

# **Technical Notes**

## **Career and Technical Education Programs in Public School Districts**

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### **Data Disclosure Warning**

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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 (usually about 1,200 to 1,800 respondents per survey) 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 *Career and Technical Education Programs in Public School Districts* consisted of approximately 1,800 eligible public school districts with high school grades in the 50 states and the District of Columbia. The nationally representative sample was selected from the 2013–14 NCES Common Core of Data (CCD) Local Education Agency (LEA) Universe file, which was the most current file available at the time of selection. The sampling frame for this survey included 11,394 eligible public schools districts that were coded with a highest grade of instruction of 11 or 12 in the CCD LEA Universe file. For purposes of this study, an eligible public district was either (1) a regular school district; or (2) a nonregular district that was not federally operated and had at least one operating vocational education school that did not have shared instruction. Regular school districts are generally administered by local education agencies and are responsible for providing instruction. Nonregular school districts include supervisory unions that provide administrative services to multiple districts, regional education service agencies, state operated school districts, federally operated school districts (excluded from this study), charter school districts, and other nonregular school districts.<sup>1</sup> Excluded from the sampling frame were districts with a highest grade of instruction below grade 11, districts with enrollment coded as zero, missing, “not applicable,” or “does not meet NCES quality standards,” federally operated districts, and districts outside the 50 states and the District of Columbia. Of the 11,394 eligible districts on the sampling frame, 11,340 were regular districts.

To select the sample, the district sampling frame was stratified by district enrollment size (less than 1,000; 1,000 to 2,499; 2,500 to 9,999; 10,000 to 24,999; 25,000 to 99,999; 100,000 or more) and community type (city, suburban, town, and rural) to create 21 primary strata. Within stratum, districts were sorted by region (Northeast, Southeast, Central, and West) and poverty status<sup>2</sup> (poverty equal to less than 10 percent; 10 to 19.99 percent; 20 to 29.99 percent; and 30 percent or more) prior to selection to induce additional implicit stratification. The variables for district enrollment size, community type, and region are from the CCD LEA universe file, and are defined in more detail in the “Definitions of Analysis Variables” section of these technical notes. Within each primary stratum, districts were selected systematically using sampling rates that depended on the size classification of the district.

## Data Collection and Response Rates

Questionnaires and cover letters were mailed to the superintendent of each sampled district in January 2017. The letter stated the purpose of the study and requested that the questionnaire be completed by the person in the district most knowledgeable about career and technical education programs for high school students. Respondents were asked to respond for the current 2016–17 school year and the summer of 2016. 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 2017 and completed in June 2017.

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<sup>1</sup> For purposes of this study, “regular” school districts were those with TYPE equal to 1 or 2 on the CCD LEA file (a local school district that is not a component of a supervisory union, or a local school district component of a supervisory union sharing a superintendent and administrative services). “Nonregular” school districts for this study included those with TYPE equal to 3 (supervisory union administrative center, or a county superintendent serving the same purpose), 4 (regional education services agency, or a county superintendent serving the same purpose), 5 (state-operated institution charged, at least in part, with providing elementary and/or secondary instruction or services to a special-needs population), 7 (agencies for which all associated schools are charter schools), and 8 (other education agencies that do not fit into the other categories). Districts with TYPE equal to 6 (federally-operated institution charged, at least in part, with providing elementary and/or secondary instruction or services to a special-needs population) were not eligible districts for this study.

<sup>2</sup> Poverty status is from the Small Area Income and Poverty Estimates (SAIPE) for school districts, created by the U.S. Census Bureau and available at <http://www.census.gov/did/www/saipe/index.html>.

Of the approximately 1,800 school districts in the sample, approximately 40 were found to be ineligible because the district was closed or did not meet some other criterion for inclusion in the sample (e.g., did not have at least one school with high school grades). For the eligible districts, an unweighted response rate of 87 percent was obtained for this survey (about 1,530 responding districts divided by the approximately 1,760 eligible districts in the sample). The corresponding weighted response rate using the initial base weights was 86 percent. Among the respondents who completed the survey, 76 percent completed it via the Web, 24 percent completed it by paper (sent by mail, fax, or email), and less than 1 percent completed it by telephone.

## Imputation for Item Nonresponse

Cases with missing data were recontacted by telephone to collect the missing information. However, for cases in which this data retrieval was unsuccessful, missing data were imputed. Although item nonresponse was very low (less than 1 percent for any item), missing data were imputed for the 73 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 were all categorical data, such as whether the district offered CTE programs to high school students at various locations. The missing data were imputed using a “hot-deck” approach to obtain a “donor” district from which the imputed values were derived. Under the hot-deck approach, a donor district that matched selected characteristics of the district with missing data (the recipient district) was identified. The matching characteristics included district enrollment size, community type, region, and poverty status. In addition, 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 district. Imputation flags are included in the data.

**Table 1. Weighted percent of public school districts with imputed data, by questionnaire item:  
School year 2016–17**

Questionnaire item		Percent imputed (weighted)
<b>Question 2.</b>	<b>Which of the following entities provide the CTE programs that your district offers to your high school students?</b>	
Q2a	Entities providing CTE: area/regional CTE center or group/consortium of districts .....	0.06
Q2b	Entities providing CTE: district individually .....	0.13
Q2c	Entities providing CTE: 2-year community or technical college(s) .....	0.06
Q2d	Entities providing CTE: 4-year college(s) or universities .....	0.13
Q2e	Entities providing CTE: other (specify) .....	0.06
<b>Question 3.</b>	<b>At which of the following locations does your district offer CTE programs to high school students?</b>	
Q3a	CTE locations: district's regular high schools .....	0.06
Q3b	CTE locations: another district's regular high schools .....	0.06
Q3c	CTE locations: CTE-focused high school attended full time .....	0.06
Q3d	CTE locations: CTE center attended part time .....	0.06
Q3e	CTE locations: 2-year or 4-year college/university or technical college .....	0.06
Q3f	CTE locations: other (specify) .....	0.06
<b>Question 4.</b>	<b>About how many of the CTE programs offered by your district to high school students are structured as career pathways that align with related postsecondary programs?</b>	
Q4	How many CTE programs are structured as career pathways? .....	0.06
<b>Question 5.</b>	<b>Does your district offer any CTE courses in which students may earn high school credits in math, science, English/language arts, or social studies?</b>	
Q5	Offer CTE courses earning HS credit in math, science, English, or social studies? .....	0.06

See notes at end of table.

**Table 1. Weighted percent of public school districts with imputed data, by questionnaire item:  
School year 2016–17—Continued**

Questionnaire item		Percent imputed (weighted)
<b>Question 6.</b>	<b>Does your district offer any CTE courses for which students can earn both high school and postsecondary credits for the same course?</b>	
Q6	Offer CTE courses earning both HS & postsecondary credit? .....	0.06
<b>Question 7.</b>	<b>Does your district offer any CTE courses online (include courses in a blended/hybrid format)?</b>	
Q7	Offer CTE courses online (including blended/hybrid)? .....	0.15
<b>Question 8.</b>	<b>Which of the following are included in any of the CTE programs offered by your district to high school students?</b>	
Q8a	CTE programs include: student-run enterprises or services .....	0.11
Q8b	CTE programs include: mentoring by local employers .....	0.14
Q8c	CTE programs include: on-the-job training, internships, practicums, clinicals, or co-op ed .....	0.11
Q8d	CTE programs include: apprenticeships or pre-apprenticeship programs .....	0.11
Q8e	CTE programs include: other work-based learning (specify) .....	0.11
<b>Question 9.</b>	<b>About how many of the CTE programs offered by your district to high school students require work-based learning activities (such as those listed in Question 8) for completion of the program?</b>	
Q9	How many CTE programs require work-based learning? .....	0.06
<b>Question 10.</b>	<b>To what extent are employers involved in the following ways with the CTE programs offered by your district to high school students?</b>	
Q10a	Employer involvement: provide work-based learning .....	0.64
Q10b	Employer involvement: serve on district's CTE advisory council .....	0.72
Q10c	Employer involvement: advise on which occupations are in demand .....	0.67
Q10d	Employer involvement: provide advice on CTE programs to add or eliminate .....	0.76
Q10e	Employer involvement: review CTE program curriculum .....	0.67
Q10f	Employer involvement: provide guidance on industry standards .....	0.76
Q10g	Employer involvement: provide guidance on equipment or facilities .....	0.76
Q10h	Employer involvement: donate equipment .....	0.86
Q10i	Employer involvement: host student field trips .....	0.76
Q10j	Employer involvement: serve as guest speakers .....	0.76
Q10k	Employer involvement: provide guidance for student CTE projects .....	0.76
Q10l	Employer involvement: judge student CTE competitions .....	0.81
Q10m	Employer involvement: provide training for CTE teachers .....	0.85
Q10n	Employer involvement: other (specify) .....	0.60
<b>Question 11.</b>	<b>How much of a barrier to your district is each of the following in offering CTE programs to high school students?</b>	
Q11a	Barrier to district: lack of funding or high cost of programs .....	0.47
Q11b	Barrier to district: facilities or space limitations .....	0.43
Q11c	Barrier to district: finding/keeping teachers for in-demand industries/occupations .....	0.52
Q11d	Barrier to district: limited availability of professional development .....	0.57
Q11e	Barrier to district: difficulty keeping CTE teachers' technical skills up to date .....	0.52
Q11f	Barrier to district: CTE teachers' difficulty obtaining regular teaching certificate .....	0.69
Q11g	Barrier to district: difficulty developing partnerships for work-based learning .....	0.67
Q11h	Barrier to district: other (specify) .....	0.58
<b>Question 12.</b>	<b>How much of a barrier is each of the following to student participation in the CTE programs offered by your district to high school students?</b>	
Q12a	Barrier to students: lack of time in students' schedules .....	0.46
Q12b	Barrier to students: students' or parents' negative perceptions of CTE .....	0.43
Q12c	Barrier to students: teachers' or guidance counselors' negative perceptions of CTE .....	0.43

See notes at end of table.

**Table 1. Weighted percent of public school districts with imputed data, by questionnaire item:  
School year 2016–17—Continued**

Questionnaire item		Percent imputed (weighted)
Q12d	Barrier to students: transportation to CTE programs .....	0.46
Q12e	Barrier to students: transportation for work-based learning .....	0.43
Q12f	Barrier to students: students' costs for supplies, uniforms, or materials .....	0.43
Q12g	Barrier to students: students' difficulty finding work-based learning .....	0.43
Q12h	Barrier to students: lack of student support services for special populations .....	0.43
Q12i	Barrier to students: other (specify) .....	0.52
<b>Question 13.</b>	<b>To what extent does each of the following factors influence your district's decision on whether to add a new CTE program for high school students?</b>	
Q13box	Check box if district does not have decision-making role in adding/phasing out CTE programs	0.06
Q13a	Influences decision to add program: student interest .....	0.32
Q13b	Influences decision to add program: facilities/space considerations .....	0.22
Q13c	Influences decision to add program: costs for a new program .....	0.32
Q13d	Influences decision to add program: availability of qualified teachers .....	0.36
Q13e	Influences decision to add program: in-demand industries/occupations .....	0.32
Q13f	Influences decision to add program: employer recommendations .....	0.32
Q13g	Influences decision to add program: postsecondary institution recommendations .....	0.22
Q13h	Influences decision to add program: state dept of ed recommendations .....	0.22
Q13i	Influences decision to add program: career pathways from HS to postsecondary .....	0.22
Q13j	Influences decision to add program: other (specify) .....	0.22
<b>Question 14.</b>	<b>To what extent does each of the following factors influence your district's decision on whether to phase out a CTE program for high school students?</b>	
Q14a	Influences decision to phase out: enrollment or student interest .....	0.69
Q14b	Influences decision to phase out: facilities/space considerations .....	0.79
Q14c	Influences decision to phase out: cost of program .....	0.69
Q14d	Influences decision to phase out: availability of qualified teachers .....	0.79
Q14e	Influences decision to phase out: in-demand industries/occupations .....	0.79
Q14f	Influences decision to phase out: employer recommendations .....	0.79
Q14g	Influences decision to phase out: postsecondary institution recommendations .....	0.79
Q14h	Influences decision to phase out: state dept of ed recommendations .....	0.79
Q14i	Influences decision to phase out: career pathways from HS to postsecondary .....	0.79
Q14j	Influences decision to phase out: other (specify) .....	0.79

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), "Career and Technical Education Programs in Public School Districts," FRSS 108, 2017.

## Weighting Procedures and Sampling Errors

The responses were weighted to produce national estimates (see table 2). The weights were designed to reflect the probabilities of selection of the sampled districts and were adjusted for differential unit (questionnaire) nonresponse. FRSS survey data are based on complex sample designs that require the use of weights to compensate for variable probabilities of selection, differential response rates, and possible deficiencies in the sampling frame. The reciprocal of the probability of selection, referred to as the "base weight," will produce unbiased (or consistent) estimates of population totals and ratios if there is no nonresponse in the survey. Since a stratified sample design was employed for the survey, the base weight for the  $i$ -th district in stratum  $h$  was computed as  $w_{hi}=1/f_h$  where  $f_h$  is the overall sampling rate used to select districts in stratum  $h$ .

**Table 2. Number and percentage of responding public school districts in the study sample, and estimated number and percentage of public school districts the sample represents, by district characteristics: School year 2016–17**

District characteristic	Respondent sample (unweighted)		National estimate (weighted) <sup>1</sup>	
	Number	Percent	Number	Percent
<b>All public school districts .....</b>	<b>1,530</b>	<b>100</b>	<b>10,800</b>	<b>100</b>
<b>District enrollment size</b>				
Less than 2,000 .....	510	34	6,500	60
2,000 to 4,999 .....	440	29	2,600	24
5,000 or more .....	580	38	1,800	16
<b>Community type</b>				
City .....	230	15	700	6
Suburban .....	500	33	2,400	22
Town .....	310	20	2,200	21
Rural .....	490	32	5,500	51
<b>Region</b>				
Northeast .....	280	18	2,100	20
Southeast .....	320	21	1,500	14
Central .....	470	31	4,200	39
West .....	460	30	2,900	27

<sup>1</sup> Weighted count of responding districts using the final nonresponse-adjusted weights. The weighted count is an estimate of the number of eligible districts in the study universe (see text for definition of the types of districts included in the study).

NOTE: Based on public school districts with high school grades. 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), “Career and Technical Education Programs in Public School Districts,” FRSS 108, 2017.

Although the survey had a high response rate, adjustment of the base weights was necessary to compensate for the survey nonrespondents (i.e., whole questionnaire or unit nonresponse). The nonresponse weighting adjustments were made within classes defined by district enrollment size and community type. Within the final weighting classes, the base weights (i.e., the reciprocal of districts’ probabilities of selection) of the responding districts 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 *Career and Technical Education Programs in Public School Districts: 2016–17* (NCES 2018-028). 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 school districts that offer any CTE courses for which students can earn both high school and postsecondary credit for the same course is 73 percent, and the standard error is 1.6 percent. The 95 percent confidence interval for the statistic extends from  $73 - (1.6 \times 1.96)$  to  $73 + (1.6 \times 1.96)$ , or from 70 to 76 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 JKN method was used to construct the replicates. Under the JKN method, the replicates were formed within groups of districts (called “variance strata”) within which districts were sampled at approximately the same rate. By creating the jackknife replicates within the variance strata, finite population correction factors (FPCs) can be introduced in the variance estimator to account for the fact that districts in some variance strata were sampled at relatively high rates. 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 JKN option.

The sample of districts for this survey is relatively large compared to the population of eligible districts, so finite population correction (FPC) factors are required to estimate standard errors accurately; otherwise, the standard errors would tend to be overestimated. In addition to the FPC factors, a second set of factors referred to as JKN factors are also required to compute standard errors using the JKN option. The JKN factors pertain to the numbers of replicates that are formed for variance estimation. To facilitate loading of the factors into statistical software, the data for these factors are provided in the following two separate files: F108FACT\_FPC.DAT is a text file containing the 100 FPC factors (one for each replicate), and F108FACT\_JKN.DAT is a text file containing the corresponding 100 JKN factors. Alternatively, table 3 provides the same factor information contained in the text files.

**Table 3. Values of finite population correction (FPC) and jackknife replication (JKN) factors to be used for calculating standard errors for FRSS 108: School year 2016–17**

Replicate	FPC factor	JKN factor
1 to 11 .....	0.36	0.909091
12 to 24 .....	0.62	0.923077
25 to 59 .....	0.81	0.971429
60 to 81 .....	0.88	0.954545
82 to 100 .....	1.00	0.947368

NOTE: FPC factors are based on the average sampling rate in the variance stratum.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System (FRSS), “Career and Technical Education Programs in Public School Districts,” FRSS 108, 2017.

## Nonsampling Errors, Coding, 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 district-level personnel considered to be the most knowledgeable about career and technical education programs for high school students. 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.

Editing of the questionnaire responses was conducted to check the data for accuracy and consistency. Cases with missing or inconsistent items were recontacted by telephone. A coding source file and editing specifications were used to produce the codebook. The codebook served as the main tool for coding, editing, and processing completed questionnaires. Coders used the codebook to identify cases requiring data retrieval or clarification and prepare cases for entry into the web application. The source file served as a data dictionary and included the data file layout, a description of each data item, a list of valid response codes or range formats with codes for nonresponse and inapplicable, and defined skip patterns.

Logics, ranges, and validation checks were prepared prior to data collection and included online edit checks, manual logic checks, and automated checks using SAS. Online checks were incorporated into the web application and manual edits were conducted to process cases received by mail, fax, or telephone. Steps were taken to ensure that the method of entering data from web and hardcopy questionnaires was the same, regardless of mode. For example, to enter survey data received by mail, fax, or telephone, the data processing staff accessed the survey website as “respondents” and “completed” the survey using the responses on the hardcopy survey. Subjecting all survey responses to the same set of built-in logics, ranges, and validation checks helps to ensure that data entry does not produce systematic differences in the survey data. In addition, all hardcopy data were subject to 100 percent verification using “doublekeying.”

## Definitions of Analysis Variables

Many of the district characteristics described below may be related to each other. For example, district enrollment size and community type are related, with districts located in cities typically being larger than districts located in rural areas. Other relationships between these analysis variables may exist.

**District enrollment size in 3 categories (DSIZCL3)**—This variable indicates the total number of students enrolled in the district based on data from the 2013–14 CCD LEA Universe file. The variable used six categories for sampling, but was collapsed into the following three categories for analysis:

**Less than 2,000 students**

**2,000 – 4,999 students**

**5,000 or more students**

**Community type (URBAN)**—This is a created variable collapsed from the 12-category urban-centric locale variable, as defined in the 2013–14 CCD LEA Universe file. The urban-centric locale code is an indicator of a district’s location relative to a populous area. It is based upon the location of the school buildings in the district and in some cases may not reflect the entire attendance area or residences of enrolled students. This classification system has four major locale categories—city, suburban, town, and rural—each of which is subdivided into three subcategories. Community type was based on the 12-category urban-centric locale variable from CCD 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

**Region (OEREG)**—This variable classifies districts into one of the four geographic regions used by the Bureau of Economic Analysis of the U.S. Department of Commerce. Data were obtained from the 2013–14 CCD LEA Universe file. The geographic regions are as follows:



**Northeast**—Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont

**Southeast**—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia

**Central**—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin

**West**—Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oklahoma, Oregon, Texas, Utah, Washington, and Wyoming