Data for this report were drawn primarily from the 1999 "Public School Teachers Use of Computers and the Internet" survey, conducted through the Fast Response Survey System (FRSS) of the National Center for Education Statistics (NCES). Supplemental data presented in this report were taken from the National Assessment of Educational Progress (NAEP) administrations, Current Population Surveys (CPS), and past FRSS surveys on computers and the Internet in public schools. The following sections will describe the data sources and analytical procedures used to calculate the descriptive estimates presented in this report.

The Fast Response Survey System (FRSS)

The Fast Response Survey System (FRSS), conducted through the National Center for Education Statistics (NCES), was established in 1975 to collect and report data on key education issues at the elementary and secondary level quickly and with minimum response burden. The FRSS was designed to meet the data needs of Department of Education analysts, planners, and decision-makers when information could not be collected quickly through traditional NCES surveys. Data collected through FRSS surveys are representative at the national level, drawing from a universe that is appropriate for each study.

In addition to using data collected as part of the 1999 "Public School Teachers Use of Computers and the Internet" survey, this report drew on data published in previous FRSS publications on the technology available in public schools (Bare and Meek, 1998; Carpenter, 1996; Heaviside et al., 1995, 1997). Sampling and data collection procedures, as well as response rates and definitions of analysis variables for each technology survey, are described in detail in those reports.

Sample Selection for the 1999 FRSS Survey

The sample for the FRSS Survey on Public School Teachers' Use of Computers and the Internet consisted of 2,019 full-time teachers in regular public elementary, middle, and high schools in the 50 states and the District of Columbia. To derive the sample of teachers, a sample of 1,000 public schools was first selected from the 1995-96 NCES Common Core of Data (CCD) Public School Universe File. The sampling frame constructed from the 1995-96 CCD file contained 78,697 regular public schools. Special education schools, vocational schools, alternative/other schools, schools in the territories, overseas Department of

Defense schools, schools with a high grade lower than grade 1 or ungraded, and schools that taught only adult education were excluded from the frame. The frame contained 48,714 regular elementary schools, 14,003 regular middle schools, and 15,980 regular high/combined schools. Elementary schools were defined as schools with the lowest grade less than or equal to grade 3 and the highest grade less than or equal to grade 8. Secondary schools were defined as schools with a lowest grade higher than or equal to grade 7 and a highest grade less than or equal to grade 12. Combined schools were defined as having a lowest grade less than or equal to grade 3 and a highest grade greater than or equal to grade 9. Secondary schools and combined schools were combined into one category for sampling. Middle schools were assigned to either the elementary or the secondary/combined stratum depending on their grade span.

The public school sampling frame was stratified by instructional level (elementary and secondary/combined) and school size (less than 300, 300 to 999, and 1,000 or more). Within the primary strata, schools were also sorted by type of locale (central city, urban fringe, town, rural), geographic region, and percent of students in the school eligible for free or reduced-price school lunch to produce additional implicit stratification. A sample of 1,000 schools was then selected from the sorted frame with probabilities proportionate to size, where the measure of size was the square root of the estimated number of full-time-equivalent (FTE) teachers in the school. The sample contained 500 elementary schools and 500 secondary/combined schools. Each sampled school was asked to send a list of their eligible teachers, from which a teacher sampling frame was prepared. The teacher sampling frame was designed to represent regular full-time teachers who taught in any of grades 1 through 12. Only teachers whose primary assignment was bilingual education/English as a second language, special education, and vocational education were excluded. To prepare the teacher lists, schools were asked to start with a list of all the teachers in the school, and then to cross off the following types of teachers: part-time, itinerant, and substitute teachers; teachers' aides; unpaid volunteers; principals (even those who teach); kindergarten or preschool teachers; or anyone on the list who was not a classroom teacher (e.g., librarians, secretaries, or custodians). Next, schools were instructed to cross off the list any teachers whose primary teaching assignment was bilingual education/English as a second language, special education, or vocational education.

Within selected schools, teacher sampling rates were designed to select at least one but no more than four teachers per school, with an average of slightly more than two teachers per school. The resulting sample of 2,019 teachers contained 1,016 elementary school and 1,003 secondary/combined school teachers.

Respondent and Response Rates

A letter and instruction sheet for preparing the list of teachers was sent to the principal of each sampled school in October 1998. The letter introduced the study, requested the principal's cooperation to sample teachers, and asked the principal to prepare a list of teachers that included only full-time teachers. Telephone followup was conducted from November 1998 through March 1999 with principals who did not respond to the initial request for teacher lists. Of the 1,000 schools in the sample, 7 were found to be out of the scope of the survey (no longer in existence), for a total of 993 eligible schools. Teacher lists were provided by 903 schools, or 91 percent of the eligible schools.

Questionnaires were mailed to teachers in March 1999. Telephone followup was conducted from April through June 1999 with teachers who did not respond to the initial questionnaire mailing. Nonresponse followup was suspended in June because a large portion of schools had closed or were closing, and it began again in September 1999. Teachers were sent a reminder flyer at the beginning of their fall 1999 school year informing them that questionnaires would be mailed to them in about 2 weeks. Questionnaires, along with a magnet with the survey name on it to thank teachers for their participation, were remailed to nonrespondents based on when their schools opened in the fall. Data collection was completed in October 1999. Of the 2,019 teachers selected for the sample, 172 were found to be out of the scope of the survey, usually because they were not regular full-time classroom teachers. This left a total of 1,847 eligible teachers in the sample. Completed questionnaires were received from 1,674 teachers, or 91 percent of the eligible teachers. The overall response rate was 83 percent (91 percent for the list collection multiplied by 91 percent for the teacher questionnaire). Weighted item nonresponse rates ranged from 0 percent to 1.1 percent for the items presented in this report. Because item nonresponse was so low, imputation for item nonresponse was not implemented.

Sampling and Nonsampling Errors

The responses were weighted to produce national estimates (see table B-1). The weights were designed to adjust for the variable probabilities of selection and differential nonresponse. The findings in this report are estimates based on the sample selected and, consequently, are subject to sampling variability.

The survey estimates are also subject to nonsampling errors that can arise because of nonobservation (nonresponse or noncoverage) errors, errors of reporting, and errors made in data collection. These errors can sometimes bias the data. Nonsampling errors may include such problems as misrecording of responses; incorrect editing, coding, and data entry; differences related to the particular time the survey was conducted; or errors in data preparation. While general sampling theory can be used in part to determine how to estimate the sampling variability of a statistic, nonsampling errors are not easy to measure and, for measurement purposes, usually require that an experiment be conducted as part of the data collection procedures or that data external to the study be used.

To minimize the potential for nonsampling errors, the questionnaire was pretested with respondents like those who completed the survey. During the design of the survey and the survey pretest, an effort was made to check for consistency of interpretation of questions and to eliminate ambiguous items. The questionnaire and instructions were extensively reviewed by the National Center for Education Statistics and the Office of the Secretary, U.S. Department of Education. Manual and machine editing of the questionnaire responses were conducted to check the data for accuracy and consistency, and cases with missing or inconsistent items were recontacted by telephone. Data were keyed with 100 percent verification.

Table B-1.—Number and percent of responding full-time public school teachers in the study sample and estimated number and percent of full-time public school teachers the sample represents, by school and teacher characteristics: 1999

School and teacher characteristic	Respondent sample		National estimate	
	Number	Percent	Number	Percent
All public school teachers[1]	1,674	100	1,777,940	100
School instructional level[2]				
Elementary	868	54	1,188,974	69
Secondary	738	46	540,264	31
School enrollment size				
Less than 300	194	12	189,946	11
300 to 999	1,025	61	1,172,015	66
1,000 or more	455	27	415,979	23
Locale				
City	445	27	531,055	30
Urban fringe	617	37	667,395	38
Town	275	16	264,875	15
Rural	337	20	314,615	18
Region				
Northeast	313	19	343,093	19
Southeast	388	23	410,159	23
Central	431	26	434,997	25
West	542	32	589,692	33
Percent minority enrollment in school				
Less than 6 percent	466	28	469,677	27
6 to 20 percent	383	23	405,337	23
21 to 49 percent	412	25	446,130	25
50 percent or more	398	24	446,292	25
Percent of public school students in school eligible for free or reduced-price school lunch				
Less than 11 percent	267	16	266,776	15
11 to 30 percent	552	33	573,955	33
31 to 70 percent	587	35	625,966	35
71 percent or more	258	16	300,830	17
Main teaching assignment[3]				
Self-contained classroom	582	42	786,919	44
Math/science	341	25	315,150	21
Other academic subject	463	33	406,733	27
Teaching experience				
3 or fewer years	226	14	249,483	14
4 to 9 years	351	21	376,411	21
10 to 19 years	431	26	462,213	26
20 or more years	662	40	685,402	39

[1]Teachers were full-time public school teachers who taught in any of grades 1 through 12. Only teachers whose main teaching assignment was bilingual education/English as a second language, special education, or vocational education were excluded.
[2]Data for combined schools are not reported as a separate instructional level, because there are very few in the sample. Data for combined schools are included in the totals and in analyses of other school and teacher characteristics.
[3]Teachers were asked to report the field in which they taught the most classes. A self-contained classroom teacher teaches all or most academic subjects to the same group of students all or most of the day (99 percent are elementary teachers). In the other categories, there was a mixture of teachers across instructional level. Forty-three percent of math/science teachers were elementary teachers. The category "other academic subjects" includes English, foreign language, and social studies; 38 percent are elementary teachers. Teachers in other fields (e.g., arts, physical education/health, and technology) are not included as a separate category. They are included in the totals and in analyses of other school and teacher characteristics.
NOTE: Details may not sum to totals because of rounding or missing data. There were very small amounts of missing data for the following variables percent minority enrollment in school (0.6 percent), and percent of students in school eligible for free or reduced-price lunch (0.6 percent). Percents are computed within each classification variable, but may not sum to 100 because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, Survey on Teachers' Use of Computers and the Internet, 1999.

Variances and Statistical Procedures

The standard error is a measure of the variability of estimates due to sampling. It indicates the variability of a sample estimate that would be obtained from all possible samples of a given design and size. Standard errors are used as a measure of the precision expected from a particular sample. If all possible samples were surveyed under similar conditions, intervals of 1.96 standard errors below to 1.96 standard errors above a particular statistic would include the true population parameter being estimated in about 95 percent of the samples. This is a 95 percent confidence interval.

For example, the estimated percentage of teachers who feel very well prepared to use computers and the Internet for classroom instruction in class is 10 percent, and the estimated standard error is 0.9 percent. The 95 percent confidence interval for the statistic extends from [10 - (0.9 times 1.96)] to [10 + (0.9 times 1.96)], or from 8.2 to 11.8 percent. Tables of standard errors for each table and figure in the report are provided in Appendix A.

Data from the 1999 FRSS technology survey were analyzed using Stata, a computer program which allows users to calculate nationally representative estimates of proportions and standard errors for those estimates. The proportion estimates were weighted to compensate for unequal probabilities of selection and to adjust for the effects of nonresponse, resulting in estimates that can be projected to the U.S. population of elementary and secondary public school teachers. The standard errors for those estimates were computed through a procedure called Taylor Series approximation. This method is used to take into account the variability introduced into the estimates by using sampling procedures other than random sampling. The resulting variances can then be used in the calculation of the test statistics.

Comparisons that have been made between FRSS 1999 estimates in this report have been tested for statistical significance to ensure that the differences are larger than those that might be expected due to sampling variation. The statistical comparisons were based on the Student's *t*

statistic. Differences between estimates are tested against the probability of a Type I error, or significance level. The significance levels were determined by calculating the Student's *t* values for the differences between each pair of means or proportions and comparing these with published tables of significance levels for two-tailed hypothesis testing. Student's *t* values may be computed to test the difference between estimates with the following formula:

$$t = \frac{(E_1 - E_2)}{(se_1^2 + se_2^2)} \quad (1)$$

where E_1 and E_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors. This formula is valid only for independent estimates! When estimates are not independent a covariance term must be added to the formula. If the comparison is between the mean of a subgroup and the mean of the total group, the following formula is used:

$$t = \frac{(E_{tot} - E_{sub})}{(se_{tot}^2 + se_{sub}^2 - 2(p)se_{sub}^2} \quad (2)$$

where *p* is the proportion of the total group contained in the subgroup. When comparing two percentages from a distribution that adds to 100 percent, the following formula is used:

$$t = \frac{(E_1 - E_2)}{(se_1^2 + se_2^2 - 2(r)se_1se_2} \quad (3)$$

where *r* is the correlation between the two estimates. There are hazards in reporting statistical tests for each comparison. First, comparisons based on large *t* statistics may appear to merit special attention. This can be misleading, since the magnitude of the *t* statistic is related not only to the observed differences in means or percentages but also to the number of students in the specific

categories used for comparison. Hence, a small difference compared across a large number of students would produce a large *t* statistic.

A second hazard in reporting statistical tests for each comparison occurs when making multiple comparisons among categories of an independent variable. For example, when making paired comparisons across different racial/ethnic groups, the probability of a Type I error for these comparisons taken as a group is larger than the probability for a single comparison. When more than one difference between groups of related characteristics or "families" are tested for statistical significance, one must apply a standard that assures a level of significance for all of those comparisons taken together. Comparisons were made in this report only when $p < .05/k$ for a particular pairwise comparison, where that comparison was one of k tests within a family. This guarantees both that the individual comparison would have $p < .05$ and that for k comparisons within a family of possible comparisons, the significance level for all the comparisons will sum to $p < .05$.[2] Therefore, to guard against errors of inference based on multiple comparisons, Bonferroni-adjusted significance testing was used for each set of comparisons presented in this report, as appropriate.

Definitions of Analysis Variables

School instructional level. Schools were classified according to their grade span in the Common Core of Data (CCD).

- **Elementary school**—lowest grade less than or equal to grade 3 and highest grade less than or equal to grade 8.
- **Secondary** school—lowest grade higher than or equal to grade 7 and highest grade 7 or higher.

School enrollment size. Total number of students enrolled as defined by the Common Core of Data (CCD).

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[1] U.S. Department of Education, National Center for Education Statistics, *A Note from the Chief Statistician,* No. 2, 1993.

[2] The standard that $p<.05/k$ for each comparison is more stringent than the criterion that the significance level of the comparisons should sum to $p<.05$. For tables showing the *t* statistic required to ensure that $p<.05/k$ for a particular family size and degrees of freedom, see Olive Jean Dunn, "Multiple Comparisons Among Means," *Journal of the American Statistical Association* 56 (1961): 52–64.

- Less than 300 students
- 300 to 999 students
- 1,000 or more students

Locale. As defined in the Common Core of Data (CCD).

- **City**—central city of a Metropolitan Statistical Area (MSA).
- **Urban fringe**—a place within an MSA of a central city, but not primarily its central city.
- **Town**—a place not within an MSA, but with a population greater than or equal to 2,500 and defined as urban by the U.S. Bureau of the Census.
- **Rural**—a place with a population less than 2,500 and defined as rural by the U.S. Bureau of the Census.

Percent minority enrollment in the school. The percent of students enrolled in the school whose race or ethnicity, based on data in the 1995-96 CCD file, is classified as one of the following: American Indian or Alaskan Native, Asian or Pacific Islander, black, or Hispanic. Data on this variable were missing for 0.4 percent of the teachers. The break points used for analysis were based on empirically developed quartiles from the weighted survey data.

- Less than 6 percent
- 6 to 20 percent
- 21 to 50 percent
- More than 50 percent

Percent of students at the school eligible for free or reduced-price lunch. This was based on information collected from the school during the teacher list collection phase; if it was missing from the list collection, it was obtained from the CCD file, if possible. Data on this variable were missing for 0.2 percent of the teachers. This item served as the measurement of the concentration of poverty at the school. The break points used for analysis were based on the breaks used for the 1999 FRSS Internet Access in U.S. Public Schools Survey.

- Less than 11 percent

- 11 to 30 percent
- 31 to 49 percent
- 50 to 70 percent
- 71 percent or more

Teaching experience. Total years of teaching experience, based on responses to question 14 on the survey questionnaire.

- 3 or fewer years
- 4 to 9 years
- 10 to 19 years
- 20 or more years

It is important to note that many of the school and teacher characteristics used for independent analyses may also be related to each other. For example, enrollment size and instructional level of schools are related, with secondary schools typically being larger than elementary schools. Similarly, poverty concentration and minority enrollment are related, with schools with a high minority enrollment also more likely to have a high concentration of poverty. Other relationships between analysis variables may exist. Because of the relatively small sample size used in this study, it is difficult to separate the independent effects of these variables. Their existence, however, should be considered in the interpretation of the data presented in this report.

Teacher Access to Computers and the Internet at Home and School

The data reported in this publication represent all regular full-time public school teachers. Less than 1 percent of these teachers reported that they did not have access to computers or the Internet either at home or at school (table B-2). More than half of all teachers reported they had access to both a computer and the Internet at school and at home.

Background Information

The survey was performed under contract with Westat, using the Fast Response Survey System (FRSS). Westat's Project Director was Elizabeth Farris, and the Survey Manager was

Cassandra Rowand. Shelley Burns was the NCES Project Officer. NCES requested the survey with support from Linda Roberts, Office of the Secretary, U.S. Department of Education.

Table B-2.—Percent of full-time public school teachers reporting their level of access to computers and the Internet at home, by school level access: 1999

School access to a computer and the Internet	Home access to a computer and the Internet			
	Both computer and the Internet	Internet only	Computer only	Neither
Both computer and the Internet	58	*	18	15
Internet only	0	0	0	0
Computer only	5	0	2	2
Neither	*	0	*	*

*Less than 1 percent.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, Survey on Teachers' Use of Computers and the Internet, 1999.

Analysis of Data from the National Assessment of Educational Progress (NAEP)

The Nation's Report Card, the National Assessment of Educational Progress (NAEP), is a congressionally mandated project of NCES and the Department of Education. Since 1969, assessments have been conducted periodically in reading, mathematics, science, and other subject areas. In addition to assessing academic performance in these areas, these surveys also collect background information from students, teachers, and school administrators. As part of the collection of background information, respondents are asked questions on special topics, such as the availability and use of computers in their schools.

Data on the availability and use of technology in public schools were drawn from the following administrations to calculate the NAEP estimates presented in this report: 1990 math and reading assessments; 1992 math and reading assessments; 1994 reading assessment; 1996 math and science assessments; and 1998 reading assessment. Information on the sampling and survey methods used is available in the technical report for each administration.[3]

Data from the NAEP surveys were analyzed using SAS (Statistical Analysis System), a computer program similar to Stata, which allows users to calculate nationally representative estimates

[3] See Phillips and Johnson (1991); Gorman (1994); Allen, Kline and Zelenal (1997); Ballator (1997); and Calderone, Horkay, and King (1997).

of proportions and standard errors for those estimates. SAS computes standard errors through a procedure called jackknife replication. This method, like Stata's Taylor Series procedure, is used to take into account the variability introduced into the estimates by using sampling procedures other than random sampling. The resulting variances can then be used in testing differences among the proportion estimates. All comparisons made between the NAEP estimates presented in this report were tested with Bonferroni-adjusted *t*-tests of the difference between mean proportions.

Analysis of Data from the Current Population Survey (CPS)

The Current Population Survey (CPS) is a monthly survey conducted by the Bureau of the Census to collect data on employment and other characteristics of the civilian noninstitutionalized population. Since the mid-1960s, NCES has funded a supplemental survey each year, to collect information on education-related topics, including computer use and access.

Data collected from teachers and adults in other occupations[4] on the availability and use of technology in their homes were drawn from the following surveys to calculate the CPS estimates presented in this report: November, 1994; October, 1997; and December, 1998. Information on the sampling and survey methods used is available on the CPS Web site.[5] Nationally representative estimates are calculated by summing the products of the variable of interest (e.g., a computer in the household) by the final CPS person weights for all persons having the desired characteristic (e.g., elementary or secondary teachers).

The standard error for an estimated CPS proportion is derived from the following formula:

$$S_{x,y} = \mathrm{SQRT}\left[\left(\frac{a}{y} \right) / (y) \right] p(1-p) \qquad (4)$$

[4] Adults in other occupations includes all survey respondents who reported a profession which was not elementary or secondary teacher.

[5] See http://www.bls.census.gov/cps/cpsmain.htm

where b is a parameter determined by the Census Bureau and provided on the CPS Web site; y is the estimated number of persons in the base; and p is the estimated proportion.

Estimates of the CPS proportions provided in this report were calculated using Stata. Standard errors were calculated by using the formula listed above. Any comparisons made between CPS estimates were tested with Bonferroni-adjusted t-tests of the difference between mean proportions.

This report was reviewed by the following individuals:

Outside NCES

- David Malouf, Office of Special Education Programs, U.S. Department of Education
- Diane Reed, Office of Educational Technology, U.S. Department of Education
- Linda Roberts, Office of Educational Technology, U.S. Department of Education
- Jeff Rodamer, Planning and Evaluation Services, U.S. Department of Education
- Mary Schifferli, Office for Civil Rights, U.S. Department of Education

Inside NCES

- Ellen Bradburn, Early Childhood, International, and Crosscutting Studies Division
- Shelley Burns, Early Childhood, International, and Crosscutting Studies Division
- Bernie Greene, Early Childhood, International, and Crosscutting Studies Division
- Edith McArthur, Early Childhood, International, and Crosscutting Studies Division
- Marilyn McMillen, Chief Statistician
- Larry Ogle, Assessment Division

- Valena Plisko, Associate Commissioner, Early Childhood, International, and Crosscutting Studies Division
- John Ralph, Early Childhood, International, and Crosscutting Studies Division
- Carl Schmitt, Elementary/Secondary and Libraries Studies Division

For more information about the Fast Response Survey System (FRSS), contact Shelley Burns, Early Childhood, International, and Crosscutting Studies Division, National Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education, 1990 K Street, NW, Washington, DC 20006-5650, e-mail: Shelley_Burns@ed.gov, telephone (202) 502-7348. For more information about the Survey on Teachers' Use of Computers and the Internet, contact Edith McArthur, Early Childhood, International, and Crosscutting Studies Division, National Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education, 1990 K Street, NW, Washington, DC 20006-5650, e-mail: Edith_McArthur@ed.gov, telephone (202) 502-7393.