Technical Notes
Use of Educational Technology for Instruction

Data Disclosure Warning

Under law, public use data collected and distributed by the National Center for Education Statistics (NCES) within the Institute of Education Sciences (IES) may be used only for statistical purposes.

Any effort to determine the identity of any reported case by public-use data users is prohibited by law. Violations are subject to Class E felony charges of a fine up to $250,000 and/or a prison term up to 5 years.

NCES does all it can to assure that the identity of data subjects cannot be disclosed. All direct identifiers, as well as any characteristics that might lead to identification, are omitted or modified in the dataset to protect the true characteristics of individual cases. Any intentional identification or disclosure of a person or institution violates the assurances of confidentiality given to the providers of the information. Therefore, users shall:

- Use the data in this dataset for statistical purposes only.
- Make no use of the identity of any person or institution discovered inadvertently, and advise NCES of any such discovery.
- Not link this dataset with individually identifiable data from other NCES or non-NCES datasets.
- To proceed you must signify your agreement to comply with the above-stated statutorily based requirements.

Data perturbations were conducted on some background data to preclude identification of individuals and institutions.

Fast Response Survey System

The Fast Response Survey System (FRSS) was established in 1975 by the National Center for Education Statistics (NCES), U.S. Department of Education. FRSS is designed to collect issue-oriented data within a relatively short time frame. FRSS collects data from state education agencies, local education agencies, public and private elementary and secondary schools, public school teachers, and public libraries. To ensure minimal burden on respondents, the surveys are generally limited to three pages of questions, with a response burden of about 30 minutes per respondent. Sample sizes are relatively small so that data collection can be completed quickly. Data are weighted to produce national estimates of the sampled education sector. The sample size permits limited breakouts by analysis variables. However, as the number of categories within any single analysis variable increases, the sample size within categories decreases, which results in larger sampling errors for the breakouts by analysis variables.

Sample Design and Selection

The sample for the FRSS survey *Use of Educational Technology for Instruction* consisted of approximately 1,300 regular public schools in the 50 states and the District of Columbia. The nationally representative sample was selected from the 2016–17 Common Core of Data (CCD) Public School Universe file, which was the most current file available at the time of selection. The sampling frame for the survey included only regular schools. Vocational education, special education, alternative/other nonregular schools, and schools operated by the Department of Defense or Bureau of Indian Education were ineligible for the survey. Schools that did not offer at least one of the grades 1 through 12, virtual schools, and schools in the outlying U.S. territories were also ineligible for the survey.

To select the sample, the school sampling frame was stratified by instructional level (elementary, middle, high, and other) and five enrollment size class (less than 300, 300 to 499, 500 to 999, and 1,000 to 1,499, and 1,500 or more) to create 20 primary strata. Within each primary sampling stratum, schools in the sampling frame were sorted by community type (city, suburban, town, rural) and categories of poverty level based on the percentage of students eligible for free or reduced-price lunch (FRPL) (missing, under 35 percent, 35 to 49 percent, 50 to 74 percent, 75 percent or more) to induce additional implicit stratification. Implicit stratification is a way of ensuring a strictly proportional sample allocation of schools across all the groups used for implicit stratification. The sample of schools was selected with probabilities proportionate to the square root of the enrollment in the school.

The variables for school instructional level, enrollment size class, community type, and poverty status (based on percent of students in school eligible for free or reduced-price lunch) are defined in more detail in the "Definitions of Analysis Variables" section of these technical notes.

Data Collection and Response Rates

Prior to contacting schools, informational letters were sent to the superintendents of the school districts where the sampled schools were located, and study staff implemented any special procedures required by school districts. Questionnaires and cover letters were mailed to the principal of each sampled school in January 2020. The letter stated the purpose of the study and requested that the questionnaire be completed by the principal or person most knowledgeable about the use of educational technology for instruction at the school. Respondents were offered options of completing the survey on paper or online. Telephone follow-up for survey nonresponse and data clarification was initiated in February 2020 and completed in June 2020. Respondents were asked to respond for the 2019–20 school year. In addition, when schools began to close due to the pandemic, schools were asked to respond to the survey based on the situation at the school prior to the pandemic.

Of the 1,300 schools in the sample, about 40 were found to be ineligible for the survey because they were closed, merged, or did not meet the eligibility requirements for inclusion (e.g., they were special education, vocational, or alternative schools). For the eligible schools, the weighted response rate using the base weights[1] was 64 percent. Among the respondents who completed the survey, 76 percent completed it via the web and 24 percent completed it by paper (sent by mail, fax, or e-mail).

[1] The base weight is the inverse of the probability of selection of the school that accounts for circumstances that affect the school's overall probability of selection that are identified after the data collection has begun, such as a merger or duplication.

Imputation for Item Nonresponse

Schools with missing FRSS survey data were contacted by e-mail and telephone to collect the missing information. However, for cases in which this data retrieval was unsuccessful, missing survey data were imputed. Although item nonresponse was low (less than 3.3 percent for any item), missing data were imputed for the 69 items with a response rate of less than 100 percent. Table 1 shows the weighted percent of schools with imputed data for each questionnaire item. The missing items included both numerical data such as the estimated number of computers assigned to individual students, as well as categorical data such as whether students are allowed to take school-provided computers home with them. The missing data were imputed using a "hot-deck" approach to obtain a "donor" from which the imputed values were derived. Under the hot-deck approach, a donor that matched selected characteristics of the school with missing data (the recipient) was identified. The matching characteristics included instructional level, community type, and percent of students in the school eligible for free or reduced-price lunch (FRPL). In addition, other relevant questionnaire items were used to form appropriate imputation groupings. Once a donor was found, the imputed value was simply the corresponding value from the donor. Note that data drawn from CCD were not imputed. Variables constructed from CCD are described in the "Definitions of Analysis Variables" section of these technical notes.

Table 1. Weighted percent of public schools with imputed data, by questionnaire item: School year 2019–20

Questionnaire item		Percent imputed (weighted)
Question 2.	Does this school have a computer for every student in some grade levels or classrooms?	
Q2	Q2: School has a computer for every student in some grade levels or classrooms	0.4
Question 3.	Are students at this school allowed to take school-provided computers home with them at the end of the day?	
Q3	Q3: Students allowed to take school-provided computers home (long-term)	0.2
Question 4.	How many computers for student use does this school have in the following locations?	
Q4A	Q4a Computers assigned to individual students that they carry with them during the school day	0.7
Q4B	Q4b Computers assigned to stay in a specific classroom	3.2
Q4C	Q4c Computers that move from classroom to classroom	1.3
Q4D	Q4d Computers located in resource rooms, computer labs, or the library/media center	0.8
Q4E	Q4e Computers in other locations	0.8
Question 5.	How would you rate the overall quality of the instructional computers at this school?	
Q5	Q5: Overall quality of instructional computers	#
Question 6.	How would you rate the overall quality of the software used for instruction at this school? Include instructional software accessed through the Internet as well as software loaded on the computers.	
Q6	Q6: Overall quality of software used for instruction	0.4
Question 7.	To what extent do the computers at this school meet the school's instructional needs?	
Q7	Q7: Extent computers meet school's instructional needs	0.1
Question 8.	When teachers at this school want to use computers with their students, how easy is it for them to find enough computers to use in a lab or in their classroom?	
Q8	Q8: How easy for teachers to find enough computers to use with their students	0.1
Question 9.	In general, how reliable is the Internet connection in the instructional areas of this school?	
Q9	Q9: Reliability of Internet connection in instructional areas	0.1

See notes at end of table.

Table 1. Weighted percent of public schools with imputed data, by questionnaire item: School year 2019–20—Continued

Questionnaire item		Percent imputed (weighted)
Question 10.	To what extent does this school experience problems with Internet connectivity or speed when large numbers of students must be online at the same time (e.g., during state testing periods)?	
Q10	Q10: Extent of Internet problems when large numbers of students are online	0.6
Question 11.	How much flexibility do school-level leaders at this school have in determining which types and how much educational technology is purchased for this school?	
Q11	Q11: School-level leaders' flexibility determining technology purchased for school	0.9
Question 12.	How much flexibility do school-level leaders at this school have in determining which types and how much professional development in educational technology is provided for this school?	
Q12	Q12: School-level leaders' flexibility determining professional development in technology	0.8
Question 13.	Does this school allow students to borrow computers to take home on a short-term basis (e.g., for a day or a week)?	
Q13	Q13: School allows students to take home computers short-term	1.1
Question 14.	Does this school provide mobile hotspots or web-enabled devices with paid data plans for students to take home for Internet access?	
Q14	Q14: School provides students with mobile hotspots or web-enabled devices to take home	0.4
Question 15.	Please indicate the extent to which various types of online resources are used for instruction at this school.	
Q15A	Q15a School uses online, interactive textbooks in some courses/classes	0.4
Q15B	Q15b School uses online, non-interactive (“click-through”) textbooks in some courses/classes	0.4
Q15C	Q15c School uses online supplemental materials for instruction	0.4
Q15D	Q15d School uses online self-contained packages for instruction	0.4
Q15E	Q15e School participates in online interactive experiences	0.6
Q15F	Q15f Teachers use online resources that they locate themselves for instruction	0.5
Q15G	Q15g Teachers create their own online instructional materials to use in their classes	0.6
Question 16.	Please indicate the extent to which each of the following statements about educational technology applies to the teachers at this school.	
Q16A	Q16a Teachers use educational technology for activities normally done in the classroom	1.1
Q16B	Q16b Teachers use educational technology for classroom activities that would not be possible without technology	1.1
Q16C	Q16c Teachers provided prof. dev. focused on mechanics of how to use computer/software	0.8
Q16D	Q16d Teachers are provided professional development that focuses on how to use educational technology during classroom instruction for specific areas of the curriculum	1.0
Question 17.	Please indicate whether the following types of staff work with teachers at this school to integrate educational technology into classroom instruction.	
Q17A	Q17a District or school curriculum specialist whose primary focus is curriculum content	0.8
Q17B	Q17b District or school educational tech. specialist whose primary focus is educational tech.	0.8
Q17C	Q17c Classroom teachers who have received specialized training in educational technology	0.8
Q17D	Q17d Other types of school staff	0.8
Question 18.	Please indicate the extent to which you agree or disagree with each of the following statements about how student learning is affected by the ways that educational technology is used in the instructional program at this school.	
Q18A	Q18a Helps students be more independent and self-directed in their learning	1.1
Q18B	Q18b Helps students engage in more active learning	1.1
Q18C	Q18c Helps students learn at their own pace	1.0
Q18D	Q18d Helps students learn collaboratively with peers	1.2
Q18E	Q18e Helps students think critically	1.5

See notes at end of table.

Table 1. Weighted percent of public schools with imputed data, by questionnaire item: School year 2019–20—Continued

Questionnaire item		Percent imputed (weighted)
Question 19.	Please indicate the extent to which you agree or disagree with each of the following statements about the use of educational technology in the instructional program at this school.	
Q19A	Q19a Teachers are sufficiently trained in the mechanics of technology use.....	1.6
Q19B	Q19b Teachers are sufficiently trained to integrate technology into classroom instruction.....	1.3
Q19C	Q19c Teachers are interested in using technology in classroom instruction	1.3
Q19D	Q19d Technical support for educational technology is adequate	1.0
Q19E	Q19e Competing priorities in the classroom adversely affect the use of educational technology	1.2
Question 20.	Please indicate the extent to which each of the following is a challenge for teachers at this school in using educational technology for instruction.	
Q20A	Q20a Lack of time to become familiar with new tech. and lack of time to int. into instruction.	1.2
Q20B	Q20b The steep learning curve for teachers regarding educational technology.....	1.1
Q20C	Q20c Ensuring that the use of technology is truly contributing to learning	1.3
Q20D	Q20d Identifying high quality educational tech. resources that will address learning needs.....	1.3
Q20E	Q20e Staying up to date with the technology	1.3
Q20F	Q20f Outdated computers/software.....	1.1
Q20G	Q20g Insufficient number of computers	1.2
Q20H	Q20h Insufficient or inadequate software	1.2
Q20I	Q20i Insufficient or inadequate Internet speed	1.2
Q20J	Q20j Insufficient or inadequate support using technology in the classroom.....	1.2
Q20K	Q20k Teachers spend time helping students learn basic skills needed to use computers effectively	1.6

Rounds to zero (less than 0.05).
NOTE: Percentages are calculated as the weighted number of imputed cases divided by the weighted number of questionnaire respondents for whom the question applied. Only questionnaire items with missing data are listed in the table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System (FRSS), "Use of Educational Technology for Instruction," FRSS 110, 2020.

Weighting Procedures and Sampling Errors

The responses were weighted to produce national estimates (table 2). The weights were designed to reflect the probabilities of selection of the sampled schools, and were adjusted for differential unit (questionnaire) nonresponse. The nonresponse weighting adjustments were made within classes defined by school-level variables correlated with response propensity: instructional level, categories of school enrollment size class, community type, and categories for percent of students eligible for free or reduced-price lunch. Within the final weighting classes, the base weights (i.e., the reciprocal of schools' probabilities of selection) of the responding schools were inflated by the inverse of the weighted response rate for the class. Such weights are appropriate for analysis of the types of data collected in the survey.

The survey findings are presented in a *First Look* report titled *Use of Educational Technology for Instruction in Public Schools: 2019–20* (NCES 2021-017). The reported findings are estimates based on the sample selected and, consequently, are subject to sampling variability. The standard error is a measure of the variability of an estimate 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 percent of public schools that have a computer for every student in the school is 45 percent, and the standard error is 2.0 percent. The 95 percent confidence interval for the statistic extends from 45 – (2.0 x 1.96) to 45 + (2.0 x 1.96), or from 41 to 49 percent.

Because the survey data were collected using a complex sampling design, the variances of the estimates from the survey (e.g., estimates of proportions) are typically different from what would be expected from data collected with a simple random sample. Not taking the complex sample design into account can lead to an under- or overestimation of the standard errors associated with such estimates. Estimates of standard errors were computed using a technique known as jackknife replication. As with any replication method, jackknife replication involves constructing a number of subsamples (replicates) from the full sample and computing the statistic of interest for each replicate. A form of jackknife replication referred to as the JK1 method was used to construct the replicates. The mean square error of the replicate estimates around the full sample estimate provides an estimate of the variance of the statistic. To construct the replications, 100 stratified subsamples of the full sample were created and then dropped one at a time to define 100 jackknife replicates. Estimates of standard errors can be computed using statistical packages such as SAS or WesVar using the JK1 option.

Table 2. Number and percentage of responding public schools in the study sample, and estimated number and percentage of public schools the sample represents, by school characteristics: School year 2019–20

	Respondent sample (unweighted)		National estimate (weighted)[1]	
Characteristic	Number	Percent	Number	Percent
All public schools	**800**	**100**	**83,700**	**100**
Instructional level[2]				
Elementary school	250	32	50,600	60
Middle school	250	31	14,200	17
High and other school	300	37	18,900	23
Enrollment size class				
Less than 300	130	17	21,700	26
300 to 499	170	22	23,100	28
500 to 999	300	38	30,100	36
1,000 or more	190	24	8,900	11
Community type				
City	180	23	20,500	24
Suburban	280	35	28,000	33
Town	110	14	10,400	12
Rural	230	29	24,900	30
Percent of students eligible for free or reduced-price lunch				
Less than 35 percent[3]	290	36	28,400	34
35 to 49 percent	170	22	16,900	20
50 to 74 percent	200	25	20,800	25
75 percent or more	140	18	17,600	21

[1] Weighted count of responding schools using the final nonresponse-adjusted weights. The weighted count is an estimate of the number of eligible schools in the study universe.

[2] Elementary school has low grade PK–4 and high grade PK–8; middle school has low grade 5–8 and high grade 5–8; high and other school has all other schools with one or more grades 1–12 and not falling in the above two categories.

[3] Includes schools with missing values.

NOTE: Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System (FRSS), "Use of Educational Technology for Instruction," FRSS 110, 2020.

Nonsampling Errors and Editing

Nonsampling error is the term used to describe variations in the estimates that may be caused by population coverage limitations and data collection, processing, and reporting procedures. The sources of nonsampling errors are typically problems such as unit and item nonresponse, differences in respondents' interpretations of the meaning of questions, response differences related to the particular time the survey was conducted, and mistakes made during data preparation. It is difficult to identify and estimate either the amount of nonsampling error or the bias caused by this error.

To minimize the potential for nonsampling error, the questionnaire was pretested with principals who were part of the eligible population. During the design of the survey and the survey pretest, an effort was made to check for consistency of interpretation of questions and definitions and to eliminate ambiguous items. The questionnaire and instructions were also extensively reviewed by NCES and the Office of Educational Technology. In addition, extensive editing of the questionnaire responses was conducted to check the data for accuracy and consistency. Respondents with questionnaires that had missing, inconsistent, or out-of-range items were contacted by e-mail or telephone to resolve problems. Survey responses received by mail, fax, or telephone were entered into the web survey application. Responses were entered a second time to ensure accuracy of entry. One potential source of nonsampling error is nonresponse bias, which is discussed in the following sections for unit (questionnaire) nonresponse and item nonresponse.

Unit Nonresponse Bias Analysis

Because NCES statistical standards and guidelines require a nonresponse bias analysis if the base-weighted unit response rate at any stage of data collection is less than 85 percent, an analysis was conducted to identify potential nonresponse bias. This analysis used the following characteristics from the 2016–17 Common Core of Data (CCD) Public School Universe file:

- Instructional level (elementary, middle, high/other)
- Enrollment size class (less than 300, 300 to 499, 500 to 999, 1,000 or more)
- Community type (city, suburban, town, rural)
- Percent of students eligible for free or reduced-price lunch (less than 35 percent - includes missing, 35 to 49 percent, 50 to 74 percent, 75 percent or more)
- Percent minority (less than 6 percent, 6 to 20 percent, 21 to 49 percent, 50 percent or more)
- Census region (Northeast, Midwest, South, West)

For each characteristic, a statistical test (*t* test) was conducted of the hypothesis that the base-weighted distribution of the respondent sample is the same as the base-weighted distribution of the total sample for the characteristic. An "*" in the middle column of table 3 indicates the characteristics where a statistically significant difference was found using this test.

Table 3. Indication of potential sources of bias based on comparisons between total sample distribution and base-weighted or nonresponse-adjusted respondent distributions of schools: School year 2019–20

Characteristic	Base-weighted respondent distribution[1]	Nonresponse-adjusted respondent distribution[2]
Instructional level	†	†
Enrollment size class	*	*
Community type	*	†
Percent of students eligible for free or reduced-price lunch	*	†
Percent minority	*	*
Census region	†	†

† Not applicable.

* $p<0.05$.

[1] Test comparing total sample with respondent sample using the base weights.

[2] Test comparing respondent sample using nonresponse adjusted weights with total sample using the base weights.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System (FRSS), "Use of Educational Technology for Instruction," FRSS 110, 2020.

To compensate for the differential response rates, weight adjustments were used to derive nonresponse-adjusted weights for analysis purposes. In general, such weight adjustments will reduce nonresponse bias if the variables used in forming the weight adjustment classes are correlated with response propensity (the probability that a sampled school will respond to the survey) and with the characteristics obtained from the survey. To examine the extent to which the nonresponse adjustments mitigated the effect of the differential response rates, a statistical test was conducted comparing the weighted distribution of the respondent sample using the nonresponse-adjusted weights with the corresponding weighted distribution of the total sample using the base weights. As indicated in the rightmost column of table 3, two of the characteristics that were previously statistically significant are no longer significant based on this test.

The nonresponse adjustment of the weights thus appears to be partially effective in removing differences between the distributions of the responding and nonresponding schools. Although some differences were not eliminated completely, subsequent analysis showed that the differences did not seem to be large enough to have a material impact on the weighted estimates derived from the survey. A comparison of weighted estimates of selected survey items before and after nonresponse adjustment indicated that for attribute variables, there were no significant differences for total schools and only one difference for high/other schools between the nonresponse-adjusted estimates and the corresponding base-weighted estimates prior to adjustment. For numeric variables, most differences before and after nonresponse adjustment were found for high/other schools.

Item Nonresponse Bias Analysis

NCES statistical standards and guidelines also require a nonresponse bias analysis if item-level response rates are below 85 percent. No items in the study had response rates below this threshold.

Definitions of Analysis Variables

Many of the school characteristics described below may be related to each other. For example, school instructional level and enrollment size class are related, with high schools typically being larger than elementary schools. Other relationships between these analysis variables may exist.

Instructional level (LEVEL3)—Schools were classified according to their response to FRSS survey question 21 about the grades currently taught at the school.

Elementary school—low grade of PK through 4 and high grade of PK through 8
Middle school—low grade of 5 through 8 and high grade of 5 through 8
High and other school—all other schools with one or more grades 1–12 and not falling in the above two categories.

Enrollment size class (SIZCL2)—This variable indicates the total number of students enrolled in the school based on data from FRSS survey responses to question 22. The variable was collapsed into the following categories:

Less than 300
300 – 499
500 – 999
1,000 or more

Community type (URBAN)—This variable indicates the type of community in which the school is located, as defined in the 2016–17 CCD Public School Universe file. These codes are based on the location of school buildings. This classification system has four major locale categories—city, suburban, town, and rural—each of which is subdivided into three subcategories. This variable was based on the 12-category urban-centric locale variable from CCD and collapsed into the four categories below.

City—Territory inside an urbanized area and inside a principal city
Suburban—Territory outside a principal city and inside an urbanized area
Town—Territory inside an urban cluster
Rural—Territory outside an urbanized area and outside an urban cluster

Percent of students in school eligible for free or reduced-price lunch (POVST4)— Based on the 2016–17 CCD Public School Universe file data on the students in the school who are eligible to participate in the Free Lunch and Reduced Price Lunch Programs under the National School Lunch Act of 1946. The category for "Less than 35 percent" includes schools with missing data (about 7 percent of cases).

Less than 35 percent (includes missing)
35 – 49 percent
50 – 74 percent
75 percent or more

Definitions and Instructions Provided in This Survey

The following definitions and instructions were provided to respondents in the questionnaire.

- Please respond for the 2019–20 school year.[2]
- For purposes of this survey, computers include desktop, laptop, and tablet computers (including Chromebooks and iPads). Smartphones are not included in the definition of computers.

[2] Once schools began to close due to the pandemic, schools were asked to respond to the survey based on the situation at the school prior to the pandemic.