



Career and Technical Education Credentials in Virginia High Schools: Trends in Attainment and College Enrollment Outcomes

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See <https://go.usa.gov/xfDK> for the full report.

Appendix A. About the study

This section provides additional information about the study. It begins with a description of the relevance of career and technical education (CTE) credentials and then describes the Virginia context, including information about the state's policies relevant to this study.

Relevance of career and technical education credentials

In recent years, states have rapidly increased their attention to policies on earning CTE credentials in high school (Education Strategy Group, Advance CTE, & Council of Chief State School Officers, 2018). From 2013 to 2015, 36 states adopted policies on such credentials (Association for Career and Technical Education & National Association of State Directors of Career Technical Education Consortium, 2014, 2015, 2016). By 2013, 42 states had K–12 pathways leading to CTE credentials (National Center for Education Statistics, 2016). In 2016, 11 states included attainment of industry-specific credentials in their school accountability systems as indicators of career readiness (Advance CTE, 2016).

States offering CTE credentials have reason to hypothesize that credentials will boost college enrollment and completion as well as improve workforce outcomes. Assessments that lead to industry credentials have the potential to signal to employers that individuals are prepared for entry-level employment (Bartlett, 2004). Because CTE credentialing assessments require students to demonstrate industry-specific levels of occupational skills and competencies, many states also see the potential for such assessments to add rigor to high school CTE programs and improve high school graduates' readiness for college and additional training.

The Virginia context

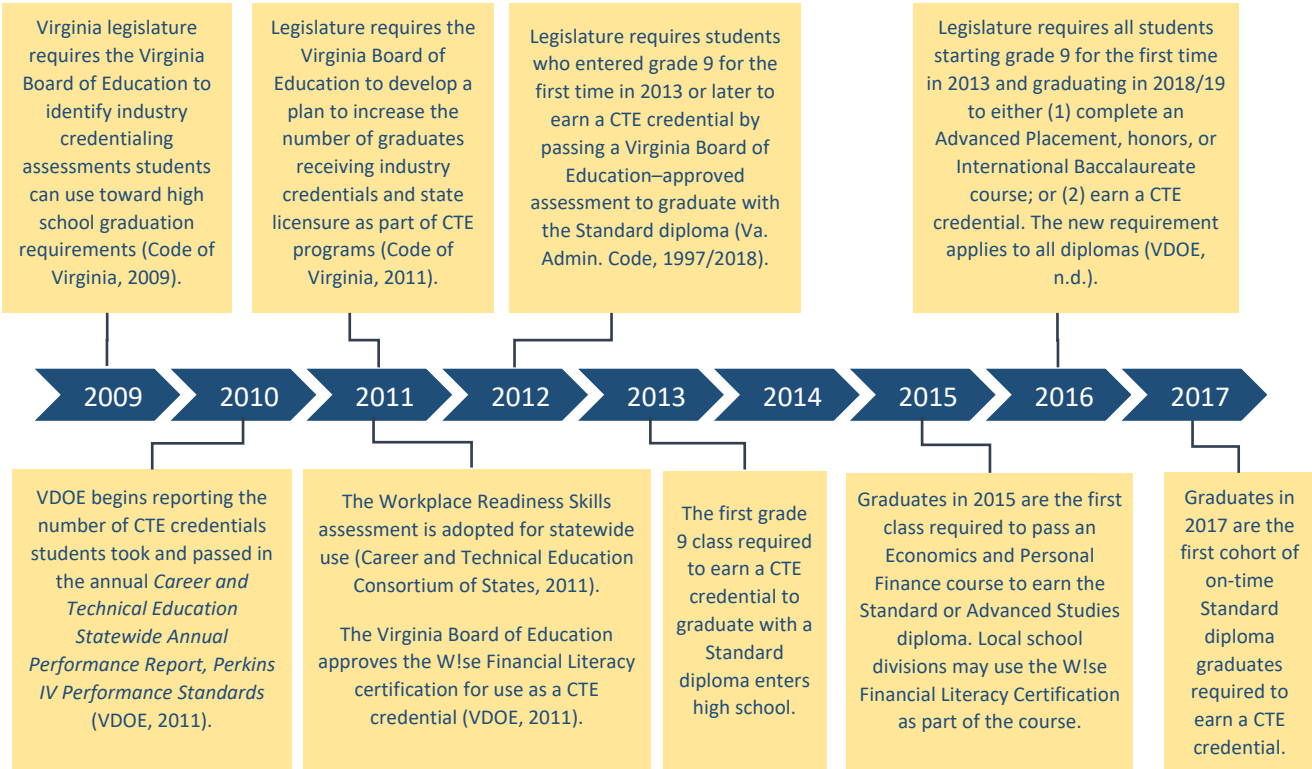
Previous research shows that high school graduates who earn Virginia's Standard diploma are less likely to enroll in, persist in, or complete college—including one-, two-, and four-year programs—compared with graduates who earn a college preparatory diploma (the Advanced Studies diploma). Research has shown this to be true for Standard diploma graduates who completed CTE programs of study (Jonas et al., 2014; Yamaguchi et al., 2014) and for Standard diploma graduates overall (Garland et al., 2011; Holian & Mokher, 2011; Jonas & Garland, 2014). For example, researchers estimated that, within four years of high school graduation, fewer than 8 percent of

Standard diploma graduates in the class of 2008 had earned any type of college credential, compared with 46 percent of Advanced Studies diploma graduates (Jonas & Garland, 2014).

In an economy in which most jobs require some type of college or training (Carnevale et al., 2013), the relatively low college enrollment and completion rates of graduates with the Standard diploma raise concerns about the value of this diploma. In response, Virginia joined states across the country looking to strengthen the college and career readiness of their high school graduates by adding CTE credentialing assessments to the requirements for earning the Standard diploma.

For several years, Virginia’s CTE education programs have offered students credentialing assessments and opportunities to earn state licensure in some programs. The state has conducted a long-term effort to increase the availability of these assessments in high school (figure A1). For example, legislation enacted in 2009 required the Virginia Board of Education to identify industry credentialing assessments that could substitute for assessments that were already required for graduation (Va. Code Ann., 1988/2009). Starting in the 2009/10 school year, the Virginia Department of Education (VDOE) began reporting the number of credentialing assessments that students took and passed in its annual *Career and Technical Education Statewide Annual Performance Report, Perkins IV Performance Standards* (VDOE, Office of Career and Technical Education Services, 2011). In 2011, the legislature required the Virginia Board of Education to develop a plan for increasing the number of graduates receiving industry credentials and state licensures as part of CTE programs. That same year, Virginia passed a law requiring students who entered grade 9 for the first time in 2013 or later to earn a CTE credential by passing a Virginia Board of Education–approved assessment to earn the Standard diploma (Va. Code Ann., 1999/2011).⁸

Figure A1. Timeline of major Virginia legislative, state board, and department of education activities related to career and technical education credentials, 2009–17



CTE is career and technical education. VDOE is the Virginia Department of Education.
 Note: The 2016 legislation does not apply to the graduates included in this study.
 Source: Authors’ compilation from the sources cited in the figure.

⁸ The Standard diploma is one of two federally recognized diplomas in Virginia. The other is the Advanced Studies diploma. See box 1 (key terms) in the main report for additional information on these two diplomas.

The rationale for this policy was in part to raise the bar on CTE knowledge and skills learned in high school and, by so doing, to strengthen the preparation of graduates with a Standard diploma for college and careers. In addition to viewing the CTE credential requirement as a way to increase graduates' attainment in workplace and technical skills (VDOE, Office of Career and Technical Education Services, 2016), the credentials can serve as a stepping-stone toward achieving more advanced certification that may require additional college education or training (VDOE, 2008). Adding the CTE credential as a graduation requirement to the Standard diploma was a substantial change in policy that affected the graduating class of 2017 and beyond, potentially requiring 40 percent of high school graduates (approximately 34,000 graduates annually) to earn a CTE credential (VDOE, n.d.).

Graduates can meet the CTE credential requirement by passing one of four types of Virginia Board of Education–approved assessments:

- Industry-specific credentials issued by a third party such as a business (for example, Cisco, Microsoft), trade association (for example, National Healthcareer Association), or industry group (for example, National Institute for Automotive Service Excellence). These parties provide an independent assessment of specific technical competencies and knowledge.
- State licensure examinations required for certain occupations (for example, Cosmetology Licensure Examination administered by the Virginia Board of Barbers and Cosmetology).
- National Occupational Competency Testing Institute assessments that measure the specific knowledge and skills needed for a particular occupation (for example, the Accounting-Basic or Accounting-Advanced assessment).
- The Virginia Workplace Readiness Skills assessment that measures general skills needed for employment.

References

- Advance CTE. (2016). *Credentials of value: State strategies for identifying and endorsing industry-recognized credentials*. <https://careertech.org/resource/credentials-of-value>
- Association for Career and Technical Education & National Association of State Directors of Career Technical Education Consortium. (2014). *State policies impacting CTE: 2013 year in review*. <https://careertech.org/resource/2013-state-policies-review>
- Association for Career and Technical Education & National Association of State Directors of Career Technical Education Consortium. (2015). *State policies impacting CTE: 2014 year in review*. <https://careertech.org/resource/2014-state-policies-review>
- Association for Career and Technical Education & National Association of State Directors of Career Technical Education Consortium. (2016). *State policies impacting CTE: 2015 year in review*. <https://careertech.org/resource/2015-state-policies-review>
- Bartlett, K. R. (2004). *The signaling power of occupational certification in the automobile service and information technology industries*. National Research Center for Career and Technical Education. <https://eric.ed.gov/?id=ED483201>
- Career and Technical Education Consortium of States. (2011). *CTECS Workplace Readiness Skills assessment*. <https://www.ctecs.org/tcfiles/COPmtg/CTECS%20Workplace%20Readiness%20Skills%20Assessment%20Initiative%20Brief.pdf>
- Carnevale, A. P., Smith, N., & Strohl, J. (2013). *Recovery: Job growth and education requirements through 2020*. Georgetown University, Georgetown Public Policy Institute, Center on Education and the Workforce. <https://eric.ed.gov/?id=ED584413>
- Education Strategy Group, Advance CTE, & Council of Chief State School Officers. (2018). *Credential currency: How states can identify and promote credentials of value*. <https://ccsso.org/resource-library/credential-currency-how-states-can-identify-and-promote-credentials-value>

- Garland, M., LaTurner, J., Ware Herrera, A., Ware, A., Jonas, D., & Dougherty, C. (2011). *High school predictors of college readiness: Determinants of developmental course enrollment and second year postsecondary persistence in Virginia*. Virginia Department of Education. <https://eric.ed.gov/?id=ED539120>
- Holian, L., & Mokher, C. (2011). *Estimating college enrollment rates for Virginia public high school graduates* (Issues & Answers Report, REL 2011–104). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Appalachia. <https://eric.ed.gov/?id=ED515839>
- Jonas, D. L., Garland, M., & Yamaguchi, R. (2014). *Following Virginia's career and technical education completers out of high school and into college: A study of high school graduates' college enrollment, persistence, and completion*. Virginia Department of Education. <https://vlds.virginia.gov/media/1016/ctepostsecondary.pdf>
- Jonas, D. L., & Garland, M. W. (2014). *Virginia's 2008 on-time graduation rate cohort: Four year college enrollment, persistence, and completion*. Center for Innovative Technology. https://vlds.virginia.gov/media/1015/final_ccr_report_on_enrollment_persistence_and_completion_may_9_2014_updated.pdf
- National Center for Education Statistics. (2016). Work readiness definitions, states offering high school diplomas with career specialization, and K–12 systems offering pathways to certification, licenses or credits for postsecondary education systems, by state: 2012–13 (Table 5.12). In *State education practices*. U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/statereform/tab5_12.asp
- Va. Admin. Code § 8VAC20-131-50 (1997 & rev. 2018). <https://law.lis.virginia.gov/admincode/title8/agency20/chapter131/section50/>
- Va. Code Ann. § 22.1-227.1 (1999 & rev. 2011). <https://law.lis.virginia.gov/vacode/22.1-227.1>
- Va. Code Ann. § 22.1-253.13:3 (1988 & rev. 2009). <https://law.lis.virginia.gov/vacode/22.1-253.13:3>
- Virginia Department of Education. (n.d.). *Detailed state, division and school cohort reports: Class of 2020 four-year reports; School divisions*. http://www.doe.virginia.gov/statistics_reports/graduation_completion/cohort_reports/index.shtml
- Virginia Department of Education. (2008). *Why credentialing in career and technical education in Virginia?* http://www.doe.virginia.gov/instruction/career_technical/path_industry_certification/cte_credentials/why_credential.pdf
- Virginia Department of Education, Office of Career and Technical Education Services. (2011). *Career and technical education statewide annual performance report: Perkins IV performance standards; School year 2009–2010*. http://www.doe.virginia.gov/instruction/career_technical/statistics_reports/annual_performance/2009-2010.pdf
- Virginia Department of Education, Office of Career and Technical Education Services. (2016). *Statewide annual performance report: School year 2014–2015*. http://www.doe.virginia.gov/instruction/career_technical/statistics_reports/annual_performance/2014-2015.pdf
- Yamaguchi, R., Garland, M., & Jonas, D. L. (2014). *Long-term outcomes of high school CTE completers in Virginia: Employment status and wages*. Virginia Department of Education. https://img1.wsimg.com/blobby/go/d37f4ea5-d437-4ee4-85ed-e71b2d52590e/downloads/1crr2n3uk_785386.pdf?ver=1635349533130

Appendix B. Methods

This section describes the study methods in more detail.

Data sources

This study used several student-level data elements from the Virginia Longitudinal Data System (VLDS; table B1). The VLDS is a federated data system that permits authorized users to merge de-identified state administrative data from multiple Virginia state agencies, including data from the Virginia Department of Education (VDOE), the State Council of Higher Education for Virginia (SCHEV), and the National Student Clearinghouse (NSC).

Table B1. Variables in the analysis

Variable	Description
Career and technical education (CTE) data	
CTE program of study completer	An indicator for whether a graduate completed a CTE program of study. For this study, a graduate completed a CTE program of study if they earned two or more standard credits toward a state-approved CTE program and were marked as a “CTE finisher” in the Virginia Longitudinal Data System (VLDS).
Result of exam	An indicator for whether a graduate passed the CTE credential exam. A graduate earned the credential if they passed the exam. Not all CTE exams have an associated course or require course completion.
CTE credential type	Categorical variable including the following: Industry, National Occupational Competency Testing Institute, state professional license, and Workplace Readiness Skills.
Graduate demographics	
Gender	Binary variable including male or female.
Race/ethnicity	Categorical variable including the following: White, Asian, Black, and Hispanic. Graduates in other racial/ethnic categories, including graduates who are of more than one race, are included in the analysis, but the results broken down by race/ethnicity are not presented for these groups because they make up less than 5 percent of the population. If a graduate had conflicting race records, the analysis used the most common race. Hispanic or Latino is defined as a person of Cuban, Mexican, Puerto Rican, South American, Central American, or other Spanish culture or origin, regardless of race. Black or African American is defined as a person having origins in any of the Black racial groups of Africa.
Federal program participation	
English learner status	Binary variable indicating whether a graduate was identified as an English learner student at any point while enrolled in a Virginia high school.
Economically disadvantaged status	Binary variable indicating whether a graduate was identified in economically disadvantaged circumstances at any point in a Virginia high school. A student in economically disadvantaged circumstances is one “who (1) is eligible for free or reduced-price meals, (2) receives Temporary Assistance for Needy Families (TANF), (3) is eligible for Medicaid, or (4) [is] identified as either migrant or experiencing homelessness at any point during the school year” (VLDS, 2020).
Special education status	Binary variable indicating whether a graduate was identified as being eligible to receive special education services at any point in a Virginia high school.
Academic achievement data	
Gifted	Binary variable indicating that a graduate was placed in the gifted program or was referred to and found eligible for the gifted program at any point while enrolled in a Virginia high school.
Algebra II proficiency	Categorical variable for a graduate’s proficiency level on the Algebra II state assessment that is taken when a student is enrolled in Algebra II. Virginia’s state assessments, called Standards of Learning assessments, have three proficiency levels. Scores of 0–399 are

Variable	Description
	classified as below proficient, scores of 400–499 are classified as proficient, and scores of 500–600 are classified as advanced proficient. Scores of 400–600 (proficient and advanced proficient) are considered passing scores (Virginia Department of Education, n.d.). The report uses two categories: proficient (a score of 400 or higher) and not proficient (a score of 399 or lower, including students who did not take the assessment).
Writing proficiency	Categorical variable for a graduate’s proficiency level on the grade 11 writing assessment. The proficiency levels are the same as those for Algebra II.
Graduation data	
Diploma type	Binary variable indicating whether a graduate earned a Standard or Advanced Studies diploma. If a graduate had records for multiple diploma types, Advanced diploma records were selected over Standard diploma records, and Standard diploma records were selected over the remaining types of diplomas. Students who earned neither a Standard nor an Advanced Studies diploma were not included in the analysis.
Graduation year	Year in which a graduate earned a diploma. If a graduate had graduation records from multiple years, the analysis used grade 12 records over other grades.
District and school ID	ID for the responsible district and school that a graduate attended upon graduation. District ID was used to identify the region a graduate was in.
College enrollment data	
Enrollment within first 12 months	Binary variable indicating whether a graduate enrolled in college within 12 months after high school graduation. College enrollment includes two- and four-year institutions, public and private institutions, and in-state and out-of-state institutions.
College type	Binary variable indicating whether a graduate was enrolled in a two- or four-year institution.

Note: All data came from the Virginia Longitudinal Data System (2010/11–2016/17).

Source: Authors’ analysis and the Virginia Longitudinal Data System (2020) *Data Dictionary*.

There were no missing values in any of the demographic, course record, or CTE data. VDOE regularly conducts automated validity checks throughout data collection, a process that minimizes or eliminates missing data on demographic characteristics. For example, the data verification process requires records to include information about race/ethnicity, gender, and other demographic variables. Further, all students who take state assessments have data included in the state data system. Therefore, if a record lacks assessment data, either the graduate did not take the test or there is a data error, but this does not necessarily mean that data are missing. For example, graduates who do not take the Algebra II assessment can still earn a Standard diploma. A record therefore can be complete even if there is no score on the Algebra II assessment.

VDOE collects, analyzes, and reports these data as part of state and federal accountability requirements, and the data are subject to audit. These reports include credentialing data, which Virginia includes in accountability reporting for CTE programs’ federal accountability. This combination of factors is typically associated with increased data quality (Jonas, 2015) and is likely to reduce error.

The dataset also included college enrollment records from SCHEV and the NSC that are linked to the K–12 data from VDOE. Graduates were considered to be enrolled if they appeared in either the SCHEV or NSC data, and graduates who did not appear in the data were assumed not to be enrolled. There could, however, be missing college enrollment records (if a graduate enrolled in college but does not show up in either source), but it is not possible to distinguish missing data from graduates who did not enroll in college.

The combination of NSC data and SCHEV data should include the vast majority of high school graduates who have enrolled in college, both in and out of state. The vast majority of Virginia high school graduates who attend college stay in state (Jonas, 2015), and SCHEV data capture these enrollments for public and private institutions. Previous analysis of NSC data suggested that the NSC data include 97.4 percent of all Virginia college-enrolled graduates

who were enrolled in-state as of 2011 (Dynarski et al., 2015). Additionally, NSC data capture approximately 4 percent more graduates than SCHEV each year (Jonas, 2015), and most of the increase is from graduates enrolled in colleges and universities outside of Virginia.

Sample and selection criteria

The study population consisted of all Virginia public high school graduates who received either the Standard or Advanced Studies diploma between 2011 and 2017. Although the policy that added a CTE credential requirement to the Standard diploma first applied to students who graduated on time in 2017, the analyses included earlier years and other diploma types to capture overarching trends in CTE credentials. VDOE did not start collecting student-level CTE credential data until the 2007/08 school year, when it began collecting a snapshot of these data at the end of each year. Thus, the 2011 graduating class is the first cohort for which the CTE credential data are complete. The study runs through the 2017 graduating class, as those graduates were the first to complete high school with the new requirement in place and 2017 was the last year with complete data at the time of the analyses. Between 2011 and 2017, there were 246,819 Standard diploma graduates and 330,006 Advanced Studies diploma graduates.

Analysis plan

This study used a descriptive approach to address the research questions, as detailed in this section. Using straightforward numbers provides stakeholders with the status of the population in terms of demographic characteristics and high school outcomes and helps frame the results of the study in the context of the graduate population at each time point. Further, because the sample includes the universe of graduates in the target population during the period being studied, one can reasonably take a population perspective of these data rather than treat them as a sample.⁹

Research question 1

To answer research question 1, the study team calculated the percentage of high school graduates who earned any type of CTE credential, by diploma type and graduate cohort, as shown in the equation below.

$$P1a_{dc} = \frac{N_{CTE\ credential,dc}}{N_{dc}} \tag{B1}$$

$P1a_{dc}$ is the percentage of graduates with diploma type d ($d = \text{Standard, Advanced Studies}$) from cohort c ($c = 2011, \dots, 2017$) who earned any type of CTE credential.

The study team also calculated the percentage of high school graduates who earned each type of credential, by diploma type and graduate cohort, as shown in the equation below.

$$P1b_{idc} = \frac{N_{idc}}{N_{dc}} \tag{B2}$$

$P1b_{idc}$ is the percentage of graduates with diploma type d ($d = \text{Standard or Advanced Studies, Standard only, Advanced Studies only}$) from graduate cohort c ($c = 2011, \dots, 2017$) who earned CTE credential type i ($i = 1, \dots, 4$).

Next, the study team calculated the percentage of high school graduates who earned multiple CTE credentials, by graduate cohort and number of CTE credentials earned, as shown in the equation below.

$$P1c_{ndc} = \frac{N_{ndc}}{N_{dc}} \tag{B3}$$

⁹ Seastrom (2017) describes potential benefits and drawbacks of treating state administrative data as a population or a sample from which one can derive estimates for purposes of school accountability. Similar principles apply here.

$P1_{c,ndc}$ is the percentage of graduates with diploma type d ($d = \text{Standard, Advanced Studies}$) from graduate cohort c ($c = 2011, \dots, 2017$) who earned n ($n = 1, 2, 3, \text{ more than } 3$) CTE credentials.

Finally, the study team calculated the percentage of high school graduates who completed a CTE program of study, by diploma type and graduate cohort, as shown in the equation below.

$$P1d_{dc} = \frac{N_{\text{program of study},dc}}{N_{dc}} \quad (\text{B4})$$

$P1d_{dc}$ is the percentage of graduates with diploma type d ($d = \text{Standard, Advanced Studies}$) from graduate cohort c ($c = 2011, \dots, 2017$) who completed a CTE program of study.

Research question 2

To answer research question 2, the study team calculated the percentage of Standard diploma graduates earning any type of CTE credential, by characteristics and graduate cohort, as shown in the equation below.

$$P1_{sc} = \frac{N_{\text{CTE credential},sc}}{N_{sc}} \quad (\text{B5})$$

$P1_{sc}$ is the percentage of graduates who have the student-level characteristic s and were in graduate cohort c ($c = 2011, \dots, 2017$) who earned any type of CTE credential. The study team examined the following student-level characteristics:

- Demographics
 - Gender
 - Race/ethnicity
- Federal program participation
 - Economically disadvantaged status
 - English learner status
 - Special education status
- High school academic achievement
 - Gifted status
 - Outcomes on the state writing and Algebra II assessments

Research question 3

To answer research question 3, the study team calculated the percentage of graduates who enrolled in college, by diploma type and graduate cohort, as shown in the equation below.

$$P3a_{dc} = \frac{N_{\text{enrolled in college},dc}}{N_{dc}} \quad (\text{B6})$$

$P3a_{dc}$ is the percentage of graduates with diploma type d ($d = \text{Standard, Advanced Studies}$) from graduate cohort c ($c = 2011, \dots, 2017$) who enrolled in college.

The study team also calculated the percentage of graduates with at least one CTE credential who enrolled in college, by diploma type and graduate cohort, as shown in the equation below.

$$P3b_{dc} = \frac{N_{\text{enrolled in college},dc}}{N_{\text{CTE credential},dc}} \quad (\text{B7})$$

$P3b_{dc}$ is the percentage of CTE credential earners with diploma type d ($d = \text{Standard, Advanced Studies}$) from graduate cohort c ($c = 2011, \dots, 2017$) who enrolled in college. The study team computed similar percentages for the group of graduates who did not earn a CTE credential.

Next, the study team calculated the percentage of graduates who enrolled in college, by diploma type, number of CTE credentials earned, and graduate cohort, as shown in the equation below.

$$P3c_{ndc} = \frac{N_{\text{enrolled in college,ndc}}}{N_{ndc}} \quad (\text{B8})$$

$P3c_{ndc}$ is the percentage of graduates with diploma type d ($d = \text{Standard, Advanced Studies}$) from graduate cohort c ($c = 2011, \dots, 2017$) with n ($n = 1, 2, 3, \text{ more than } 3$) CTE credentials who enrolled in college.

In addition, the study team calculated the percentage of graduates who enrolled in college, by diploma type, credential type, and graduate cohort, as shown in the equation below.

$$P3d_{idc} = \frac{N_{\text{enrolled in college,idc}}}{N_{idc}} \quad (\text{B9})$$

$P3d_{idc}$ is the percentage of graduates with diploma type d ($d = \text{Standard, Advanced Studies}$) and CTE credential type i ($i = 1, \dots, 4$) from graduate cohort c ($c = 2011, \dots, 2017$) who enrolled in college.

Finally, the study team calculated the percentage of graduates who completed a CTE program of study who enrolled in college, by diploma type and graduate cohort, as shown in the equation below.

$$P3e_{pdc} = \frac{N_{\text{enrolled in college,pdc}}}{N_{pdc}} \quad (\text{B10})$$

$P3e_{pdc}$ is the percentage of graduates with program of study completer status p ($p = 0, 1$) with diploma type d ($d = \text{Standard, Advanced Studies}$) from graduate cohort c ($c = 2011, \dots, 2017$) who enrolled in college. The study team computed similar percentages for the group of graduates who did not complete a CTE program of study.

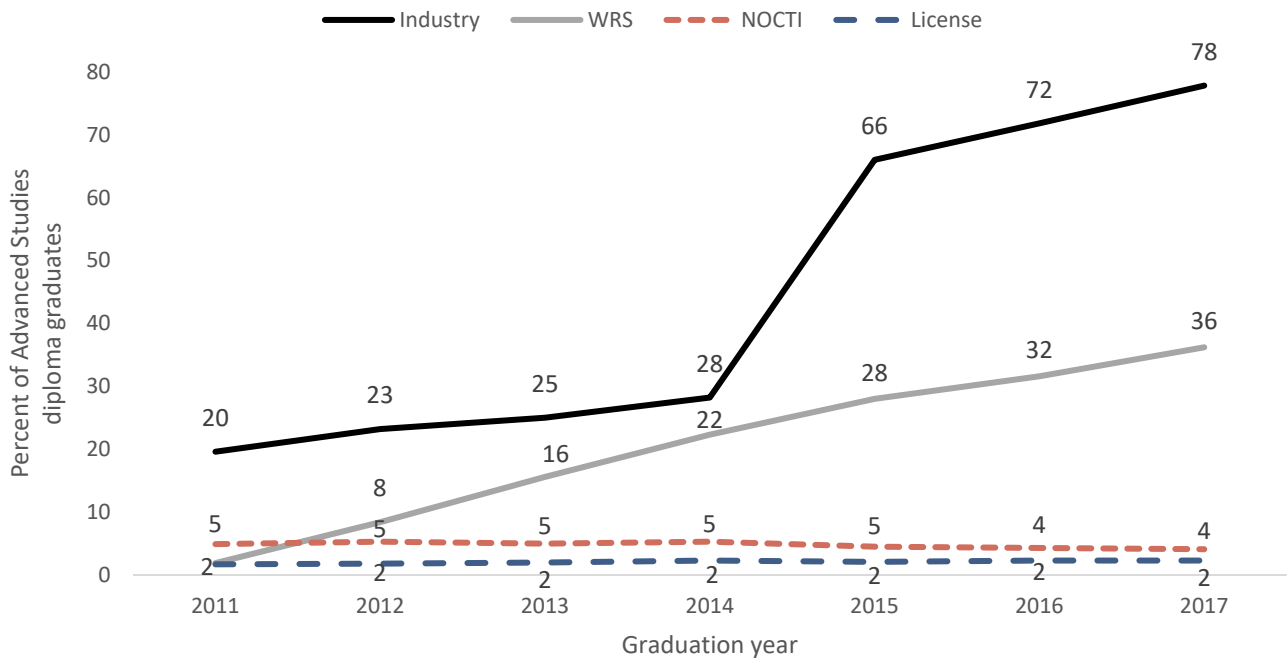
References

- Dynarski, S. M., Hemelt, S. W., & Hyman, J. M. (2015). The missing manual: Using National Student Clearinghouse data to track postsecondary outcomes. *Educational Evaluation and Policy Analysis*, 37(1S), 53S–79S. <https://doi.org/10.3102%2F0162373715576078>
- Jonas, D. (with Goldschmidt, W., & Garland, M.). (2015). *Researchers guide to using VLDS* (Version 1.1). Virginia Department of Education. <https://vlds.virginia.gov/media/1051/researchersguidevldsversion11.docx>
- Seastrom, M. (2017). *Best practices for determining subgroup size in accountability systems while protecting personally identifiable student information* (IES 2017–147). U.S. Department of Education, Institute of Education Sciences. <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2017147>
- Virginia Department of Education. (n.d.). *SOL test scoring and performance reports*. <http://www.pen.k12.va.us/testing/scoring/index.shtml>
- Virginia Longitudinal Data System. (2020). *VLDS data dictionary*. <https://vlds.virginia.gov/insights>

Appendix C. Supporting analyses

This appendix includes results for Advanced Studies diploma graduates and other supporting analyses relevant to Standard diploma graduates. Stakeholders may be interested in comparing the results for Advanced Studies diploma graduates to those of Standard diploma graduates, or they may find value in better understanding how credential-earning and college enrollment rates have changed over time for this group of graduates.

Figure C1. The percentage of Advanced Studies diploma graduates who earned an industry or Workplace Readiness Skills credential increased annually from 2011 to 2017, but there was little to no change in the percentage who earned a credential from a state professional license or the National Occupational Competency Testing Institute



NOCTI is the National Occupational Competency Testing Institute. WRS is Workplace Readiness Skills.

Note: Percentages can total to more than 100 percent each year because graduates can earn multiple credentials. The Virginia Department of Education's definition of industry credentials includes broad CTE credentials that apply to a wide range of occupations and industries and narrowly aligned credentials that support preparation for a specific occupation or industry.

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C1. Percentage of Standard diploma graduates, by characteristic, 2011–17

Characteristic	2011	2012	2013	2014	2015	2016	2017
Female	45	44	44	44	44	44	44
Asian	4	3	4	4	4	4	3
Black	33	33	31	31	30	31	31
Hispanic	10	11	12	12	13	13	15
White	50	50	49	50	49	47	46
English learner	9	10	11	8	9	10	10
Economically disadvantaged	51	52	54	56	57	59	61
Gifted	10	10	11	11	9	8	5
Receiving special education services	19	19	19	20	20	21	23
Proficient in Algebra II	39	33	26	27	30	32	33
Proficient in writing	96	96	96	93	91	91	91
Total number of Standard diploma graduates	36,456	35,703	35,232	34,383	33,757	35,678	35,603

Note: For binary characteristics (all characteristics other than race/ethnicity), the table shows the results for only one of the two groups because the values for the two groups always sum to 100 percent.

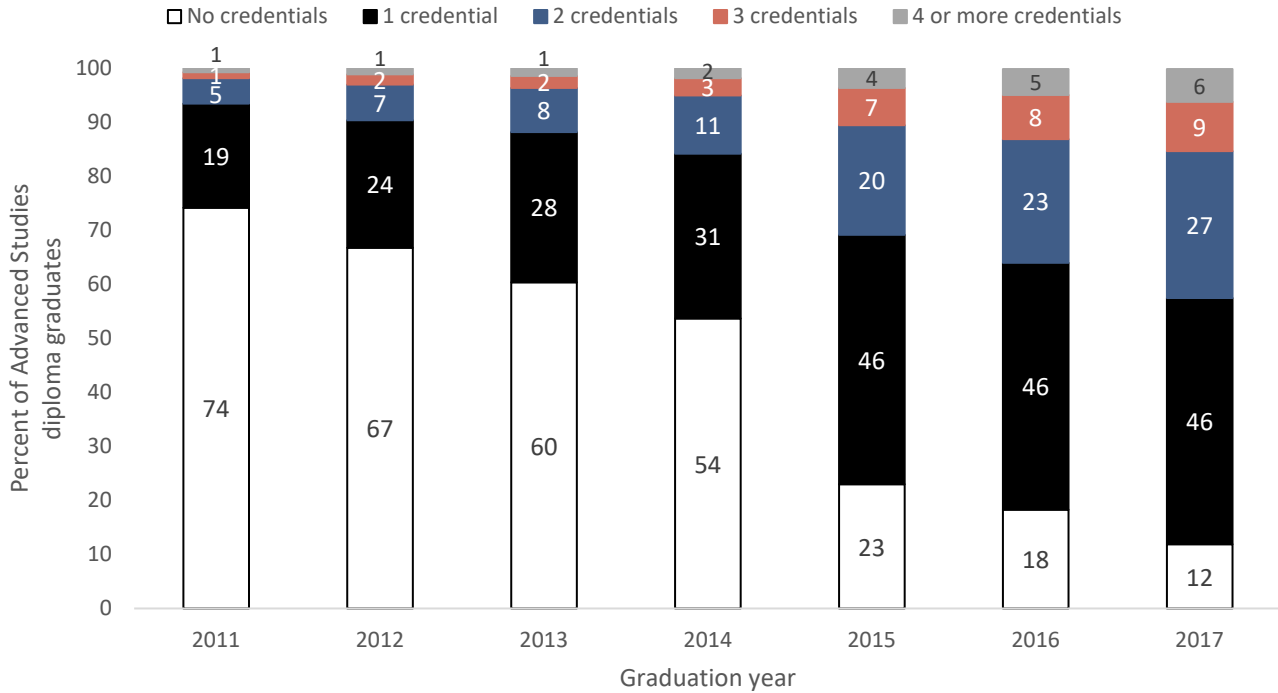
Source: Authors' calculations using data from the Virginia Longitudinal Data System

Table C2. Number of Standard diploma graduates who earned each credential type, 2011–17

Credential type	2011	2012	2013	2014	2015	2016	2017
Industry	6,010	7,060	7,598	8,638	18,072	21,190	26,237
Workplace Readiness Skills	637	2,792	4,817	6,794	9,007	10,169	14,466
National Occupational Competency Testing Institute	1,438	1,480	1,567	1,644	1,542	1,544	1,468
Professional license	1,018	861	977	1,167	962	1,109	1,075

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Figure C2. The percentage of Advanced Studies diploma graduates who earned one or more career and technical education credentials increased annually from 2011 to 2017, but most graduates who earned a credential earned only one credential



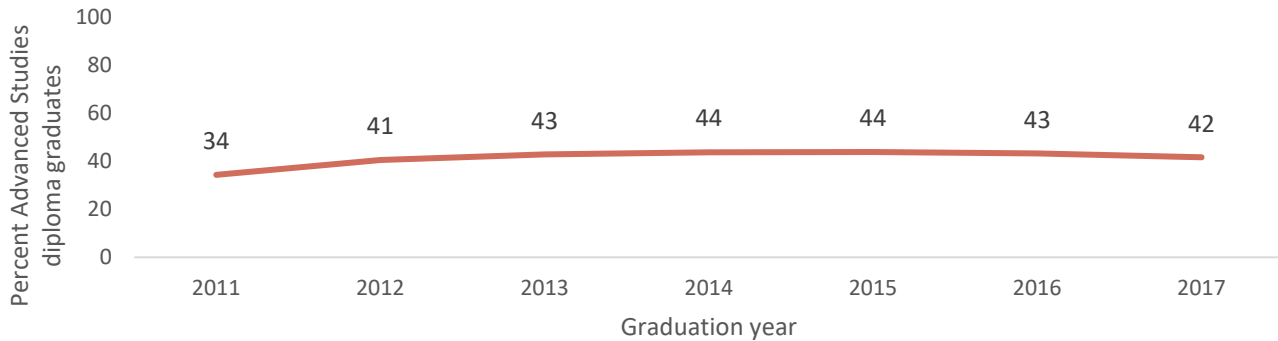
Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C3. Number of Standard diploma graduates by number of credentials earned, 2011–17

Number of credentials	2011	2012	2013	2014	2015	2016	2017
None	28,055	25,006	22,758	19,607	11,240	10,321	3,116
One	6,482	7,890	8,906	10,148	13,552	14,592	19,075
Two	1,374	2,013	2,581	3,221	6,096	7,090	9,085
Three	305	502	603	893	1,875	2,345	2,714
Four or more	242	295	384	515	994	1,330	1,614

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Figure C3. The percentage of Advanced Studies diploma graduates who completed a career and technical education program of study increased from 2011 to 2014 but decreased in 2016 and 2017



Note: A graduate completed a career and technical education (CTE) program of study after they finished a CTE sequence of courses and were marked as a "CTE finisher" in the Virginia Longitudinal Data System.

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C4. Percentage of Standard diploma graduates who earned each type of credential, by characteristic, 2011 and 2017

Characteristic	Industry 2011	Industry 2017	WRS 2011	WRS 2017	NOCTI 2011	NOCTI 2017	Professional license 2011	Professional license 2017
Gender								
Female	14	71	2	41	4	4	6	5
Male	19	76	2	41	4	4	0	1
Race/ethnicity								
Asian	17	74	1	37	3	2	2	1
Black	14	71	1	37	2	3	3	2
Hispanic	12	67	1	41	2	2	3	2
White	19	78	2	43	6	6	3	5
Federal program participation								
English learner	13	63	2	33	1	1	2	1
Non-English learner	17	75	2	42	4	5	3	3
Economically disadvantaged	15	72	2	39	3	4	3	3
Non-economically disadvantaged	18	77	2	44	5	5	3	3
Received special education services	15	66	1	38	3	3	2	2
Did not receive special education services	17	76	2	41	4	5	3	3
Academic achievement measures								
Gifted	18	75	1	44	4	5	2	3
Non-gifted	16	74	2	40	4	4	3	3
Proficient in Algebra II	20	80	2	44	5	5	3	4
Not proficient in Algebra II	14	70	1	39	3	4	3	3
Proficient in writing	17	75	2	41	4	4	3	3
Not proficient in writing	9	60	1	34	2	2	1	2

NOCTI is the National Occupational Competency Testing Institute. WRS is Workplace Readiness Skills.

Note: Percentages can total to more than 100 percent each year within a group because graduates can earn multiple credentials. The Virginia Department of Education's definition of industry credentials includes broad CTE credentials that apply to a wide range of occupations and industries and narrowly aligned credentials that support preparation for a specific occupation or industry. Federal program participation refers to graduates who participated in or were eligible for federal programs for English learner students, students who were in economically disadvantaged circumstances, or students who received special education services at any point during their enrollment in a Virginia high school. Although the career and technical education (CTE) credential requirement first applied to 2017 Standard diploma graduates, there are a few possible reasons the data may show they did not earn a credential. Some graduates may have started high school before the requirement went into effect but did not graduate until 2017, so they were not subject to the requirement. Graduates may also have had an exemption determined in their Individualized Education Program (for students who received special education services), or they may have transferred into Virginia public schools during grade 12 and met prescribed conditions, which may allow the use of the Student Competency Record (a record for keeping track of progress when traditional grades do not provide adequate documentation of achievement in competency-based education; Virginia Department of Education, 2016).

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C5. Percentage of Standard diploma graduates who earned one, two, three, or four or more credentials, by characteristic, 2011 and 2017

Characteristic	One credential 2011	One credential 2017	Two credentials 2011	Two credentials 2017	Three credentials 2011	Three credentials 2017	Four or more credentials 2011	Four or more credentials 2017
Gender								
Female	19	57	3	25	1	7	0	3
Male	17	51	4	26	1	8	1	6
Race/ethnicity								
Asian	17	56	3	23	1	6	1	3
Black	15	57	3	24	1	6	0	2
Hispanic	14	59	2	22	1	5	0	2
White	21	49	5	28	1	10	1	7
Federal program participation								
English learner	13	63	2	16	1	3	1	2
Non-English learner	18	53	4	27	1	8	1	5
Economically disadvantaged	17	55	3	24	1	7	0	4
Non-economically disadvantaged	19	51	4	27	1	9	1	6
Received special education services	16	56	3	21	1	6	1	3
Did not receive special education services	18	53	4	27	1	8	1	5
Academic achievement measures								
Gifted	17	52	4	27	1	9	1	6
Non-gifted	18	54	4	25	1	8	1	4
Proficient in Algebra II	21	50	5	30	1	9	1	6
Not proficient in Algebra II	16	56	3	23	1	7	1	4
Proficient in writing	18	53	4	26	1	8	1	5
Not proficient in writing	9	60	2	17	0	3	0	2

Note: Federal program participation refers to graduates who participated in or were eligible for federal programs for English learner students, students who were in economically disadvantaged circumstances, or students who received special education services at any point during their enrollment in a Virginia high school. Although the career and technical education (CTE) credential requirement first applied to 2017 Standard diploma graduates, there are a few possible reasons the data may show they did not earn a credential. Some graduates may have started high school before the requirement went into effect but did not graduate until 2017, so they were not subject to the requirement. Graduates may also have had an exemption determined in their Individualized Education Program (for students who received special education services), or they may have transferred into Virginia public schools during grade 12 and met prescribed conditions, which may allow the use of the Student Competency Record (a record for keeping track of progress when traditional grades do not provide adequate documentation of achievement in competency-based education; Virginia Department of Education, 2016).

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C6. Percentage of Standard diploma graduates who completed a career and technical education program of study, by characteristic, 2011–17

Characteristic	2011	2012	2013	2014	2015	2016	2017
Gender							
Female	46	53	55	55	54	53	51
Male	49	56	60	59	60	59	57
Race/ethnicity							
Asian	41	47	48	45	48	44	44
Black	48	57	59	58	58	57	54
Hispanic	44	50	49	50	49	48	46
White	50	55	60	60	60	59	58
Federal program participation							
English learner	44	47	49	47	49	45	44
Non–English learner	48	56	58	58	58	58	55
Economically disadvantaged	49	55	59	58	58	56	55
Non–economically disadvantaged	47	54	56	56	55	56	53
Received special education services	50	55	58	57	55	55	53
Did not receive special education services	48	55	57	58	58	57	54
Academic achievement measures							
Gifted	40	46	50	49	51	48	49
Non-gifted	49	56	58	58	58	57	54
Proficient in Algebra II	47	54	56	55	54	54	52
Not proficient in Algebra II	48	55	58	58	58	57	55
Proficient in writing	48	55	58	58	58	57	55
Not proficient in writing	36	38	41	50	51	51	49
Total number of graduates	36,458	35,706	35,232	34,384	33,757	35,678	35,604

Note: Federal program participation refers to graduates who participated in or were eligible for federal programs for English learner students, students who were in economically disadvantaged circumstances, or students who received special education services at any point during their enrollment in a Virginia high school. Although the career and technical education (CTE) credential requirement first applied to 2017 Standard diploma graduates, there are a few possible reasons the data may show they did not earn a credential. Some graduates may have started high school before the requirement went into effect but did not graduate until 2017, so they were not subject to the requirement. Graduates may also have had an exemption determined in their Individualized Education Program (for students who received special education services), or they may have transferred into Virginia public schools during grade 12 and met prescribed conditions, which may allow the use of the Student Competency Record (a record for keeping track of progress when traditional grades do not provide adequate documentation of achievement in competency-based education; Virginia Department of Education, 2016).

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C7. Difference in the credential earning rate between various groups of graduates, 2011–17

Group comparison	2011	2012	2013	2014	2015	2016	2017
Male – female	1	1	2	1	2	3	0
White – Asian	7	11	14	13	6	12	5
White – Black	9	10	11	11	12	14	4
White – Hispanic	11	15	18	15	10	12	5
Non–English learner – English learner	7	11	14	20	17	19	10
Non–economically disadvantaged – economically disadvantaged	4	5	5	5	9	10	3
Did not receive special education services – received special education services	4	6	9	10	11	10	7
Gifted – non-gifted	1	2	1	5	11	9	3
Proficient in Algebra II – not proficient in Algebra II	7	11	10	9	13	14	5
Proficient in writing – not proficient in writing	12	18	23	22	24	22	10

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C8. Percentage of Standard diploma graduates who enrolled in college within 12 months of graduating, by characteristic, 2011–17

Characteristic	2011	2012	2013	2014	2015	2016	2017	Change from 2011 to 2017
Gender								
Female	51	50	52	52	50	49	48	-3
Male	43	41	42	42	41	39	38	-5
Race/ethnicity								
Asian	66	63	68	69	68	67	66	0
Black	48	47	48	48	45	44	43	-5
Hispanic	41	40	43	43	43	40	38	-3
White	45	44	44	44	43	42	42	-3
Federal program participation								
English learner	45	44	46	48	48	46	42	-3
Non-English learner	47	45	46	46	44	43	42	-4
Economically disadvantaged	41	40	41	41	39	38	37	-4
Non-economically disadvantaged	52	51	53	53	52	52	51	-1
Received special education services	45	45	45	44	44	44	41	-4
Did not receive special education services	47	45	47	46	45	43	43	-4
Academic achievement measures								
Gifted	62	62	66	63	61	57	52	-10
Non-gifted	45	43	44	44	43	42	42	-3
Proficient in Algebra II	59	58	60	60	59	57	57	-2
Not proficient in Algebra II	38	39	42	41	39	37	35	-3
Proficient in writing	47	46	47	47	46	44	44	-3
Not proficient in writing	33	31	34	33	34	34	31	-2
Total number of graduates	36,458	35,706	35,232	34,384	33,757	35,678	35,604	

Note: Federal program participation refers to graduates who participated in or were eligible for federal programs for English learner students, students who were in economically disadvantaged circumstances, or students who received special education services at any point during their enrollment in a Virginia high school.

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

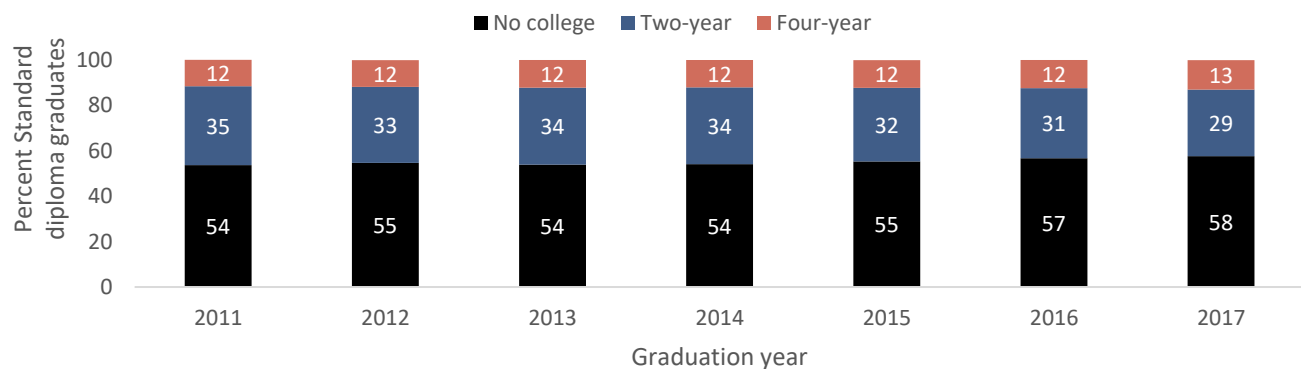
Table C9. Percentage of Advanced Studies diploma graduates who enrolled in college during within 12 months of graduating, by characteristic, 2011–17

Characteristic	2011	2012	2013	2014	2015	2016	2017	Change from 2011 to 2017
Gender								
Female	89	88	89	89	89	89	89	1
Male	87	86	85	85	86	85	85	-2
Race/ethnicity								
Asian	89	91	92	92	92	92	93	4
Black	85	84	85	84	86	85	85	0
Hispanic	79	79	80	81	82	82	82	3
White	89	89	89	89	89	88	88	-1
Federal program participation								
English learner	86	85	84	81	79	79	81	-4
Non-English learner	88	87	88	88	88	88	87	0
Economically disadvantaged	79	78	78	79	79	79	79	1
Non-economically disadvantaged	90	90	90	90	91	90	90	0
Received special education services	86	87	87	88	88	86	87	1
Did not receive special education services	88	87	88	88	88	87	87	0
Academic achievement measures								
Gifted	91	91	91	91	92	91	91	0
Non-gifted	86	85	85	85	85	85	86	0
Proficient in Algebra II	88	88	89	89	89	88	88	0
Not proficient in Algebra II	77	77	79	81	79	80	80	3
Proficient in writing	88	87	88	88	88	87	87	-1
Not proficient in writing	72	81	79	77	75	79	79	7
Total number of graduates	45,594	46,439	46,980	46,954	46,915	48,381	48,743	

Note: Federal program participation refers to graduates who participated in or were eligible for federal programs for English learner students, students who were in economically disadvantaged circumstances, or students who received special education services at any point during their enrollment in a Virginia high school.

Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Figure C4. The percentage of Standard diploma graduates who enrolled in a two-year college within 12 months of graduating decreased from 2011 to 2017, while the percentage enrolling in a four-year college remained relatively stable



Note: College enrollment includes two- and four-year institutions, public and private institutions, and in-state and out-of-state institutions. If graduates had records at both two- and four-year colleges, they were classified as enrolling in a four-year college. The number of Standard diploma graduates, by year from 2011 to 2017, was 36,458 in 2011, 35,706 in 2012, 35,238 in 2013, 34,384 in 2014, 33,757 in 2015, 35,678 in 2016, and 35,604 in 2017.

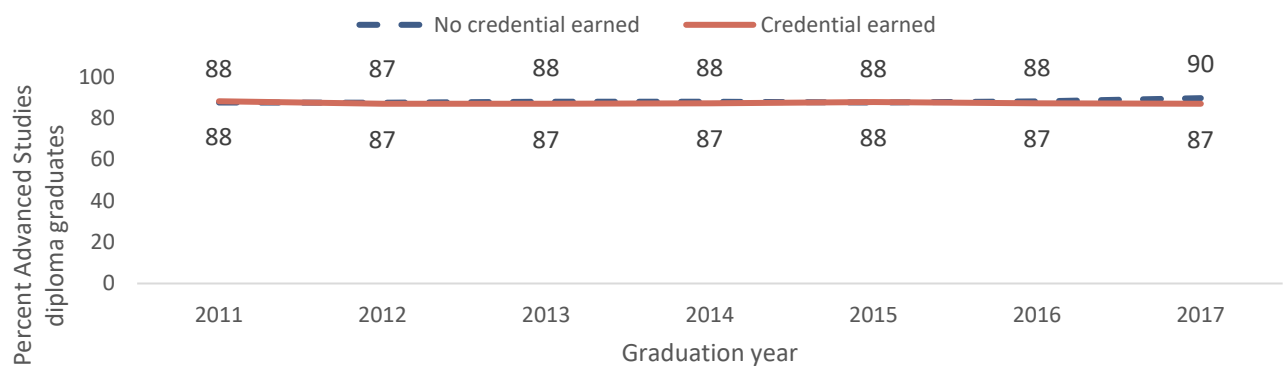
Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C10. Percentage of graduates who enrolled in college within 12 months of graduating, with and without graduates who received special education services, 2011–17

Graduate group	2011	2012	2013	2014	2015	2016	2017
Standard diploma graduates without graduates who received special education services	47	45	47	46	45	43	43
Standard diploma graduates with graduates who received special education services	46	45	46	46	45	43	42
Advanced Studies diploma graduates without graduates who received special education services	88	87	88	88	88	87	87
Advanced Studies diploma graduates with graduates who received special education services	88	87	88	88	88	87	87

Note: College enrollment includes two- and four-year institutions, public and private institutions, and in-state and out-of-state institutions.
 Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Figure C5. The percentage of Advanced Studies diploma graduates who enrolled in college within 12 months of graduating was stable for both career and technical education credential earners and non-earners



Note: College enrollment includes two-year and four-year institutions, public and private institutions, and in-state and out-of-state institutions.
 Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Table C11. Percentage of Standard diploma graduates, by characteristic and by career and technical education credential attainment status, 2011–17

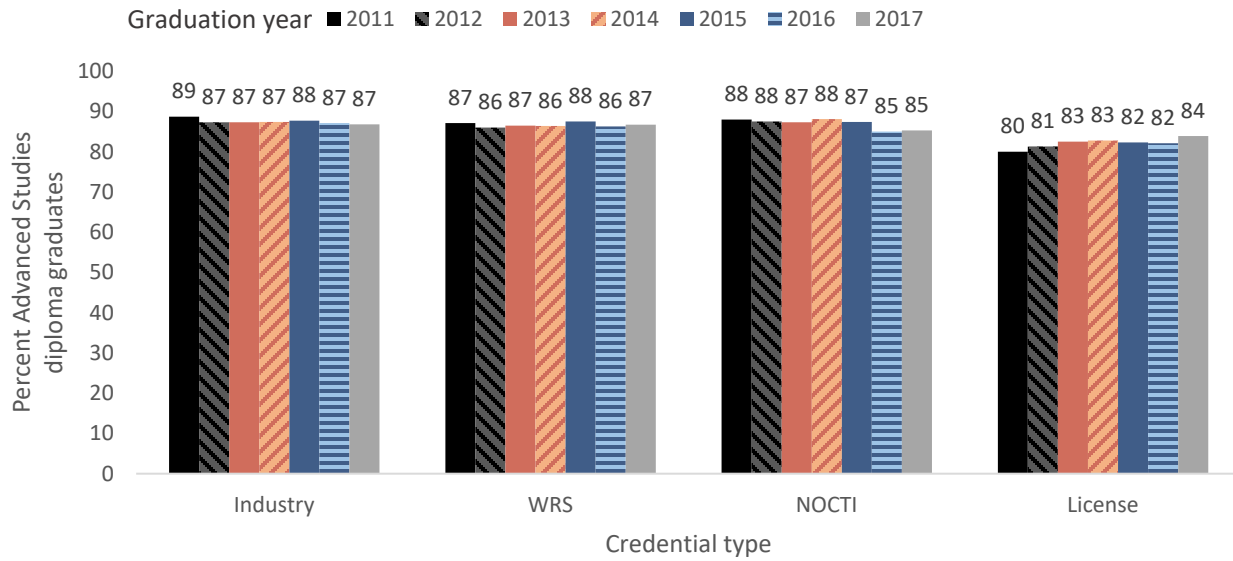
Characteristic	2011	2012	2013	2014	2015	2016	2017
Percent female							
Did not earn	45	45	45	44	46	46	44
Earned	44	43	43	44	43	43	44
Percent Asian							
Did not earn	4	4	4	4	4	4	5
Earned	3	3	3	3	4	3	3
Percent Black							
Did not earn	35	35	33	33	37	39	37
Earned	27	28	27	27	27	28	30
Percent Hispanic							
Did not earn	11	12	14	14	15	16	20
Earned	7	8	8	9	12	13	14
Percent White							
Did not earn	47	46	45	45	41	37	35
Earned	60	59	58	56	53	52	48
Percent English learner							
Did not earn	10	12	13	11	13	16	20
Earned	7	7	7	5	7	8	9
Percent economically disadvantaged							
Did not earn	52	54	56	58	64	67	70
Earned	47	49	51	52	53	56	60
Percent gifted							
Did not earn	10	10	11	10	7	6	4
Earned	11	11	11	12	11	9	6
Percent receiving special education services							
Did not earn	20	21	21	23	25	26	37
Earned	16	16	15	16	17	18	21
Percent proficient in Algebra II							
Did not earn	36	30	23	24	22	22	21
Earned	46	41	31	31	34	36	35
Percent proficient in writing							
Did not earn	95	95	95	91	86	84	81
Earned	98	99	99	96	94	94	92
Total number of graduates							
Did not earn	28,053	25,003	22,758	19,606	11,240	10,321	3,115
Earned	8,403	10,700	12,474	14,777	22,517	25,357	32,488

Table reads: “45 percent of Standard diploma graduates who did not earn a CTE credential were female and 44 percent of Standard diploma graduates who earned a CTE credential were female.”

Note: For binary characteristics such as gender, the table shows the results for only one of the two groups because the values for the two groups always sum to 100 percent. Although the career and technical education (CTE) credential requirement first applied to 2017 Standard diploma graduates, there are a few possible reasons the data may show they did not earn a credential. Some graduates may have started high school before the requirement went into effect but did not graduate until 2017, so they were not subject to the requirement. Graduates may also have had an exemption determined in their Individualized Education Program (for students who received special education services), or they may have transferred into Virginia public schools during grade 12 and met prescribed conditions, which may allow the use of the Student Competency Record (a record for keeping track of progress when traditional grades do not provide adequate documentation of achievement in competency-based education; Virginia Department of Education, 2016).

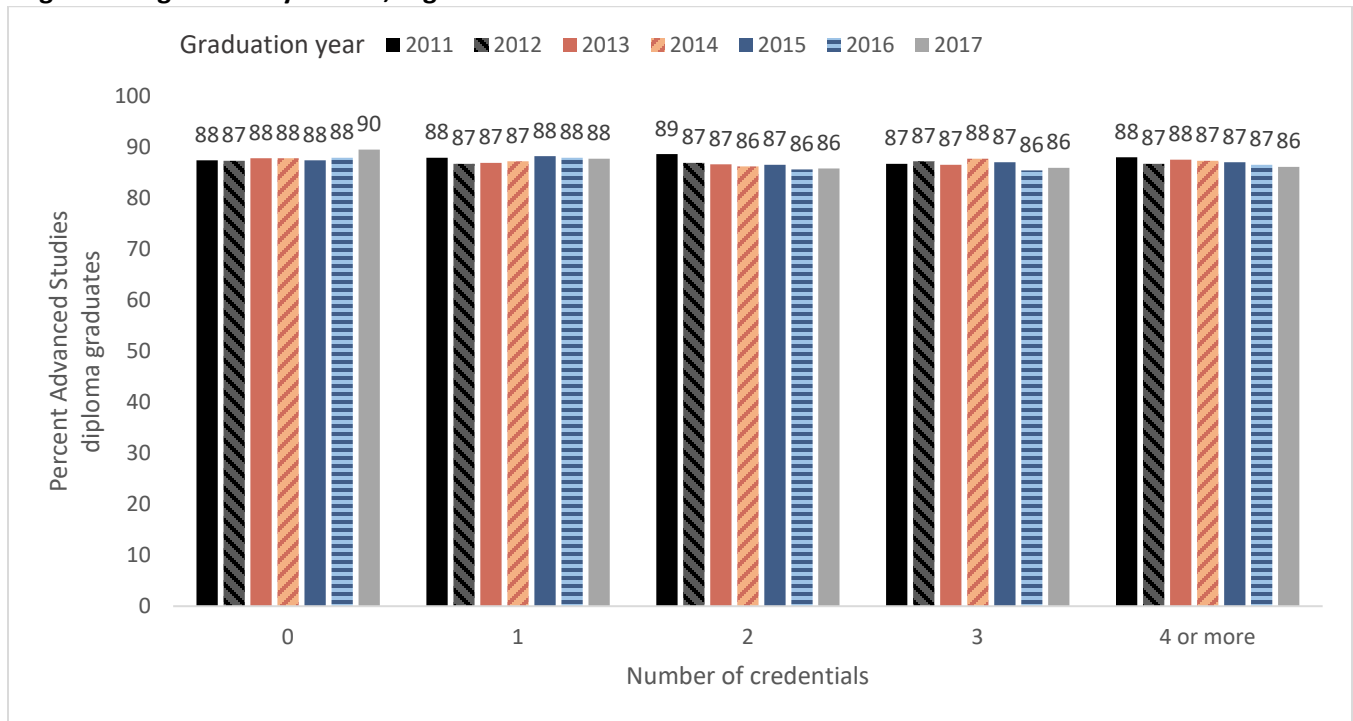
Source: Authors’ calculations using data from the Virginia Longitudinal Data System.

Figure C6. The percentage of Advanced Studies diploma graduates who enrolled in college within 12 months of graduating decreased from 2011 to 2017 for graduates earning an industry, Workplace Readiness Skill, or National Occupational Competency Testing Institute credential, while the enrollment rate increased for graduates who earned a professional license



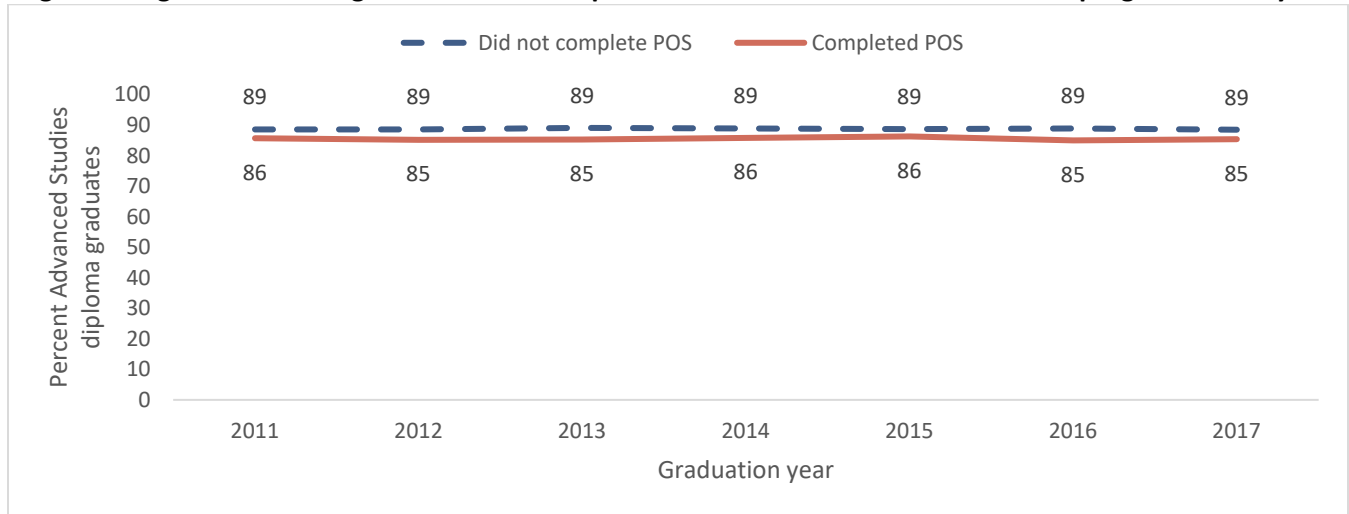
NOCTI is the National Occupational Competency Testing Institute. WRS is Workplace Readiness Skills.
 Note: College enrollment includes two- and four-year institutions, public and private institutions, and in-state and out-of-state institutions.
 Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Figure C7. The percentage of Advanced Studies diploma graduates who enrolled in college within 12 months of graduating was fairly similar, regardless of the number of credentials earned



Note: College enrollment includes two- and four-year institutions, public and private institutions, and in-state and out-of-state institutions.
 Source: Authors' calculations using data from the Virginia Longitudinal Data System.

Figure C8. The percentage of Advanced Studies diploma graduates who enrolled in college within 12 months of graduating was lower for graduates who completed a career and technical education program of study



POS is program of study.

Note: Graduates completed a career and technical education (CTE) program of study if they finished a CTE sequence of courses and were marked as a “CTE finisher” in the Virginia Longitudinal Data System. College enrollment includes two- and four-year institutions, public and private institutions, and in-state and out-of-state institutions.

Source: Authors’ calculations using data from the Virginia Longitudinal Data System.

Reference

Virginia Department of Education. (2016). *Career and technical education (CTE) credential graduation requirement: Frequently asked questions* (Attachment A, Supt’s Memo No. 296-16).

https://www.doe.virginia.gov/administrators/superintendents_memos/2016/296-16a.pdf