/Life sciences
212 Chemistry
213 Earth sciences
215 Integrated science
216 Physical science
217 Physics

Social Sciences
220 Social studies, general
221 Anthropology
225 Economics
226 Geography
227 Government/Civics
228 History
231 Native American studies
233 Psychology
234 Sociology

Vocational/Technical Education
241 Agriculture and natural resources
242 Business/Office
243 Keyboarding
244 Marketing and distribution
245 Health occupations
246 Construction trades
247 Mechanics and repair
248 Drafting/Graphics/Printing
249 Metals/Woods/Plastics, and other precision production (electronics, leatherwork, meatcutting, etc.)
250 Communications and other technologies (not including computer science)
251 Culinary arts/Hospitality
252 Child care and education
253 Personal and other services (including cosmetology, custodial services, clothing and textiles, and interior design)
254 Family and consumer sciences education
255 Industrial arts/Technology education
256 Other vocational/Technical education

Miscellaneous
262 Driver education
264 Library/Information science
265 Military science/ROTC
266 Philosophy
267 Religious studies/Theology/Divinity

Other
268 Other

Codes for grade levels of students

PK	Prekindergarten
K	Kindergarten
01	1st grade
02	2nd grade
03	3rd grade
04	4th grade
05	5th grade
06	6th grade
07	7th grade
08	8th grade
09	9th grade
10	10th grade
11	11th grade
12	12th grade
UG	Ungraded

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

Exhibit C-5. Teacher certification items from the 2003–04 Teacher Questionnaire

IV CERTIFICATION AND TRAINING

30a. Which of the following describes the teaching certificate you currently hold in this state?

- *Mark (X) only one box.*
- *If you currently hold more than one of the following, a second certification may be listed in item 31.*

0166

1. ☐ Regular or standard state certificate or advanced professional certificate
2. ☐ Probationary certificate (issued after satisfying all requirements except the completion of a probationary period)
3. ☐ Provisional or other type of certificate given to persons who are still participating in what the state calls an "alternative certification program"
4. ☐ Temporary certificate (requires some additional college coursework, student teaching, and/or passage of a test before regular certification can be obtained)
5. ☐ Waiver or emergency certificate (issued to persons with insufficient teacher preparation who must complete a regular certification program in order to continue teaching)
6. ☐ I do not have any of the above certifications in THIS state. → *GO TO item 32 on page 24.*

b. Some certificates may allow you to teach in multiple content areas. In what content area(s) does the teaching certificate marked above allow you to teach in this state?

(For some teachers the content area may be the grade level [e.g., elementary general, secondary general, etc].)

- *Please record the content area code from Table 3 on page 19.*

0167 **1) Code** ☐☐☐ 5167 **Content Area**

2) Which of the following grade ranges does this certificate apply to?

- *Mark (X) all that apply.*

0168 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0169 1 ☐ Secondary grades (including middle school)

0170 1 ☐ Ungraded

c. If there is an additional content area that the certificate described above allows you to teach, please list it below. Otherwise, GO TO item 31a on page 22.

0171 **1) Code** ☐☐☐ 5171 **Content Area**

2) Which of the following grade ranges does this certificate apply to?

- *Mark (X) all that apply.*

0172 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0173 1 ☐ Secondary grades (including middle school)

0174 1 ☐ Ungraded

If there is an additional content area that the certificate described above allows you to teach, please list it in 30d on page 21. Otherwise, GO TO item 31a on page 22.

See notes at end of exhibit.

Exhibit C-5. Teacher certification items from the 2003–04 Teacher Questionnaire—Continued

30d. Some certificates may allow you to teach in multiple content areas. In what content area(s) does the teaching certificate marked in 30a allow you to teach in this state?

(For some teachers the content area may be the grade level [e.g., elementary general, secondary general, etc].)

Please record the content area code from Table 3 on page 19.

0175 **1) Code** ☐☐☐ 5175 **Content Area** ☐

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0176 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0177 1 ☐ Secondary grades (including middle school)

0178 1 ☐ Ungraded

---

e. If there is an additional content area that the certificate described above allows you to teach, please list it below. Otherwise, GO TO item 31a on page 22.

0179 **1) Code** ☐☐☐ 5179 **Content Area** ☐

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0180 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0181 1 ☐ Secondary grades (including middle school)

0182 1 ☐ Ungraded

---

f. If there is an additional content area that the certificate described above allows you to teach, please list it below. Otherwise, GO TO item 31a on page 22.

0183 **1) Code** ☐☐☐ 5183 **Content Area** ☐

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0184 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0185 1 ☐ Secondary grades (including middle school)

0186 1 ☐ Ungraded

See notes at end of exhibit.

Exhibit C-5. Teacher certification items from the 2003–04 Teacher Questionnaire—Continued

31a. Do you have another current teaching certificate in this state?

0187
1 ☐ Yes
2 ☐ No → *GO TO item 32 on page 24.*

b. Which of the following describes this current teaching certificate you hold in this state?

Mark (X) only one box.

0188
1 ☐ Regular or standard state certificate or advanced professional certificate
2 ☐ Probationary certificate (issued after satisfying all requirements except the completion of a probationary period)
3 ☐ Provisional or other type of certificate given to persons who are still participating in what the state calls an "alternative certification program"
4 ☐ Temporary certificate (requires some additional college coursework, student teaching, and/or passage of a test before regular certification can be obtained)
5 ☐ Waiver or emergency certificate (issued to persons with insufficient teacher preparation who must complete a regular certification program in order to continue teaching)

c. In what content area(s) does this current teaching certificate, marked in 31b above, allow you to teach in this state?

(For some teachers the content area may be the grade level [e.g., elementary general, secondary general, etc].)

Please record the content area code from Table 3 on page 19.

0189 5189
1) Code ☐☐☐ **Content Area** _____

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0190 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)
0191 1 ☐ Secondary grades (including middle school)
0192 1 ☐ Ungraded

---

d. If there is an additional content area that the certificate described above allows you to teach, please list it below. Otherwise, GO TO item 32 on page 24.

0193 5193
1) Code ☐☐☐ **Content Area** _____

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0194 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)
0195 1 ☐ Secondary grades (including middle school)
0196 1 ☐ Ungraded

If there is an additional content area that the certificate described above allows you to teach, please list it in 31e on page 23. Otherwise, GO TO item 32 on page 24.

See notes at end of exhibit.

Exhibit C-5. Teacher certification items from the 2003–04 Teacher Questionnaire—Continued

31e. In what content area(s) does this current teaching certificate, marked in 31b, allow you to teach in this state?

(For some teachers the content area may be the grade level [e.g., elementary general, secondary general, etc].)

Please record the content area code from Table 3 on page 19.

0197 **1) Code** ☐☐☐ 5197 **Content Area** ☐

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0198 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0199 1 ☐ Secondary grades (including middle school)

0200 1 ☐ Ungraded

---

f. If there is an additional content area that the certificate described above allows you to teach, please list it below. Otherwise, GO TO item 32 on page 24.

0201 **1) Code** ☐☐☐ 5201 **Content Area** ☐

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0202 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0203 1 ☐ Secondary grades (including middle school)

0204 1 ☐ Ungraded

---

g. If there is an additional content area that the certificate described above allows you to teach, please list it below. Otherwise, GO TO item 32 on page 24.

0205 **1) Code** ☐☐☐ 5205 **Content Area** ☐

2) Which of the following grade ranges does this certificate apply to?

Mark (X) all that apply.

0206 1 ☐ Elementary grades (including early childhood, preschool and kindergarten)

0207 1 ☐ Secondary grades (including middle school)

0208 1 ☐ Ungraded

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

Exhibit C-6. Certification content area codes from the 2003–04 Teacher Questionnaire

Table 3. Certification Content Area Codes
For questions 30 and 31 on pages 20-23

General Education

Elementary Education
101 Early childhood/Pre-K, general
102 Elementary grades, general

Secondary Education
103 Middle grades, general
104 Secondary grades, general

Special Education
111 Special education, general
112 Autism
113 Deaf and hard-of-hearing
114 Developmentally delayed
115 Early childhood special education
116 Emotionally disturbed or behavior disorders
117 Learning disabilities
118 Mentally retarded
119 Mildly/Moderately disabled
120 Orthopedically impaired
121 Severely/Profoundly disabled
122 Speech/Language impaired
123 Traumatically brain-injured
124 Visually impaired
125 Other special education

Subject Matter Specific

Arts & Music
141 Art/Arts or crafts
143 Dance
144 Drama/Theater
145 Music

English and Language Arts
151 Communications
152 Composition
153 English
154 Journalism
155 Language arts
158 Reading
159 Speech

English as a Second Language
160 ESL/Bilingual education: General
161 ESL/Bilingual education: Spanish
162 ESL/Bilingual education: Other languages

Foreign Languages
171 French
172 German
173 Latin
174 Spanish
175 Other foreign language

Health Education
181 Health education
182 Physical education

Mathematics and Computer Science
190 Mathematics
197 Computer science

Natural Sciences
210 Science, general
211 Biology/Life sciences
212 Chemistry
213 Earth sciences
216 Physical science
217 Physics
218 Other natural sciences

Social Sciences
220 Social studies, general
221 Anthropology
225 Economics
226 Geography
227 Government/Civics
228 History
231 Native American studies
233 Psychology
234 Sociology
235 Other social sciences

Vocational/Technical Education
241 Agriculture and natural resources
242 Business/Office
243 Keyboarding
244 Marketing and distribution
245 Health occupations
246 Construction trades
247 Mechanics and repair
248 Drafting/Graphics/Printing
249 Metals/Woods/Plastics, and other precision production (electronics, leatherwork, meat cutting, etc.)
250 Communications and other technologies (not including computer science)
251 Culinary arts/Hospitality
252 Child care and education
253 Personal and other services (including cosmetology, custodial services, clothing and textiles, and interior design)
254 Family and consumer sciences education
255 Industrial arts/Technology education
256 Other vocational/technical education

Miscellaneous
262 Driver education
263 Humanities/Liberal studies
264 Library/Information science
265 Military science/ROTC
266 Philosophy
267 Religious studies/Theology/Divinity

Other
268 Other

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

What Might these Changes Mean?

In 1999–2000, high school teachers with a main assignment of pre-algebra and a certification in "secondary grades, general" should have reported a main assignment of mathematics. When asked whether they were certified in the main assignment, they might have responded "yes" if they considered the general secondary school certification applicable or it was acceptable in the school and/or state in which they taught.

In 2003–04, however, the same teachers would indicate that their main assignment is pre-algebra (Subject Code = 199) and, later in the survey, report that they hold a "secondary grades, general" teaching certificate (Subject Code = 104). Based on this information, they would not be considered to be certified in mathematics, because only codes for mathematics (190), computer science (197), and physics (217) are valid for a mathematics certification in the analyses of this report.

Due to these differences in measurement, along with changes in the analyses, readers are strongly cautioned against making comparisons of the 2003–04 certification data with prior administrations and previously published reports. Although the subject codes for main assignment and postsecondary majors changed slightly between 1999–2000 and 2003–04, the structure of those questions remained the same. Unlike certification, an analysis of majors in relation to assignment is more possible, but analysts should be aware of coding changes.

Appendix D: Description of Variables Used in the Report

General Table Variables

Teacher Level

The SASS restricted-use data files allow users to identify high school teachers in several ways. Users may select TEALEV, where high school-level teachers are identified based on the grade level of the students they teach. TEALEV uses a four-category distribution of primary, middle, high school, and combined. Users may also select the four-category variable SCHLEVE2, where high school teachers are identified as those who teach in schools that offer high school grades. SCHLEVE2 also allows users to identify schools at the primary, middle, high school, and combined levels.

Examination of the correspondence between departmentalized high school-level teachers and teachers in high schools indicated that the large majority of teachers of students in grades 10–12, or grade 9 and no grade lower, teach in what SASS considers a high school: that is, a school in which the lowest grade offered is any of grades 7–12 and the highest grade offered is any of grades 9–12. Among teachers who instruct students in grades 9–12, 1 percent teach in elementary schools, 1 percent teach in middle schools, 89 percent teach in high schools, and 9 percent teach in combined schools. For this reason, attention must be paid to understanding the meaning of "high school-level teachers" in this analysis sample.

The teacher-level analyses (tables 1–3) of this report define high school-level teachers using TEALEV (category 3), the level of students they reported teaching. TEALEV is constructed from responses to variables T0051-T0065, found in the Public School Teacher Data File. These analyses use TEALEV = 3; teachers who instruct students in grades 10–12, or grade 9 and no grade lower. Using this definition, about 1 percent of teachers of 9th-grade students were dropped from these analyses because they also reported teaching a grade lower than grade 9. The majority of the teachers who were dropped instructed students in grades 7 and/or 8, therefore moving them to TEALEV = 2 (middle-level teacher).

In test analyses of table 2 (not shown), there were no statistically significant differences between estimates of all 9th- through 12th-grade teachers and those teachers included in TEALEV = 3.

Class and Student Levels

Like prior SASS Teacher Questionnaires, the 2003–04 questionnaire asked teachers of departmentalized and elementary enrichment classes to report information on up to 10 class(es) or section(s) they taught, including the subject and enrollment of each class. In 2003–04, a new item was added to this section; teachers were asked to report the grade level of the class(es) they taught. Classes (table 4) and the students enrolled in them (table 5) were included if they were taught at the 9th- through 12th-grade level.

Classroom Organization

This report includes data on departmentalized teachers—defined as teachers who instruct several classes of different students most or all of the day in one or more subjects. These teachers were selected because they provided extensive details on the classes and students they taught. These details allow for analyses that tie specific teachers to specific classes and students. Departmentalized teachers were defined using question 12 (T0066), which asks, "Which statement best describes the way YOUR classes at this school are organized?"

Main Assignment

Tables 1–3 report the qualifications of departmentalized teachers with respect to their main assignment. These tables are constructed using question 17 (T0075), which asks, "This school year, what is your MAIN teaching assignment field at this school? (Your main assignment is the field in which you teach the most classes.)" Each teacher has one reported main assignment field.

Course Subject Area(s) Taught

Departmentalized teachers are asked to report the subject area of up to 10 classes taught in column B of question 19 in the Teacher Questionnaire (T0077, T0080, T0083, T0086, T0089, T0092, T0095, T0098, T0101, and T0104). These classes comprise the course subject area(s) taught and were used in constructing tables 4 and 5. Course subject area(s) taught include both classes taught within the reported main assignment and in other assignments (where applicable).

Using exhibit D-1, readers are able to crosswalk the majors and certification areas that were matched to the subjects teachers instructed (main assignments and course subject areas taught) (i.e., the "in-field" qualifications for each subject). In general, the subjects and corresponding "in-field" qualifications included in this report are closely aligned with the prior publication, *Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-Field Teaching, 1987–88 to 1999–2000* (NCES 2002-603 REVISED).

Exhibit D-1. Coding of main assignment and course subject areas, major fields, and certification areas, by subject area

Subject area	Main assignment/ course subject area	Major field	Certification area
English	Communications (151) Composition (152) English (153) Journalism (154) Language arts (155) Reading (158) Speech (159)	Communications (151) Composition (152) English (153) Journalism (154) Language arts (155) Linguistics (156) Literature/Literary criticism (157) Reading (158) Speech (159)	Communications (151) Composition (152) English (153) Journalism (154) Language arts (155) Reading (158) Speech (159)
Mathematics	Algebra, elementary (191) Algebra, intermediate (192) Algebra, advanced (193) Basic and general mathematics (194) Business and applied math (195) Calculus and precalculus (196) Computer science (197) Geometry (198) Pre-algebra (199) Statistics and probability (200) Trigonometry (201)	Mathematics (190) Computer science (197) Engineering (214) Physics (217)	Mathematics (190) Computer science (197) Physics (217)
Science	Science, general (210) Biology/life sciences (211) Chemistry (212) Earth sciences (213) Integrated science (215) Physical science (216) Physics (217)	Biology/life sciences (211) Chemistry (212) Earth sciences (213) Engineering (214) Physics (217) Other natural sciences (218)	Science, general (210) Biology/life sciences (211) Chemistry (212) Earth sciences (213) Physical science (216) Physics (217) Other natural sciences (218)
Biology/life sciences	Biology/life sciences (211)	Biology/life sciences (211)	Biology/life sciences (211)
Physical science	Chemistry (212) Earth sciences (213) Integrated science (215) Physical science (216) Physics (217)	Chemistry (212) Earth sciences (213) Engineering (214) Physics (217)	Chemistry (212) Earth sciences (213) Physical science (216) Physics (217)
Chemistry	Chemistry (212)	Chemistry (212)	Chemistry (212)
Earth sciences	Earth sciences (213)	Earth sciences (213)	Earth sciences (213)
Physics	Physics (217)	Engineering (214) Physics (217)	Physics (217)

See notes at end of exhibit.

Exhibit D-1. Coding of main assignment and course subject areas, major fields, and certification areas, by subject area—Continued

Subject area	Main assignment/ course subject area	Major field	Certification area
Social science	Social studies, general (220) Anthropology (221) Economics (225) Geography (226) Government/Civics (227) History (228) Native American studies (231) Psychology (233) Sociology (234)	Anthropology (221) Area/Ethnic studies (222) Criminal justice (223) Cultural studies (224) Economics (225) Geography (226) Government/Civics (227) History (228) International studies (229) Law (230) Native American studies (231) Political science (232) Psychology (233) Sociology (234) Other social sciences (235)	Social studies, general (220) Anthropology (221) Economics (225) Geography (226) Government/Civics (227) History (228) Native American studies (231) Psychology (233) Sociology (234) Other social sciences (235)
Economics	Economics (225)	Economics (225)	Economics (225)
Geography	Geography (226)	Geography (226)	Geography (226)
Government/ Civics	Government/Civics (227)	Government/Civics (227)	Government/Civics (227)
History	History (228)	History (228)	History (228)
French	French (171)	French (171)	French (171)
German	German (172)	German (172)	German (172)
Latin	Latin (173)	Latin (173)	Latin (173)
Spanish	Spanish (174)	Spanish (174)	Spanish (174)
Art/Arts or Crafts	Art/Arts or Crafts (141)	Art/Arts or Crafts (141) Art history (142)	Art/Arts or Crafts (141)
Music	Music (145)	Music (145)	Music (145)
Dance/Theater	Dance (143) Drama/Theatre (144)	Dance (143) Drama/Theatre (144)	Dance (143) Drama/Theatre (144)

NOTE: Numbers in parentheses correspond to the main assignment and subject matter codes, major field of study codes, and certification content area codes in the 2003–04 SASS Teacher Questionnaire.

The following section describes in detail the analytical requirements for in-field certifications and in-field majors for each main assignment or course subject area.

English teachers were those who taught communications, composition, English, journalism, language arts, reading, or speech. In order to have a major in the subject, these teachers were required to hold a major in communications, composition, English, journalism, language arts, linguistics, literature/literary criticism, reading, or speech. English teachers were considered certified in the subject if they reported a certification in communications, composition, English, journalism, language arts, reading, or speech.

Mathematics teachers were those who taught algebra, elementary; algebra, intermediate; algebra, advanced; basic and general mathematics; business and applied math; calculus and precalculus; computer science; geometry; pre-algebra; statistics and probability; or trigonometry. In order to have a major in the subject, these teachers were required to hold a major in mathematics, computer science, engineering, or physics. Mathematics teachers were considered certified in the subject if they reported a certification in mathematics, computer science, or physics.

Science teachers are reported in a general science row in the tables. These science teachers included teachers of science (general), biology/life sciences, chemistry, Earth sciences, integrated science, physical science, or physics. In order to have a major in the subject, these teachers were required to hold a major in biology/life sciences, chemistry, Earth sciences, engineering, physics, or other natural sciences. Science teachers were considered certified in the subject if they reported a certification in science (general), biology/life sciences, chemistry, Earth sciences, physical science, physics, or other natural sciences.

Many high school-level science teachers teach specific subfields within the science field. A **biology/life sciences** teacher was required to hold both a major and certification in biology/life sciences. **Physical science** teachers were considered in-field with a major and certification in any of: chemistry, Earth sciences, engineering, or physics.

Within physical science, qualifications were further specified. **Chemistry** and **Earth sciences** teachers were required to hold a major and certification in chemistry and Earth sciences, respectively. **Physics** teachers are considered to have a major in the subject if they have a major in physics or engineering. They are considered certified in the subject if they hold a physics certification. This was done both to account for more specific qualification requirements in some states and to align with past reports NCES reports on teacher qualifications (U.S. Department of Education 2004).

Social science teachers are reported in a general social science row. These social science teachers included teachers of social studies (general); anthropology; economics; geography; government/civics; history; Native American studies; psychology; or sociology. In order to have a major in the subject, these teachers were required to hold a major in anthropology, area/ethnic studies, criminal justice, cultural studies, economics, geography, government/civics, history, international studies, law, Native American studies, political science, psychology, sociology, or other social science. Social science teachers were considered certified in the subject if they reported a certification in social studies (general); anthropology; economics; geography; government/civics; history; Native American studies; psychology; sociology; or other social science.

Within the individual rows, teachers of the social science subfields of **economics**, **geography**, **government/civics**, and **history** were each held to stricter standards at the subfield level compared to the broad field level. At the broad field level any social science major or certification was considered in field. However, in order to be considered as having an in-field major and certification, teachers of the social science subfields were

required to have a major and certification in the respective subfield (i.e., economics teachers had to earn a major and certification in economics). Again, this was done both to account for more specific qualification requirements in some states and to align with past reports NCES reports on teacher qualifications (U.S. Department of Education 2004).

In order to meet qualification conditions, **French** teachers were required to hold a major and certification in French. The same requirements were applied to teachers of **German**, **Latin**, and **Spanish**. In order to meet qualifications requirements, foreign language teachers were required to hold a major and certification in their respective foreign language. As mentioned above, teachers of other foreign languages were not included in the tables due to small sample sizes and because certification in these less commonly taught languages is rarely awarded.

Art/Arts or crafts teachers were required to hold a major in art/arts or crafts or art history. They must also have held a certification in art/arts or crafts.

Music teachers were required to hold a major and certification in music.

Dance/Theater teachers were required to hold a major and certification in dance or theater/drama.

Variables Used in the Creation of the Columns

Major field of study. Teachers' major fields of study were calculated using variables T0119 (first bachelor's, first major), T0121 (first bachelor's, second major), T0126 (first master's, major), T0132 (second bachelor's, major), T0135 (second master's, major), T0138 (educational specialist/professional diploma), T0140 (Certificate of Advanced Graduate Studies), and T0142 (doctorate or first-professional degree). Codes provided in these variables were matched to teachers' main assignment/subject areas(s) taught and certification area(s).

Certification type. Certification type was measured using questions 30a (T0166) and 31a (T0188) for the first and, if applicable, second certification held in the state in which teachers currently teach. Teachers were required to hold a regular or standard state certification or advanced certification, or a probationary certificate. A probationary certificate is awarded after satisfying all requirements except the completion of a probationary period. All other certification types (provisional, temporary, and emergency/waiver), along with those teachers without a certification, comprised the not certified category.

Since SASS collects information on two certifications, it is not known how many teachers have three or more certifications or the additional fields in which they may be certified. About 8 percent of teachers in this report held a second certification. Given this finding, it can be surmised that few teachers hold three or more certifications. Therefore, the findings of the report should be minimally impacted. If anything, having data on three or more certifications would have provided more information on the fields in which a

teacher is qualified to teach, thereby causing estimates of the rates of teachers with in-field certifications to increase slightly.

Certification content area. Teachers were asked to report the content area(s) covered by their first and, if applicable, second certification in questions 30b[1]-f[1] (T0167, T0171, T0175, T1079, and T1083) and 31c[1]-g[1] (T0189, T0193, T0197, T0201, and T0205). Codes provided in these variables were matched to teachers' main assignment/subject area(s) taught and major(s).

Certification grade range(s). The 2003–04 SASS Teacher Questionnaire included new items that measured the grade range(s) for which teachers' certification applied (elementary, secondary, combined). In this report, analyses of in-field qualifications required that most teachers hold a secondary-level certification in the subject(s) that they teach. This determination was made using questions 30b[2]-f[2] (T0169, T0173, T0177, T0181, and T0185) and 31c[2]-g[2] (T0191, T0195, T0199, T0203, and T0207). A review of state certification requirements showed that many states allow teachers with an ungraded certification in the arts to teach at the high school level. For this reason, teachers of the art/arts or crafts, music, or dance/theater were also considered certified if they held an ungraded certification (T0170, T0174, T0178, T0182, T0186, T0192, T0196, T0200, T0204, and T0208).

Variables Used in Creation of Rows: Tables A-1 through A-6

Table A-1

STATE: A SASS frame variable based on the Federal Information Processing Standards (FIPS) state code that identifies the state with administrative control over the district and the schools within that district. For a complete list of FIPS codes, see http://www.itl.nist.gov/fipspubs/fip5-2.htm or refer to the *Documentation for the 2003–04 Schools and Staffing Survey* (Tourkin et al. 2007). Recoded to a numeric variable and formatted alphabetically by state name.

Table A-2 through A-6

CLASSZ_D (Average class size): A SASS-created variable based on the average number of students enrolled in classes taught by departmentalized and elementary enrichment classroom teachers. Teachers can report student enrollments for up to 10 classes. For this report, elementary enrichment teachers are excluded. CLASSZ_D is a continuous variable that is calculated by summing the student enrollments of all classes taught and dividing by the total number of classes. Recoded into four categories for this report: 1 = 10 or fewer students, 2 = 11–18 students, 3 = 19–27 students, and 4 = 28 or more students.

TOTEXPER (Years of teaching experience): A SASS-created variable based on teachers' total number of years teaching full or part time in public, BIA, and private

schools. TOTEXPER is calculated by summing the variables T0036, T0037, T0039, and T0040. Recoded into four categories for this report: 1 = 3 or fewer years, 2 = 4–9 years, 3 = 10–19 years, and 4 = 20 or more years.

CHARFLAG (School classification): A SASS-created variable based on the school's indication of charter school status. A public charter school provides free elementary and/or secondary education to eligible students under a specific charter granted by the state legislature or other appropriate authority. CHARFLAG is based on S0661 from the public school and BIA school files. Coded as 1 = public charter school and 2 = traditional public school.

URBANS03 (Community type): A SASS frame variable based on the physical location of the school in which the respondent taught: 1 = "Central city," which includes schools located in large and midsize central cities, as defined by the Census Bureau; 2 = "Urban fringe/large town," which includes schools located in urban fringes of large and midsize central cities, in large towns, and in rural areas inside a core-based statistical area or consolidated statistical area; and 3 = "Rural/small town," which includes schools located in small towns or rural areas outside a core-based statistical area or consolidated statistical area. In this report, these categories are based on the 2000 Census definitions of locale codes. For more information on how locale code definitions have changed over time, see "Caution Concerning Changes in Estimates Over Time" in appendix C.

SCHSIZE (Student enrollment): A SASS-created variable based on the number of K–12 and ungraded students enrolled in the respondents' schools (ENRK12UG). Recoded into six categories for this report: 1 = less than 100, 2 = 100–199, 3 = 200–499, 4 = 500–749, 5 = 750–999, and 6 = 1,000 or more.

MINENR (Percentage of K–12 students in school who are of a racial/ethnic minority): A SASS-created variable based on the percentage of enrolled minority students as reported by the respondent's school. MINENR is a continuous variable and was created by dividing the number of minority students enrolled in the school (NMINST_S) by the total number of K–12 and comparable ungraded students enrolled in the school (ENRK12UG). Recoded into three categories for this report: 1 = less than 20 percent, 2 = 20–59.9 percent, 3 = 60 percent or more. Eighteen (unweighted) teachers in the subsample of this report are missing data for MINENR, due both to SASS school nonresponse and CCD frame nonresponse. When teachers' schools did not respond, SASS imputed the percentage of minority students from data in the CCD frame. In some cases, data were also missing in the CCD. For these teachers, data on minority enrollment are unavailable.

NSLAPP_S (Percentage of K–12 students in school who were approved for free or reduced-price lunch): A SASS-created variable that is computed by dividing the number of K–12 students approved for free or reduced-price lunch in the respondents' schools (S0634) by the number of K–12 students enrolled in the respondents' schools, provided the respondents' schools participate in the National School Lunch Program (S0632 = 1).

Recoded into five categories for this report: 1 = less than 35 percent, 2 = 35–49.9 percent, 3 = 50–74.9 percent, 4 = 75 percent or more, and 5 = Did not participate in program.

Appendix E: Glossary of Terms

Certification: A license or certificate awarded to teachers by the state to teach in a public school. The Schools and Staffing Survey (SASS) includes five types of certification: regular or standard state certification or advanced professional certificate; probationary certificate—issued after satisfying all requirements except the completion of a probationary period; provisional or other type of certificate—given to persons who are still participating in what the state calls an "alternative certification program"; temporary certification—requires some additional college coursework, student teaching, and/or passage of a test before regular certification can be obtained; and waiver or emergency certificate—issued to persons with insufficient teacher preparation who must complete a regular certification program in order to continue teaching.

Charter school: See Public charter school.

Common Core of Data (CCD): The CCD is a group of surveys that acquires and maintains public elementary and secondary education data from the 50 states, the District of Columbia, Department of Defense schools, and the outlying areas through state-level (or equivalent) education agencies. Information about staff and students in public schools is collected annually at the school, LEA (local education agency or school district), and state levels. Information about revenues and expenditures is also collected at the state level. The CCD is the basis for the SASS sampling frame for public, public charter, and BIA-funded schools.

Course subject area taught: This term is not defined in the SASS questionnaires. A general definition is any subject taught by a teacher, including both main assignment and other assignment(s). Teachers may report multiple subject areas taught.

Departmentalized teacher: The SASS Teacher Questionnaire defines departmentalized teachers as those who instruct several classes of different students most or all of the day in one or more subjects (such as algebra, history, or biology).

Elementary enrichment teacher: The SASS Teacher Questionnaire defines elementary enrichment teachers as elementary school teachers who instruct only one subject, such as art, music, physical education, or computer skills.

Free or reduced-price lunches: A federally funded program to aid schools in providing an adequate lunch at school. Schools are reimbursed to provide meals to students, either free or for a reduced price. See also the description of the National School Lunch Program.

In-field teacher: This term is not defined by SASS. In the literature, an in-field teacher is usually one whose postsecondary degree (major) and/or certification (type or content area covered) matches the subject(s) in which they have been assigned to teach.

Itinerant teacher: See Teacher.

Main assignment field: The SASS Teacher Questionnaire defines main assignment as the field in which the teacher teaches the most classes. Teachers may report only one main assignment.

Major: This term is not defined by SASS, but is meant as a field of study in which an individual has taken substantial academic coursework, implying that the individual has substantial knowledge of the academic discipline or subject area.

National School Lunch Program: The National School Lunch Program (NSLP) is a federally assisted meal program operating in public and nonprofit private schools and residential child care institutions. It provides nutritionally balanced, low-cost or free lunches to children each school day. School districts and independent schools that choose to take part in the lunch program get cash subsidies and donated commodities from the U.S. Department of Agriculture for each meal they serve. In return, they must serve lunches that meet federal requirements, and they must offer free or reduced-price lunches to eligible children. School food authorities can also be reimbursed for snacks served to children through age 18 in after-school educational or enrichment programs.

Public charter school: A public charter school is a public school that, in accordance with an enabling state statute, has been granted a charter exempting it from selected state or local rules and regulations. A public charter school may be a newly created school or it may previously have been a public or private school.

Public school: A public school is an institution or part of an institution that provides classroom instruction to students, has one or more teachers to provide instruction, serves students in one or more of grades 1–12 or the ungraded equivalent, and is located in one or more buildings. It is possible for two or more schools to share the same building; in this case, they were treated as different schools if they had different administrations (i.e., principals). Public schools include regular, special education, vocational/technical, alternative, and public charter schools. Schools in juvenile detention centers and schools located on domestic military bases and operated by the Department of Defense are included. See also entries for Public charter school and Traditional public school.

Pull-out teacher: The SASS Teacher Questionnaire defines a pull-out teacher as one who instructs students released from their regular classes in specific skills or to address specific needs such as gifted and talented, special education, reading, or English as a Second Language.

Regular full-time teacher: See Teacher.

Self-contained teacher: The SASS Teacher Questionnaire defines a self-contained teacher as one who instructs the same groups of students all or most of the day in multiple subjects.

Student enrollment: The number of students officially enrolled in the school or district as of October 1, 2003.

Teacher: A teacher is defined as a full-time or part-time teacher who teaches any regularly scheduled classes in any of grades K–12. This includes administrators, librarians, and other professional or support staff members who teach regularly scheduled classes on a part-time basis. Itinerant teachers are included, as well as long-term substitutes who are filling the role of regular teacher on a long-term basis. An itinerant teacher is defined as a teacher whose assignment requires teaching at more than one school (e.g., a music teacher who teaches 3 days per week at one school and 2 days per week at another). Itinerant teachers who teach full time in any district, but teach part time in a particular school, are considered part-time teachers at that particular school. A regular full-time teacher is any teacher whose primary position in a school is not as an itinerant teacher, a long-term substitute, a short-term substitute, a student teacher, a teacher aide, an administrator, a library media specialist or librarian, another type of professional staff (e.g., counselor, curriculum coordinator, social worker), support staff (e.g., secretary), or a part-time teacher. Short-term substitute teachers and student teachers are not included.

Teacher level: This is based on the grade level of students taught by teachers. Teachers are grouped into four categories based on the grade levels of the students taught and the teachers' main assignments. Teacher level does not necessarily reflect the level of the school in which teachers teach. Primary-level teachers include teachers who taught only grades K–4, as well as other teachers who taught grades 5–8 but identified themselves as elementary or special education teachers. Middle-level teachers include teachers who taught students in grades 5–9 and did not teach any students in grades 10–12; some teachers who taught grades 5–8 who identified themselves as elementary or special education teachers were classified as primary-level teachers. High school-level teachers include all teachers who taught any of grades 10–12, as well as teachers who taught grade 9 and no grade lower. All other teachers are categorized as combined.

Team teacher: The SASS Teacher Questionnaire defines a team teacher as one of two or more teachers in the same class at the same time who is jointly responsible for teaching a single group of students.

Traditional public school: Traditional public schools are the subset of all public schools that are not public charter schools. They include regular, special education, vocational/technical, and alternative schools. They also include schools in juvenile detention centers and schools located on domestic military bases and operated by the Department of Defense. See also the definitions for Public school and Public charter school.