Institute of Education Sciences

Public High School Students' Career and Technical Education Coursetaking: 1992 to 2013

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Statistics in Brief publications present descriptive data in tabular or graphic formats to provide useful information to a broad audience, including members of the general public. They address simple and topical issues and questions. They do not investigate more complex hypotheses, account for interrelationships among variables, or support causal inferences.

We encourage readers who are interested in more complex questions and in-depth analysis to explore other National Center for Education Statistics (NCES) resources, including publications, online data tools, and public- and restricted-use datasets. See nces.ed.gov and references noted in the body of this document for more information.

The federal government has long supported career and technical education (CTE). Federal policymakers first invested in CTE in 1917 by providing funding under the Smith-Hughes Act for high school vocational education programs in agriculture, home economics, and trade and industrial education. Today the Strengthening Career and Technical Education for the 21st Century Act (P.L. 115-224) funds CTE programs across a wide range of occupational areas for secondary and subbaccalaureate postsecondary students.[1] In 2014-15, a total of 7.4 million high school students enrolled in CTE courses supported by federal funding (U.S. Department of Education 2018).

Prior studies have documented the large role of CTE in the high school curriculum. For example, Arbeit, Leu, and Dalton (2017) found 79 percent of high school graduates earned at least one credit in CTE.

Past research has also shown coursetaking is more common in some CTE subject areas, such as business, than in other subject areas, and different groups of students participate in CTE at different levels (Arbeit, Leu, and Dalton 2017; Levesque et al. 2008). For example, males have been found to earn more CTE credits than females, and Asian students have been found to earn fewer CTE credits than students from other racial/ethnic groups.

Finally, Hudson (2013) found that from 1990 to 2009, the percentage of public high school graduates earning credits in CTE decreased, but that in spite of that overall decline, some CTE subject areas grew in prevalence (e.g., communications and design, healthcare).

To help set the context for CTE research and policymaking, this Statistics in Brief updates previous descriptive analyses of high school student participation in CTE.[2] The analysis in this brief differs from those for past studies, however, because it uses a new course coding system and a new taxonomy to organize courses into subject areas.

[1] This legislation, in effect since July 1, 2019, includes a mandate for the National Center for Education Statistics (NCES) to collect and report national data on CTE. This report helps meet that mandate. The NCES CTE Statistics website (https://nces.ed.gov/surveys/ctes) provides a more comprehensive set of statistics on CTE at the secondary and postsecondary levels and on adults' preparation for work.

[2] Previous studies of high school students' CTE participation include Arbeit, Leu, and Dalton 2017; Dalton et al. 2013; Hudson and Laird 2009; Levesque et al. 2008; and U.S. Department of Education 2014.

Data and Methods

The findings in this report are based on three nationally representative data collections conducted by NCES: the National Education Longitudinal Study of 1988 (NELS:88), the Education Longitudinal Study of 2002 (ELS:2002), and the High School Longitudinal Study of 2009 (HSLS:09). NELS:88 is a longitudinal study of students who were in eighth grade in spring 1988, ELS:2002 is a longitudinal study of students who were in tenth grade in spring 2002, and HSLS:09 is a longitudinal study of students in ninth grade in fall 2009. All three data collections followed students over time and included a high school transcript data collection in the year participants were expected to graduate from high school–1992 for NELS:88, 2004 for ELS:2002, and 2013 for HSLS:09–to enable analyses of high school coursetaking.[3]

The analytic samples used in this report consist of students who graduated from public high schools by their scheduled graduation dates and whose transcripts were deemed complete. Specifically, the samples consist of high school students who graduated from a public high school with an honors or standard diploma by August 31 of the scheduled graduation year (1992, 2004, or 2013) and whose transcripts recorded at least 16 Carnegie units[4] including units completed in English. The unweighted number of such graduates was approximately 10,600 in NELS:88; 8,600 in ELS:2002; and 11,500 in HSLS:09.

The HSLS:09, NELS:88, and ELS:2002 transcript data were coded using the School Courses for the Exchange of Data (SCED) and the 2018 Secondary School Course Taxonomy (SSCT). The SCED includes about 1,400 five-digit course codes organized into 22 subject areas (Bradby, Pedroso, and Rogers 2007). While the HSLS:09 was already coded using the SCED, NCES recoded the NELS:88 and ELS:2002 data using the same system to provide comparable data across the studies. To facilitate a more consistent analysis of CTE in particular, the approximately 1,400 SCED-coded courses in all 3 longitudinal studies were aggregated into subject areas using the SSCT (Hudson 2019). The SSCT includes 6 broad subject areas in the academic curricular area (4 core academic subjects of English, mathematics, science, and social studies, plus fine arts and foreign languages), 10 broad subject areas in the CTE curricular area (agriculture and natural resources; business, finance, and marketing; communication and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; healthcare; mechanical repair and operation; and public services), and 7 broad subject areas in the enrichment curricular area (family and consumer sciences education, career exploration, religious education, physical and health education, military sciences, computer literacy, and miscellaneous).[5]

This report measures participation in CTE in three ways: the percentage of graduates who earned CTE credits, the average number of CTE credits graduates earned, and the percentage of graduates with a CTE concentration. Students are considered to "concentrate" in CTE if they earn a minimum number of credits in 1 of the 10 CTE areas listed above. Students who earned at least two credits in a single CTE subject area are referred to as two-credit concentrators, and students who earned at least three credits in a single CTE subject area are referred to as three-credit concentrators.[6] Participation in CTE is examined in detail for graduates in 2013; for selected questions, participation trends are examined for graduates in 1992, 2004, and 2013.

All statements of comparison were tested for statistical significance using the Student's *t* statistic. No adjustments were made for multiple comparisons. Because the study design is descriptive, readers are cautioned against drawing causal inferences based on the results presented. The Technical Notes section at the end of this brief includes more information on the data sources and analyses used in this report.

For readers interested in additional information about the survey from which the findings were drawn and the analyses underlying the findings, please see the "View Technical Notes" link at https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020010.

[3] The HSLS:09 transcript data are the most recent national high school transcript data available as of 2020.

[4] A Carnegie unit is a credit hour, defined at the secondary level as the equivalent of a course taken every school day, one period per day, for a full school year.

[5] Because of the use of this newer taxonomy, the names of subject fields in this study are somewhat different from those used in past NCES studies. For example, "communications and design" no longer includes design courses and is now "communication and communication technologies." Two subject areas in the enrichment curriculum–family and consumer sciences education, and career exploration–were included in the definition of CTE in some past NCES studies but are no longer classified as CTE. See Hudson (2019) for more information on how the new and old taxonomies compare.

[6] Two and three credits are the thresholds for defining concentration used in past NCES reports (e.g., Hudson and Laird 2009; Levesque et al. 2008). Current federal legislation defines concentrators using the two-credit threshold (P.L. 115-224, section 3). "Concentrating" in a CTE area may indicate a student is preparing for a career in that area because CTE is intended to provide students with skills required for future work.

STUDY QUESTIONS AND KEY FINDINGS

1 **To what extent do public high school graduates participate in career and technical education (CTE), and has their participation changed over time?**

- Most public high school graduates earned CTE credits but did not necessarily concentrate in a specific CTE subject area. Overall, 88 percent of graduates earned CTE credits, 20 percent were 3-credit concentrators, and an additional 18 percent (for a total of 38 percent) were 2-credit concentrators.
- Public high school graduates earned more credits in business, finance, and marketing than in any other CTE area (**FIGURE 2**).
- CTE participation declined from 1992, when public high school graduates earned an average of 3.13 CTE credits, to 2013, when they earned an average of 2.60 CTE credits (**FIGURE 4**).
- Credit earning decreased in the three CTE subject areas of mechanical repair and operation; engineering, design, and production; and business, finance, and marketing, while it increased in the five subject areas of public services, healthcare, agriculture and natural resources, computer and information science, and communication and communication technologies (**FIGURE 5**).

2 **Does participation in CTE vary by the characteristics of public high school graduates, and have gender gaps in CTE subject areas changed over time?**

- Male public high school graduates earned more CTE credits than female graduates (**FIGURE 6**). White and Black graduates earned more CTE credits than their Asian/Pacific Islander peers. Graduates whose first language was English earned more CTE credits than their peers whose first language was not English.
- Students who had an Individualized Education Program (IEP) earned more CTE credits than students who did not have an IEP, and students whose parents had lower levels of educational attainment earned more CTE credits than students whose parents had higher levels of attainment (**FIGURE 7**).
- In business, finance, and marketing, a gender gap favoring females disappeared between 1992 and 2013. Over the same period, a gender gap favoring females appeared in communication and communication technologies and in public services, and a gender gap favoring males appeared in computer and information sciences (**FIGURE 8**).

3 **Does the participation of public high school graduates in CTE vary by their academic achievement at the start of high school?**

- Public high school graduates who took lower and mid-level mathematics courses in ninth grade completed more CTE credits than graduates who took higher-level mathematics courses (**FIGURE 9**).
- Relatedly, public high school graduates with lower levels of mathematics achievement in ninth grade earned more CTE credits than those with higher levels of mathematics achievement (**FIGURE 9**).

1 To what extent do public high school graduates participate in career and technical education (CTE), and has their participation changed over time?

Career and Technical Education Participation Among 2013 Graduates

Earning CTE credits was relatively common among public high school graduates in 2013, although most graduates did not concentrate in a specific CTE area. Among 2013 graduates, 88 percent earned CTE credits.[7] One in 5 graduates (20 percent) were 3-credit concentrators, meaning they earned at least 3 credits in one of the 10 CTE subject areas. An additional 18 percent (for a total of 38 percent) were 2-credit concentrators, earning at least 2 credits in a specific CTE area.

Overall, CTE credits represented 10 percent of credits earned across all curricular areas in 2013 (not shown in figures; see https://nces.ed.gov/surveys/ctes/tables/H185.asp).

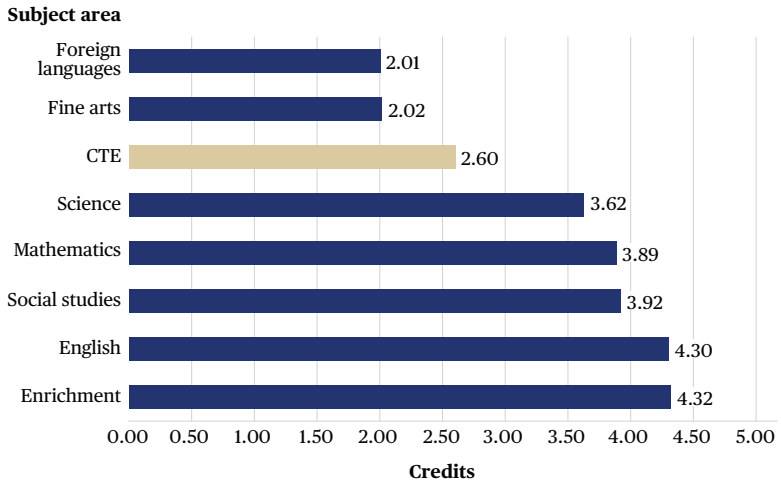
Another measure of CTE participation is the average number of CTE credits graduates earn. Graduates in 2013 earned an average of 2.60 CTE credits, which was lower than the average earned in each of the four core academic subject areas (**FIGURE 1**). By contrast, the average number of CTE credits earned was higher than that earned in fine arts and in foreign languages.

Public high school graduates earned more credits in some CTE subject areas than in others. Graduates earned a higher average number of credits in business, finance, and marketing (0.56 credits) than in any other CTE area and a lower average number of credits in mechanical repair and operation (0.11) than in any other CTE area (**FIGURE 2**).

Career and Technical Education Participation Over Time

Based on several measures, participation in CTE declined from 1992 to 2013. The percentage of graduates earning CTE credits declined from 95 percent in 1992 to 88 percent in 2013 (**FIGURE 3**). The percentage of graduates who were 2-credit concentrators decreased from 51 percent in 1992 to 38 percent in 2013, and the percentage of graduates who were 3-credit concentrators decreased from 27 percent in 1992 to 20 percent in 2013 (**FIGURE 3**).[8]

FIGURE 1. Average number of credits public high school graduates earned, by subject area: 2013

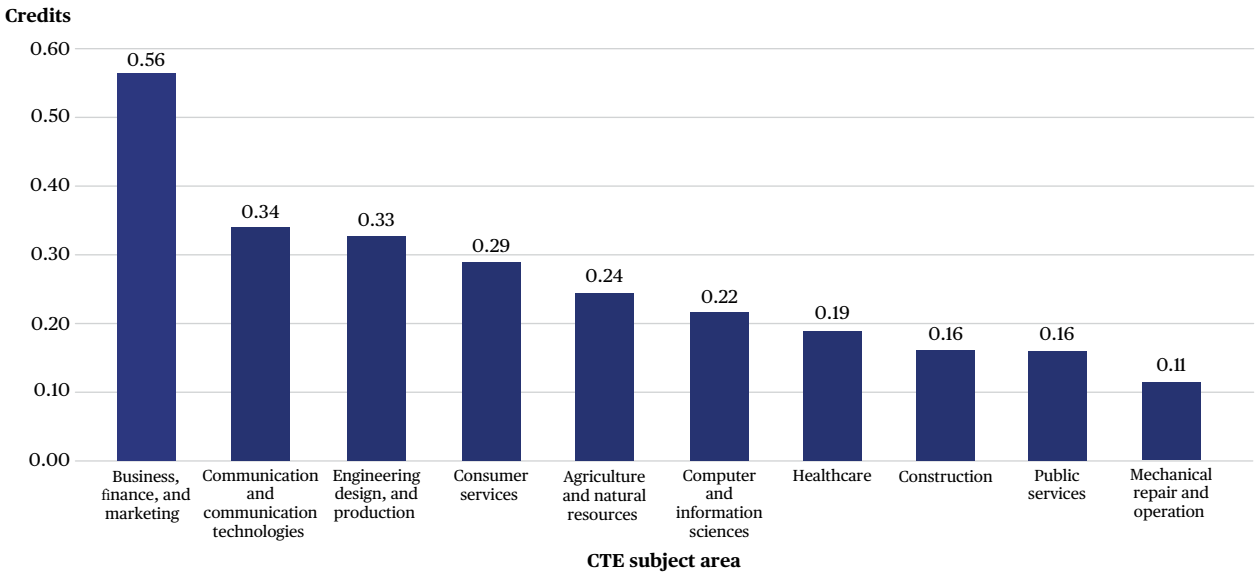


NOTE: CTE = career and technical education. Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (2013). CTE credits are credits in these 10 subject areas: agriculture and natural resources; business, finance, and marketing; communications and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; healthcare; mechanical repair and operation; and public services. Enrichment credits are credits in family and consumer sciences education, career exploration, religious education, physical and health education, military sciences, computer literacy, and miscellaneous other courses. Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h185.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

[7] In past NCES reports, CTE included credit earning in the two CTE-related subject areas of family and consumer sciences education and career exploration. Among 2013 graduates, 45 percent earned credits in these CTE-related areas. Taken together, 92 percent of graduates in 2013 earned credits in either CTE or CTE-related areas. The remainder of this report focuses exclusively on credits in CTE. More information on CTE-related credits is available in the secondary-level tables on the CTE Statistics website at https://nces.ed.gov/surveys/ctes/.

[8] Information on the percentage of graduates who concentrated in each CTE subject area is available at https://nces.ed.gov/surveys/ctes/tables/h178.asp.

FIGURE 2. Average number of credits public high school graduates earned, by career and technical education (CTE) subject area: 2013

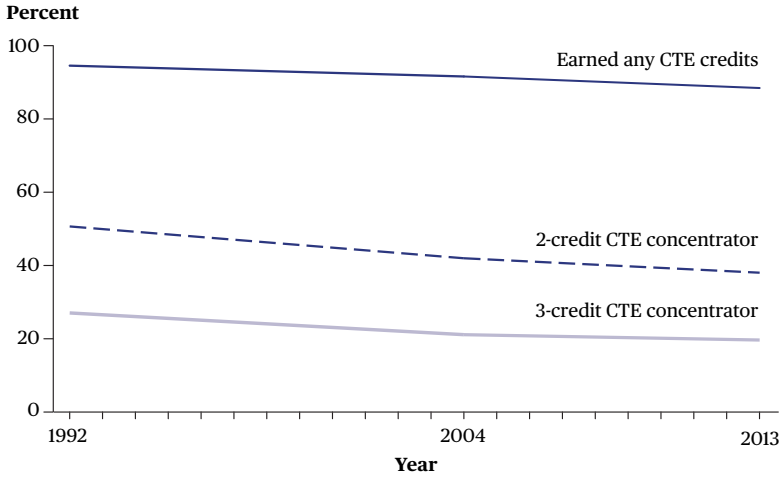


NOTE: Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (2013). Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h185.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

The average number of credits earned in CTE also decreased, from 3.13 credits in 1992 to 2.60 credits in 2013 (**FIGURE 4**). By contrast, the average number of credits earned increased in each of the six academic subject areas and the enrichment curriculum. For example, the average number of credits earned in mathematics increased from 3.27 credits in 1992 to 3.89 credits in 2013.

Patterns of change differed across CTE subject areas, with participation increasing in five CTE areas and decreasing in three (**FIGURE 5**). Note that because the average number of credits earned in each CTE area is relatively small—ranging from 0.11 credits to 0.56 credits (see https://nces.ed.gov/surveys/ctes/tables/H175.asp)—small changes in credits earned were statistically significant. The average number of credits earned increased in public services, healthcare, agriculture and natural resources, computer and information science, and communication and communication technologies. By contrast, the average number of credits earned decreased in mechanical repair and operation; engineering, design, and production; and business, finance,

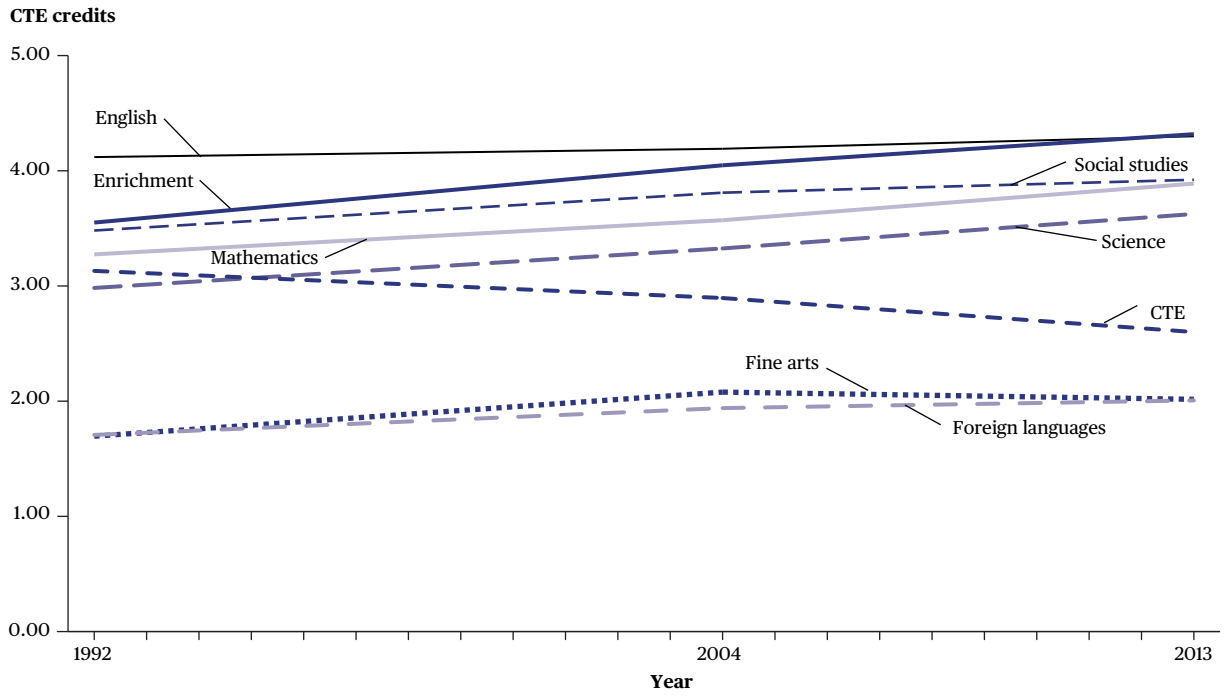
FIGURE 3. Percentage of public high school graduates who earned any career and technical education (CTE) credits and who concentrated in CTE: 1992, 2004, and 2013



NOTE: Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (1992, 2004, or 2013). CTE credits are credits in these 10 subject areas: agriculture and natural resources; business, finance, and marketing; communication and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; healthcare; mechanical repair and operation; and public services. The 2- and 3-credit CTE concentrators are students who earned at least 2 or at least 3 credits, respectively, in one of these 10 CTE fields. Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h176.asp and https://nces.ed.gov/surveys/ctes/tables/h177.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88), Second Follow-up and High School Transcript File; Education Longitudinal Study of 2002 (ELS:2002), First Follow-up and High School Transcript File; and High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

and marketing. As figure 5 shows, business, finance, and marketing had the greatest decline. In the SSCT, this broad subject area includes four sub-areas—business support, business management, finance, and marketing. Among these four sub-areas, business support accounted for most of the decrease (0.60 of the 0.79 credit decrease; not shown in figures; see https://nces.ed.gov/surveys/ctes/tables/H175.asp). There was no statistically significant change in the average number of credits earned in the two CTE subject areas of consumer services and construction.

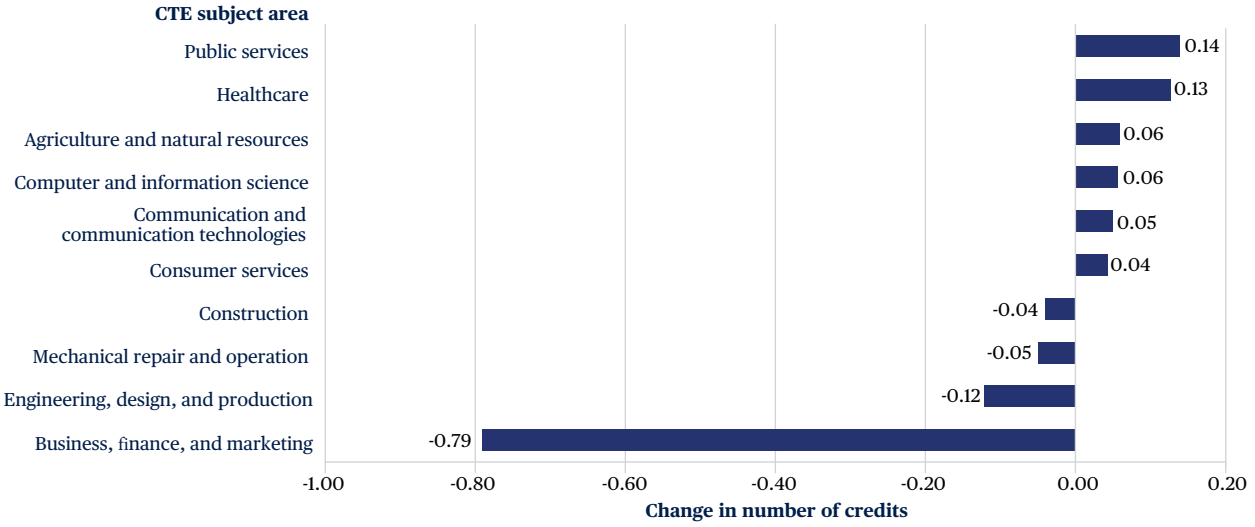
FIGURE 4. Average number of credits public high school graduates earned, by subject area: 1992, 2004, and 2013



NOTE: CTE = career and technical education. Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (1992, 2004, or 2013). CTE credits are credits in these 10 subject areas: agriculture and natural resources; business, finance, and marketing; communications and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; healthcare; mechanical repair and operation; and public services. Enrichment credits are credits in family and consumer sciences education, career exploration, religious education, physical and health education, military sciences, computer literacy, and miscellaneous other courses. Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h175.asp.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88), Second Follow-up and High School Transcript File; Education Longitudinal Study of 2002 (ELS:2002), First Follow-up and High School Transcript File; and High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

FIGURE 5. Change in the average number of credits public high school graduates earned in each career and technical education (CTE) subject area: 1992 to 2013



NOTE: Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (1992 or 2013). Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h175.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88), First Follow-up and High School Transcript File; and High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

2 Does participation in CTE vary by characteristics of public high school graduates, and have gender gaps in CTE subject areas changed over time?

Career and Technical Education Participation by Student Characteristics in 2013

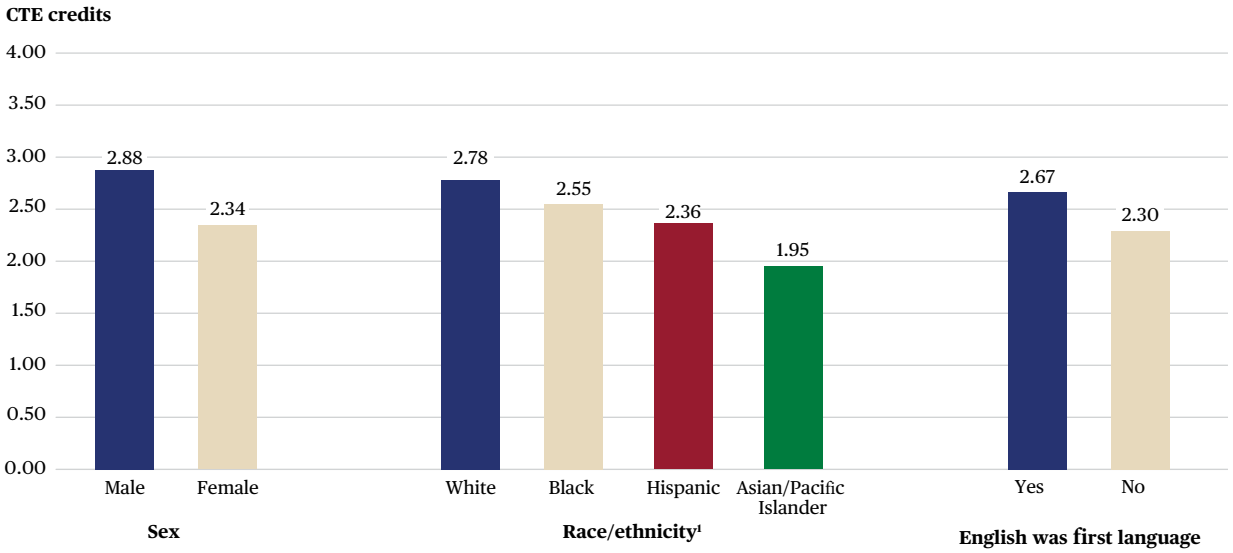
As past studies have found (Arbeit, Leu, and Dalton 2017; Levesque et al. 2008), student participation in CTE varied by student sex, race/ethnicity, and whether English was the student's first language.

In general, male public high school graduates participated in CTE to a greater extent than females. Male graduates earned an average of 2.88 CTE credits compared with 2.34 CTE credits for female graduates (**FIGURE 6**). However, in contrast to earning fewer CTE credits, female graduates earned more credits in the academic curriculum than did male graduates (20.38 versus 19.10, respectively).

Participation in CTE also varied by race and ethnicity. White and Black graduates earned more CTE credits on average than their Asian/Pacific Islander peers (2.78 and 2.55 versus 1.95, respectively), but there was no measurable difference between the average numbers of CTE credits earned by Hispanic and Asian/Pacific Islander graduates (2.36 and 1.95, respectively). Although Asian/Pacific Islanders earned fewer CTE credits than their White and Black peers, they earned more academic credits than those peers (21.02 versus 19.80 and 20.07, respectively).[9]

There also was a significant difference in CTE participation between high school graduates who did and who did not speak English as a first language. Graduates whose first language was English earned more CTE credits on average than those whose first language was not English (2.67 versus 2.30 credits, respectively).

FIGURE 6. Average number of credits public high school graduates earned in career and technical education (CTE), by student sex, race/ethnicity, and whether English was first language: 2013



[1] Black includes African American, Hispanic includes Latino, and Asian/Pacific Islander includes Native Hawaiian. Race categories exclude persons of Hispanic origin.
NOTE: Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (2013). CTE credits are credits in these 10 subject areas: agriculture and natural resources; business, finance, and marketing; communications and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; healthcare; mechanical repair and operation; and public services. Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h196.asp and https://nces.ed.gov/surveys/ctes/tables/h197.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

[9] Statistics for academic coursetaking are not shown in figures; see https://nces.ed.gov/surveys/ctes/tables/h186.asp and https://nces.ed.gov/surveys/ctes/tables/h188.asp.

The average number of CTE credits earned also varied by the highest level of education of high school graduates' parents (**FIGURE 7**). Graduates whose parents had no more than a high school education and those whose parents completed some college earned more CTE credits than graduates whose parents had at least a bachelor's degree (2.77 and 2.75 versus 2.31 credits, respectively).

Finally, graduates who had an Individualized Education Program (IEP) in grade 9 earned more CTE credits than those who did not have an IEP (2.91 versus 2.40 credits).[10]

Gender Gap in Career and Technical Education Participation by Subject Area

Increasing the participation of male and female students in nontraditional (for their sex) CTE areas has long been of policy interest. For example, current federal CTE legislation defines students enrolled in classes in nontraditional CTE areas as a "special population," one of the student groups designated to be served by the Act.

In line with this federal interest, this section examines the size and direction of gender gaps in each CTE subject area among 1992 and 2013 graduates. A gender gap is defined as the difference between the average number of credits earned by male graduates and those earned by female graduates. A positive value for a gender gap indicates males earned more credits than females, whereas a negative value indicates females earned more credits than males.

In 2013, male graduates tended to earn more credits in CTE subject areas aligned with traditionally male-dominated occupations, while female graduates tended to earn more credits in CTE subject areas aligned with traditionally female-dominated occupations (U.S. Department of Labor, Bureau of Labor Statistics 2019). Among the 2013 cohort, males earned more credits than females in the five CTE subject areas of engineering, design, and production; construction; mechanical repair and operation; computer and information sciences; and agriculture and natural resources (**FIGURE 8**).

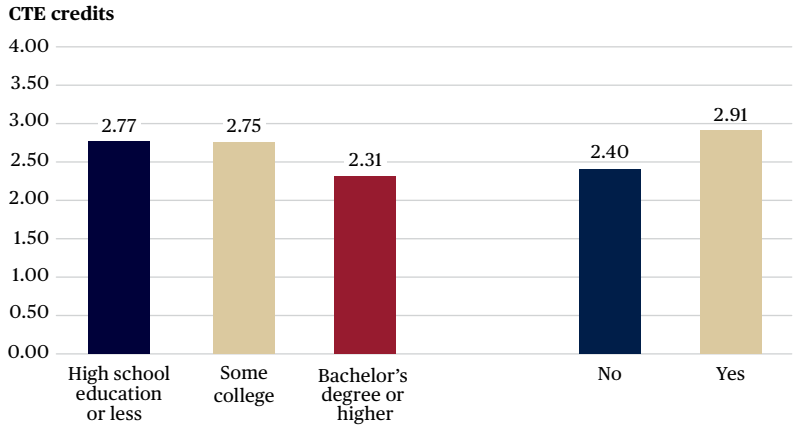
Females earned more credits than males in the four CTE subject areas of consumer services, healthcare, communication and communication technologies, and public services. In 2013 there was no statistically significant gender gap in credit earning in business, finance, and marketing.

These coursetaking patterns reflect gender gaps that were sometimes larger in 2013 than in 1992, sometimes smaller, and sometimes not measurably different.

Gender gaps were larger in 2013 than in 1992 in four subject areas. First, in healthcare, a gender gap favoring females (that is, females earned more credits than males) existed in both years, but the size of the gap was significantly larger in 2013 than in 1992. In communication and communication technologies and in public services, a gender gap favoring females existed in 2013 although there had not been a gender gap in 1992. Likewise, in computer and information sciences, a gender gap favoring males existed in 2013, but there had not been a gender gap in 1992.

Gender gaps were smaller in 2013 than in 1992 in four other subject areas. There was no gender gap favoring females in business, finance, and marketing in 2013, although there had been one in 1992. And while gender gaps favoring males existed in both 2013 and 1992 in the three subject areas of agriculture and natural resources; engineering, design and production; and mechanical repair and

FIGURE 7. Average number of credits public high school graduates earned in career and technical education (CTE), by individualized education program (IEP) status in ninth grade and parents' highest level of education: 2013



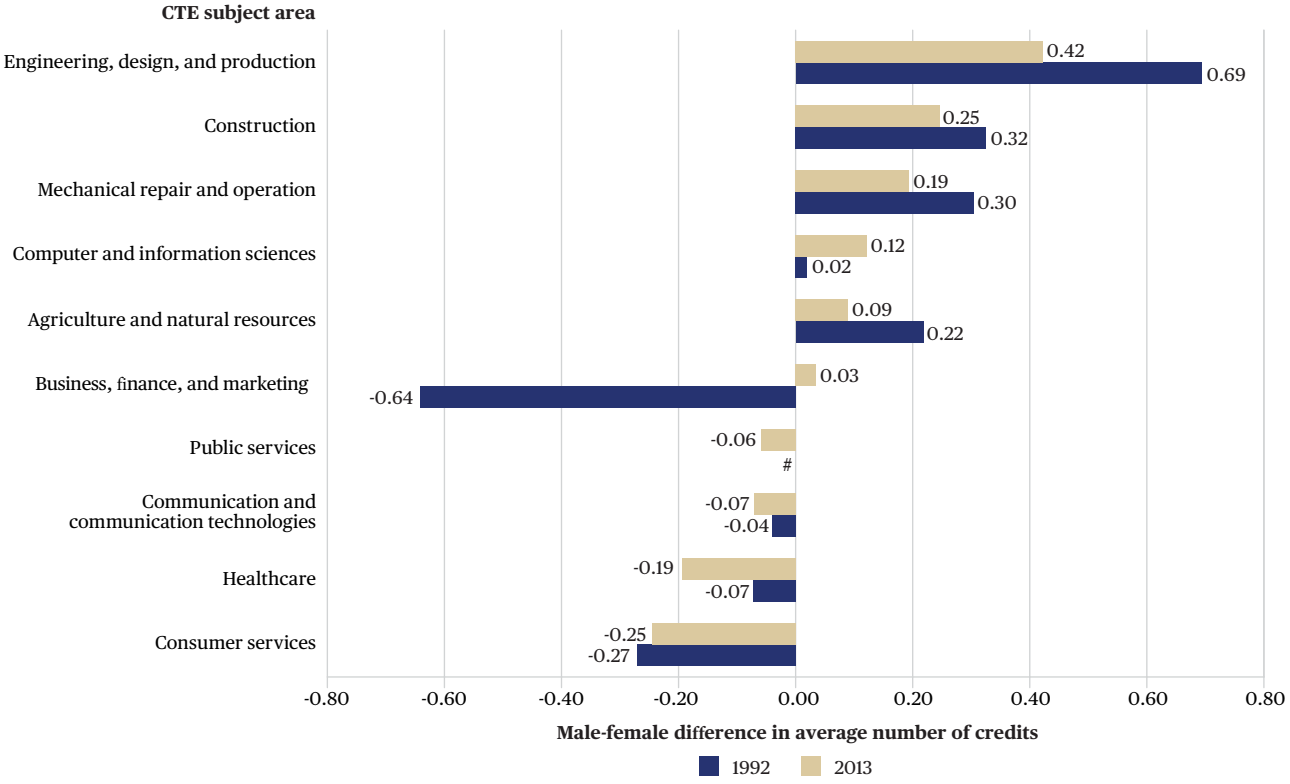
NOTE: Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their graduating year (2013). CTE credits are credits in these 10 subject areas: agriculture and natural resources; business, finance, and marketing; communications and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; healthcare; mechanical repair and operation; and public services. Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h197.asp and https://nces.ed.gov/surveys/ctes/tables/h198.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

[10] The Individuals with Disabilities Education Act requires that every student who receives special education services under the Act have a written IEP.

operation, the gap was significantly smaller in each subject area in 2013 than in 1992.

Finally, there was no measurable difference in the size of the gender gap favoring females in consumer services in 2013 versus 1992, nor in the size of the gender gap favoring males in construction.

FIGURE 8. Male-female gap in average credits public high school graduates earned in each career and technical education (CTE) subject area: 1992 to 2013



Rounds to zero.
NOTE: Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (1992 or 2013). Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h181.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88), First Follow-up and High School Transcript File; and High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

3 Does the participation of public high school graduates in CTE vary by their academic achievement at the start of high school?

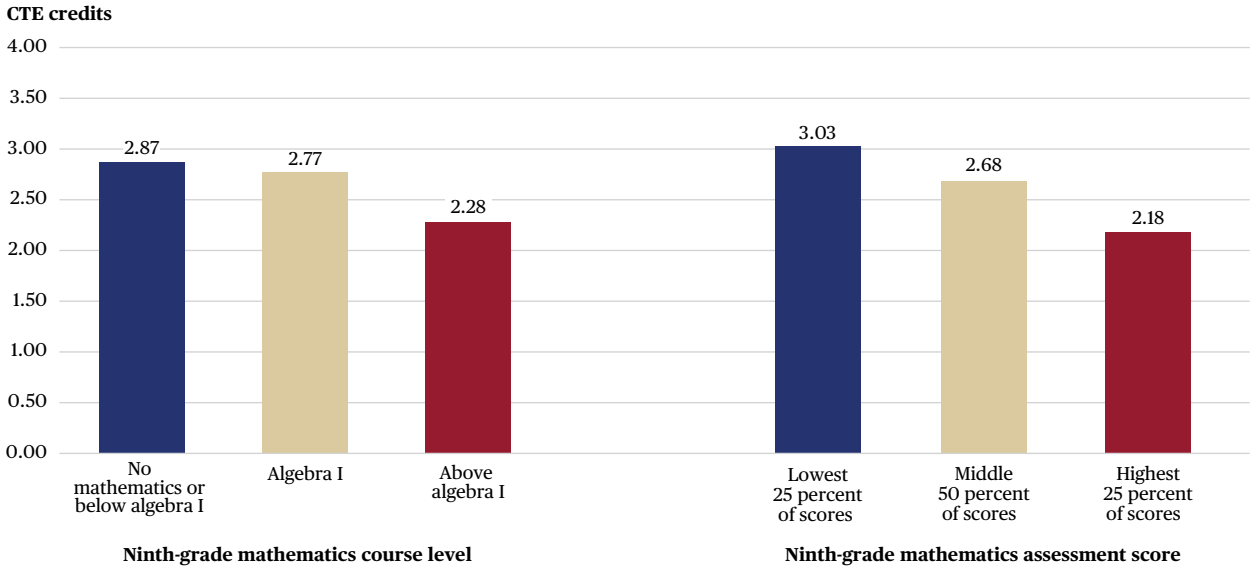
This section compares CTE coursetaking of public high school graduates who started high school with different levels of academic achievement, based on (1) the highest level mathematics course they took in grade 9 and (2) their scores on a mathematics assessment administered as part of the HSLS:09 base-year survey in grade 9.

As in past studies (e.g., Levesque et al. 2008), students who started high school at lower academic achievement levels were found to participate in CTE at higher levels than those who started at higher academic achievement levels (**FIGURE 9**). Specifically, graduates whose grade 9 mathematics course was either below algebra I or algebra I earned more CTE credits than their peers who took mathematics above algebra I in grade 9 (2.77 and 2.87 versus 2.28 credits, respectively.

Similarly, graduates who had lower grade 9 mathematics assessment scores completed more CTE credits than their peers who had higher scores. Graduates whose grade 9 mathematics score was in the lowest 25 percent of scores completed the most CTE credits, followed by graduates with scores in the middle 50 percent, then graduates with scores in the highest 25 percent (3.03, 2.68, and 2.18 credits, respectively).

Focusing on assessment scores, a negative relationship between initial academic achievement and CTE coursetaking was also found in most CTE subject areas (**FIGURE 10**).

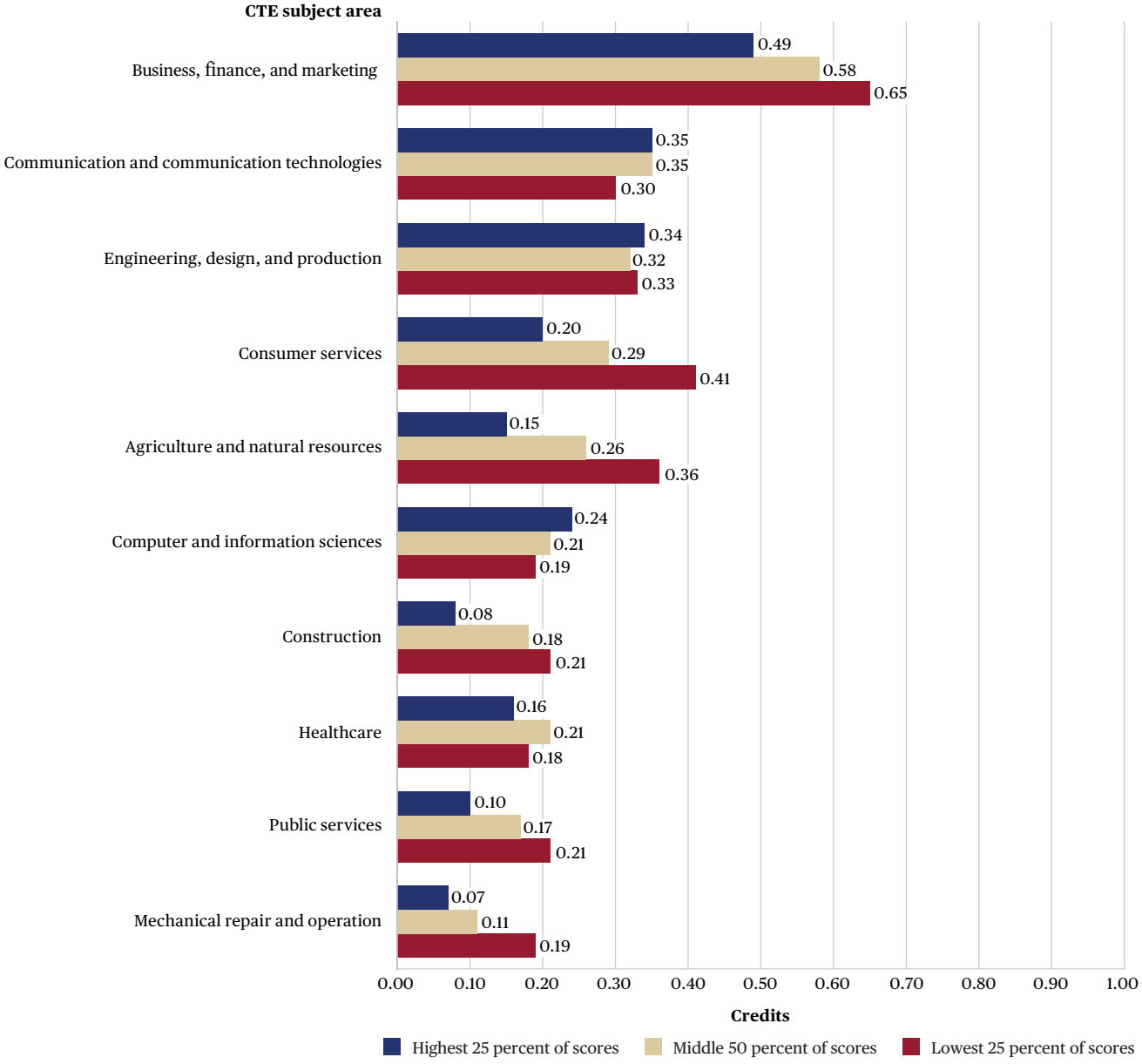
FIGURE 9. Average number of credits public high school graduates earned in career and technical education (CTE), by ninth-grade mathematics course level and ninth-grade mathematics assessment score: 2013



NOTE: Mathematics courses are ordered here in increasing level as basic mathematics, other (not advanced) mathematics, prealgebra, algebra I, geometry, algebra II, trigonometry, other advanced mathematics, probability and statistics, precalculus, and calculus. Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (2013). CTE credits are credits in these 10 subject areas: agriculture and natural resources; business, finance, and marketing; communications and communication technologies; computer and information sciences; construction; consumer services; engineering, design, and production; healthcare; mechanical repair and operation; and public services. The mathematics assessment was designed to measure student achievement in algebra. Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h195.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

However, among graduates who scored at different levels on the grade 9 mathematics assessment, no statistically significant differences were found for credits earned in engineering, design, and production or in healthcare. And graduates whose assessment score was in the highest 25 percent earned *more* credits in computer and information sciences than graduates whose score was in the lowest 25 percent (0.24 versus 0.19 credits, respectively).[11]

FIGURE 10. Average number of credits public high school graduates earned in each career and technical education (CTE) subject area, by ninth-grade mathematics assessment score: 2013



NOTE: Public high school graduates are defined as students who graduated from a public high school with an honors or standard diploma by August 31 of their scheduled graduation year (2013). The mathematics assessment was designed to measure achievement in algebra. Estimates and standard errors are available at https://nces.ed.gov/surveys/ctes/tables/h195.asp.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09), Base-Year, 2013 Update, and High School Transcript File.

[11] A similar pattern was found when looking at grade 9 mathematics coursetaking, except that there was no measurable relationship between that coursetakng and credits earned in computer and information sciences (see https://nces.ed.gov/surveys/ctes/tables/h195.asp).

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https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020010

More detailed information on CTE coursetaking at the high school and postsecondary levels can be found on the CTE Statistics website at https://nces.ed.gov/surveys/ctes and in the following NCES publications:

Career and Technical Education Coursetaking in 2013, by Locale (NCES 2019-099). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019099

Participation in High School Career and Technical Education and Postsecondary Enrollment (NCES 2018-043). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2018043

Participants in Subbaccaulaureate Occupational Education: 2012 (NCES 2018-149). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2018149

Trends in Subbaccalaureate Occupational Awards: 2003 to 2015 (NCES 2018-010). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2018010

Readers might also be interested in the following NCES products using HSLS:09, ELS:2002, and/or NELS:88:

Dual Enrollment: Participation and Characteristics (NCES 2019-176). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019176

Parent and Student Expectations of Highest Education Level (NCES 2019-015). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019015

Factors That Influence Student College Choice (NCES 2019-119). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019119

High School Students' Views on Who Influences Their Thinking About Education and Careers (NCES 2018-088). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2018088

Public High School Students' Use of Graduation, Career, or Education Plans (NCES 2017-111). https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2017111

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