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July 2011

Prepared by

Christine Mokher, Ph.D.
CNA Education

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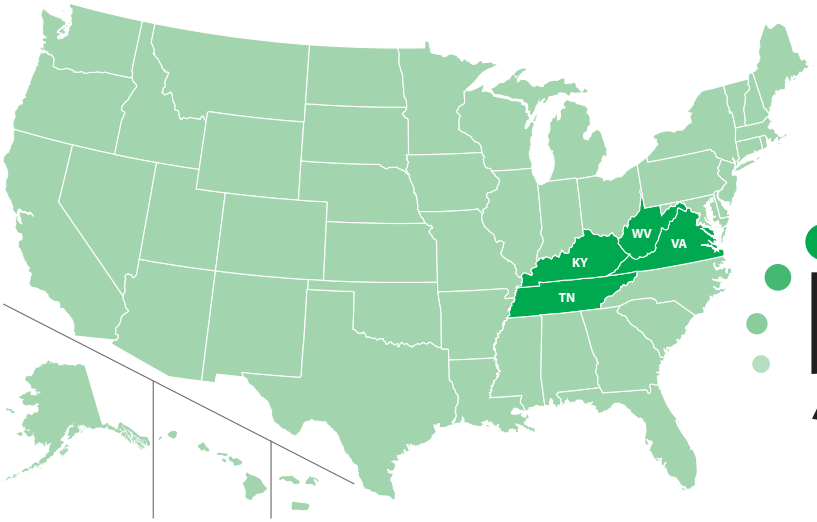

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July 2011

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Summary

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Aligning career and technical education with high-wage and high-demand occupations in Tennessee

This study examines the availability of career and technical education program areas in Tennessee high schools, concentrations (a three-or-more credit sequence in a program area) completed by 2007/08 high school graduates, and how these concentrations align with jobs in the labor market. It looks at how these outcomes differ, statewide and by region, and identifies corresponding high-wage and high-demand occupations projected over 2006–16.

A primary purpose of career and technical education is to prepare students for "high skill, high wage, or high demand occupations in current or emerging professions" (Perkins IV 2006, Sec. 2-1). How well career and technical education participation corresponds to labor market demands is important for both students and employers. Students want good careers; employers want to fill jobs in high-demand areas. Previous research indicates that policymakers in many states have struggled to align education and training with labor market demands.

This study uses school-level data from the Tennessee Department of Education (2009) on the number and percentage of concentrators (high school graduates completing a three-or-more credit sequence) in each career and technical education program area (agricultural education, business technology, family and consumer services, health science, marketing, technology engineering, and trade and industrial education), and region-level data on employment projections and median annual wages from the Tennessee Department of Labor and Workforce Development (2009). Data on school characteristics are from the Common Core of Data, maintained by the U.S. Department of Education National Center for Education Statistics (2008b). The school-level data are for 2007/08, occupational wage data are for 2006, and employment projections are for 2006–16.

This study addresses five sets of questions on career and technical education in Tennessee:

- On average, how many program areas are available in high schools, and which are most and least common, statewide and by region (a cluster of neighboring counties with similar labor market characteristics)?
- How does the percentage of high school graduates who graduated from schools with at least one available program area, and of high school graduates who completed at least one concentration, vary by program area and region?
- Statewide and for each region, how many concentrators would need to change

program areas to match the distribution of workers in the labor market? For each program area, how does the percentage of high school graduates who completed a concentration compare with the percentage of workers employed in corresponding occupations?

- For each region, which program areas correspond to low-, moderate-, and high-wage occupations projected over 2006–16? What percentage of jobs projected over 2006–16 are in 2007/08 program areas that correspond to high-wage occupations? What is the percentage of concentrators in these program areas? How do the median annual wages in occupations that correspond to each program area vary by education level?

- For each region, which program areas correspond to low-, moderate-, and high-demand occupations projected over 2006–16? What percentage of jobs projected over 2006–16 are in 2007/08 program areas that correspond to high-demand occupations? What is the percentage of concentrators in these program areas?

Key findings include:

- Statewide, the average number of program areas offered in non–career and technical education schools (schools where students received their diploma and that offer courses in addition to those in career and technical education program areas) was 3.6 (out of 7). Across regions, it ranged from 2.9 to 4.7.

- Statewide, 92 percent of graduates were enrolled in a school offering trade and industrial education, the program area most commonly available, and 26 percent were enrolled in a school offering technology engineering, the program area least commonly available. The range in program area availability was just as striking by region. Technology engineering was not available to any high school graduates in two regions, but nearly three-fourths (74 percent) of graduates in one region were enrolled in a school that offered it. The percentage of high school graduates who completed at least one concentration ranged from 22 percent to 55 percent by region and from 1 percent (technology engineering) to 20 percent (trade and industrial education) by program area.

- Statewide, 18 percent of concentrators would need to change program areas to match the distribution of workers in the labor market. The values ranged from 14 percent to 35 percent. The greatest differences in the percentage of high school graduates completing a concentration and the percentage of workers in the labor market were in agricultural education (16 percent compared with 1 percent) and in business technology (13 percent compared with 23 percent).

- Except for technology engineering occupations, which were high wage in all regions, occupations classified as high-wage varied by region.

    - Statewide, approximately 17 percent of jobs projected over 2006–16 were in 2007/08 program areas that correspond to high-wage occupations, ranging from 0 percent to 51 percent. The percentage of graduates concentrating in program areas that correspond to high-wage

occupations was 6 percent statewide, ranging from 0 percent to 13 percent.

- Up to 4.1 percent of jobs in high-wage occupations projected over 2006–16 could potentially be filled by 2007/08 concentrators in corresponding program areas, suggesting that up to 41 percent of these jobs could be filled over the 10-year period if the number of these concentrators remains constant.

- No program area corresponded to a high-demand occupation in all regions. Business technology and trade and industrial education were the only program areas that did not correspond to a high-demand occupation in any region.

  - Statewide, approximately 31 percent of jobs projected over 2006–16 were in 2007/08 program areas that correspond to high-demand occupations, ranging from 12 percent to 84 percent. The percentage of graduates concentrating in program areas that correspond to high-demand occupations was 18 percent, ranging from 3 percent to 66 percent.

  - Up to 7.1 percent of jobs in high-demand occupations projected over 2006–16 could potentially be filled by 2007/08 concentrators in corresponding program areas, suggesting that up to 71 percent of these jobs could be filled over the 10-year period if the number of these concentrators remains constant.

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This study examines the availability of career and technical education program areas in Tennessee high schools, concentrations completed by 2007/08 high school graduates in these program areas, and how these concentrations align with jobs in the labor market. It looks at how these outcomes differ, statewide and by region, and identifies corresponding high-wage and high-demand occupations projected over 2006–16.

WHY THIS STUDY?

Aligning career and technical education program areas with labor market demands is important for both students and employers. Students want good careers; employers want to fill jobs in high-demand areas. Although employers might be able to fill some of their need for skilled workers with those trained elsewhere, such as retirees or immigrants, a state's ability to produce skilled young adults is critical for its economic growth.

A primary purpose of career and technical education is to prepare students for "high-skill, high-wage, or high-demand occupations in current or emerging professions" (Perkins IV 2006, Sec. 2-1). Recent U.S. Department of Education reports have examined national trends in career and technical education in many fields but do not assess how well program areas align with labor market demands (Hudson and Laird 2009; Levesque et al. 2008). A study of 10 states, however, found that state policymakers have struggled to match education and training with labor market demands (Grubb et al. 1999). One contributing factor is that typically, different departments oversee different areas, and coordination among them is lacking. In Tennessee, the Department of Labor and Workforce Development maintains data on employment and labor projections, and the Department of Education's career and technical education division tracks the number of concentrations (three-or-more credit sequences) completed in each program area. (See box 1 for definitions of key terms.)

Career and technical education and a changing workforce in Tennessee

In 2008/09, approximately 90 percent (177,832 students) of Tennessee public high school students enrolled in at least one career and technical education course (Tennessee Department of Education 2009; Tennessee Council for Career and Technical Education 2009). Students can take career and technical education courses at non–career and technical education schools (schools where students received their diploma

BOX 1

Key terms

Career and technical education–only school. A specialized school available in some regions offering only career and technical education courses. Enrollment is generally open to all students in good standing in the district or surrounding districts but may be limited to students attending specific schools or meeting district-set eligibility criteria.

Concentration. A three-or-more credit sequence in a career and technical education program area.

Concentrator. A secondary student with three or more credits (full-year courses) in a single career and technical education program area. In some cases, the state may allow a student to complete a concentration with two credits in one program area and one credit in a related program area; in others, the state may authorize districts to make such determinations (Tennessee State Board of Education 2008). Unless otherwise noted, in this report concentrators are public high school graduates who completed a concentration in any grade in high school.

Crosswalk. A tabular representation of the relationship between two or more sets of data. For this study, a crosswalk was developed between Tennessee's career and technical education program areas and the corresponding Standard of Classification codes for related occupations in the labor market.

High-demand occupation. Occupation where the change in the projected number of jobs over 2006–16 is at least 20 percent greater than that for all occupations in the region.

High-wage occupation. Occupation area where the weighted median of the annual wages is at least 20 percent greater than the median of the annual wages for all occupations in the region.

Index of dissimilarity. An indicator commonly used to examine differences across two groups in a distribution. The index is bounded by the values 0 and 1, with lower values indicating greater similarity. In this study, the index of dissimilarity is the proportion of concentrators who would need to change program areas for the distribution of program areas and corresponding occupations to be identical among concentrators and workers in the labor market.

Low-demand occupation. Occupation where the change in the projected number of jobs over 2006–16 is at least 20 percent less than that for all occupations in the region.

Low-wage occupation. Occupation where the weighted median of the annual wages is at least 20 percent less than the median of the annual wages for all occupations in the region.

Moderate-demand occupation. Occupation where the change in the projected number of jobs over 2006–16 is within 20 percent of that for all occupations in the region.

Moderate-wage occupation. Occupation where the weighted median of the annual wages is within 20 percent of the median of the annual wages for all occupations in the region.

Non–career and technical education school. The school where students received their high school diplomas. These schools can provide concentrations, but they offer other courses as well. Most non–career and technical education schools are "regular schools" in the Common Core of Data school type, but they can also include "special education" or "other/alternative" schools.

Program area. One of seven categories classifying secondary career and technical education fields in Tennessee during the 2007/08 school year, as defined in the state's annual accountability reports submitted to the U.S. Department of Education for Perkins reporting purposes. The program areas are agricultural education, business technology, family and consumer services, health science, marketing, technology engineering, and trade and industrial education.

Region. A cluster of neighboring counties with similar labor market characteristics (see box 2 for a map of Tennessee regions used in this report).

Total concentrations. The total number of concentrations completed by high school graduates in each program area in high school. These totals may include duplicate records for the same student (students who completed concentrations in more than one program area).

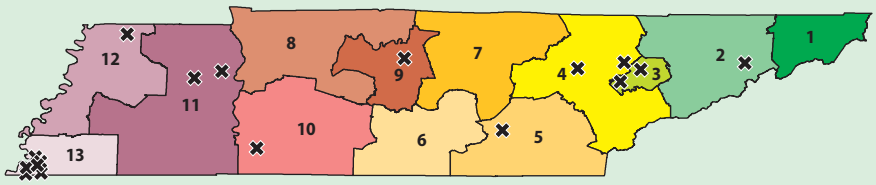
Total concentrators. A nonduplicated count of the number of high school graduates who completed a concentration in any program area in high school.

BOX 2

Tennessee regions

Tennessee has established 13 Local Workforce Investment Areas, clusters of counties with similar labor market characteristics. Four of these regions have no career and technical education–only schools (regions 1, 6, 7, and 8); five regions have one (regions 2, 5, 9, 10, and 12); three regions have two (regions 3, 4, and 11); and one region has six (region 13; see map).

Locations of career and technical education–only schools, by region



and that offer courses in addition to those in career and technical education program areas) if offered there or at one of Tennessee's 17 career and technical education–only schools (specialized schools available in some regions offering only career and technical education courses). Career and technical education–only schools are generally available to all students in good standing in the district or surrounding districts, but enrollment may be limited to students attending specific schools or those meeting district-set eligibility criteria.

The Tennessee Department of Education has developed seven career and technical education program areas: agriculture, business technology, family and consumer services, health science, marketing, technology engineering, and trade and industrial education. All of these program areas prepare students for jobs in the local workforce.

The Tennessee workforce has changed over time, most recently with the shift in the 1990s from a manufacturing economy to a knowledge economy (Wong, Sims, and Schuermann 2004). This change is reflected in the Tennessee Department of Labor and Workforce Development employment projections for 2016, which indicate that the five highest-growth industries are administrative and support services, food services and drinking places, educational services, ambulatory healthcare services, and professional, scientific, and technical services (Tennessee Department of Labor and Workforce Development 2006).

Similar changes can be seen nationally, in population and workforce characteristics as well as in the demand for goods and services. The U.S. Bureau of Labor Statistics (2008) highlights the magnitude of the shift in the number of jobs generated from goods-producing to service-providing industries. The health and education services supersector[1] is projected to grow the most over 2006–16, and 7 of the 20 fastest-growing occupations over 2006–16 are in health care.

Despite these statewide and national trends, projections for specific occupations differ at a more local level. For example, 2006–16 projections for growth in employment in health care and social assistance range from 18.1 percent to 42.6 percent across Tennessee regions (author's calculations based on data from Tennessee Department of Labor and Workforce Development 2009), meaning that the need for training more qualified workers in this field will vary significantly throughout the state. This report is a step in understanding the relationship between the projected need for workers in different industries and the supply of concentrators in program areas that correspond to those industries.

The percentages of projected jobs in high-wage and high-demand occupations in Tennessee were more than twice the percentage of concentrators in corresponding program areas

Research questions

This study addresses five sets of questions on career and technical education in Tennessee:

- On average, how many program areas are available in high schools, and which are most and least common, statewide and by region?
- How does the percentage of high school graduates who graduated from schools with at least one available program area, and of high school graduates who completed at least one concentration vary by program area and region?
- Statewide and for each region, how many concentrators would need to change program areas to match the distribution of workers in the labor market? For each program area, how does the percentage of high school graduates who completed a concentration compare with the percentage of workers employed in corresponding occupations?
- For each region, which program areas correspond to low-, moderate-, and high-wage occupations projected over 2006–16? What percentage of jobs projected over 2006–16 are in 2007/08 program areas that correspond to high-wage occupations? What is the percentage of concentrators in these program areas? How do the median annual wages in occupations that correspond to each program area vary by education level?
- For each region, which program areas correspond to low-, moderate-, and high-demand occupations projected over 2006–16? What percentage of jobs projected over 2006–16 are in 2007/08 program areas that correspond to high-demand occupations? What is the percentage of concentrators in these program areas?

See box 3 for a summary of the study methodology and appendix A for details.

FINDINGS

The findings of this study indicate that the percentages of projected jobs in high-wage and high-demand occupations in Tennessee were more than twice the percentage of concentrators in corresponding program areas. How well concentrations and projections for high-wage and high-demand occupations align, however, varied by region.

Students' opportunities to pursue concentrations in program areas that correspond to high-wage and high-demand occupations may be affected by availability. Statewide, schools provide an average of 3.6 program areas (out of 7), ranging from 2.9 (region 3) to 4.7 (region 6). The percentage of schools with each program area ranged from 18 percent in technology engineering to 72 percent in family and consumer services.

At the student level, trade and industrial education was the most commonly available program area; 92 percent of high school graduates were enrolled in a school in a district offering this program area (either directly through instruction provided at their school or indirectly through instruction provided at a local career and technical education–only school). Technology engineering was the program area least commonly available, with 26 percent of high school students who graduated in 2007/08 enrolled in a school in a district offering it.

How well the percentage of concentrators in each program area aligned with the percentage of workers employed in the corresponding occupation also varied by region. The index of dissimilarity, an indicator commonly used to examine differences across two groups in a distribution (Jacobs 1995; Turner and Bowen 1999), was 0.18. This value suggests that statewide, approximately 18 percent of concentrators would need to change program areas for the distribution of program areas to be identical among concentrators and workers in the labor market. The greatest differences were in agricultural education (16 percent of concentrators and 1 percent of workers employed in corresponding occupations) and in business

BOX 3

Data sources and methodology

Data sources. This study used three data sources:

- The Tennessee Department of Education (2009) provided school-level data for 2007/08 on the total number of high school graduates, a nonduplicated count of high school graduates completing a career and technical education concentration at any time in high school, a nonduplicated count of students in grades 9–12 completing a concentration in the 2007/08 school year, the number of concentrations completed by 2007/08 high school graduates in each program area at any time in high school, and the number of concentrations completed by students in grades 9–12 in each program area in 2007/08.

  Separate files were provided with school-level data on concentrations based on the school where students completed them (delivery-school file) and the school where students received their high school diplomas (home-school file). All analyses are based on the home-school file unless otherwise noted. These data are available on Tennessee Department of Education websites but for ease of access were provided to the study team in a single data file.

- The Tennessee Department of Labor and Workforce Development (2009) provided state and regional data on the number of workers in each occupation in 2006, median annual wages for each occupation in 2006, and projected change in the number of workers in each occupation over 2006–16. These data are available on Tennessee Department of Labor and Workforce Development websites but for ease of access were provided to the study team in a single data file.

- The Common Core of Data (U.S. Department of Education 2008) provided data on school addresses and school type for each school for 2007/08.

Data analysis. The analysis consisted of three main steps:

- Matching counties and public school districts with regions.
- Developing a crosswalk of the relationship between program areas and occupations in the labor market.
- Calculating descriptive statistics and drawing maps to provide a visual representation of the results by region.

The study used data for the entire universe of regular and special education high school graduates in Tennessee public schools in 2007/08. Unless otherwise noted, all analyses were conducted at the region and state levels. Tests of statistical significance were not conducted because the analyses use population data, not a sample of data.

See appendix A for greater detail about the data sources and methodology.

technology (13 percent of concentrators and 23 percent of workers employed in corresponding occupations).

High-wage and high-demand occupations varied by region. Technology engineering was the only program area that correspond to high-wage occupations in all regions; business technology and health science occupations were high wage in some regions. Up to 4.1 percent of new jobs in high-wage occupations projected over 2006–16 statewide could potentially be filled by 2007/08 concentrators in corresponding program areas. The extent to which the supply of 2007/08 concentrators could meet labor market demands for jobs in high-wage occupations over 2006–16, however, varied by region, from 0.7 percent to 12.5 percent.

No program area corresponded to a high-demand occupation in all regions. Business technology and trade and industrial education were the only program areas that did not correspond to a high-demand occupation in any region. Up to 7.1 percent of new jobs in high-demand occupations projected over 2006–16 statewide could potentially be filled by 2007/08 concentrators in corresponding program areas. The extent to which the supply of 2007/08 concentrators could meet labor market demands for jobs in high-demand occupations over 2006–16, however, varied by region, from 1.4 percent to 41.7 percent.

How many program areas do Tennessee schools offer, and which are most common and least common?

This question defined the percentage of schools with at least one student completing a concentration as the metric for availability for program areas (see appendix A).[2] On average, Tennessee schools offered concentrations in 3.6 program areas, ranging from 2.9 in region 13 to 4.7 in region 6 (table 1). Further disaggregated by school district, the average number of program areas offered per school ranged from 0 to 7 (see table B1 in appendix B). Ninety-four percent of career and technical education–only schools[3] and 89 percent of non–career and technical education schools had at least one concentration.

Statewide, the most common program area in non–career and technical education schools was family and consumer services, available at 72 percent of schools, followed by trade and industrial education and business technology, both available at 67 percent of schools. (See table B2 in appendix B for the numbers used to calculate these percentages.) These program areas were the three most common in 9 of 13 regions.[4] The least common in non–career and technical education schools was technology engineering, available at 18 percent of schools.

How does the percentage of graduates of high schools that offered at least one concentration vary by program area and region?

The previous question defined program area availability by the percentage of schools with at least one student completing a concentration. However, the number of students with access

TABLE 1

Non–career and technical education schools with available program areas in Tennessee, by region, 2007/08 (percent)

Region	Number of schools[a]	Average number of program areas available per school	Percentage of schools with available program areas in:						
			Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	19	4.1	53	68	68	74	42	21	84
2	29	3.1	69	41	62	34	28	24	48
3	16	4.5	25	75	75	63	75	50	88
4	32	3.9	53	69	84	53	44	16	75
5	31	3.1	26	58	55	52	29	16	71
6	9	4.7	89	89	78	56	44	33	78
7	21	3.2	76	48	76	43	10	24	48
8	42	4.2	67	81	76	55	40	31	71
9	33	3.2	42	73	61	33	30	9	76
10	23	4.0	83	87	74	65	30	0	65
11	30	3.6	73	57	70	60	37	3	63
12	19	4.1	74	63	89	63	42	0	79
13	46	2.9	15	67	74	22	41	17	50
Tennessee	350	3.6	53	67	72	49	37	18	67

Note: A program area is defined as available in a school if any students in grades 9–12 completed a concentration in that program area at that school.

a. Includes both career and technical education–only and non–career and technical education schools.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

to each program area can depend on the size of the schools and the number of students who can complete concentrations at a career and technical education–only school.

Program area availability. For this research question, the metric for program area availability was estimated at the student level—by examining how many graduates attended a school where any students in grades 9–12 completed a concentration, regardless of whether instruction was provided at a non–career and technical education school or a career and technical education–only school. Actual availability may be constrained by the enrollment each school can accommodate in a given year. Data are not available to quantify the extent to which space limitations prevent students from completing concentrations; however, this is not expected to significantly constrain participation in most schools. Indeed, approximately 90 percent of Tennessee public high school students enrolled in a career and technical education course in 2008/09 (Tennessee Department of Education 2009).

Statewide, 92 percent of graduates were enrolled in a school offering trade and industrial education and 89 percent were enrolled in a school offering family and consumer services, the program areas most commonly available (table 2). Approximately one-fourth (26 percent) of students were enrolled in a school offering technology engineering, the program area least commonly available.

Program area availability at the student level varied by region. Technology engineering was not available to any high school graduates in regions 10 and 12, but nearly three-fourths (74 percent) of graduates in region 3 were enrolled in a school that offered it. (See table B5 in appendix B for the numbers used to calculate these percentages.)

Concentration completion. In 2007/08, 20,305 graduates were concentrators, representing

TABLE 2

Tennessee graduates of high schools with an available program area, by program area and region, 2007/08 (percent, unless otherwise noted)

Region	Number of graduates	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	3,245	50	81	84	94	58	31	98
2	4,285	93	57	89	69	47	32	85
3	3,285	27	98	98	82	98	74	98
4	4,522	68	79	95	81	65	22	95
5	4,532	38	76	75	62	48	15	88
6	2,047	87	83	84	76	64	32	92
7	2,478	97	50	89	74	12	33	73
8	8,019	65	87	89	67	58	36	92
9	7,538	59	88	75	48	45	19	90
10	2,385	95	94	89	81	50	0	91
11	3,383	91	64	91	88	53	10	93
12	2,505	93	70	100	85	56	0	94
13	8,632	48	84	99	79	78	22	98
Tennessee	56,856	65	80	89	73	58	26	92

Note: Availability was estimated separately for each program area, by examining how many graduates had attended a school where any students in grades 9–12 completed a concentration in that program area at a non–career and technical education school or a career and technical education–only school.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

31,542 concentrations. Concentrators in multiple program areas were double-counted in the number of concentrations. Approximately 36 percent of Tennessee high school graduates completed a concentration in at least one program area, ranging from 22 percent in region 13 to 55 percent in region 12 (table 3). The percentage of high school graduates completing concentrations tended to be higher for the program areas most commonly available to them (see tables 1 and 2). Trade and industrial education, available to the highest percentage of graduates, was the concentration completed by the highest percentage of graduates (20 percent). Least commonly available at the school level and student level was technology engineering, with the lowest percentage of graduates (1 percent) completing that concentration. (See appendix table B6 for the number of observations used to calculate these percentages; table B7 replicates the results for the percentage of total concentrations in each program area.) Similar to the findings reported here, these results show that among concentrators, trade and industrial education was the most common program area and technology engineering was the least common.

How does the percentage of high school graduates who completed a concentration compare with the percentage of workers employed in corresponding occupations?

This question was addressed by calculating an index of dissimilarity (see box 1).[5] The index is bounded by the values 0 and 1, with lower values indicating greater similarity. In this study, the index of dissimilarity is the proportion of concentrators who would need to change program areas for the distribution of program areas and corresponding occupations to be identical among concentrators and workers in the labor market. The value 0 indicates that the proportion of concentrators in each program area is identical to the proportion of workers with occupations that correspond to those program areas. The

TABLE 3

Tennessee high school graduates completing at least one concentration, by program area and region, 2007/08 (percent)

Region	Any program area	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	37	6	6	7	12	3	1	33
2	38	16	5	11	4	4	2	21
3	44	0	10	10	5	4	3	25
4	38	7	10	11	6	5	1	20
5	41	4	10	7	8	3	1	31
6	46	11	10	9	6	4	2	19
7	35	21	5	17	4	2	2	20
8	35	7	8	9	5	3	3	16
9	24	8	6	5	4	2	0	13
10	51	12	13	13	11	2	0	30
11	43	18	9	14	11	4	0	17
12	55	24	8	24	15	6	0	23
13	22	1	3	6	2	2	0	11
Tennessee	36	9	7	10	6	3	1	20

Note: The percentage of graduates with concentrations in any program area does not sum to that of high school graduates with concentrations in each program area because the program area totals double-count students with more than one concentration.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

value 1 indicates that no high school graduates completed concentrations in program areas that correspond to occupations in the workforce (say, if all high school concentrations are in agricultural education and business technology but all occupations are in health science and marketing). Concentrators in multiple program areas are double-counted, so the index could also change if these graduates failed to complete multiple concentrations or if any graduates completed another concentration in a different program area.

The statewide index of dissimilarity is 0.18, indicating that 18 percent of concentrators would need to change program areas to match the distribution of workers in the labor market. The index ranges from less than 0.15 in regions 3 and 4 to more than 0.30 in region 12, indicating that how well concentrators align with the current labor market varies by region (map 1).

Statewide, the greatest differences between the percentage of concentrators in each program area and the percentage of workers employed in corresponding occupations were in agricultural education (16 percent of concentrators and 1 percent of workers in corresponding occupations) and in business technology (13 percent of concentrators and 23 percent of workers in corresponding occupations; table 4). Disaggregating the results by region, the discrepancies were even larger. (See table B10 in appendix B for a complete list of results by region.)

What percentage of jobs in high-wage occupations projected over 2006–16 could potentially be filled by 2007/08 concentrators in corresponding program areas?

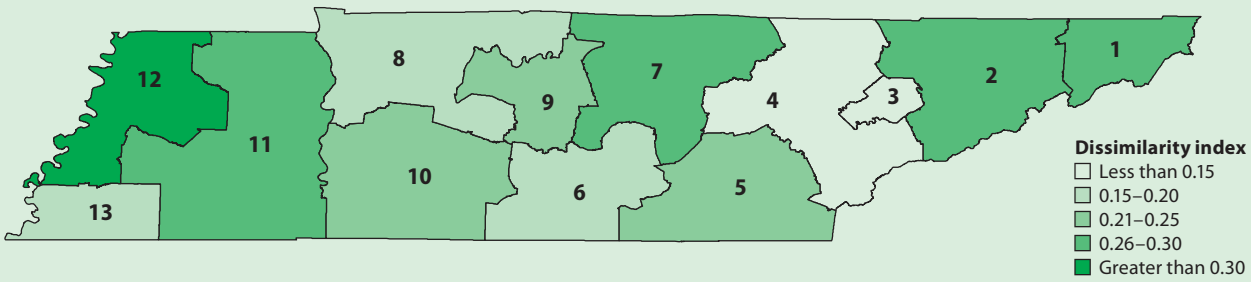
The number of program areas that correspond to high-wage occupations in each region ranged from one to three (table 5). Technology engineering corresponded to high-wage occupations in all 13 regions. Business technology (two regions) and health science (nine regions) were the only other program areas that corresponded to high-wage occupations. See table B9 in appendix B for a complete list of values used to categorize low-, moderate-, and high-wage occupations by region.

For all occupations, the median annual wages for students with a bachelor's degree or higher are above the high-wage classification of $33,636,[6] with occupations that correspond to business technology ($64,454) and technology engineering ($63,381) having the highest[7] (table 6; see table B10 in appendix B for these results disaggregated by region).[8]

Statewide, the percentage of jobs projected over 2006–16 in high-wage occupations (17 percent) almost tripled the percentage of concentrators in corresponding program areas (6 percent; table 7). Up to 4.1 percent of projected new jobs in high-wage occupations could potentially be filled by 2007/08 concentrators in corresponding program areas, suggesting that high school graduates could

MAP 1

Index of dissimilarity between the percentage of concentrators in each program area and the percentage of workers employed in corresponding occupations, by region, 2007/08



Note: Lower values indicate greater similarity.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

TABLE 4

Tennessee concentrators in each program area and workers employed in corresponding occupations, by program area, 2007/08

	Concentrators		Employees		Percentage point difference
Program area	Number	Percent	Number	Percent	
Agricultural education	4,944	16	53,706	1	14
Business technology	4,132	13	830,960	23	–9
Family and consumer services	5,442	17	740,294	20	–3
Health science	3,393	11	256,860	7	4
Marketing	1,877	6	328,200	9	–3
Technology engineering	613	2	104,396	3	–1
Trade and industrial education	11,141	35	1,365,490	37	–2
Total	31,542		3,679,906		
Index of dissimilarity	0.18				

Note: Percentages may not sum to 100 and percentage point differences shown may differ from those calculated from values in the table because of rounding.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

TABLE 5

Median annual wage classification for occupations that correspond to each program area, by region, 2007/08

Region	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	Low	Moderate	Low	High	Low	High	Moderate
2	Low	Moderate	Low	High	Low	High	Moderate
3	Low	Moderate	Low	High	Moderate	High	Moderate
4	Low	Moderate	Low	High	Low	High	Moderate
5	Low	Moderate	Low	High	Low	High	Moderate
6	Low	Moderate	Low	Moderate	Low	High	Moderate
7	Moderate	High	Low	High	Moderate	High	Moderate
8	Low	Moderate	Low	High	Low	High	Moderate
9	Low	Moderate	Low	High	Moderate	High	Moderate
10	Moderate	Moderate	Low	Moderate	Low	High	Moderate
11	Low	Moderate	Low	Moderate	Low	High	Moderate
12	Moderate	Moderate	Low	Moderate	Low	High	Moderate
13	Low	High	Low	High	Low	High	Moderate

Note: High-wage occupations have median annual wages at least 20 percent greater than the regional median; low-wage occupations have median annual wages at least 20 percent less than the regional median; all other occupations are classified as moderate wage.

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009) using wage classifications from Tennessee State Board of Education. (2008).

fill up to 41 percent of these jobs over the 10-year period if the number of concentrators in program areas that correspond to high-wage occupations remains constant.[9]

How much the supply of concentrators could meet labor market demands for jobs in high-wage occupations over 2006–16 varied by region (map 2). In regions 6 and 12, more than 10 percent of

TABLE 6

Tennessee median annual wages for occupations that correspond to each program area, by highest level of education completed, 2007/08 (dollars)

Program area	At most high school	More than high school but less than bachelor's degree	At least bachelor's degree	Overall
Agricultural education	22,012	23,688	49,702	22,012
Business technology	19,931	30,057	64,554	33,834
Family and consumer services	15,702	19,420	42,584	19,420
Health science	21,886	34,986	55,904	37,563
Marketing	15,702	19,420	48,268	19,420
Technology engineering	32,994	44,874	63,381	61,524
Trade and industrial education	25,549	36,472	39,598	27,269
All	23,767	29,899	50,768	28,700

Note: Median annual wages are weighted by the number of workers employed in each occupation.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

projected jobs in high-wage occupations could be filled by 2007/08 concentrators. If in these regions the number of concentrators in program areas corresponding to high-wage occupations remains constant, up to 100 percent of these jobs could be filled by high school graduates over the 10-year period. By contrast, in region 11, just 0.7 percent of projected jobs in high-wage occupations could be filled by 2007/08 concentrators, suggesting that high school graduates could fill just 7 percent of projected jobs in high-wage occupations if the number of concentrators remains constant. In region 12, the number of jobs in the one high-wage program area, technology engineering, is projected to be the same in 2006 and 2016; no high school graduates completed a concentration in this program area in 2008.

What percentage of jobs in high-demand occupations projected over 2006–16 could potentially be filled by 2007/08 concentrators in corresponding program areas?

The number of program areas that corresponded to high-demand occupations in each region ranged from one to four, and seven regions had three program areas that corresponded to high-demand occupations (table 8). No program area corresponded to a high-demand occupation in all regions. Occupations in health science were high demand most often, in 12 of 13 regions.

The demand for some occupations varied by region. Occupations in agricultural education were high demand in seven regions but low demand in five. Occupations in business technology and in trade and industrial education were the only ones not high demand in any region.

Demand does not always correspond to wages (see table 5). Occupations in agricultural education were high demand but low wage in five regions. Similarly, occupations in family and consumer services, high demand in eight regions, were low wage in all regions. Occupations in technology engineering show the opposite pattern—low demand in seven regions but high wage in all regions. See table B11 in appendix B for the values used to categorize low-, moderate-, and high-demand occupations for each region.

Statewide, the percentage of projected jobs in high-demand occupations (31 percent) was greater than that of concentrators in corresponding program areas (18 percent; table 9). Up to 7.1 percent of new jobs in high-demand occupations projected over 2006–16 could potentially be filled by 2007/08

TABLE 7

Projected jobs in high-wage occupations over 2006–16 that could be filled by 2007/08 concentrators, by region

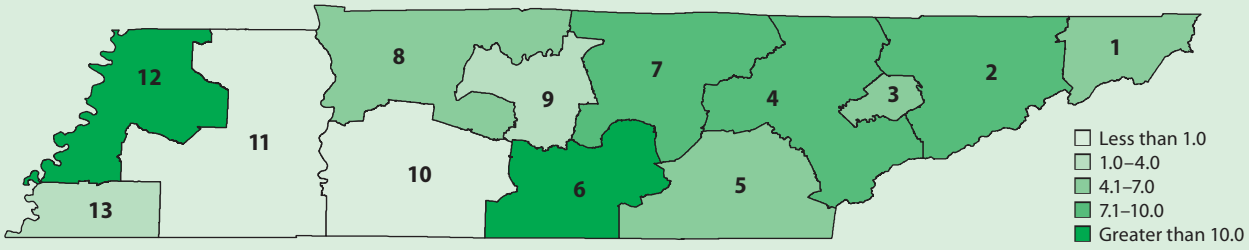
Region	Program area	Projected new jobs in high-wage occupations over 2006–16		2008 high school graduates who concentrated in corresponding program areas		Projected jobs in high-wage occupations over 2006–16 that could be filled by 2007/08 concentrators (percent)
		Number	Percent	Number	Percent	
1	Health science, technology engineering	6,460	26	426	13	6.6
2	Health science, technology engineering	3,040	11	220	5	7.2
3	Health science, technology engineering	5,880	14	277	8	4.7
4	Health science, technology engineering	3,570	10	287	6	8.0
5	Health science, technology engineering	7,200	19	386	9	5.4
6	Technology engineering	300	3	32	2	10.7
7	Business technology, health science, technology engineering	3,000	39	276	11	9.2
8	Health science, technology engineering	14,100	15	629	8	4.5
9	Health science, technology engineering	10,735	11	313	4	2.9
10	Technology engineering	0	0	1	0	0.0
11	Technology engineering	260	1	2	0	0.7
12	Technology engineering	40	0	5	0	12.5
13	Business technology, health science, technology engineering	26,660	51	442	5	1.7
Tennessee	Varies by region	81,245	17	3,296	6	4.1

Note: Differences may be greater or less than expected due to rounding. High-wage occupations are identified separately for each region. Values for Tennessee are aggregates of regional values. The percentage of projected jobs in high-wage occupations is the number of projected jobs in high-wage occupations divided by the total number of projected jobs. The percentage of graduates who concentrated in corresponding program areas is the number of graduates with a concentration in a program area that corresponds to a high-wage occupation divided by the total number of high school graduates.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009) using wage classifications from Tennessee State Board of Education (2008).

MAP 2

Percentage of projected jobs in high-wage occupations over 2006–16 that could be filled by 2007/08 concentrators, by region



Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

TABLE 8
Projected job demand over 2006–16, by corresponding program area and region, 2007/08

Region	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	Low	Moderate	High	High	High	Low	Low
2	High	Moderate	Low	High	Moderate	Moderate	Moderate
3	Moderate	Moderate	Moderate	High	Low	Low	Moderate
4	High	Moderate	High	High	Moderate	Low	Moderate
5	Low	Moderate	High	High	Moderate	High	Low
6	Low	Low	High	High	Low	Moderate	Moderate
7	High	Moderate	High	High	Moderate	Low	Low
8	High	Moderate	Moderate	High	Moderate	High	Low
9	High	Moderate	High	Moderate	Moderate	High	Low
10	High	Low	High	High	Low	Low	Low
11	Low	Moderate	Moderate	High	Low	Low	Low
12	Low	Low	High	High	Low	Low	Moderate
13	High	Moderate	Moderate	High	Low	High	Low

Note: High-demand occupations have a projected change in employment over 2006–16 at least 20 percent greater than that for all occupations in the region; low-demand occupations have a projected change in employment over 2006–16 at least 20 percent less than that for all occupations in the region; all other occupations are classified as moderate demand. Demand classifications for corresponding program areas are identified separately for each region.

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009) using demand calculations based on Tennessee State Board of Education (2008).

concentrators in corresponding program areas, suggesting that high school graduates could fill up to 71 percent of these jobs over the 10-year period if the number of these concentrators remains constant.[10]

How well the supply of concentrators in 2007/08 matched projected jobs in high-demand occupations over 2006–16 varied by region (map 3). In regions 2, 7, 10, and 12, more than 10 percent of projected jobs in high-demand occupations could be filled by 2007/08 concentrators. If in these regions the number of concentrators in program areas that correspond to high-demand concentrations remains constant, up to 100 percent of these jobs could be filled by high school graduates over 2006–16. By contrast, in region 13, just 1.4 percent of projected jobs in high-demand occupations could be filled by 2007/08 concentrators, suggesting that high school graduates could fill just 14 percent of projected jobs in high-demand occupations if the number of these concentrators remains constant.

STUDY LIMITATIONS

Several limitations affected this study and inform how the results are interpreted:

- Data on high school graduate concentrators could not be linked to postsecondary education enrollment. Many program areas require training beyond high school for students to qualify for high-wage or high-demand occupations in a related field. Among the students who attend college, many will not enter the workforce until at least several years after graduating high school, possibly overestimating in the near term the alignment of concentrations with occupations in corresponding program areas. However, that the occupation projections go to 2016 mitigates this timing issue, so many 2007/08 high school graduates will enter the workforce close to the last year of the occupation projections. Still, not all students who complete a specific concentration will seek an occupation that corresponds

TABLE 9

Projected jobs in high-demand occupations over 2006–16 that could be filled by 2007/08 concentrators, by region

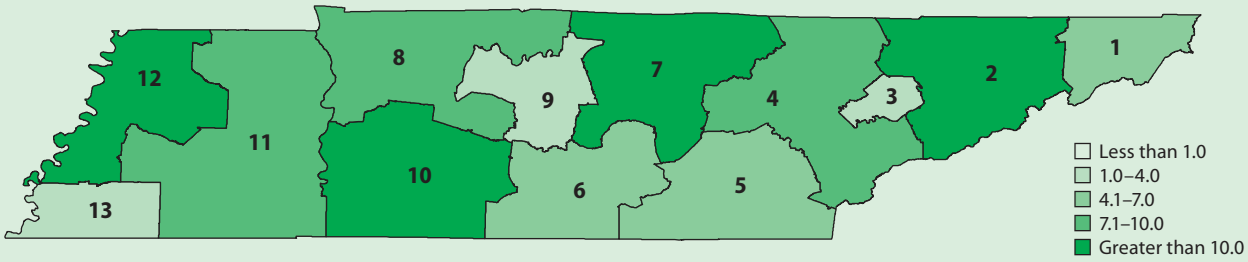
Region	Program area	Projected new jobs over 2006–16 in high-demand occupations		2008 high school graduates who concentrated in corresponding program areas		Projected jobs in high-demand occupations over 2006–16 that could be filled by 2008 career and technical education graduates (percent)
		Number	Percent	Number	Percent	
1	Family and consumer services, health science, marketing	16,400	65	709	22	4.3
2	Agricultural education, health science	3,490	13	856	20	24.5
3	Health science	5,230	12	170	5	3.3
4	Agricultural education, family and consumer services, health science	14,530	39	1,061	23	7.3
5	Family and consumer services, health science, technology engineering	17,060	44	706	16	4.1
6	Family and consumer services, health science	4,380	37	293	14	6.7
7	Agricultural education, family and consumer services, health science	4,230	54	1,053	42	24.9
8	Agricultural education, health science, technology engineering	16,110	17	1,212	15	7.5
9	Agricultural education, family and consumer services, technology engineering	34,585	35	1,001	13	2.9
10	Agricultural education, family and consumer services, health science	3,760	84	1,568	66	41.7
11	Health science	4,390	24	376	11	8.6
12	Family and consumer services, health science	3,180	38	964	38	30.3
13	Agricultural education, health science, technology engineering	15,340	29	218	3	1.4
Tennessee	Varies by region	142,685	31	10,187	18	7.1

Note: Differences may be greater or less than expected because of rounding. High-demand occupations are identified separately for each region. The percentage of projected jobs in high-demand occupations is the number of projected jobs in high-demand occupations divided by the total number of projected jobs. The percentage of graduates who concentrated in corresponding program areas is the number of graduates with a concentration in a program area that corresponds to a high-demand occupation divided by the total number of high school graduates.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009) using demand calculations from Tennessee State Board of Education (2008).

MAP 3

Projected jobs in high-demand occupations over 2006–16 that could be filled by 2007/08 concentrators, by region (percent)



Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

to that program area, which could further overestimate the supply of potential workers. Likewise, students who do not complete a concentration could seek an occupation corresponding to a program area.

- The results also did not account for student mobility across or outside Tennessee. Regions with high demand for a particular occupation could perhaps fill labor market demands by attracting students from other regions or states. Yet even though students might move for employment opportunities, many are likely to remain in the same state and region. Indeed, approximately 70 percent of people ages 15–24 in 1995 had remained in the same residence or moved within the county between 1995 and 2000 (when they were ages 20–29; Franklin 2003).

- Occupational projections were based on current employment data and employer surveys of future employment needs. The data, however, cannot predict what new industries might surface in a region or account for other factors affecting demand and competitive position. As high school career and technical education programs prepare students for near-term and emerging labor market demands, the long-term projections might not fully reflect these demands if new industries develop or technology changes, affecting employment in specific occupations.

- Wage data were not available for all occupations in all regions, due primarily to confidentiality reporting requirements. Procedures for handling missing data may introduce some uncertainty when identifying high-wage program areas (see appendix A).

- There was also uncertainty in matching program areas with corresponding occupations. Some program areas have a fairly straightforward match. (For example, nursing matches the health science program area.) Occupations in such areas as information technology could possibly align with the business technology program area or the technology engineering program area. Where possible, each occupation was matched with the single most relevant program area, to avoid double counting; where not possible, the occupation was matched with multiple program areas. So the estimates of the matches of concentrations to projections of high-demand or high-wage occupations are more precise for some program areas than for others. Less than 1 percent of workers were employed in occupations that could not be matched to a program area. Appendix C replicates tables 4–9 using an alternate crosswalk for occupations where the appropriate corresponding program areas were less certain. Results at the state level were not substantively different using the alternate crosswalk, suggesting that double counting does not significantly affect

the findings at the state level. Some of the region-level findings, however, show greater variation.[11]

- The measures of how much program areas focus on high-wage and high-demand occupations are not necessarily good measures of whether these programs increase student earnings. For example, program areas focused on moderate-wage occupations may help students acquire useful skills and allow them to increase their earnings by a larger amount than program areas focused on higher-wage occupations.

- Concentrators in multiple program areas were double counted: projections of the percentage of jobs in high-wage and high-demand occupations that could be filled by high school graduates overestimate the actual number of concentrators. These estimates thus assume that graduates could take multiple jobs in different program areas.

Despite these limitations, the data provide for each region the best available estimates of participation in concentrations in each program area among high school graduates and how much these concentrations align with high-wage and high-demand occupations. This information can be a good start for identifying areas where availability and participation in concentrations might not align with labor market demands.

APPENDIX A
DATA SOURCES AND METHODOLOGY

This appendix describes data sources and quality, how public school districts and regions were matched, the development of a crosswalk between career and technical education program areas and occupations, and the methodology for calculating descriptive statistics.

Data sources

The study uses data for the entire universe of regular and special education high school graduates in Tennessee public schools for 2007/08. The available data cannot be used to track a single cohort of students over time. This study focuses on Tennessee's public school system—approximately 12 percent of Tennessee students graduate from private schools (U.S. Department of Education 2008b), and nationwide, almost 3 percent of students are home-schooled (U.S. Department of Education 2007). Tests of statistical significance were not conducted because the analyses used population data, not a sample of data.

The study used three data sources:

- *The Tennessee Department of Education* (2009) provided school-level data for 2007/08 on the total number of high school graduates, a nonduplicated count of high school graduates completing a career and technical education concentration at any time in high school, a nonduplicated count of students in grades 9–12 completing a concentration in the 2007/08 school year, the number of concentrations completed by 2007/08 high school graduates in each program area at any time in high school, and the number of concentrations completed by students in grades 9–12 in each program area in 2007/08.

  Separate files were provided with school-level data on concentrations based on the school where students completed them (delivery-school file) and the school where students received their high school diplomas (home-school file). Unless otherwise noted, all analyses were based on the home-school file. These data are available on Tennessee Department of Education websites but for ease of access were provided to the study team in a single data file.

- *The Tennessee Department of Labor and Workforce Development* (2009) provided state and regional data on the number of workers in each occupation in 2006, median annual wages in each occupation in 2006, and projected change in the number of workers in each occupation over 2006–16. These data are available on Tennessee Department of Labor and Workforce Development websites but for ease of access were provided to the study team in a single data file.

- *The Common Core of Data* (U.S. Department of Education 2008) provided data on school addresses and school type for each school for 2007/08.

Data quality

School-level data from the Tennessee Department of Education (2009). The researchers checked for missing data by comparing the number of schools in the Tennessee Department of Education files with the number of schools in the Common Core of Data that included grade 12. Sixty-one schools in the Common Core of Data were missing data on the number of total graduates and the number of concentrations completed by graduates, 31 of them designated a school type other than "regular school." This group consisted of special education, vocational, and other/alternative schools, which students may attend in addition to their regular school. Another 27 schools were categorized as "regular schools" or were missing school type but had names indicating that the school was "alternative," was "vocational," was an "adult high school," or did not include grade 12 (elementary, middle, or junior high schools). It was assumed that these schools were missing from the

Tennessee Department of Education file because students would be counted as graduates at their regular school rather than at these specialized schools. Three schools remained with missing data in this file on the number of total graduates and the number of concentrations completed by graduates, but none were missing data on the number of concentrations completed by students in grades 9–12, so it was assumed they had zero graduates and zero graduate concentrators in 2007/08.

The home-school file also includes five schools with no regular or special education graduates. These schools awarded only certificates or General Equivalency Diplomas in 2007/08. They were dropped from the sample.

The final sample included 333 schools with records in at least one of the five spreadsheets in the Tennessee Department of Education data file (high school graduates, nonduplicated concentrators, nonduplicated concentrators in grades 9–12, concentrations in each program area for graduates, and concentrations in each program area for students in grades 9–12). Ninety-one percent of schools (304) had records in all five files and were not missing data for any variable. The remaining 29 schools, missing values in one or more career and technical education files, were coded as zero for the corresponding variables because it appeared they were likely to have little to no participation for the year. Three percent of schools (9) had data on the number of high school graduates but were missing data in one or more career and technical education files. Six percent of schools (20) had data on the number of high school graduates but were missing data in all the career and technical education files. Each school missing career and technical education data had fewer than 50 graduates.

The variable for the total number of high school graduates includes the number of regular and special education graduates in each school. These data, used for No Child Left Behind Act reporting, are assumed to be high quality.

The variable for the total number of concentrators is a nonduplicated count of the total number of high school graduates who completed a concentration in any program area. These records indicate whether graduates completed a concentration at any time in grades 9–12. It includes all 2007/08 high school graduates, regardless of how many years it took them to graduate. There is also a variable for the total number of concentrators in grades 9–12 in 2007/08. Each year, career and technical education teachers in each school report the names and identification numbers of all their students who complete concentrations. The school's career and technical education director checks the data and approves its accuracy. The Tennessee Department of Education aggregates the concentrator data to the school level, eliminating all duplicate identification numbers so that each student is counted once as a concentrator. The data, self-reported by teachers, are subject to error, as teachers may not always be certain whether some students completed all the requirements for a concentration. Still, the teacher is "the person who has the best knowledge regarding the data for each student" (Tennessee Department of Education n.d. a), and the data are verified by the director, so there should be no substantial inaccuracies. Further, the data for these variables are used for Perkins reporting, so they are assumed to be high quality.

The school-level data also included variables for the total number of concentrations completed in each program area (by graduates and by students in grades 9–12). These data were collected through the same teacher-reporting process described above, though duplicate student identification numbers were not removed by the Tennessee Department of Education.

There are three reasons why these totals could include duplicate records for the same student:

- Students with concentrations in more than one program area were counted in the totals for each program area they complete.

- Tennessee offers different programs of study[12] for each program area. Students who complete

more than one program of study within a program area may be counted more than once as a concentrator in the same program area. For example, there are similar requirements for the programs of study "plant systems-horticulture production" and "plant systems-landscaping and turf science." A student who completes the courses required for both programs of study may be counted twice as a concentrator in the agricultural education program area.

- Students may be taking career and technical education courses with more than one teacher when they complete their concentration. When teachers complete their concentrator reports, they are instructed to designate students as concentrators only if they had not already been classified as a concentrator in the same program area. In practice, however, more than one teacher may count the same student as a concentrator in the same program area.

  It is not possible to distinguish the number of records attributed to each source of duplicate counts or to create a nonduplicated count for each program area. Statewide, there are 20,305 graduate concentrators, based on the nonduplicated counts (total concentrators), and 31,542 concentrations completed by graduates in all program areas (total concentrations), meaning that there are 11,237 duplicate student records in the variable for concentrations by program area (total concentrations).

Workforce data from the Tennessee Department of Labor and Workforce Development (2009). The Tennessee Department of Workforce Development provided two region-level files with workforce data. The first included the number of workers employed in 2006 and the projected number of workers in 2016 for each occupation in the Standard Occupational Classification (SOC).[13] The department collects initial data for the employment projections from current employment data and employer surveys of future employment needs. It next calculates statistical projections for each occupation, based on change factors developed by the Bureau of Labor Statistics. These factors consider anticipated workforce changes, such as expected openings from people permanently leaving the workforce because of such factors as death, retirement, and net transfers of workers among jobs. The projections, however, are limited. They cannot predict what new industries might surface in a region or account for other factors that might affect demand or competitive position. To protect confidentiality, employment data were suppressed when three or fewer employers reported occupational employment for a cell, one employer made up more than 50 percent of the employment for a cell, or two employers made up more than 75 percent of the employment for a cell.

The original employment data file from the Tennessee Department of Labor and Workforce Development had duplicate employment counts from the multiple levels of aggregation within the SOC codes. (That is, the same worker was counted up to four times from the major group, minor group, broad occupation, and detailed occupation.) The principal investigator developed a program in Stata to calculate a nonduplicated count of the number of workers and projected workers in each level of aggregation within the codes. These counts were read for accuracy by checking whether the total number of nonduplicated counts in all codes equaled the total employment in the corresponding major group (from the original data).

The totals in the major groups appeared slightly undercounted in some of the original records (expected, because of the cells suppressed for confidentiality reporting requirements), but the difference was within 10 in most cases. In 12 cases, the total employment in the major group from the original records undercounted by more than 30 workers. After checking the raw data, it appeared the calculated values were more accurate, as the disaggregated counts did not sum to the total occupational counts in the original data. A new variable was created for the total employment in each major code, based on calculations from the nonduplicated counts within that major code.

The second Tennessee Department of Labor and Workforce Development data file included mean and median annual wages for each SOC occupational code. Values for the wage variables were calculated by the state, based on data from the Occupational Employment Statistics survey, an ongoing federal-state cooperative program between the Bureau of Labor Statistics and the department. The survey collects data from a random sample of one-third of Tennessee employers. More detailed information on this survey can be found at http://www.bls.gov/oes/.

Also in the second data file, wages were reported only for major groups and detailed occupations. Since wages were not reported for minor groups or broad occupations, the values for the corresponding major group in the same region were substituted. Other codes missing wage data were handled as follows:

- Across all regions, in 2 records (out of 308) were wages missing for a major group. For these two, the mean wages for the corresponding major group at the state level were substituted for the missing wage variables for the major group at the region level.

- There are 9,419 records for detailed occupational codes by region, 65 percent (6,153) having values for the wage variables. Most of the records missing data were so because of confidentiality requirements that prevent the reporting of occupational wages for survey response rates of less than 75 percent and for occupations with fewer than 20 workers in a region. For 28 percent of the detailed occupational codes (2,652), the missing wage variables for the region were replaced with the values of the corresponding detailed occupational code at the state level. For 7 percent of them (614), the missing wage variables for the region were replaced with the values of the corresponding major group in the same region.

School-level data from the Common Core of Data (2008). Eight schools in the school-level Tennessee Department of Education data were not included in the Common Core of Data. Data for these schools were taken from the Institute of Education Sciences "Search for Public Schools" website (http://nces.ed.gov/ccd/schoolsearch/), the Tennessee Department of Education website, and the individual schools' websites.

The quality of the school-type variable in the Common Core of Data was also examined. Twenty-two schools in the Common Core of Data were designated "vocational schools." Officials at the Tennessee Department of Education's career and technical education division were asked to verify this list for completeness and accuracy. They indicated that five of these schools were inactive or nonpublic vocational centers, so those records were dropped from the sample. The remaining 17 were categorized as career and technical education–only schools in this study; all others, non–career and technical education schools.

Matching counties and public school districts with regions

The counties for each public school district in the Tennessee Department of Education (2009) data were matched with the county in the corresponding region from the Tennessee Department of Labor and Workforce Development (2009) data. This was straightforward—no districts spanned more than one county and no counties spanned more than one region.[14] Table A1 shows by region all the counties and public school districts that served students in grade 12.

Crosswalk between program areas and occupations

A crosswalk is a tabular representation of the relationship between two or more sets of data. For this study, a crosswalk was developed between Tennessee's career and technical education program areas and the corresponding SOC codes for related occupations in the labor market. Where possible, each occupation was matched with the single most relevant program area to avoid double counting; where not possible, the occupation was matched with multiple program areas. Less than 1

TABLE A1

Counties and public school districts that served students in grade 12 in each Tennessee region, 2007/08

County	School district
Region 1	
Carter	Carter County, Elizabethton City
Johnson	Johnson County
Sullivan	Bristol City, Kingsport City, Sullivan County
Unicoi	Unicoi County
Washington	Johnson City, Washington County
Region 2	
Claiborne	Claiborne County
Cocke	Cocke County
Grainger	Grainger County
Greene	Greene County, Greeneville City
Hamblen	Hamblen County
Hancock	Hancock County
Hawkins	Hawkins County
Jefferson	Jefferson County
Sevier	Sevier County
Union	Union County
Region 3	
Knox	Knox County, Tennessee High School for the Deaf
Region 4	
Anderson	Anderson County, Oak Ridge City
Blount	Alcoa City, Blount County, Maryville City
Campbell	Campbell County
Cumberland	Cumberland County
Loudon	Lenoir City, Loudon County
Monroe	Monroe County, Sweetwater City
Morgan	Morgan County
Roane	Roane County
Scott	Oneida City, Scott County
Region 5	
Bledsoe	Bledsoe County
Bradley	Bradley County, Cleveland City
Hamilton	Hamilton County
Marion	Marion County, Richard City Elementary
McMinn	McMinn County
Meigs	Meigs County
Polk	Polk County
Rhea	Rhea County
Sequatchie	Sequatchie County
Region 6	
Bedford	Bedford County
Coffee	Coffee County, Tullahoma City
Franklin	Franklin County
Grundy	Grundy County
Lincoln	Lincoln County
Moore	Moore County
Warren	Warren County
Region 7	
Cannon	Cannon County
Clay	Clay County
DeKalb	DeKalb County
Fentress	Fentress County, Alvin C. York Institute
Jackson	Jackson County
Macon	Macon County
Overton	Overton County
Pickett	Pickett County
Putnam	Putnam County
Smith	Smith County
Van Buren	Van Buren County
White	White County
Region 8	
Cheatham	Cheatham County
Dickson	Dickson County
Houston	Houston County
Humphreys	Humphreys County
Montgomery	Montgomery County
Robertson	Robertson County
Stewart	Stewart County
Sumner	Sumner County
Williamson	Williamson County
Region 9	
Davidson	Davidson County
Rutherford	Rutherford County
Trousdale	Trousdale County
Wilson	Wilson County
Region 10	
Giles	Giles County
Hickman	Hickman County
Lawrence	Lawrence County

(CONTINUED)

TABLE A1 (CONTINUED)

Counties and public school districts that served students in grade 12 in each Tennessee region, 2007/08

County	School district
Lewis	Lewis County
Marshall	Marshall County
Maury	Maury County
Perry	Perry County
Wayne	Wayne County
Region 11	
Benton	Benton County
Carroll	Hollow Rock-Bruceton, Huntington Special, McKenzie Special, South Carroll Special, West Carroll Special
Chester	Chester County
Decatur	Decatur County
Hardeman	Hardeman County
Hardin	Hardin County
Haywood	Haywood County
Henderson	Henderson County
Henry	Henry County
Madison	Jackson-Madison Consolidated
McNairy	McNairy County
Weakley	Weakley County
Region 12	
Crockett	Crockett County
Dyer	Dyer County, Dyersburg City
Gibson	Bradford Special, Gibson Special, Humboldt City, Milan City Special, Trenton City
Lake	Lake County
Lauderdale	Lauderdale County
Obion	Obion County, Union City
Tipton	Tipton County
Region 13	
Fayette	Fayette County
Shelby	Memphis City, Shelby County

Source: Author's calculations based on data from Tennessee Department of Education (2009), Tennessee Department of Labor and Workforce Development (2009), and Common Core of Data (2008).

percent of workers were in occupations that could not be matched with any program area (SOC code 27-2000 for "entertainers and performers, sports and related workers").

To create the crosswalk, it was necessary to understand the types of occupations in each SOC code and the content of each program area. The Bureau of Labor Statistics website (http://www.bls.gov/soc/home.htm) provided an occupation title, an occupation definition, and examples for each code. The Tennessee Department of Education website (http://www.tennessee.gov/education/cte/index.shtml) provided pages for each program area, with links to curriculum course descriptions. In addition, a website developed by the Tennessee Board of Regents and the Tennessee Department of Education (http://pathways.tbr.edu/programs.php) provided a description of each program of study in each program area and a list of related occupations. Table A2 shows a list of all the programs of study in each program area.

The crosswalk was coded independently for all the SOC occupational codes and program areas. (See box A1 for the background and experience of the coders.) Table A3 summarizes the level of agreement between the researchers in the primary program areas associated with each occupational code. For 66 percent of the codes, the researchers agreed completely on the crosswalk classifications. For 28 percent, the researchers agreed on one primary program area but disagreed on matching the occupation with multiple program areas. For 6 percent, the researchers disagreed completely.

To resolve the disagreements, a combined crosswalk was created by reexamining the coding materials and discussing the rationales for each classification. The disagreements were also reviewed by a senior labor economist with expertise in career and technical education and job-training programs. In some cases, these reviews and discussions led the researchers to reconsider their initial coding and agree on a combined crosswalk decision. In others, there was still some disagreement about

TABLE A2
Programs of study in each program area

Program of study	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
Agriculture, food and natural resources	✔						
Agribusiness, food products and process systems	✔						
Animal systems—pre-veterinary	✔						
Animal systems—production animals	✔						
Environmental and natural resources systems	✔						
Plant systems—horticulture production	✔						
Plant systems—landscaping and turf science	✔						
Power, structures and technical systems	✔						
Architecture and construction	✔		✔			✔	✔
Construction carpentry							✔
Construction electrical							✔
Construction HVAC/R							✔
Construction masonry and concrete							✔
Construction plumbing							✔
Construction welding							✔
Design and preconstruction						✔	✔
Interior design			✔				
Landscape design	✔						✔
Arts, audio/video technology and communications			✔				✔
Audio technology							✔
Design communications							✔
Fashion design			✔				
Graphic communications							✔
Journalism and broadcasting							✔
Business, management, and administration		✔					
Administrative and information support		✔					
Business analysis		✔					
Business financial management and accounting		✔					
Business management		✔					
Communications development		✔					
Human resources		✔					
Education and training		✔	✔				
Pre-K early childhood education			✔				
Teaching training services		✔	✔				

(CONTINUED)

TABLE A2 (CONTINUED)

Programs of study in each program area

Program of study	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
Finance		✔					
Banking and finance		✔					
Financial planning		✔					
Government and public administration		✔					✔
National security							✔
Public/nonprofit management and administration		✔					
Health science				✔			
Biotechnology research and development				✔			
Diagnostic services				✔			
Health informatics				✔			
Support services				✔			
Therapeutic emergency services				✔			
Therapeutic services				✔			
Hospitality and tourism			✔		✔		✔
Food and beverage services			✔				✔
Hospitality management and lodging services					✔		
Recreation, attractions, sports and entertainment					✔		
Travel and tourism					✔		
Human services			✔				✔
Consumer services			✔				
Counseling and mental health services			✔				
Early childhood development and services			✔				
Family and community services			✔				
Nutritional counseling			✔				
Personal care services							✔
Information technology		✔				✔	✔
Electronic publishing		✔					
Interactive multimedia		✔					
Networking systems		✔					✔
Web design		✔				✔	✔
Law, public safety, corrections and security		✔					✔
Law enforcement services							✔
Security and protection services		✔					✔
Manufacturing						✔	✔
Engineering						✔	✔
Operations and maintenance							✔

(CONTINUED)

TABLE A2 (CONTINUED)
Programs of study in each program area

Program of study	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
Precision productions						✔	✔
Production design						✔	✔
Marketing, sales and service					✔		
Channel management					✔		
Marketing communication					✔		
Marketing management					✔		
Marketing research					✔		
Merchandising					✔		
Selling and sales management					✔		
Science, technology, engineering and mathematics						✔	
Engineering and technology						✔	
Science and mathematics						✔	
Transportation, distribution, and logistics							✔
Automotive technology							✔
Aviation flight							✔
Aviation maintenance							✔
Collision repair technology							✔
Diesel technology							✔
Leisure craft/small engine technology							✔

Source: Author's analysis based on Tennessee Department of Education n.d. b.

BOX A1

Background and experience of the crosswalk coders

Christine Mokher, Ph.D. Dr. Mokher served as principal investigator for this study and was a coder for its crosswalk. She holds a Ph.D. in educational leadership and policy studies and recently completed research on the effects of career and technical education course-taking on student outcomes, using Florida student transcript data, for the U.S. Department of Education's National Assessment of Career and Technical Education. As part of this project, she developed an additional crosswalk, between North American Industry Classification System codes and program areas from the National Center for Education Statistics Secondary School Taxonomy (Bradby 2007).

Shira Solomon, Ph.D. Dr. Solomon served as a researcher for this study and was a coder for its crosswalk. Holding a Ph.D. in educational evaluation and research, she works with Regional Educational Laboratory Appalachia on projects related to data-driven decisionmaking.

Louis Jacobson, Ph.D. Dr. Jacobson reviewed and commented on the study's crosswalk and advised on disagreements in the coding process. A senior labor economist with expertise in career and technical education and job training programs, he has more than 30 years' experience in evaluating education and labor market programs. His work appears in peer-reviewed journals including *American Economic Review, Journal of Econometrics,* and *Industrial and Labor Relations Review.*

TABLE A3
Level of agreement among coders in the primary career and technical education program area associated with each occupational Standard of Classification code

Level of agreement	Number	Percent
Complete agreement—identical coding for primary program area(s)	619	66
Partial agreement—identical coding on one program area but disagreement on matching the occupation with multiple program areas	262	28
Complete disagreement—different coding for primary program area(s)	53	6
Total	934	100

Source: Author's calculations based on the two crosswalks developed by the study researchers.

assigning multiple program areas to a single SOC code. If there was agreement on the match between the code and one program area, that program area was assigned to the combined crosswalk. If there was disagreement on a second or third program area that could be matched with a code, the other program areas were added to an alternate version of the crosswalk. The alternate crosswalk had 84 codes where an agreement could not be reached—9 percent of all codes in the state ($n = 934$). All analyses in the report were based on the combined crosswalk and replicated in appendix C using an alternate crosswalk as a sensitivity test.

Methodology for descriptive statistics

This section reviews the methodology for calculating the descriptive statistics for each research question. Unless otherwise noted, all analyses were conducted at the region and state levels.

The percentages calculated use the total number of graduates, total concentrators (nonduplicated count of the high school graduates who completed a concentration in any program area in high school), or total concentrations (sum of the total number of concentrations completed by high school graduates in each program area in high school, which may include duplicate records for the same student; table A4).

The availability of program areas, based on the average number of program areas per school. This question examined school-level availability of each program area by district and region. Graduates could have completed concentrations through courses offered at their primary high school, or they may have had the option to take career and technical education courses at a career and technical education–only school. Career and technical education data from the delivery-school file was used to determine whether any students in grades 9–12 completed a concentration in each program area through instruction provided at that school. This measure was used as a proxy of the general availability of program areas, though actual availability may be constrained by the number of enrollments

TABLE A4
Numbers of Tennessee high school graduates, concentrators, and concentrations

Region	Graduates	Concentrators	Concentrations
1	3,245	1,213	2,209
2	4,285	1,628	2,690
3	3,285	1,453	1,919
4	4,522	1,729	2,690
5	4,532	1,859	2,885
6	2,047	933	1,230
7	2,478	877	1,780
8	8,019	2,837	4,138
9	7,538	1,812	2,880
10	2,385	1,216	1,931
11	3,383	1,445	2,498
12	2,505	1,378	2,478
13	8,632	1,925	2,214
Tennessee	56,856	20,305	31,542

Source: Author's analysis based on data from Tennessee Department of Education (2009).

districts can accommodate in a given year. A set of dichotomous variables was created for each school indicating the availability of each program area.

The number of schools offering each program area was divided by the total number of schools to calculate the percentage of schools with concentrations in each program area. The supplemental tables in appendix B disaggregate the results for career and technical education–only and non–career and technical education schools and report the average number of program areas available per school at the district level.[15]

The availability of program areas, based on the percentage of graduates enrolled in a school in a district offering each program area. This question examined the availability of each program area, based on the percentage of high school graduates enrolled in a school offering each one, either through a non–career and technical education school or a career and technical education–only school. For this question, the dichotomous variables indicating program area availability (for the first question) were merged with the home-school file containing the number of high school graduates to determine the percentage of graduates with access to each program area. This step was necessary—students who took career and technical education courses at a career and technical education–only school were counted as graduates only at their non–career and technical education school.[16] Non–career and technical education schools were matched with any available career and technical education–only schools in the district, and a new set of dichotomous variables was created, indicating whether each program area was available at the non–career and technical education school or a corresponding career and technical education–only school in the district. The number of graduates attending a school where at least one student completed a concentration in a given program area was divided by the total number of graduates in the school to calculate the percentage of high school graduates enrolled in a school offering each program area. Table B5 in appendix B provides the numbers of high school graduates enrolled in a school in a district offering each program area, used to calculate the percentages in table 2 of the main report.

The alignment of concentrators in program areas with workers employed in corresponding occupations. This question examined how the percentage of graduate concentrators in each program area compared with the percentage of workers employed in corresponding occupations. It was addressed by calculating an index of dissimilarity, an indicator commonly used to examine differences across two groups in a distribution (Jacobs 1995; Turner and Bowen 1999). In this study, the index of dissimilarity represents the proportion of concentrators who would need to change program areas for the distribution of program areas and corresponding occupations to be identical among concentrators and workers in the labor market. The index of dissimilarity is calculated as:

$$0.5 \sum_{i=1}^{N} \left| \frac{c_i}{C} - \frac{w_i}{W} \right|,$$

where i is the identifier for each program area, N is the total number of program areas, c_i is the number of concentrators in program area i, C is the total number of concentrators, w_i is the number of workers employed in an occupation that corresponds to program area i, and W is the total number of workers employed in all occupations.

The index was calculated by taking the absolute value of the difference between the percentage of concentrators in each program area and the percentage of workers in each corresponding occupation. The differences were summed, and the total was multiplied by 0.5. The index is bounded by the values 0 and 1, with lower values indicating greater similarity in the distribution between concentrators and workers in the labor market. The results from this analysis at the state level are in table 4 in the main report. These results are also replicated at the region level in table B8 in appendix B. ArcGIS software was used to draw a map showing how the index of dissimilarity differed by region. Each region is shaded a color corresponding to the value of the index. The map provides

a visual comparison to help readers identify the regions where concentrations are not well aligned with the composition of the local workforce.

The percentage of new jobs in high-wage occupations projected over 2006–16 that could potentially be filled by 2007/08 concentrators in corresponding program areas. This question examined the alignment of concentrations in program areas with high-wage occupations in each region. Median wage data from the Tennessee Department of Workforce and Development (2009) were used to calculate the weighted median of the annual wages for all occupations in the region. Weighting was based on the number of workers employed in the occupation. The calculation was made by creating a number of records for each occupation equal to the number of workers, ordering the median wages for all the occupational records from smallest to largest, and finding the midpoint in the ordered observations. The median wages were not directly comparable across regions because of differences in such factors as cost of living and the experience profiles of the workforce.

Once the weighted median wage was calculated for all occupations in each region, the value was multiplied by 0.80 and 1.20 to create a range of values for the wage classifications (see table B9 in appendix B). Occupations with median wages at least 20 percent greater than the median were classified as high wage, occupations with median wages at least 20 percent less than the median were classified as low wage, and all other occupations were classified as moderate wage. The weighted median of annual wages for all occupations in each program area was then calculated by region, using the same method (see table 6 in the main report).

A limitation in providing a single wage classification for each occupation is that it masks variability within an occupation. Although an occupation may have an overall classification of low wage, there are still opportunities for high-wage jobs, particularly for students with higher levels of education. To illustrate, data from the Bureau of Labor Statistics (2006) were used to classify the highest level of education achieved by the majority of workers in each SOC occupational code.[17] The level of education for each occupation was classified as follows:

- *At most high school.* At least 50 percent of current workers in the occupation have a high school diploma or less.
- *At least bachelor's degree.* At least 50 percent of current workers have a bachelor's degree or more.
- *More than high school but less than bachelor's degree.* Occupations that do not fit into either of the levels of education above include two groups. The first group includes occupations where at least 50 percent of current workers have some college education but not a bachelor's degree or higher (say, an associate's degree). The second group includes occupations where the highest level of education of the current workers is mixed, with no level of education having a majority (say, 20 percent high school diploma, 40 percent some college, 40 percent bachelor's degree or more).

Table 7 in the main report shows the statewide weighted median for occupations that correspond to each program area, by highest level of education completed. See table B10 in appendix B for these results disaggregated by region.

For how the percentage of concentrators in program areas that correspond to high-wage occupations compared with projected new jobs over 2006–16 in high-wage occupations in each region, the number of projected jobs in high-wage occupations was divided by the total number of projected jobs to calculate the percentage of projected new jobs in high-wage occupations. Next, the number of concentrators in program areas that correspond to high-wage occupations was divided by the total number of graduates to calculate the percentage of graduates who concentrated in program areas that correspond to high-wage occupations. The difference between

the percentage of graduates with concentrations in program areas that correspond to high-wage occupations and the percentage of projected new jobs in high-wage occupations was calculated and compared across regions. ArcGIS was used to draw a map showing the difference between the percentage of projected jobs in high-wage occupations and that of concentrators in corresponding program areas.

The percentage of new jobs in high-demand occupations projected over 2006–16 that could potentially be filled by 2007/08 concentrators in corresponding program areas. This question examined whether concentrations in program areas aligned with projected high-demand occupations in each region. The question was addressed using an approach similar to that of the previous question. The projected change in employment for each region was calculated by dividing the total employment in 2006 by the projected number of new job openings over 2006–16.

Once the projected change in employment was calculated for each region, the value was multiplied by 0.80 and 1.20 to create a range of values for the demand classifications (see table B11 in appendix B). Occupations with a projected change in employment at least 20 percent greater than that for all occupations in the region were classified as high demand, occupations with a projected change in employment at least 20 percent less than that for all occupations in the region were classified as low demand, and all other occupations were classified as moderate demand. The projected change in employment for all occupations in each program area was then calculated by region (see table 8 in the main report).

For how the percentage of concentrators in program areas that correspond to high-demand occupations compared with the percentage of projected new jobs over 2006–16 in high-demand occupations in each region, the number of projected jobs in high-demand occupations was divided by the total number of projected jobs to calculate the percentage of projected new jobs in high-demand occupations (see table 9 in the main report). Next, the number of concentrators in program areas that correspond to high-demand occupations was divided by the total number of graduates to calculate the percentage of graduates who concentrated in program areas that correspond to high-demand occupations. The difference between the percentage of graduates with concentrations in in program areas that correspond to high-demand occupations and the percentage of projected new jobs in high-demand occupations was calculated and compared across regions. ArcGIS was used to draw a map showing the difference between the percentage of projected jobs in high-demand occupations and that of concentrators in corresponding program areas.

APPENDIX B
DETAILED SUPPORTING DATA

This appendix provides supplemental tables supporting the information in the main report.

Table B1 disaggregates by school district the data in table 1 in the main report.

TABLE B1

Number of Tennessee high schools and mean program areas available, by school district and type, 2007/08

	Non–career and technical education schools		Career and technical education–only schools		All schools	
School district	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)
Alcoa City	1	3.0	0	0.0	1	3.0
Alvin C York Institute	1	3.0	0	0.0	1	3.0
Anderson County	3	3.7	1	4.0	4	3.8
Bedford County	3	5.0	0	0.0	3	5.0
Benton County	2	0.0	1	6.0	3	2.0
Bledsoe County	1	5.0	1	0.0	2	2.5
Blount County	2	6.0	0	0.0	2	6.0
Bradford Special	1	1.0	0	0.0	1	1.0
Bradley County	3	4.0	0	0.0	3	4.0
Bristol City	1	4.0	0	0.0	1	4.0
Campbell County	2	6.0	0	0.0	2	6.0
Cannon County	1	3.0	0	0.0	1	3.0
Carter County	4	3.8	0	0.0	4	3.8
Cheatham County	3	5.3	0	0.0	3	5.3
Chester County	1	5.0	0	0.0	1	5.0
Claiborne County	2	5.0	0	0.0	2	5.0
Clay County	2	1.5	0	0.0	2	1.5
Cleveland City	1	4.0	0	0.0	1	4.0
Cocke County	4	2.0	0	0.0	4	2.0
Coffee County	1	6.0	0	0.0	1	6.0
Crockett County	1	5.0	0	0.0	1	5.0
Cumberland City	1	1.0	0	0.0	1	1.0
Cumberland County	2	6.5	0	0.0	2	6.5
Decatur County	1	6.0	0	0.0	1	6.0
Dekalb County	2	3.0	0	0.0	2	3.0
Dickson County	2	6.0	0	0.0	2	6.0
Dyer County	1	5.0	0	0.0	1	5.0
Dyersburg City	1	6.0	0	0.0	1	6.0
Elizabethton City	1	6.0	0	0.0	1	6.0
Fayette County	1	4.0	0	0.0	1	4.0
Fentress County	2	2.0	0	0.0	2	2.0

(CONTINUED)

TABLE B1 (CONTINUED)

Number of Tennessee high schools and mean program areas available, by school district and type, 2007/08

School district	Non–career and technical education schools		Career and technical education–only schools		All schools	
	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)
Franklin County	2	5.5	0	0.0	2	5.5
Gibson Special District	1	5.0	0	0.0	1	5.0
Giles County	2	5.0	0	0.0	2	5.0
Grainger County	3	2.0	0	0.0	3	2.0
Greene County	4	2.8	1	3.0	5	2.8
Greeneville City	1	0.0	1	3.0	2	1.5
Grundy County	1	5.0	0	0.0	1	5.0
Hamblen County	3	4.3	0	0.0	3	4.3
Hamilton County	14	2.5	0	0.0	14	2.5
Hancock County	1	4.0	0	0.0	1	4.0
Hardeman County	2	4.0	0	0.0	2	4.0
Hardin County	1	6.0	0	0.0	1	6.0
Hawkins County	3	2.7	0	0.0	3	2.7
Haywood County	1	5.0	0	0.0	1	5.0
Henderson County	2	4.5	0	0.0	2	4.5
Henry County	1	6.0	0	0.0	1	6.0
Hickman County	2	5.0	0	0.0	2	5.0
Hollow Rock-Bruceton	1	2.0	1	6.0	2	4.0
Houston County	2	1.5	0	0.0	2	1.5
Humboldt City	1	5.0	0	0.0	1	5.0
Humphreys County	3	3.3	0	0.0	3	3.3
Huntingdon Special	1	2.0	1	6.0	2	4.0
Jackson County	1	4.0	0	0.0	1	4.0
Jackson-Madison Consolidated	5	3.0	0	0.0	5	3.0
Jefferson County	1	6.0	0	0.0	1	6.0
Johnson City	2	2.5	0	0.0	2	2.5
Johnson County	1	6.0	0	0.0	1	6.0
Kingsport City	1	4.0	0	0.0	1	4.0
Knox County	13	5.4	2	0.5	15	4.7
Lake County	1	4.0	0	0.0	1	4.0
Lauderdale County	2	5.5	0	0.0	2	5.5
Lawrence County	4	4.0	0	0.0	4	4.0
Lenoir City	1	5.0	0	0.0	1	5.0
Lewis County	1	4.0	0	0.0	1	4.0
Lincoln County	1	4.0	0	0.0	1	4.0
Loudon County	2	4.5	0	0.0	2	4.5

(CONTINUED)

TABLE B1 (CONTINUED)

Number of Tennessee high schools and mean program areas available, by school district and type, 2007/08

School district	Non–career and technical education schools		Career and technical education–only schools		All schools	
	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)
Macon County	2	2.5	0	0.0	2	2.5
Marion County	3	4.0	0	0.0	3	4.0
Marshall County	3	4.7	0	0.0	3	4.7
Maryville City	1	6.0	0	0.0	1	6.0
Maury County	6	4.3	0	0.0	6	4.3
Mckenzie Special	1	2.0	1	6.0	2	4.0
McMinn County	2	5.0	0	0.0	2	5.0
McNairy County	2	5.5	0	0.0	2	5.5
Meigs County	1	5.0	0	0.0	1	5.0
Memphis City	33	2.3	6	4.5	39	2.6
Milan City Special	1	5.0	0	0.0	1	5.0
Monroe County	3	4.7	0	0.0	3	4.7
Montgomery County Schools	6	4.3	0	0.0	6	4.3
Moore County	1	2.0	0	0.0	1	2.0
Morgan County	4	1.8	1	4.0	5	2.2
Nashville-Davidson County	18	2.1	0	0.0	18	2.1
Oak Ridge City	1	4.0	0	0.0	1	4.0
Obion County	2	4.0	1	1.0	3	3.0
Oneida City	1	2.0	0	0.0	1	2.0
Overton County	1	5.0	0	0.0	1	5.0
Perry County	1	5.0	0	0.0	1	5.0
Pickett County	1	3.0	0	0.0	1	3.0
Polk County	2	3.5	0	0.0	2	3.5
Putnam County	4	3.3	0	0.0	4	3.3
Rhea County	1	3.0	0	0.0	1	3.0
Richard City Special	1	0.0	0	0.0	1	0.0
Roane County	5	2.6	0	0.0	5	2.6
Robertson County	5	4.4	0	0.0	5	4.4
Rutherford County	9	4.4	0	0.0	9	4.4
Scott County	1	6.0	0	0.0	1	6.0
Sequatchie County	1	2.0	0	0.0	1	2.0
Sevier County	4	3.8	0	0.0	4	3.8
Shelby County	6	4.3	0	0.0	6	4.3
Smith County	2	5.0	0	0.0	2	5.0
South Carroll Special	1	4.0	1	6.0	2	5.0
Stewart County	1	5.0	0	0.0	1	5.0

(CONTINUED)

TABLE B1 (CONTINUED)

Number of Tennessee high schools and mean program areas available, by school district and type, 2007/08

School district	Non–career and technical education schools		Career and technical education–only schools		All schools	
	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)	Number of schools	Program areas (mean)
Sullivan County	5	4.2	0	0.0	5	4.2
Sumner County	10	3.9	0	0.0	10	3.9
Tennessee High School For Deaf	1	1.0	0	0.0	1	1.0
Tipton County	4	4.0	0	0.0	4	4.0
Trenton City	1	2.0	0	0.0	1	2.0
Trousdale County	1	3.0	0	0.0	1	3.0
Tullahoma City	1	4.0	0	0.0	1	4.0
Unicoi	1	5.0	0	0.0	1	5.0
Union City	1	4.0	0	0.0	1	4.0
Union County	2	2.5	0	0.0	2	2.5
Van Buren County	1	2.0	0	0.0	1	2.0
Warren County	1	6.0	0	0.0	1	6.0
Washington County	3	4.0	0	0.0	3	4.0
Wayne County	3	1.7	1	3.0	4	2.0
Weakley County	4	3.8	0	0.0	4	3.8
West Carroll Special District	1	1.0	1	6.0	2	3.5
White County	1	7.0	0	0.0	1	7.0
Williamson County	8	4.1	0	0.0	8	4.1
Wilson County	5	4.2	1	6.0	6	4.5
Tennessee	333	3.6	17	3.6	350	3.6

Note: The sum of the number of schools in each district is greater than the number of schools in the state because some career and technical education–only schools serve more than one district. A program area is defined as available in a school if any students in grades 9–12 completed a concentration in that program area at that school.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

Table B2 shows the numbers used to calculate the percentages in table 1 in the main report.

TABLE B2

Non–career and technical education schools with available program areas in Tennessee, by region, 2007/08

Region	Number of high schools[a]	Average number of program areas available per school	Number of high schools with available program areas in:						
			Agri-cultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	19	4.1	10	13	13	14	8	4	16
2	29	3.1	20	12	18	10	8	7	14
3	16	4.5	4	12	12	10	12	8	14
4	32	3.9	17	22	27	17	14	5	24
5	31	3.1	8	18	17	16	9	5	22
6	9	4.7	8	8	7	5	4	3	7
7	21	3.2	16	10	16	9	2	5	10
8	42	4.2	28	34	32	23	17	13	30
9	33	3.2	14	24	20	11	10	3	25
10	23	4.0	19	20	17	15	7	0	15
11	30	3.6	22	17	21	18	11	1	19
12	19	4.1	14	12	17	12	8	0	15
13	46	2.9	7	31	34	10	19	8	23
Tennessee	350	3.6	187	233	251	170	129	62	234

Note: A program area is defined as available in a school if any students in grades 9–12 completed a concentration in that program area at that school.

a. Includes both career and technical education–only schools and non–career and technical education schools.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

Tables B3 and B4 disaggregate the data in table 1 by school type: table B3, for career and technical education–only schools; table B4, for non–career and technical education schools.

TABLE B3

Available program areas in career and technical education–only schools, by region, 2007/08

Region	Number of schools	Program areas available per school (mean)	Schools with available program areas in:													
			Agricultural education		Business technology		Family and consumer services		Health science		Marketing		Technology engineering		Trade and industrial education	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	3.0	0	0	0	0	1	100	1	100	0	0	0	0	1	100
3	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	1	50
4	2	4.5	2	100	2	100	2	100	1	50	0	0	0	0	2	100
5	1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	6.0	0	0	1	100	1	100	1	100	1	100	1	100	1	100
10	1	4.0	0	0	1	100	1	100	1	100	0	0	0	0	1	100
11	2	6.0	2	100	1	50	2	100	2	100	2	100	1	50	2	100
12	1	1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	100
13	6	4.5	2	33	6	100	6	100	5	83	2	33	0	0	6	100
Tennessee	17	3.6	6	35	11	65	11	65	11	65	5	29	2	12	15	88

Note: A program area is defined as available in a school if any students in grades 9–12 completed a concentration in that program area at that school.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

TABLE B4

Available program areas in non–career and technical education schools, by region, 2007/08

Region	Number of schools	Program areas available per school (mean)	Schools with available program areas in:													
			Agricultural education		Business technology		Family and consumer services		Health science		Marketing		Technology engineering		Trade and industrial education	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	19	4.1	10	53	13	68	13	68	14	74	8	42	4	21	16	84
2	28	3.1	20	71	12	43	17	61	9	32	8	29	7	25	13	46
3	14	5.1	4	29	12	86	12	86	10	71	12	86	8	57	13	93
4	30	3.9	15	50	20	67	26	87	16	53	14	47	5	17	22	73
5	30	3.2	8	27	18	60	17	57	16	53	9	30	5	17	22	73
6	9	4.7	8	89	8	89	7	78	5	56	4	44	3	33	7	78
7	21	3.4	19	76	10	63	16	100	9	56	2	13	5	31	10	63
8	42	4.2	28	67	34	81	32	76	23	55	17	40	13	31	30	71
9	32	3.2	14	44	23	72	19	59	10	31	9	28	2	6	24	75
10	22	4.1	19	86	19	86	17	77	14	64	7	32	0	0	14	64
11	28	3.5	20	71	16	57	19	68	16	57	9	32	0	0	17	61
12	18	4.3	14	78	12	67	17	94	12	67	8	44	0	0	14	78
13	40	2.6	5	13	25	63	28	70	5	13	17	43	8	20	17	43
Tennessee	333	3.6	181	54	222	67	240	72	159	48	124	37	60	18	219	66

Note: A program area is defined as available in a school if any students in grades 9–12 completed a concentration in that program area at that school.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

Table B5 provides the number of high school graduates enrolled in a school offering each program area, which is used to calculate the percentages in table 2 in the main report.

TABLE B5

Number of Tennessee high school graduates enrolled in a school offering each program area, by region, 2007/08

		Number of high school graduates enrolled in a school offering program areas in:						
Region	Number of graduates	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	3,245	1,607	2,620	2,716	3,054	1,868	1,007	3,181
2	4,285	3,968	2,450	3,825	2,957	1,999	1,378	3,634
3	3,285	895	3,233	3,233	2,687	3,233	2,431	3,234
4	4,522	3,097	3,563	4,278	3,683	2,923	990	4,284
5	4,532	1,728	3,423	3,378	2,801	2,181	686	3,974
6	2,047	1,786	1,690	1,723	1,553	1,311	650	1,878
7	2,478	2,403	1,230	2,204	1,841	309	826	1,799
8	8,019	5,219	7,005	7,139	5,338	4,689	2,912	7,374
9	7,538	4,448	6,625	5,661	3,586	3,418	1,462	6,821
10	2,385	2,267	2,252	2,116	1,925	1,188	0	2,176
11	3,383	3,070	2,155	3,080	2,986	1,799	349	3,146
12	2,505	2,338	1,766	2,505	2,140	1,408	0	2,360
13	8,632	4,144	7,279	8,514	6,804	6,725	1,934	8,496
Tennessee	56,856	36,970	45,291	50,372	41,355	33,051	14,625	52,357

Note: Availability is estimated separately for each program area, by examining how many graduates attended a school where any student in grades 9–12 completed a concentration in the corresponding program area through a non–career and technical education school or a career and technical education–only school.

Source: Author's analysis based on data from Tennessee Department of Education (2009).

Table B6 provides the number of observations used to calculate the percentage of high school graduates completing concentrations in each program area (see table 3 in the main report).

TABLE B6

Tennessee high school graduates completing concentrations in each program area, by region, 2007/08

Region	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	191	202	228	388	93	38	1,069
2	703	227	461	153	158	67	921
3	13	343	315	170	142	107	829
4	310	438	501	250	235	37	919
5	194	448	320	344	126	42	1,411
6	230	201	179	114	84	32	390
7	529	122	420	104	48	50	507
8	583	625	758	427	267	202	1,276
9	601	440	379	292	171	21	976
10	296	303	312	255	59	1	705
11	624	308	460	376	142	2	586
12	608	189	591	373	138	5	574
13	62	286	518	147	214	9	978
Tennessee	4,944	4,132	5,442	3,393	1,877	613	11,141

Source: Author's calculations based on data from Tennessee Department of Education (2009).

Table B7 replicates the results from table 3 in the main report with the percentage of total concentrations completed by high school graduates in each program area, by region. The percentages are calculated using the total number of concentrations, instead of the total number of high school graduates, as the denominator.

TABLE B7

Percentage of total concentrations completed by Tennessee high school graduates in each program area, by region, 2007/08

Region	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	9	9	10	18	4	2	48
2	26	8	17	6	6	2	34
3	1	18	16	9	7	6	43
4	12	16	19	9	9	1	34
5	7	16	11	12	4	1	49
6	19	16	15	9	7	3	32
7	30	7	24	6	3	3	28
8	14	15	18	10	6	5	31
9	21	15	13	10	6	1	34
10	15	16	16	13	3	0	37
11	25	12	18	15	6	0	23
12	25	8	24	15	6	0	23
13	3	13	23	7	10	0	44
Tennessee	16	13	17	11	6	2	35

Note: Percentages may not sum to 100 because of rounding.

Source: Author's calculations based on data from Tennessee Department of Education (2009).

Table B8 replicates the results from table 4 in the main report at the region level.

TABLE B8

Tennessee concentrators in each program area and workers employed in corresponding occupations, by region and program area, 2007/08

Program area	Concentrators		Employees		Percentage point difference
	Number	Percent	Number	Percent	
Region 1					
Agricultural education	191	9	2,150	1	8
Business technology	202	9	40,610	20	–11
Family and consumer services	228	10	43,180	21	–11
Health science	388	18	18,130	9	9
Marketing	93	4	17,550	9	–4
Technology engineering	38	2	4,280	2	0
Trade and industrial education	1,069	48	76,270	38	11
Total	2,209		202,170		
Index of dissimilarity (0.27)					
Region 2					
Agricultural education	703	26	2,500	1	25
Business technology	227	8	36,680	18	–9
Family and consumer services	461	17	46,600	23	–6
Health science	153	6	11,280	5	0
Marketing	158	6	20,330	10	–4
Technology engineering	67	2	3,070	1	1
Trade and industrial education	921	34	84,670	41	–7
Total	2,690		205,130		
Index of dissimilarity (0.26)					
Region 3					
Agricultural education	13	1	4,020	1	–1
Business technology	343	18	77,080	24	–7
Family and consumer services	315	16	66,740	21	–5
Health science	170	9	24,360	8	1
Marketing	142	7	30,640	10	–2
Technology engineering	107	6	9,470	3	3
Trade and industrial education	829	43	102,750	33	11
Total	1,919		315,060		
Index of dissimilarity (0.14)					
Region 4					
Agricultural education	310	12	6,440	3	9
Business technology	438	16	45,910	20	–4
Family and consumer services	501	19	44,740	20	–1
Health science	250	9	13,820	6	3
Marketing	235	9	17,200	8	1

(CONTINUED)

TABLE B8 (CONTINUED)

Tennessee concentrators in each program area and workers employed in corresponding occupations, by region, 2007/08

Program area	Concentrators		Employees		Percentage point difference
	Number	Percent	Number	Percent	
Technology engineering	37	1	10,610	5	–3
Trade and industrial education	919	34	85,420	38	–4
Total	2,690		224,140		
Index of dissimilarity (0.13)					
Region 5					
Agricultural education	194	7	4,360	1	6
Business technology	448	16	85,240	22	–7
Family and consumer services	320	11	71,820	19	–8
Health science	344	12	23,270	6	6
Marketing	126	4	32,330	9	–4
Technology engineering	42	1	10,070	3	–1
Trade and industrial education	1,411	49	152,190	40	9
Total	2,885		379,280		
Index of dissimilarity (0.20)					
Region 6					
Agricultural education	230	19	4,740	5	14
Business technology	201	16	19,900	19	–3
Family and consumer services	179	15	20,310	19	–5
Health science	114	9	5,290	5	4
Marketing	84	7	7,450	7	0
Technology engineering	32	3	2,520	2	0
Trade and industrial education	390	32	45,010	43	–11
Total	1,230		105,220		
Index of dissimilarity (0.19)					
Region 7					
Agricultural education	529	30	3,550	4	26
Business technology	122	7	17,520	18	–12
Family and consumer services	420	24	20,030	21	2
Health science	104	6	6,680	7	–1
Marketing	48	3	7,630	8	–5
Technology engineering	50	3	1,450	2	1
Trade and industrial education	507	28	37,980	40	–12
Total	1,780		94,840		
Index of dissimilarity (0.30)					
Region 8					
Agricultural education	583	14	5,150	2	12
Business technology	625	15	69,270	23	–8
Family and consumer services	758	18	67,450	22	–4
Health science	427	10	18,460	6	4

(CONTINUED)

TABLE B8 (CONTINUED)

Tennessee concentrators in each program area and workers employed in corresponding occupations, by region, 2007/08

	Concentrators		Employees		Percentage point difference
Program area	Number	Percent	Number	Percent	
Marketing	267	6	28,140	9	–3
Technology engineering	202	5	7,380	2	2
Trade and industrial education	1,276	31	106,170	35	–4
Total	4,138		302,020		
Index of dissimilarity (0.19)					
Region 9					
Agricultural education	601	21	7,846	1	20
Business technology	440	15	193,860	25	–10
Family and consumer services	379	13	147,644	19	–6
Health science	292	10	56,050	7	3
Marketing	171	6	69,910	9	–3
Technology engineering	21	1	27,426	4	–3
Trade and industrial education	976	34	272,550	35	–1
Total	2,880		775,286		
Index of dissimilarity (0.23)					
Region 10					
Agricultural education	296	15	1,280	1	14
Business technology	303	16	17,840	19	–3
Family and consumer services	312	16	19,100	20	–4
Health science	255	13	6,310	7	7
Marketing	59	3	7,500	8	–5
Technology engineering	1	0	2,320	2	–2
Trade and industrial education	705	37	41,090	43	–7
Total	1,931		95,440		
Index of dissimilarity (0.21)					
Region 11					
Agricultural education	624	25	3,600	2	23
Business technology	308	12	34,230	19	–7
Family and consumer services	460	18	37,720	21	–2
Health science	376	15	15,250	8	7
Marketing	142	6	15,230	8	–3
Technology engineering	2	0	3,390	2	–2
Trade and industrial education	586	23	72,020	40	–16
Total	2,498		181,440		
Index of dissimilarity (0.30)					

(CONTINUED)

TABLE B8 (CONTINUED)

Tennessee concentrators in each program area and workers employed in corresponding occupations, by region, 2007/08

Program area	Concentrators		Employees		Percentage point difference
	Number	Percent	Number	Percent	
Region 12					
Agricultural education	608	24	3,920	4	20
Business technology	189	8	16,080	18	–10
Family and consumer services	591	24	17,020	19	5
Health science	373	15	5,040	6	9
Marketing	148	6	6,280	7	–1
Technology engineering	5	0	900	1	–1
Trade and industrial education	574	23	41,610	46	–23
Total	2,488		90,850		
Index of dissimilarity (0.35)					
Region 13					
Agricultural education	62	3	4,150	1	2
Business technology	286	13	176,740	25	–12
Family and consumer services	518	23	137,940	19	4
Health science	147	7	52,930	7	–1
Marketing	214	10	68,010	10	0
Technology engineering	9	0	22,070	3	–3
Trade and industrial education	978	44	249,050	35	9
Total	2,214		710,890		
Index of dissimilarity (0.15)					

Note: Percentages may not sum to 100 and percentage point differences shown may differ from those calculated from values in the table because of rounding.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

Table B9 provides the range of values used to define the low-, moderate-, and high-wage classifications in each region.

TABLE B9

Median annual wage and range of low-, moderate-, and high-wage occupations, by region, 2006 (dollars)

		Median annual wage range		
Region	Median annual wage	Low	Moderate	High
1	26,844	< 21,475	21,475 to 32,213	> 32,213
2	24,894	< 19,915	19,915 to 29,873	> 29,873
3	28,690	< 22,952	22,952 to 34,428	> 34,428
4	28,840	< 23,072	23,072 to 34,609	> 34,609
5	28,464	< 22,771	22,771 to 34,157	> 34,157
6	27,402	< 21,922	21,922 to 32,882	> 32,882
7	23,658	< 18,926	18,926 to 28,390	> 28,390
8	29,080	< 23,264	23,264 to 34,896	> 34,896
9	32,616	< 26,093	26,093 to 39,139	> 39,139
10	27,768	< 22,214	22,214 to 33,322	> 33,322
11	26,746	< 21,397	21,397 to 32,095	> 32,095
12	28,062	< 22,450	22,450 to 33,674	> 33,674
13	29,377	< 23,502	23,502 to 35,252	> 35,252

Note: High-wage occupations have median wages at least 20 percent greater than the regional median; low-wage occupations have median wages at least 20 percent less than the regional median; all other occupations are classified as moderate wage. Wage classifications for program areas are identified separately for each region.

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009).

Table B10 replicates the results from table 6 in the main report at the region level, instead of at the state level.

TABLE B10

Median wages for occupations that correspond to each program area, by highest level of education completed and region, 2007/08 (dollars)

Program area	Level of education			
	At most high school	More than high school but less than bachelor's degree	At least bachelor's degree	Overall
Region 1				
Agricultural education	18,854	18,850	50,878	21,275
Business technology	20,981	26,310	60,151	27,380
Family and consumer services	15,180	18,376	37,593	18,376
Health science	20,632	30,892	51,876	34,140
Marketing	15,170	18,376	37,701	18,376
Technology engineering	31,282	39,170	60,037	49,702
Trade and industrial education	24,779	32,431	30,716	26,844
All	22,503	25,846	42,717	26,844
Region 2				
Agricultural education	19,259	18,525	45,940	19,259
Business technology	19,519	25,866	55,337	25,866
Family and consumer services	15,548	19,101	41,637	18,939
Health science	21,594	31,769	51,688	31,769
Marketing	15,548	19,101	41,950	19,101
Technology engineering	26,959	38,589	56,575	51,043
Trade and industrial education	24,322	31,516	33,015	24,584
All	23,582	25,055	45,080	24,894
Region 3				
Agricultural education	21,439	21,172	49,629	21,439
Business technology	20,413	28,848	60,882	31,399
Family and consumer services	16,332	19,632	41,052	19,632
Health science	21,542	32,562	50,768	39,662
Marketing	16,332	19,632	51,022	24,217
Technology engineering	27,423	39,593	62,921	56,426
Trade and industrial education	23,377	32,917	37,916	25,335
All	21,542	28,848	48,939	28,690
Region 4				
Agricultural education	25,798	66,537	54,322	25,798
Business technology	19,432	27,651	63,817	31,459
Family and consumer services	15,427	20,091	42,070	18,360
Health science	21,498	32,220	51,668	40,161
Marketing	15,427	20,091	45,518	20,091
Technology engineering	34,385	45,890	69,419	67,319

(CONTINUED)

TABLE B10 (CONTINUED)

Median wages for occupations that correspond to each program area, by highest level of education completed and region, 2007/08 (dollars)

Program area	Level of education			
	At most high school	More than high school but less than bachelor's degree	At least bachelor's degree	Overall
Trade and industrial education	26,482	36,686	41,894	28,134
All	24,821	28,509	51,668	28,840
Region 5				
Agricultural education	19,881	21,596	52,576	21,596
Business technology	19,489	29,656	62,873	33,420
Family and consumer services	16,148	20,065	42,965	20,065
Health science	21,987	34,610	52,631	35,023
Marketing	15,450	20,427	53,173	20,427
Technology engineering	32,431	41,790	59,237	57,869
Trade and industrial	26,168	34,894	36,182	27,635
All	25,028	29,656	48,884	28,464
Region 6				
Agricultural education	15,889	25,377	77,452	15,889
Business technology	18,900	27,508	59,218	31,604
Family and consumer services	15,126	18,703	42,893	17,431
Health science	19,635	32,492	49,715	34,306
Marketing	15,126	18,703	48,322	18,703
Technology engineering	31,261	51,868	67,129	67,129
Trade and industrial education	26,635	30,156	33,659	26,635
All	25,416	27,508	44,688	27,402
Region 7				
Agricultural education	22,188	39,219	46,472	22,188
Business technology	15,747	28,291	55,418	28,478
Family and consumer services	15,806	19,185	37,863	19,185
Health science	20,679	32,345	55,713	33,584
Marketing	15,806	19,185	37,516	19,185
Technology engineering	29,483	46,879	48,592	48,592
Trade and industrial education	22,657	33,679	26,666	23,438
All	22,188	27,566	41,065	23,658
Region 8				
Agricultural education	23,196	18,692	54,029	23,196
Business technology	19,993	31,342	68,143	33,232
Family and consumer services	16,110	19,693	43,094	19,693
Health science	22,643	35,384	57,448	36,498
Marketing	16,110	19,693	50,789	19,693
Technology engineering	34,979	45,781	68,476	58,087
Trade and industrial education	25,591	36,840	38,010	26,721
All	23,376	30,613	50,423	29,080

(CONTINUED)

TABLE B10 (CONTINUED)

Median wages for occupations that correspond to each program area, by highest level of education completed and region, 2007/08 (dollars)

Program area	Level of education			
	At most high school	More than high school but less than bachelor's degree	At least bachelor's degree	Overall
Region 9				
Agricultural education	23,586	25,495	53,861	23,586
Business technology	20,167	33,010	66,913	36,487
Family and consumer services	16,740	19,437	42,243	19,171
Health science	23,365	38,126	59,292	51,225
Marketing	16,740	19,110	49,757	30,842
Technology engineering	36,357	45,044	66,084	58,403
Trade and industrial education	26,428	39,024	40,097	28,887
All	24,797	31,510	53,906	32,616
Region 10				
Agricultural education	25,416	29,849	47,328	33,208
Business technology	16,118	27,358	55,750	29,992
Family and consumer services	15,354	19,050	37,713	17,320
Health science	20,411	33,073	56,137	33,073
Marketing	15,354	19,050	39,120	19,050
Technology engineering	30,259	38,720	62,412	62,412
Trade and industrial education	27,768	31,540	32,776	27,768
All	25,554	27,358	42,346	27,768
Region 11				
Agricultural education	21,046	25,377	48,304	21,046
Business technology	20,015	26,746	57,305	29,616
Family and consumer services	15,154	18,778	40,542	18,778
Health science	20,160	31,695	49,918	31,695
Marketing	15,154	18,778	44,681	18,778
Technology engineering	26,731	42,689	67,929	48,304
Trade and industrial education	25,584	32,751	33,659	26,507
All	22,329	26,565	42,831	26,746
Region 12				
Agricultural education	28,062	39,706	44,864	28,062
Business technology	19,170	27,114	51,806	27,723
Family and consumer services	15,078	18,956	43,011	18,770
Health science	19,481	33,032	51,827	33,032
Marketing	15,078	18,956	48,268	18,956
Technology engineering	—	42,186	53,270	47,824
Trade and industrial education	27,665	32,237	36,452	27,698
All	27,665	28,462	43,084	28,062
Region 13				
Agricultural education	22,192	22,140	57,931	23,612

(CONTINUED)

TABLE B10 (CONTINUED)

Median wages for occupations that correspond to each program area, by highest level of education completed and region, 2007/08 (dollars)

Program area	Level of education			
	At most high school	More than high school but less than bachelor's degree	At least bachelor's degree	Overall
Business technology	20,972	33,653	72,127	36,537
Family and consumer services	15,770	20,054	45,837	20,012
Health science	22,623	33,632	60,266	39,511
Marketing	15,770	20,012	48,315	20,070
Technology engineering	41,582	42,232	70,559	70,346
Trade and industrial education	23,269	38,225	43,712	24,725
All	25,559	32,314	57,824	29,377

Note: High-wage occupations have median annual wages at least 20 percent greater than the regional median; low-wage occupations have median annual wages at least 20 percent less than the regional median; all other occupations are classified as moderate wage. Wage classifications are identified separately for each region and for the state as a whole. Median wages are weighted by the number of workers employed in each occupation.

— is reporting standards not met because there are too few cases for a reliable estimate.

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009).

Table B11 provides the range of values used to define the low-, moderate-, and high-demand classifications. (See table 8 in the main report.) The projected percentage change in the number of jobs over 2006–2016 for all occupations in Tennessee ranged from 4.3 percent (region 10) to 28.6 percent (region 8).

TABLE B11

Projected change in employment and occupational demand range, by region, 2006–16 (percent)

Region	Projected change in employment	Occupational demand range		
		Low	Moderate	High
1	11.2	< 9.4	9.4 to 14.0	> 14.0
2	13.1	< 10.9	10.9 to 16.4	> 16.4
3	12.4	< 10.4	10.4 to 15.5	> 15.5
4	14.9	< 12.4	12.4 to 18.6	> 18.6
5	9.5	< 7.9	7.9 to 11.9	> 11.9
6	10.8	< 9.0	9.0 to 13.5	> 13.5
7	7.4	< 6.2	6.2 to 9.3	> 9.3
8	28.6	< 23.8	23.8 to 35.8	> 35.8
9	11.5	< 9.6	9.6 to 14.4	> 14.4
10	4.3	< 3.6	3.6 to 5.4	> 5.4
11	10.2	< 8.4	8.4 to 12.7	> 12.7
12	8.2	< 6.9	6.9 to 10.3	> 10.3
13	7.0	< 5.9	5.9 to 8.8	> 8.8

Note: High-demand occupations have a projected change in employment over 2006–16 at least 20 percent greater than that for all occupations in the region; low-demand occupations have a projected change in employment over 2006–16 at least 20 percent less than that for all occupations in the region; all other occupations are classified as moderate demand. Demand classifications are identified separately for each region.

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009).

Table B12 identifies the occupations in each corresponding program area classified as high wage or high demand.[18]

TABLE B12

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Agricultural education		
Agricultural and food science technicians	✔	
Agricultural and food scientists	✔	
Agricultural engineers	✔	
Agricultural inspectors	✔	
Agricultural sciences teachers, postsecondary	✔	✔
Animal care and service workers		✔
Animal control workers		✔
Animal scientists	✔	
Atmospheric, earth, marine, and space sciences teachers	✔	
Biochemists and biophysicists	✔	
Biological science teachers, postsecondary	✔	✔
Biological scientists, all other	✔	
Chemistry teachers, postsecondary	✔	✔
Conservation scientists	✔	✔
Environmental science and protection technicians, including health	✔	✔
Environmental science teachers, postsecondary	✔	
Environmental scientists and specialists, including health	✔	
Farm and home management advisors	✔	
Farmworkers and laborers, crop, nursery, and greenhouse		✔
First-line supervisors/managers of farming, fishing, and forestry workers	✔	✔
Foresters	✔	
Forestry and conservation science teachers, postsecondary	✔	
Geographers	✔	
Geography teachers, postsecondary	✔	
Geoscientists, except hydrologists and geographers	✔	
Hydrologists	✔	
Landscape architects	✔	
Landscaping and groundskeeping workers		✔
Life scientists	✔	✔
Life, physical, and social science occupations	✔	✔
Microbiologists	✔	
Soil and plant scientists	✔	
Veterinarians	✔	✔
Veterinary technologists and technicians		✔
Zoologists and wildlife biologists	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Business technology		
Accountants and auditors	✔	✔
Administrative law judges, adjudicators, and hearing officers	✔	
Administrative services managers	✔	
Advertising and promotions managers	✔	
Advertising, marketing, promotions, public relations, and sales managers	✔	
Agents and business managers of artists, performers, and athletes	✔	
Appraisers and assessors of real estate	✔	
Arbitrators, mediators, and conciliators	✔	
Bill and account collectors		✔
Brokerage clerks	✔	✔
Budget analysts	✔	
Business and financial operations occupations	✔	
Business operations specialists	✔	
Business operations specialists, all other	✔	✔
Business teachers, postsecondary	✔	✔
Cargo and freight agents	✔	
Chief executives	✔	
Claims adjusters, examiners, and investigators	✔	
Compensation and benefits managers	✔	
Compensation, benefits, and job analysis specialists	✔	✔
Compliance officers, except agriculture, construction, health and safety, and transportation	✔	
Computer and information scientists, research	✔	
Computer and information systems managers	✔	✔
Computer and mathematical occupations	✔	✔
Computer programmers	✔	
Computer software engineers, applications	✔	✔
Computer software engineers, systems software	✔	✔
Computer specialists	✔	
Computer specialists, all other	✔	
Computer support specialists	✔	✔
Computer systems analysts	✔	✔
Construction managers	✔	✔
Cost estimators	✔	✔
Court reporters	✔	✔
Court, municipal, and license clerks		✔
Credit analysts	✔	✔
Customer service representatives		✔
Database administrators	✔	✔
Economics teachers, postsecondary	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Economists	✔	
Education administrators, all other	✔	✔
Education administrators, elementary and secondary	✔	✔
Education administrators, postsecondary	✔	
Education administrators, preschool and child care		✔
Emergency management specialists	✔	
Employment, recruitment, and placement specialists	✔	
Engineering managers	✔	
Executive secretaries and administrative assistants	✔	
Farm, ranch, and other agricultural managers	✔	✔
Farmers and ranchers	✔	
Financial analysts	✔	✔
Financial examiners	✔	
Financial managers	✔	
Financial specialists	✔	✔
Financial specialists, all other	✔	
First-line supervisors/managers of office and administrative support workers	✔	
Food service managers	✔	
Funeral directors	✔	
Gaming managers	✔	
General and operations managers	✔	
Human resources managers	✔	✔
Human resources managers, all other	✔	
Human resources, training, and labor relations specialists	✔	
Industrial production managers	✔	
Insurance appraisers, auto damage	✔	
Insurance underwriters	✔	
Judges, magistrate judges, and magistrates	✔	
Law teachers, postsecondary	✔	
Lawyers	✔	✔
Lawyers, judges, and related workers	✔	✔
Legal occupations	✔	
Legal and related workers, all other	✔	
Legal secretaries	✔	✔
Legal support workers	✔	✔
Legal support workers, all other	✔	
Library assistants, clerical		✔
Loan counselors		✔
Loan officers	✔	
Lodging managers	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Logisticians	✔	
Management analysts	✔	
Management occupations	✔	
Managers, all other	✔	
Market research analysts	✔	
Marketing managers	✔	✔
Material recording, scheduling, dispatching, and distributing workers		✔
Medical and health services managers	✔	✔
Medical records and health information technicians		✔
Medical secretaries		✔
Meeting and convention planners	✔	✔
Miscellaneous legal and related workers	✔	
Natural sciences managers	✔	
Network and computer systems administrators	✔	✔
Network systems and data communications analysts	✔	✔
Office clerks, general		✔
Operations specialties managers	✔	✔
Other management occupations	✔	✔
Paralegals and legal assistants	✔	✔
Personal financial advisors	✔	
Police, fire, and ambulance dispatchers		✔
Political science teachers, postsecondary	✔	
Political scientists	✔	
Postal service clerks	✔	✔
Postal service mail carriers	✔	✔
Postal service mail sorters, processors, and processing machine operators	✔	
Postmasters and mail superintendents	✔	✔
Producers and directors	✔	
Production, planning, and expediting clerks	✔	
Property, real estate, and community association managers	✔	
Public relations managers	✔	✔
Purchasing agents and buyers, farm products	✔	
Purchasing agents, except wholesale, retail, and farm products	✔	
Purchasing managers	✔	
Receptionists and information clerks		✔
Sales managers	✔	
Social and community service managers	✔	✔
Statistical assistants	✔	
Tax examiners, collectors, and revenue agents	✔	
Title examiners, abstractors, and searchers	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Top executives	✔	
Training and development managers	✔	
Training and development specialists	✔	✔
Transportation, storage, and distribution managers	✔	
Wholesale and retail buyers, except farm products	✔	
Family and consumer services		
Adult literacy, remedial education, and GED teachers	✔	✔
Amusement and recreation attendants		✔
Animal care and service workers		✔
Anthropologists and archeologists	✔	✔
Anthropology and archeology teachers, postsecondary	✔	
Archivists, curators, and museum technicians	✔	✔
Area, ethnic, and cultural studies teachers, postsecondary	✔	
Art, drama, and music teachers, postsecondary	✔	✔
Bartenders		✔
Child, family, and school social workers	✔	
Clergy	✔	✔
Clinical, counseling, and school psychologists	✔	✔
Combined food preparation and serving workers, including fast food		✔
Commercial and industrial designers	✔	
Communications teachers, postsecondary	✔	✔
Community and social service specialists, all other	✔	
Community and social services occupations	✔	✔
Cooks and food preparation workers		✔
Cooks, restaurant		✔
Counselors, social, and religious workers, all other	✔	✔
Counselors, social workers, and other community and social service specialists	✔	✔
Counter attendants, cafeteria, food concession, and coffee shop		✔
Criminal justice and law enforcement teachers, postsecondary	✔	✔
Curators	✔	
Designers, all other	✔	
Dietitians and nutritionists	✔	
Directors, religious activities and education	✔	✔
Economics teachers, postsecondary	✔	
Education administrators, all other	✔	✔
Education administrators, elementary and secondary	✔	✔
Education administrators, postsecondary	✔	
Education administrators, preschool and child care		✔
Education teachers, postsecondary	✔	
Education, training, and library occupations	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Education, training, and library workers, all other	✔	
Educational, vocational, and school counselors	✔	✔
Elementary school teachers, except special education	✔	✔
Embalmers		✔
English language and literature teachers, postsecondary	✔	✔
Entertainment attendants and related workers		✔
Farm and home management advisors	✔	
Fashion designers	✔	
Food and beverage serving workers		✔
Food preparation workers		✔
Food service managers	✔	
Foreign language and literature teachers, postsecondary	✔	✔
Funeral directors	✔	
Geography teachers, postsecondary	✔	
Graphic designers	✔	
Health educators	✔	✔
Health specialties teachers, postsecondary	✔	
History teachers, postsecondary	✔	✔
Home economics teachers, postsecondary	✔	
Hosts and hostesses, restaurant, lounge, and coffee shop		✔
Industrial-organizational psychologists	✔	
Instructional coordinators	✔	✔
Interior designers	✔	
Kindergarten teachers, except special education	✔	✔
Law teachers, postsecondary	✔	
Librarians	✔	
Librarians, curators, and archivists	✔	✔
Library science teachers, postsecondary	✔	
Library technicians		✔
Locker room, coatroom, and dressing room attendant		✔
Medical and public health social workers	✔	✔
Mental health and substance abuse social workers		✔
Merchandise displayers and window trimmers		✔
Middle school teachers, except special and vocational education	✔	✔
Miscellaneous counselors, social, and religious workers	✔	
Nursing instructors and teachers, postsecondary	✔	✔
Other education, training, and library occupations	✔	✔
Other food preparation and serving related workers		✔
Other personal care and service workers		✔
Other teachers and instructors	✔	✔

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Other teachers and instructors, all other	✔	✔
Personal and home care aides		✔
Personal care and service occupations		✔
Philosophy and religion teachers, postsecondary	✔	✔
Physics teachers, postsecondary	✔	✔
Political science teachers, postsecondary	✔	
Postsecondary teachers	✔	✔
Postsecondary teachers, all other	✔	✔
Preschool teachers, except special education		✔
Primary, secondary, and special education school teachers	✔	✔
Probation officers and correctional treatment specialists	✔	
Psychologists, all other	✔	
Psychology teachers, postsecondary	✔	✔
Recreation and fitness studies teachers, postsecondary	✔	✔
Recreation workers		✔
Religious workers	✔	✔
Religious workers, all other	✔	
Residential advisors		✔
Retail sales workers		✔
Retail salespersons		✔
Secondary school teachers, except special and vocational education	✔	✔
Self-enrichment education teachers		✔
Set and exhibit designers	✔	✔
Social and community service managers	✔	✔
Social and human service assistants		✔
Social sciences teachers, postsecondary, all other	✔	
Social scientists and related workers	✔	✔
Social scientists and related workers, all other	✔	
Social work teachers, postsecondary	✔	✔
Social workers, all other	✔	
Sociologists	✔	
Sociology teachers, postsecondary	✔	✔
Special education teachers, middle school	✔	✔
Special education teachers, preschool, kindergarten, and elementary school	✔	✔
Special education teachers, secondary school	✔	
Substance abuse and behavioral disorder counselors	✔	✔
Supervisors, personal care and service workers		✔
Teachers and instructors, all other	✔	
Travel guides	✔	
Vocational education teachers, middle school	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Vocational education teachers, postsecondary	✔	✔
Vocational education teachers, secondary school	✔	
Waiters and waitresses		✔
Health science		
Anesthesiologists	✔	✔
Athletic trainers	✔	
Audiologists	✔	
Biological technicians		✔
Biomedical engineers	✔	✔
Cardiovascular technologists and technicians	✔	✔
Chiropractors	✔	
Clinical, counseling, and school psychologists	✔	✔
Dental assistants		✔
Dental hygienists	✔	✔
Dentists	✔	✔
Dentists, all other specialists	✔	
Dentists, general	✔	
Diagnostic medical sonographers	✔	✔
Dietitians and nutritionists	✔	
Emergency medical technicians and paramedics		✔
Environmental science and protection technicians, including health	✔	✔
Epidemiologists	✔	✔
Family and general practitioners	✔	
Forensic science technicians	✔	✔
Health and safety engineers, except mining safety	✔	
Health diagnosing and treating practitioners	✔	✔
Health diagnosing and treating practitioners, all other	✔	✔
Health educators	✔	✔
Health specialties teachers, postsecondary	✔	
Health technologists and technicians	✔	✔
Health technologists and technicians, all other	✔	
Healthcare practitioners and technical occupations	✔	✔
Healthcare practitioners and technical workers, all other	✔	
Healthcare support occupations		✔
Healthcare support workers, all other		✔
Home health aides		✔
Industrial-organizational psychologists	✔	
Internists, general	✔	✔
Licensed practical and licensed vocational nurses	✔	✔
Life scientists, all other	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Massage therapists	✔	
Medical and clinical laboratory technicians		✔
Medical and clinical laboratory technologists	✔	
Medical and health services managers	✔	✔
Medical and public health social workers	✔	✔
Medical assistants		✔
Medical records and health information technicians		✔
Medical scientists, except epidemiologists	✔	✔
Medical secretaries		✔
Medical transcriptionists		✔
Mental health and substance abuse social workers		✔
Nuclear medicine technologists	✔	✔
Nursing aides, orderlies, and attendants		✔
Nursing instructors and teachers, postsecondary	✔	✔
Nursing, psychiatric, and home health aides		✔
Obstetricians and gynecologists	✔	✔
Occupational and physical therapist assistants and aides		✔
Occupational health and safety specialists	✔	
Occupational health and safety specialists and technicians	✔	
Occupational health and safety technicians	✔	
Occupational therapist assistants	✔	
Occupational therapists	✔	✔
Opticians, dispensing		✔
Optometrists	✔	
Oral and maxillofacial surgeons	✔	
Orthodontists	✔	
Orthotists and prosthetists	✔	✔
Other healthcare practitioners and technical occupations	✔	
Other healthcare support occupations		✔
Pediatricians, general	✔	
Pharmacists	✔	✔
Pharmacy technicians		✔
Physical therapist aides		✔
Physical therapist assistants	✔	✔
Physical therapists	✔	✔
Physician assistants	✔	✔
Physicians and surgeons, all other	✔	
Podiatrists	✔	
Prosthodontists	✔	
Psychiatric aides		✔

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Psychiatric technicians		✔
Psychiatrists	✔	✔
Psychologists, all other	✔	
Psychology teachers, postsecondary	✔	✔
Radiation therapists	✔	
Radiologic technologists and technicians	✔	✔
Registered nurses	✔	✔
Respiratory therapists	✔	✔
Respiratory therapy technicians	✔	
Speech-language pathologists	✔	✔
Substance abuse and behavioral disorder counselors	✔	✔
Surgeons	✔	
Surgical technologists	✔	✔
Therapists, all other	✔	
Veterinarians	✔	✔
Veterinary assistants and laboratory animal caretakers		✔
Veterinary technologists and technicians		✔
Marketing		
Advertising and promotions managers	✔	
Advertising sales agents	✔	✔
Advertising, marketing, promotions, public relations, and sales managers	✔	
Agents and business managers of artists, performers, and athletes	✔	
First-line supervisors/managers of non-retail sales workers	✔	
Gaming managers	✔	
Insurance sales agents	✔	
Lodging managers	✔	
Market research analysts	✔	
Marketing managers	✔	✔
Property, real estate, and community association managers	✔	
Public relations managers	✔	✔
Public relations specialists	✔	✔
Purchasing agents and buyers, farm products	✔	
Purchasing agents, except wholesale, retail, and farm products	✔	
Real estate brokers	✔	✔
Retail sales workers		✔
Retail salespersons		✔
Sales and related workers, all other		✔
Sales engineers	✔	✔
Sales managers	✔	
Sales representatives, services, all other	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Sales representatives, wholesale and manufacturing, except technical and scientific products	✔	
Sales representatives, wholesale and manufacturing, technical and scientific products	✔	✔
Securities, commodities, and financial services sales agents	✔	✔
Travel agents	✔	
Travel guides	✔	
Wholesale and retail buyers, except farm products	✔	
Technology engineering		
Actuaries	✔	
Aerospace engineering and operations technicians	✔	
Aerospace engineers	✔	
Agricultural and food science technicians	✔	
Agricultural engineers	✔	
Agricultural sciences teachers, postsecondary	✔	✔
Air traffic controllers	✔	
Airline pilots, copilots, and flight engineers	✔	
Architects, except landscape and naval	✔	
Architects, surveyors, and cartographers	✔	✔
Architectural and civil drafters	✔	
Architecture and engineering occupations	✔	✔
Architecture teachers, postsecondary	✔	
Astronomers	✔	
Atmospheric and space scientists	✔	
Atmospheric, earth, marine, and space sciences teachers	✔	
Biological science teachers, postsecondary	✔	✔
Biological technicians		✔
Biomedical engineers	✔	✔
Cartographers and photogrammetrists	✔	
Chemical engineers	✔	
Chemical plant and system operators	✔	
Chemical technicians	✔	
Chemistry teachers, postsecondary	✔	✔
Chemists	✔	
Civil engineering technicians	✔	
Civil engineers	✔	
Commercial pilots	✔	✔
Computer and information scientists, research	✔	
Computer and information systems managers	✔	✔
Computer and mathematical occupations	✔	✔
Computer hardware engineers	✔	
Computer programmers	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Computer science teachers, postsecondary	✔	
Computer software engineers, applications	✔	✔
Computer software engineers, systems software	✔	✔
Computer specialists	✔	
Computer specialists, all other	✔	
Computer support specialists	✔	✔
Computer systems analysts	✔	✔
Construction and building inspectors	✔	
Database administrators	✔	✔
Drafters, all other	✔	
Drafters, engineering, and mapping technicians	✔	
Drafters, engineering, and mapping technicians; all other	✔	
Electrical and electronic engineering technicians	✔	
Electrical and electronics drafters	✔	✔
Electrical engineers	✔	
Electro-mechanical technicians	✔	
Electronics engineers, except computer	✔	✔
Engineering managers	✔	
Engineering teachers, postsecondary	✔	✔
Engineering technicians, except drafters, all other	✔	
Engineers	✔	
Engineers, all other	✔	
Environmental engineering technicians	✔	✔
Environmental engineers	✔	✔
Environmental science teachers, postsecondary	✔	
Environmental scientists and specialists, including health	✔	
Forestry and conservation science teachers, postsecondary	✔	
Gas plant operators	✔	
Geographers	✔	
Geological and petroleum technicians	✔	
Geoscientists, except hydrologists and geographers	✔	
Health and safety engineers, except mining safety	✔	
Hydrologists	✔	
Industrial engineering technicians	✔	✔
Industrial engineers	✔	✔
Landscape architects	✔	
Life, physical, and social science occupations	✔	✔
Life, physical, and social science technicians	✔	✔
Life, physical, and social science technicians, all other	✔	✔
Locomotive engineers	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Marine engineers and naval architects	✔	
Materials engineers	✔	
Materials scientists	✔	
Mathematical science occupations	✔	
Mathematical science teachers, postsecondary	✔	✔
Mathematical technicians	✔	
Mathematicians	✔	
Mechanical drafters	✔	
Mechanical engineering technicians	✔	
Mechanical engineers	✔	
Mining and geological engineers, including mining	✔	
Natural sciences managers	✔	
Network and computer systems administrators	✔	✔
Network systems and data communications analysts	✔	✔
Nuclear engineers	✔	
Nuclear technicians	✔	
Operations research analysts	✔	
Petroleum engineers	✔	
Petroleum pump system operators, refinery operators, and gaugers	✔	
Physical scientists	✔	
Physical scientists, all other	✔	✔
Physicists	✔	
Physics teachers, postsecondary	✔	✔
Plant and system operators, all other	✔	✔
Power distributors and dispatchers	✔	
Power plant operators	✔	
Ship engineers	✔	
Stationary engineers and boiler operators	✔	
Statisticians	✔	
Surveying and mapping technicians		✔
Surveyors	✔	
Urban and regional planners	✔	
Water and liquid waste treatment plant and system operators		✔
Trade and industrial education		
Aerospace engineering and operations technicians	✔	
Air traffic controllers	✔	
Aircraft mechanics and service technicians	✔	
Aircraft structure, surfaces, rigging, and systems	✔	
Airline pilots, copilots, and flight engineers	✔	
Ambulance drivers and attendants, except emergency		✔

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Animal control workers		✔
Announcers	✔	
Architectural and civil drafters	✔	
Art and design workers	✔	
Art and design workers, all other	✔	
Art directors	✔	
Art, drama, and music teachers, postsecondary	✔	✔
Arts, design, entertainment, sports, and media occupations	✔	✔
Assemblers and fabricators, all other		✔
Audio and video equipment technicians		✔
Automotive body and related repairers	✔	
Automotive glass installers and repairers	✔	
Avionics technicians	✔	
Bailiffs		✔
Bartenders		✔
Boilermakers	✔	
Brickmasons and blockmasons	✔	✔
Bridge and lock tenders	✔	
Broadcast news analysts	✔	
Building and grounds cleaning and maintenance occupations, all other		✔
Building cleaning and pest control workers		✔
Bus and truck mechanics and diesel engine specialists	✔	
Bus drivers, school		✔
Bus drivers, transit and intercity		✔
Camera and photographic equipment repairers	✔	
Camera operators, television, video, and motion picture	✔	
Captains, mates, and pilots of water vessels	✔	✔
Cement masons and concrete finishers		✔
Chemical equipment operators and tenders	✔	
Chemical plant and system operators	✔	
Civil engineering technicians	✔	
Combined food preparation and serving workers, including fast food		✔
Commercial and industrial designers	✔	
Commercial divers	✔	
Commercial pilots	✔	✔
Communications teachers, postsecondary	✔	✔
Computer, automated teller, and office machine rep	✔	
Construction and building inspectors	✔	
Construction and extraction occupations		✔
Construction and related workers, all other	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Construction laborers		✔
Construction managers	✔	✔
Construction trades workers		✔
Control and valve installers and repairers, except mechanical door	✔	
Cooks and food preparation workers		✔
Cooks, restaurant		✔
Counter attendants, cafeteria, food concession, and coffee shop		✔
Court reporters	✔	✔
Crane and tower operators	✔	
Criminal justice and law enforcement teachers, postsecondary	✔	✔
Cutters and trimmers, hand		✔
Dental laboratory technicians		✔
Designers, all other	✔	
Detectives and criminal investigators	✔	✔
Drafters, all other	✔	
Drafters, engineering, and mapping technicians	✔	
Drafters, engineering, and mapping technicians; all other	✔	
Earth drillers, except oil and gas		✔
Editors	✔	
Electrical and electronic engineering technicians	✔	
Electrical and electronic equipment mechanics, installers, and repairers	✔	
Electrical and electronics drafters	✔	✔
Electrical and electronics installers and repairer	✔	
Electrical and electronics repairers, commercial and industrial equipment	✔	
Electrical and electronics repairers, powerhouse, substation, and relay	✔	✔
Electrical power-line installers and repairers	✔	
Electricians	✔	✔
Electro-mechanical technicians	✔	
Elevator installers and repairers	✔	
Emergency management specialists	✔	
Engineering technicians, except drafters, all other	✔	
Environmental engineering technicians	✔	✔
Explosives workers, ordnance handling experts, and blasters	✔	
Extruding and forming machine setters, operators, and tenders, synthetic and glass fibers	✔	
Fashion designers	✔	
Fiberglass laminators and fabricators		✔
Film and video editors	✔	
Fine artists, including painters, sculptors, and illustrators	✔	✔
Fire fighters	✔	✔
Fire fighting and prevention workers		✔

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Fire inspectors and investigators	✔	
First-line supervisors/managers of construction trades and extraction workers	✔	
First-line supervisors/managers of correctional officers	✔	
First-line supervisors/managers of fire fighting and prevention workers	✔	✔
First-line supervisors/managers of helpers, laborers and material movers, hand	✔	
First-line supervisors/managers of landscaping, lawn service, and groundskeeping workers	✔	✔
First-line supervisors/managers of mechanics, installers and repairers	✔	
First-line supervisors/managers of police and detectives	✔	
First-line supervisors/managers of production and operating workers	✔	
First-line supervisors/managers of transportation	✔	
First-line supervisors/managers, protective service workers		✔
First-line supervisors/managers, protective service workers, all other	✔	
Food and beverage serving workers		✔
Food preparation workers		✔
Food processing workers		✔
Forensic science technicians	✔	✔
Furnace, kiln, oven, drier, and kettle operators and kettle operators and tenders	✔	
Gas compressor and gas pumping station operators	✔	
Gas plant operators	✔	
Geological and petroleum technicians	✔	
Glaziers		✔
Graphic designers	✔	
Hazardous materials removal workers		✔
Heat treating equipment setters, operators, and tenders		✔
Heating, air conditioning, and refrigeration mechanics and installers		✔
Helpers, construction trades		✔
Helpers, construction trades, all other		✔
Helpers—brickmasons, blockmasons, stonemasons, and tile and marble setters		✔
Helpers—electricians		✔
Helpers—installation, maintenance, and repair workers		✔
Helpers—pipelayers, plumbers, pipefitters, and steamfitters		✔
Home appliance repairers		✔
Hosts and hostesses, restaurant, lounge, and coffee shop		✔
Industrial engineering technicians	✔	✔
Industrial machinery mechanics	✔	✔
Installation, maintenance, and repair occupations	✔	
Interior designers	✔	
Interpreters and translators		✔
Jewelers and precious stone and metal workers	✔	✔
Job printers	✔	

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Landscaping and groundskeeping workers		✔
Legal support workers	✔	✔
Legal support workers, all other	✔	
Life, physical, and social science technicians	✔	✔
Life, physical, and social science technicians, all other	✔	✔
Locksmiths and safe repairers	✔	✔
Locomotive engineers	✔	
Machinists	✔	✔
Maintenance workers, machinery	✔	
Mechanical door repairers	✔	
Mechanical drafters	✔	
Mechanical engineering technicians	✔	
Media and communication equipment workers	✔	
Media and communication workers	✔	✔
Media and communication workers, all other	✔	
Medical appliance technicians		✔
Medical equipment repairers	✔	✔
Merchandise displayers and window trimmers		✔
Metal-refining furnace operators and tenders	✔	
Millwrights	✔	
Mine cutting and channeling machine operators	✔	
Mobile heavy equipment mechanics, except engines	✔	✔
Model makers, metal and plastic	✔	✔
Model makers, wood	✔	
Molders, shapers, and casters, except metal and plastic		✔
Motor vehicle operators		✔
Motorboat mechanics		✔
Motorcycle mechanics		✔
Multi-media artists and animators	✔	
Musical instrument repairers and tuners	✔	
News analysts, reporters and correspondents	✔	
Nuclear technicians	✔	
Numerical tool and process control programmers	✔	
Operating engineers and other construction equipment operators		✔
Ophthalmic laboratory technicians		✔
Other construction and related workers		✔
Other construction and related workers, all other		✔
Other food preparation and serving related workers		✔
Other installation, maintenance, and repair occupations	✔	
Other protective service workers		✔

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Painters, construction and maintenance		✔
Painters, transportation equipment	✔	
Paralegals and legal assistants	✔	✔
Parking enforcement workers	✔	
Patternmakers, metal and plastic	✔	✔
Paving, surfacing, and tamping equipment operators		✔
Petroleum pump system operators, refinery operators, and gaugers	✔	
Pile-driver operators	✔	
Pipelayers		✔
Plant and system operators, all other	✔	✔
Plating and coating machine setters, operators, and tenders, metal and plastic		✔
Plumbers, pipefitters, and steamfitters	✔	✔
Police and sheriff's patrol officers	✔	✔
Pourers and casters, metal	✔	
Power distributors and dispatchers	✔	
Power plant operators	✔	
Precision instrument and equipment repairers, all other	✔	
Prepress technicians and workers	✔	
Private detectives and investigators	✔	✔
Probation officers and correctional treatment specialists	✔	
Protective service occupations		✔
Protective service workers, all other		✔
Public relations specialists	✔	✔
Pump operators, except wellhead pumpers	✔	✔
Radio mechanics	✔	
Rail car repairers	✔	
Rail transportation workers, all other	✔	
Railroad brake, signal, and switch operators	✔	
Railroad conductors and yardmasters	✔	
Rail-track laying and maintenance equipment operators	✔	
Recreational vehicle service technicians		✔
Refractory materials repairers, except brickmasons	✔	
Reinforcing iron and rebar workers	✔	✔
Reporters and correspondents	✔	
Roofers		✔
Sailors and marine oilers	✔	
Security and fire alarm systems installers		✔
Security guards		✔
Separating, filtering, clarifying, precipitating, and still machine setters, operators, and tenders	✔	
Septic tank servicers and sewer pipe cleaners	✔	✔

(CONTINUED)

TABLE B12 (CONTINUED)

High-wage and high-demand occupations in Tennessee, by corresponding program area, 2007/08

Program area and occupation	High-wage	High-demand
Service station attendants		✔
Service unit operators, oil, gas, and mining	✔	
Set and exhibit designers	✔	✔
Sheet metal workers		✔
Ship engineers	✔	
Signal and track switch repairers	✔	
Sound engineering technicians	✔	
Stationary engineers and boiler operators	✔	
Structural iron and steel workers	✔	✔
Structural metal fabricators and fitters		✔
Supervisors of installation, maintenance, and repair workers	✔	
Supervisors, transportation and material moving workers		✔
Surveying and mapping technicians		✔
Tank car, truck, and ship loaders	✔	
Tapers	✔	
Technical writers	✔	
Telecommunications equipment installers and repairers	✔	
Telecommunications line installers and repairers	✔	
Terrazzo workers and finishers		✔
Tile and marble setters		✔
Timing device assemblers, adjusters, and calibrators		✔
Title examiners, abstractors, and searchers	✔	
Tool and die makers	✔	
Traffic technicians	✔	
Transit and railroad police	✔	
Transportation inspectors	✔	
Transportation, storage, and distribution managers	✔	
Truck drivers, heavy and tractor-trailer	✔	
Urban and regional planners	✔	
Vehicle and mobile equipment mechanics, installers, and repairers	✔	✔
Vocational education teachers, postsecondary	✔	✔
Vocational education teachers, secondary school	✔	
Waiters and waitresses		✔
Watch repairers	✔	
Water and liquid waste treatment plant and system operators		✔
Water transportation workers		✔
Welders, cutters, solderers, and brazers		✔
Welding, soldering, and brazing machine setters, operators and tenders		✔

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009).

APPENDIX C
SENSITIVITY ANALYSES WITH ALTERNATE CROSSWALK

Sensitivity analyses were conducted to determine whether any key findings from the main report would change if an alternate crosswalk were used to classify occupations where the corresponding program areas were uncertain. The results at the state-level were almost identical. There is greater variation in the findings when the results are disaggregated by region. This appendix discusses differences between the primary analyses and the sensitivity analyses for the last three research questions.

How does the percentage of high school graduates who completed a concentration compare with the percentage of workers employed in corresponding occupations?

The index of dissimilarity at the state level was 0.18 using the combined crosswalk. With the alternate crosswalk, it was 0.19, a difference of 0.01 (table C1). At the region level, the changes range from 0.00 to 0.04 (results not shown).

What percentage of jobs in high-wage occupations projected over 2006–16 could potentially be filled by 2007/08 concentrators in corresponding program areas?

Using the alternate crosswalk, health science occupations switch from moderate wage to high wage in one region; technology engineering occupations, from high wage to moderate wage in six regions (table C2).

Using the alternate crosswalk, the median annual wage for each occupation by level of education differed from the combined crosswalk by an average of $698 for at most high school education, $793 for more than high school but less than a bachelor's degree, and $2,142 for at least a bachelor's degree. Table C3 shows the statewide median annual wages for occupations in each corresponding program area, by highest level of education completed, using the alternate crosswalk.

The percentage of jobs projected in high-wage occupations changed from the combined crosswalk by less than 1 percentage point at the state level, and there was no change in the percentage of graduates with concentrations in program areas that correspond to high-wage occupations (table C4). The percentage of projected jobs in high-wage occupations over 2006–16 that could be filled by 2007/08 concentrators dropped from 4.1 percent to 3.3 percent. At the region level, the change in the percentage of projected new jobs over 2006–16 in program areas that correspond to high-wage occupations ranged from 0 percentage point to 18 percentage points, with an average difference of 3 percentage points. The change in the percentage of graduates with concentrations in program areas

TABLE C1
Tennessee concentrators in each program area and workers employed in corresponding occupations, alternate crosswalk, by program area, 2007/08

	Concentrators		Employees		Percentage
Program area	Number	Percent	Number	Percent	point difference
Agricultural education	4,944	16	55,966	1	14
Business technology	4,132	13	833,760	19	–6
Family and consumer services	5,442	17	865,624	20	–3
Health science	3,393	11	276,430	6	4
Marketing	1,877	6	331,300	8	–2
Technology engineering	613	2	322,416	7	–6
Trade and industrial education	11,141	35	1,627,950	38	–2
Total	31,542		4,313,446		
Index of dissimilarity (0.19)					

Note: Percentages may not sum to 100 and percentage point differences shown may differ from those calculated from values in the table because of rounding.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

TABLE C2

Median annual wage classifications for occupations that correspond to each program area, alternate crosswalk, by region, 2007/08

Region	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	Low	Moderate	Low	High	Low	Moderate	Moderate
2	Low	Moderate	Low	High	Low	High	Moderate
3	Low	Moderate	Low	High	Moderate	High	Moderate
4	Low	Moderate	Low	High	Low	High	Moderate
5	Low	Moderate	Low	High	Low	High	Moderate
6	Low	Moderate	Low	**High**	Low	**Moderate**	Moderate
7	Moderate	High	**Moderate**	High	Moderate	High	Moderate
8	Low	Moderate	Low	High	Low	**Moderate**	Moderate
9	Low	Moderate	Low	High	Moderate	High	Moderate
10	Moderate	Moderate	Low	Moderate	Low	**Moderate**	Moderate
11	Low	Moderate	Low	Moderate	Low	**Moderate**	Moderate
12	Moderate	Moderate	Low	Moderate	Low	**Moderate**	Moderate
13	**Moderate**	High	Low	High	Low	High	Moderate

Note: Values in bold differ from those in table 5. High-wage occupations have median annual wages at least 20 percent greater than the regional median; low-wage occupations have median annual wages at least 20 percent less than the regional median; all other occupations are classified as moderate wage. Wage classifications are identified separately for each region.

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009).

TABLE C3

Tennessee median annual wages for occupations that correspond to each program area, alternate crosswalk, by highest level of education completed, 2007/08 (dollars)

Program area	At most high school	More than high school but less than bachelor's degree	At least bachelor's degree	Overall
Agricultural education	22,012	23,688	49,702	22,012
Business technology	19,931	30,057	64,554	33,834
Family and consumer services	15,702	19,420	42,584	18,561
Health science	21,886	32,233	55,904	36,706
Marketing	15,702	19,420	48,268	19,420
Technology engineering	28,140	47,191	62,036	33,379
Trade and industrial education	25,515	35,990	53,249	27,828

Note: Median annual wages are weighted by the number of workers employed in each occupation.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

that correspond to high-wage occupations ranged from 0 percentage point to 6 percentage points, with an average difference of 1 percentage point. The change in the percentage of projected jobs in high-wage occupations over 2006–16 that could be filled by 2007/08 concentrators ranged from 0.0 percentage point to 12.5 percentage points, with an average difference of 2.3 percentage points.

TABLE C4

Projected jobs in high-wage occupations over 2006–16 that could be filled by 2007/08 concentrators, alternate crosswalk, by region

		Projected new jobs in high-wage occupations over 2006–16		2008 high school graduates who concentrated in corresponding program areas		Projected jobs in high-wage occupations over 2006–16 that could be filled by 2007/08 concentrators (percent)
Region	Program area	Number	Percent	Number	Percent	
1	Health science, technology engineering	6,670	24	388	12	5.8
2	Health science, technology engineering	5,230	16	220	5	4.2
3	Health science, technology engineering	7,660	15	277	8	3.6
4	Health science, technology engineering	4,580	11	287	6	6.3
5	Health science, technology engineering	8,900	19	386	9	4.3
6	Technology engineering	2,870	20	146	7	5.1
7	Business technology, health science, technology engineering	3,650	39	276	11	7.6
8	Health science, technology engineering	10,810	10	427	5	4.0
9	Health science, technology engineering	15,925	13	313	4	2.0
10	Technology engineering	0	0	0	0	0.0
11	Technology engineering	0	0	0	0	0.0
12	Technology engineering	0	0	0	0	0.0
13	Business technology, health science, technology engineering	29,280	46	442	5	1.5
Tennessee	Varies by region	95,575	17	3,162	6	3.3

Note: Differences may be greater or less than expected due to rounding. High-wage occupations are identified separately for each region. Values for Tennessee are aggregates of the regional values. The percentage of projected jobs in high-wage occupations is the number of projected jobs in high-wage occupations divided by the total number of projected jobs. The percentage of graduates who concentrated in a corresponding program area is the number of graduates with a concentration in a program area that corresponds to a high-wage occupation divided by the total number of high school graduates.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

What percentage of jobs in high-demand occupations projected over 2006–16 could potentially be filled by 2007/08 concentrators in corresponding program areas?

Using the alternate crosswalk, technology engineering occupations switch demand classifications in eight regions, and occupations in family and consumer services and in trade and industrial education switch demand classifications in one region (table C5).

Using the alternate crosswalk, at the state level, the percentage of projected jobs in high-demand occupations changes from the combined crosswalk by less than 1 percentage point, and there is no change in the percentage of graduates with concentrations in program areas that correspond to high-demand occupations (table C6). The percentage of jobs in high-demand occupations projected over 2006–16 that could be filled by 2007/08 concentrators drops from 7.1 percent to 6.1 percent. At the region level, the change in the percentage of projected jobs in high-demand occupations ranges from 0 percentage point to 25 percentage points, with an average difference of 5 percentage points. The change in the percentage of graduates with concentrations in program areas that correspond to high-demand occupations ranges from 0 percentage point to 10 percentage points, with an average difference

TABLE C5

Projected job demand over 2006–16, by corresponding program area and region, alternate crosswalk, 2007/08

Region	Agricultural education	Business technology	Family and consumer services	Health science	Marketing	Technology engineering	Trade and industrial education
1	Low	Moderate	High	High	High	Low	Low
2	High	Moderate	Low	High	Moderate	**High**	Moderate
3	Moderate	Moderate	**High**	High	Low	Low	Moderate
4	High	Moderate	High	High	Moderate	Low	Moderate
5	Low	Moderate	High	High	Moderate	**Moderate**	Low
6	Low	Low	High	High	Low	**High**	Moderate
7	High	Moderate	High	High	Moderate	**Moderate**	Low
8	High	Moderate	Moderate	High	Moderate	**Moderate**	Low
9	High	Moderate	High	Moderate	Moderate	**Moderate**	Low
10	High	Low	High	High	Low	Low	Low
11	Low	Moderate	Moderate	High	Low	**Moderate**	Low
12	Low	Low	High	High	Low	**High**	Moderate
13	High	Moderate	Moderate	High	Low	High	**Moderate**

Note: Values in bold differ from those in table 8. High-demand occupations have a projected change in employment over 2006–16 at least 20 percent greater than that of all occupations in the region; low-demand occupations have a projected change in employment over 2006–16 at least 20 percent less than that of all occupations in the region; all other occupations are classified as moderate demand. Demand classifications are identified separately for each region.

Source: Author's calculations based on data from Tennessee Department of Labor and Workforce Development (2009).

of 2 percentage points. The change in the percentage of projected jobs in high-demand occupations over 2006–16 that could be filled by 2007/08 concentrators ranges from 0.1 percentage point to 9.5 percentage points, with an average difference of 1.5 percentage points.

TABLE C6

Projected jobs in high-demand occupations over 2006–16 that could be filled by 2007/08 concentrators, alternate crosswalk, by region

Region	Program areas	Projected new jobs over 2006–16 in high-demand occupations		2008 high school graduates who concentrated in corresponding program areas		Projected jobs in high-demand occupations over 2006–16 that could be filled by 2008 career and technical education graduates (percent)
		Number	Percent	Number	Percent	
1	Family and consumer services, health science, marketing	17,750	65	709	22	4.0
2	Agricultural education, health science, technology engineering	6,150	19	923	22	15.0
3	Family and consumer services, health science	18,370	37	485	15	2.6
4	Agricultural education, family and consumer services, health science	16,060	39	1,061	23	6.6
5	Family and consumer services, health science	18,880	40	664	15	3.5
6	Family and consumer services, health science, technology engineering	6,460	46	325	16	5.0
7	Agricultural education, family and consumer services, health science	4,610	49	1,053	42	22.8
8	Agricultural education, health science	13,020	12	1,010	13	7.8
9	Agricultural education, family and consumer services	37,900	32	980	13	2.6
10	Agricultural education, family and consumer services, health science	4,050	86	1,568	66	38.7
11	Health science	4,320	20	376	11	8.7
12	Family and consumer services, health science, technology engineering	3,230	31	969	39	30.0
13	Agricultural education, health science, technology engineering	17,960	28	218	3	1.2
Tennessee	Varies by region	168,760	31	10,341	18	6.1

Note: Differences may be greater or less than expected due to rounding. High-demand occupations are identified separately for each region. Values for Tennessee are aggregates of the regional values. The percentage of projected jobs in high-demand occupations is the number of projected jobs in high-demand occupations divided by the total number of projected jobs. The percentage of graduates who concentrated in corresponding program areas is the number of graduates with a concentration in a program area that corresponds to a high-demand occupation divided by the total number of high school graduates.

Source: Author's calculations based on data from Tennessee Department of Education (2009) and Tennessee Department of Labor and Workforce Development (2009).

NOTES

1. The Bureau of Labor Statistics uses the North American Industry Classification System (NAICS) as the structure for collecting, aggregating, presenting, and analyzing data on the U.S. economy (http://www.bls.gov/bls/naics.htm). NAICS uses a six-digit hierarchical coding system to classify all economic activity into 20 industry sectors. For analysis, the bureau has further aggregated the 20 sectors into 12 supersectors, divided into two groups. The first group is goods-producing, with three supersectors: natural resources and mining, construction, and manufacturing. The second group is service-providing, with nine supersectors: trade, transportation, and utilities; information; financial activities; professional and business services; education and health services; leisure and hospitality; other services; public administration; and unclassified (Walker and Murphy 2001).

2. This measure estimates the general availability of concentrations in program areas, though actual availability may be constrained by the number of enrollments each school can accommodate in a given year.

3. One of 17 career and technical education–only schools had no students complete three or more courses in the same program area (required for a concentration in 2007/08).

4. Disaggregated by school type, the average number of program areas available was similar for career and technical education–only schools and non–career and technical education schools (mean = 3.6 for both types; see tables B3 and B4 in appendix B). There were, however, some differences in the types of program areas available. At career and technical education–only schools, the most common was trade and industrial education, available at 88 percent of the schools. At non–career and technical education schools, the most common was family and consumer services, available at 72 percent.

5. The index of dissimilarity is calculated as:

$$0.5 \sum_{i=1}^{N} \left| \frac{c_i}{C} - \frac{w_i}{W} \right|,$$

where i is the identifier for each program area, N is the total number of program areas, c_i is the number of concentrators in program area i, C is the total number of concentrators, w_i is the number of workers employed in an occupation that corresponds to program area i, and W is the total number of workers employed in all occupations.

6. Calculated by multiplying the median annual wage of $28,030 by 1.2 (20 percent above the median annual wage).

7. Median annual wages for all occupations in the state of Tennessee ranged from $23,658 to $32,616 by region. However, the median annual wages were not directly comparable across regions due to differences in such factors as cost of living and the experience profiles of the workforce. Therefore, this section focuses on identifying the high-wage occupations in each region rather than comparing the median annual wages across regions.

8. A limitation in providing a single wage classification for each occupation is that it masks variability within an occupation. Even though an occupation may have an overall classification of low wage, there are still opportunities for high-wage jobs, particularly for students who complete higher levels of education. Data from the Bureau of Labor Statistics (2006) was used to categorize the highest level of education achieved by the majority of workers in each occupation.

9. These projections overestimate the actual number of concentrators, since graduates

may have concentrations in multiple program areas.

10. These projections overestimate the actual number of concentrators since graduates may have concentrations in multiple program areas.

11. The percentage of projected jobs in high-wage occupations changes by less than 1 percentage point statewide, with an average difference of 3 percentage points at the region level (see appendix C). The percentage of projected jobs in high-demand occupations changes by less than 1 percentage point statewide, with an average difference of 5 percentage points at the region level. Technology engineering had the most uncertainty in matching with corresponding occupations.

12. A program of study is a sequence of three or more credits in an "elective focus," based on students' career interests and goals. The elective focus may be career and technical education, science and mathematics, humanities, fine arts, Advanced Placement/International Baccalaureate, or other areas approved by the local board of education. Many programs of study integrate the curriculum with learning experiences, such as cocurricular activities or work-site learning. Tennessee offers more than 70 programs of study, many having a career and technical education elective focus (Tennessee Department of Education 2008).

13. Standard Occupational Classification (SOC) is a structure of occupations developed by the U.S. Bureau of Labor Statistics. The 2000 SOC classifies workers at four levels of aggregation: major group, minor group, broad occupation, and detailed occupation. Occupations with similar skills or work activities are grouped at each level to ease comparisons. Each item in the hierarchy has a six-digit code. The first two digits represent the major group; the third represents the minor group; the fourth and fifth represent the broad occupation; and the sixth represents the detailed occupation. More information about the SOC can be found at http://data.bls.gov/cgi-bin/print.pl/soc/socguide.htm.

14. See http://www.tennessee.gov/labor-wfd/cc/ccareas.htm for a list of counties in each region.

15. No career and technical education–only schools served students in more than one region.

16. All career and technical education–only schools have zero high school graduates in the home-school file. High school diplomas are awarded by the non–career and technical education school attended by the students.

17. The Bureau of Labor Statistics collects education attainment data by occupation from the American Community Survey. These data are used to group occupations by the percentage of workers with a high school diploma or less, some college or an associate's degree, or a bachelor's degree or more. More information on the Bureau of Labor Statistics education and training classification systems can be found at http://www.bls.gov/emp/ep_education_tech.htm.

18. A more detailed crosswalk of all occupations to concentrations is available upon request.

REFERENCES

Carl D. Perkins Career and Technical Education Improvement Act of 2006. (2006). Pub. L. No. 109–270, 120 Stat. 683. Retrieved April 12, 2008, from http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:s250enr.txt.pdf.

Franklin, R.S. (2003). *Migration of the young, single, and college educated: 1995 to 2000. Census 2000 special report.* (U.S. Census Publication CENSR-12). Suitland, MD: U.S. Census Bureau.

Grubb, N.W., Badway, N., Bell, D., Chi, B., King, C., Herr, J., and Prince, H. (1999). *Toward order from chaos: state efforts to reform workforce development systems.* (NCRVE Publication MDS-1249). Berkeley, CA: National Center for Research in Vocational Education.

Hudson, L., and Laird, J. (2009). *New indicators of high school career/technical education coursetaking: class of 2005* (NCES 2009-038). Washington, DC: U.S. Department of Education.

Jacobs, J. (1995). Gender and academic specialties: trends among recipients of college degrees in the 1980s. *Sociology of Education, 68*(1), 81–98.

Jacobson, L., and Mokher, C. (2009). *Rural-urban differences in the effectiveness of career and technical education in Florida.* CNA Working Paper. Alexandria, VA: CNA.

Levesque, K., Laird, J., Hensley, E., Choy, S.P., Cataldi, E.F., and Hudson, L. (2008). *Career and technical education in the United States: 1990 to 2005* (NCES 2008-035). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Murphy, J.B., and Walker, J.A. (2001, December). Implementing the North American Industry Classification System at BLS. *Monthly Labor Review,* pp. 15–21.

The Tennessee Council for Career and Technical Education. (2009). *2008/2009 biennial report.* Retrieved August 31, 2010, from http://www.state.tn.us/education/cte_council/doc/biennialreport0809.pdf.

Tennessee Department of Education. (2008). *Career clusters and programs of study.* Retrieved January 7, 2009, from http://www.tennessee.gov/education/cte/ad/clupos/clupos.shtml.

Tennessee Department of Education. (2009). *CTE 2020 vision.* Retrieved August 31, 2010, from http://www.state.tn.us/education/cte/index.shtml.

Tennessee Department of Education. (n.d. a). *Tennessee career-technical data reporting system.* Retrieved from www.tennessee.gov/education/cte/ad/tiger/index.shtml

Tennessee Department of Education. (n.d. b). *CTE program areas and career clusters.* Retrieved from www.tennessee.gov/education/cte/ad/clupos/cluctepas.shtml.

Tennessee Department of Education (n.d. c). *Pathways: programs of study.* Retrieved from http://pathways.tbr.edu/programs.php.

Tennessee Department of Labor and Workforce Development. (2006). *Hot jobs to 2016.* Retrieved January 7, 2009, from http://www.tennessee.gov/labor-wfd/outlooks/select.htm.

Tennessee Department of Labor and Workforce Development. (2009). Labor market analysis data, occupation-specific data. Retrieved April 14, 2008, from http://www.sourcetn.org/analyzer/startanalyzer.asp.

Tennessee State Board of Education. (2008). The Carl D. Perkins Career and Technical Education Act of 2006: Tennessee state plan. Retrieved January 7, 2009, from http://www.state.tn.us/education/cte/ad/perkins/PerkinsIV.shtml.

Turner, S.E., and Bowen, W.G. (1999). Choice of major: the changing (unchanging) gender gap. *Industrial and Labor Relations Review, 52*(2), 289–313.

U.S. Bureau of Labor Statistics. (2006). *Occupational projections and training data*. Retrieved December 7, 2009, from http://www.bls.gov/emp/optd/.

U.S. Bureau of Labor Statistics. (2008). *Occupational outlook handbook, 2008–09 edition.* Retrieved January 7, 2009, from http://www.bls.gov/oco/oco2003.htm.

U.S. Department of Education, National Center for Education Statistics. (2007). Parent and family involvement in education survey of the 2007 National Household Education Surveys Program (NHES). In S. Bielick (2008), *1.5 million homeschooled students in the United States in 2007.* Institute of Education Sciences Issue Brief 2009-030, Washington, DC.

U.S. Department of Education, National Center for Education Statistics. (2008a). *Digest of education statistics.* Retrieved April 12, 2008, from http://nces.ed.gov/programs/digest/d08/tables/dt08_100.asp

U.S. Department of Education, National Center for Education Statistics. (2008b). *Private School Universe Survey (PSS), 2007–2008.* Retrieved August 5, 2009, from http://nces.ed.gov/surveys/pss/tables/table_2008_15.asp.

Wong, K., Sims, P., and Schuermann, P. (2004). *The Tennessee workforce development system: investing in the future.* Nashville, TN: Peabody Center for Education Policy and the Leadership Development Center at Vanderbilt University.