Washington State Auditor's Office

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Performance Audit

Workforce Development: Identifying CTE Student Outcomes

December 22, 2016

Washington spends more than $400 million annually for career and technical education (CTE) courses statewide, serving more than 300,000 high school students.

Washington possesses valuable information about its students, including statewide education and employment data. This data is collected by the Office of Superintendent of Public Instruction (OSPI), the Employment Security Division (ESD) and others, and is centrally administered by the Education Research and Data Center (ERDC). However, ERDC is subject to restrictions on how and by whom its data may be used, which are imposed by state and federal privacy laws or set out in data-sharing agreements with its partners.

In this audit, the first of two focused on the state's CTE program, we wanted to know what the state's data could tell us about the characteristics of high school students who participated in CTE courses and those who did not, and their achievements after graduation.

By following graduates' post-secondary paths, we found that by 2015:

- A higher percentage of CTE students enrolled in community or technical college, entered into an apprenticeship, or were employed, than non-CTE students.
- A lower percentage of CTE students had acquired a degree or certificate from a community or technical college or enrolled in a four-year university.
- Among graduates who did not enter higher education, CTE students were significantly more likely to achieve in terms of employment and apprenticeships.

Report Number: 1018364

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Note: The audit results presented here use confidential data from the Education Research and Data Center (ERDC), located within the Washington Office of Financial Management (OFM). The ERDC works with educators, policymakers and other partners to provide information and analysis from its statewide longitudinal data system; which includes de-identified information about people's preschool, educational, and workforce experiences. The views expressed here are those of the State Auditor's Office and do not represent those of OFM or other data contributors. Any errors in data interpretation or analyses are attributable to the State Auditor's Office.

State Auditor's Office contacts

State Auditor Troy Kelley
360-902-0370, Auditor@sao.wa.gov

Jan M. Jutte, CPA, CGFM – Deputy State Auditor
360-902-0360, Jan.Jutte@sao.wa.gov

Chuck Pfeil, CPA – Director of State & Performance Audit
360-902-0366, Chuck.Pfeil@sao.wa.gov

Christopher Cortines, CPA – Principal Performance Auditor
360-725-5431, Christopher.Cortines@sao.wa.gov

Carolyn Cato – Senior Performance Auditor
360-725-5551, Carolyn.Cato@sao.wa.gov

William Clark – Performance Auditor
360-725-5632, William.Clark@sao.wa.gov

To request public records

Public Records Officer
360-725-5617, PublicRecords@sao.wa.gov

Executive Summary

In 2014, Washington spent more than $400 million in state and federal funds on career and technical education (CTE). In high schools alone, more than 300,000 students across the state participated in CTE programs. CTE programs are meant to engage students in a wide variety of subjects, incorporating academic, career and technical skills to prepare students for life after high school. These programs are intended to be relevant to the interests of students, but also responsive to the needs of employers and the economy.

CTE course offerings are determined by school districts, but the Office of Superintendent of Public Instruction (OSPI) oversees and approves all CTE course curricula in the state. Given the money invested in CTE, and the importance of the programs to students and the state's economy, we asked this question:

- What are the education and employment outcomes of Washington's secondary students who concentrate in or complete a CTE program?

By examining data compiled by the Education Research and Data Center (ERDC), we traced the post-secondary experiences of the 2012 and 2013 graduating classes. Using five markers of achievement we identified as positive outcomes (summarized in the sidebar), we found that CTE and non-CTE students had similar overall rates of achievement after graduating from high school. For those who did not enroll in a four-year university or did not enroll in any type of college, CTE students had higher rates of achievement compared to non-CTE students.

Achievements include: persistent enrollment in a university or a community or technical college (CTC), certificates or degrees from a CTC, persistence in an apprenticeship, and living-wage employment.

Differences in student outcomes are affected by the different paths that CTE and non-CTE students take

To analyze the educational and employment outcomes of CTE students, we compared them with the outcomes of non-CTE students. Though CTE and non-CTE students appeared to have similar rates of positive post-secondary outcomes, we found that CTE students from the 2012 graduating class were 5 percent less likely to attain one or more achievements. However when we looked at 2012 graduates who did not attend a four-year university, CTE students were 11 percent more likely than non-CTE students to achieve, and 37 percent more likely to achieve among students who did not enroll in any higher education.

We also compared CTE and non-CTE students in terms of certain characteristics and experiences. Our analysis identified these differences for the 2012 and 2013 graduating classes:

All achievers in 2012 and 2013 graduating classes	CTE students	Non-CTE students
While in school, were more likely to be low income, have accommodations for a disability under a Section 504 plan, and have a lower GPA	X	
More likely to persist in an apprenticeship program	X	
More likely to persist in a community or technical college	X	
More likely to be employed	X	
More likely to receive a degree or certificate from a community or technical college, or persist in a four-year university		X

We found that CTE students as a group were more likely to come from low-income families, have accommodations for a disability under a Section 504 plan, and have a lower grade point average (GPA) than non-CTE students. However, we found a greater difference in these characteristics between high-achieving students and low-achieving students regardless of CTE status. Low-achieving students were also more likely to be enrolled in special education.

Making student data available to Washington's school districts could help them improve their CTE programs

We found that ERDC-managed datasets provide valuable insights into the paths students pursue and their achievements. We also found that these datasets can highlight important differences between the achievement and CTE status of students. Without this data, districts may not recognize whether their programs are successful at preparing graduates for the world after high school, or if those programs require improvement.

ERDC currently makes some of this data available to districts in the form of online reports at both the school and district levels. The more detailed data from ERDC that we used to make our assessments could further help districts assess their programs. OSPI and ERDC have an opportunity to make this more detailed data available and easier for school districts to use. This partnership approach is essential because some districts are likely too small to be able to invest the time and staff resources necessary to meet ERDC requirements for accessing the data; even larger districts may not have employees able to perform the necessary analysis to draw conclusions from the data once they have access to it. Furthermore, ERDC's own limited staff and competing priorities may restrict its ability to make this data easier and more available to use without OSPI's assistance.

Recommendations:

We recommend OSPI work with the ERDC to make student data more accessible for school districts to improve their CTE programs. Our suggestions include:

- Obtain and reformat ERDC data sets for easy use by school districts
- Make ERDC data openly available online in a format that conforms with ERDC privacy restrictions
- Help districts request ERDC data and complete data access agreements when more extensive data is requested

We also recommend OSPI consider ways it can support school districts' analyses of student outcomes data.

Introduction

Career and Technical Education (CTE) programs are a key component of the workforce development system in Washington. Secondary CTE programs (programs at middle schools, high schools and skill centers) introduce students to a wide variety of occupational and technical skills in an instructional setting. In the 2013-14 school year, Washington spent more than $400 million in state and federal funds on secondary CTE courses across the state, serving more than 300,000 high school students. In 2015, CTE courses were taught in 239 school districts, as well as at skill centers and on military bases.

The educational prerequisites for most occupations are growing increasingly complex and analysts in workforce preparation have reported that the gap between the skills young hires possess and estimated employer requirements is widening. Many Washington agencies have collaborated over the last five years to assess the needs of Washington's employers and the skills students need to be successful in postsecondary education and employment. The Office of Superintendent of Public Instruction (OSPI) and postsecondary educators have recognized that effective CTE curricula must incorporate 21st-century skills if schools are to adequately prepare students to become productive workers in fields that are actually growing. However, even as state agencies recognize these issues, individual school districts have considerable discretion over their CTE course offerings.

The 21st Century Skills Framework

The P21 Framework for 21st Century Learning was developed with input from educators, education experts, and business leaders to define and illustrate the skills, knowledge, expertise, and support systems that students need to succeed in work, life, and citizenship.

Source: **Partnership for 21st Century Learning**

Studying data around student achievement outcomes can help school districts better tailor CTE offerings

Education researchers have encountered several difficulties in establishing direct connections between CTE courses and workplace success, in part due to the varying definitions of what constitutes a CTE student. It is also challenging to effectively measure the impact of CTE courses on any one student's achievement, because many factors influence student success after graduation. Despite these limitations, student data already in the state's possession can reveal much about the relationship between secondary CTE programs and student outcomes.

The Education Research and Data Center (ERDC), housed in the Office of Financial Management, collects and maintains data on Washington students for research and reporting purposes, including postsecondary education and employment data. ERDC reports student outcomes at the statewide level, but has not performed an in-depth analysis of CTE student outcomes that takes postsecondary education, employment and apprenticeship into consideration. We wanted to see what could be learned about CTE student outcomes using the ERDC's data.

In our 2015 audit of Washington's workforce development system, we identified three key risks in the system: variations in local service delivery, varying degrees of engagement between employers and educators, and inconsistent quality of counseling to help students transfer into training and employment. We scoped this audit, and the one that follows in early 2017, based on those risks. The second audit will examine leading practices that could benefit our state's CTE program.

We designed this audit to answer this question:

- What are the education and employment outcomes of Washington's secondary students who concentrate in or complete a CTE program?

Background

Young workers in the 21st century require different skills than their parents or grandparents

Technical and vocational education was historically unrelated to academic educational tracks. For much of the 20th century, students in these classes were prepared for jobs in fields that were considered "blue collar" – construction or heavy industry, for example – while students on the academic track were prepared for universities and "white collar" jobs and professions. The requirements of the 21st century workplace have placed new demands on students who were once sure of well-paying jobs that required less formal education. Graduates are now expected to start work with a much more sophisticated skill set. For example, manual jobs such as auto mechanic now require familiarity with electronics or computer technology. Furthermore, today's graduates are also competing with workers in an increasingly globalized marketplace.

Secondary career and technical education gives students in middle schools and high schools a chance to sample instructional programs within career pathways, including agriculture, business, technology, health and more, while sometimes receiving college credit. These programs are intended to teach occupational and technical skills, often in a hands-on learning environment. Personal development is a cornerstone: courses should help students develop a solid work ethic and gain leadership skills while they prepare for jobs or further career training and education after high school.

Career and technical education (CTE) courses are structured to offer students flexibility while meeting academic standards. The latter has become increasingly important in light of Washington's 24-credit graduation requirements, which limit high school students to just four elective courses. Students are better able to take advantage of CTE course offerings when the content helps them gain the 17 core credits (out of the total 24 credits) they need to graduate (see **sidebar 1**). However, the state requires all students complete at least one credit in a CTE-aligned course in order to graduate; this credit is categorized as "occupational education" (defined in **sidebar 2**). Though occupational education courses must meet certain standards, they do not need to be an OSPI-approved CTE course or be taught by a CTE-certified instructor.

Career and technical education introduces students to the wide world of work

All CTE courses are approved by OSPI. They are designated as either **exploratory** or **preparatory**.

In **exploratory CTE courses**, students demonstrate foundational and occupation-specific skills required to meet current industry standards that are approved by local advisory councils or other nationally defined standards. Students also explore and demonstrate knowledge of career options within a related career cluster, and demonstrate leadership and employability skills. At a minimum, occupational education courses must meet the definition of an "exploratory" course. Examples of exploratory courses include *Photograph and Video Foundations, Digital Communications Tools,* and *Family Health.*

1. 'Two-for-one' classes help students meet core and CTE graduation requirements

When CTE courses are designed to also meet the 17 core credits necessary to graduate, more students are willing and able to pursue CTE programs and to successfully complete them.

2. How state law defines occupational education

"…A series of learning experiences designed to assist the student to acquire and demonstrate competency of skills… which are required for success in current and emerging occupations."

Preparatory CTE courses are technically intensive and rigorous. Students demonstrate a mastery of skills that meet industry-defined standards needed for a career in that field. Completing a sequence of prescribed courses can lead to a certificate or credential necessary for employment, or result in college credit (known as dual credit) if the student receives a letter grade of at least a "B". These courses can lead in turn to employment, approved apprenticeships or postsecondary education in a related field. Examples include *Commercial Photography, Computer Engineering Technology,* and *Biomedical Innovation*.

CTE courses are grouped into 16 industry-specific career clusters

OSPI approves CTE courses, grouped into 16 occupational and industry-specific clusters (listed in **Exhibit 1**) that are consistent with federal grant reporting requirements.

Exhibit 1 – Career clusters reflect CTE course designations at the federal level

CTE cluster/Program areas	
Agriculture & Natural Resources	Hospitality & Tourism
Architecture & Construction	Human Services
Arts, A/V Technology & Communications	Information Technology
Business & Administration	Law & Public Safety
Education & Training	Manufacturing
Finance	Retail/Wholesale Sales & Service
Government & Public Administration	Science Research & Engineering
Health Science	Transportation, Distribution & Logistics

Source: OSPI.

CTE courses are assembled into **programs of study** designed to achieve two goals: align secondary education with postsecondary education and adequately prepare students to enter postsecondary education, an apprenticeship and/or employment. CTE programs of study offer a coordinated, progressive sequence of CTE courses and related learning experiences. Among other requirements, a program of study must lead to an industry-recognized credential, an academic certificate or degree, or employment.

Any secondary student who has enrolled in two or more CTE courses above the exploratory level in a single career cluster is defined as a **Career Concentrator**. A secondary student who has completed a CTE instructional program (360 hours of instruction in a single program area with grades of "D" or better) is defined as a **Program Completer**.

State requirements for CTE programs

State law requires that approved CTE programs align with rigorous industry and academic standards, and CTE course instructors must hold a valid CTE teaching certificate for their assigned content area. Each district's CTE programs must also have a local advisory committee to provide direction and guidance to administrators and teachers. A district's CTE advisory committee must include balanced representation from business/industry and labor, reflecting the diversity of local communities.

For the purposes of this audit, we considered CTE students as students who were completers, concentrators or both as follows:

Career Concentrators are high school students who have enrolled in two or more preparatory CTE courses in a single career cluster.

Program Completers are high school students who have completed a CTE instructional program with 360 hours of instruction, in a single career cluster, with grades of "D" or better.

The limits of OSPI's oversight over Washington's secondary CTE programs

OSPI is the primary agency charged with overseeing K-12 public education in Washington, including the state's secondary CTE programs. While OSPI plays an important role in coordinating and overseeing school districts, it is not directly responsible for providing educational content or instruction. Washington is considered a "local control" state, which means that school districts are generally responsible for setting content, including CTE courses, and delivering instruction to their students.

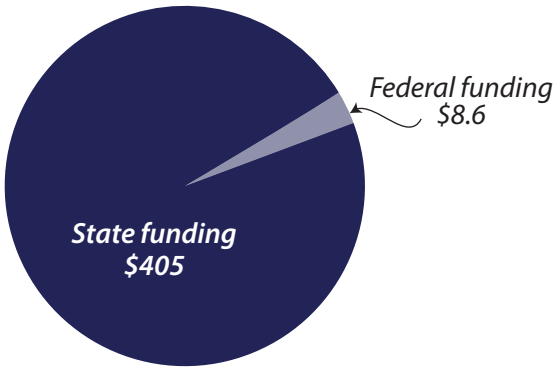
Most CTE financing comes from the state's General Fund

CTE courses can be costly to operate. They sometimes involve more than one teacher in a room for each course, and can require extra materials or expensive industry-quality equipment to enhance course curriculum. Almost 98 percent of the funding for CTE programs is drawn from the State General Fund. The remainder comes from federal Perkins Grant funding, which is intended to improve career-technical education programs and help integrate academic and career-technical instruction.

As shown in **Exhibit 2**, in 2014, funding for Washington's CTE programs in middle and high schools totaled about $413 million, including $8.6 million in federal Perkins Grant funds. About $7.3 million of the federal funding was distributed to school districts for CTE related projects and programs, while around $1.3 million was used for state-level administration, leadership, special projects and staffing costs.

State funding for secondary CTE programs consists primarily of the regular apportionment funding that school districts receive for basic education. Additional CTE funding is distributed to individual school districts based on the enrollment of students in qualified CTE courses.

Exhibit 2 - CTE funding in 2014
Dollars in millions



Source: *Matrix on Workforce Development Services (2016),* Workforce Training & Education Coordinating Board.

The state maintains centrally stored data but it is not easy for school districts to access

In addition to OSPI, a number of other agencies in Washington collect data about students, CTE courses or statewide employment. They include the State Board for Community and Technical Colleges (SBCTC), the Department of Labor and Industries (L&I), the Employment Security Department (ESD) and the federal Department of Defense. The Education Research and Data Center (ERDC) serves as a central administrator and distributor of much of this data.

ERDC receives and maintains limited employment and education information about graduates who move out of state. Although it collects data about graduates who enlist in the military, access to it is restricted to very limited use by a data-sharing agreement.

ERDC's database is an exceptionally rich source for districts to study the experiences of young people as they move through high school, postsecondary education, and into the workforce. However, state or federal privacy laws and data-sharing agreements with its partners limit what data is collected and how it may be shared.

Finally, ERDC has a small staff of 12 people, who must fulfill the agency's several legally mandated responsibilities. This means it has limited capacity to address opportunities to more widely share the information it collects with other state agencies and school districts, or to directly help school districts understand the information available to them and successfully navigate the data request process.

Scope & Methodology

This audit examined the postsecondary outcomes, through the end of 2015, of CTE and non-CTE students who graduated from high school in 2012 and 2013. We used several approaches to address our audit objective using data we obtained from the Education Research and Data Center (ERDC) and the Office of Superintendent of Public Instruction (OSPI). For more information about our data sources, our testing methods and the limitations that we encountered, see **Appendix B**.

Audit approach

1. Identifying CTE and non-CTE students

To be able to explore the data and compare student groups accurately, we first developed our own method of identifying CTE students and non-CTE students. To be considered CTE in our analysis, a student needed to be a CTE career concentrator, a program completer or both. We did this to create non-overlapping groups of students. Using our definition, there were more CTE students in the state than non-CTE students for both the 2012 and 2013 graduating classes, as shown in **Exhibit 3**.

Exhibit 3 – Using our definition of a CTE student, there are more CTE students in the state than non-CTE students

CTE Status	2012 Graduates	2013 Graduates
Concentrator (took 2+ classes above 'exploratory' level in a single career cluster)	14,170	17,931
Completer (completed 360 hours of instruction in an individualized program of study)	8,039	5,280
Concentrator/Completer (fulfilled both requirements: Concentrator in at least one program of study and Completer in at least one other)	14,106	17,248
Subtotal of all CTE (defined as Concentrators, Completers and Concentrator/Completers)	36,315	40,459
Non-CTE students*	29,711	25,359
Total	**66,026**	**65,818**

*Note: *This total includes some students who have taken CTE courses, but are neither completers or concentrators.*

Source: ERDC datasets for the 2012 and 2013 graduating classes.

2. Identifying levels of achievement after high school graduation

In order to gauge student accomplishments after high school, we created measures of achievement to apply to our high-level student profiles. We designated students as "achievers" if they met at least one of several rigorous conditions. **Exhibit 4** shows these achievements.

Exhibit 4 – What activities qualified for postsecondary achievement in our analysis

Achievement areas after high school	Any item in this column equaled an 'achievement'
Higher education	Enrolled in a two- or four-year college for at least half the period we have data for **OR** Received a degree or certificate from a community or technical college
Apprenticeship	Entered into an apprenticeship and did not have status of 'cancelled'
Work	Had a 'living wage job' for at least half the period we have data for *

**Note: We defined 'living wage job' as earning at least 150% of federal poverty level for a one-person household in any given quarter.*

Our final step in this analysis was to combine the CTE designations we developed with the achievement variables. We merged the CTE and achievement variables with student demographic information, and then rolled the individual student information up to the school district level.

We looked at how a school district's CTE participation corresponded with levels of achievement. To determine this relationship, we compared the percent of CTE students in a school district with the percent of achievement for all students in that district using correlation analysis.

We looked for characteristics that best accounted for differences in student achievement. To determine what variables were most likely to account for the variation in student achievement, we used logistic regression with several demographic and other variables (low-income indicator, special education status, race, CTE status, etc.) to see what effect they appeared to have on student achievement.

Audit performed to standards

We conducted this performance audit under the authority of state law (RCW 43.09.470), approved as Initiative 900 by Washington voters in 2005, and in accordance with Generally Accepted Government Auditing Standards (December 2011 revision) issued by the U.S. Government Accountability Office. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. See **Appendix A**, which addresses the I-900 areas covered in the audit. **Appendix B** contains more information about our methodology.

Next steps

Our performance audits of state programs and services are reviewed by the Joint Legislative Audit and Review Committee (JLARC) and/or by other legislative committees whose members wish to consider findings and recommendations on specific topics. Representatives of the State Auditor's Office will review this audit with JLARC's Initiative 900 Subcommittee in Olympia. The public will have the opportunity to comment at this hearing. Please check the JLARC website for the exact date, time, and location (**www.leg.wa.gov/JLARC**). The State Auditor's Office conducts periodic follow-up evaluations to assess the status of recommendations and may conduct follow-up audits at its discretion.

Audit Results

Question: What are the education and employment outcomes of Washington's secondary students who concentrate in or complete a CTE program?

Answer in brief

We found about 80 percent of students from both high school graduating classes in the state's central data warehouse, maintained by the Education Research and Data Center (ERDC). We were able to trace these students' post-secondary achievements in terms of work, apprenticeships and higher education. By following these graduates' post-secondary paths, we learned that by 2015:

- A higher percentage of CTE students than non-CTE students enrolled in community or technical college, entered into an apprenticeship, or were employed
- A lower percentage of CTE students had acquired a degree or certificate from a community or technical college or enrolled in a four-year university
- Among graduates who did not enter higher education, CTE students were significantly more likely to achieve in terms of employment and apprenticeships

However, we identified complications for any organization that wishes to continue building on our foundational work. Access to the data we used for our analysis is restricted by privacy laws and through agreements that ERDC maintains with its partners. For some users, the process to gain permission to use it is burdensome. Important audiences for similar future analyses are the state's 295 school districts, but they may not have the resources and expertise to apply for access and conduct the necessary data analyses. Without this data, districts may not recognize whether their programs are successful at preparing students for the post-secondary world, or if those programs require improvement. We offer recommendations that may help the districts more easily access and use this data to improve their CTE programs.

We identified 55,119 students in the 2012 graduating class, and 53,501 in the 2013 class.

Establishing basic characteristics about CTE and non-CTE students from ERDC datasets

As a first step in understanding post-secondary educational and occupational outcomes of students in Washington, we established several basic characteristics of high school graduates who enrolled – or did not – in CTE programs. As **Exhibit 5** illustrates, the demographic characteristics of 2012 graduates who are CTE career concentrators and/or program completers differ from students who are neither. (Students from the two graduating classes we studied were very similar; see Appendix B for a table showing results for 2013 graduates.)

Exhibit 5 – CTE students differed slightly from non-CTE students

2012 graduating class only

CTE students were…	CTE	Non-CTE	Based on the…
More likely to come from lower-income families	37.8%	34.8%	Percent of the population that is enrolled in the free and reduced price lunch program
More likely to be male	51.2%	46.5%	Percent of the population that is male
More likely to have a 504 plan	3.2%	2.7%	Percent of the population that had accommodations for a disability under a Section 504 plan of the Rehabilitation Act
More likely to have a lower Grade Point Average (GPA)	2.83	2.95	Average GPA, on a 4 point scale

Source: ERDC datasets for the 2012 graduating class.

Though CTE students as an overall group were more likely to come from lower-income families, receive accommodations for a disability under a Section 504 plan, and have a lower grade point average (GPA) than non-CTE students, we found a greater difference in these characteristics between high-achieving students and non-achieving students regardless of CTE status. Non-achieving students were also more likely to be enrolled in special education. These results were also true, on average, for 2013 graduates (shown in Appendix B). And finally, CTE students were more likely to graduate high school with an industry certification. **Exhibit 6** compares the characteristics of students based on their achievement level and CTE status.

Exhibit 6 – Comparing achievers and non-achievers by CTE status

2012 graduates

CTE and achievement status	Free reduced price lunch	Special education program	Disability program	GPA	HS industry certification
Non-CTE achiever	29.9%	3.1%	2.6%	3.15	2.0%
CTE achiever	32.1%	4.8%	3.0%	3.03	7.3%
Achiever total	**31.1%**	**4.1%**	**2.8%**	**3.08**	**4.9%**
Non-CTE non-achiever	38.4%	12.3%	2.8%	2.80	1.6%
CTE non-achiever	41.7%	11.3%	3.3%	2.70	6.4%
Non-achiever total	**40.2%**	**11.8%**	**3.1%**	**2.74**	**4.3%**

Note: Achievers include any graduate who persisted at a university or a community and technical college (CTC), received a certificate or degree from a CTC, persisted in an apprenticeship, or persisted in living wage employment.

Source: ERDC datasets for the 2012 graduating class.

Our success at identifying 2012 and 2013 graduates in 2015

More than 80 percent of students from the 2012 and 2013 graduating classes appeared somewhere in the postsecondary datasets that we received from ERDC for our analysis. We were unable to access a dataset that shows entrance into the military due to legal restrictions on that information, which would have increased the number of students we were able to track.

Exhibit 7 shows the percentage of students that appeared in our postsecondary outcomes datasets, broken out by CTE status, for the two graduating classes. We found CTE and non-CTE students in our data at similar rates across all groups.

Exhibit 7 – We found students at similar rates across all groups of CTE status

CTE status	2012 graduates	2013 graduates
Concentrator	83.6%	80.7%
Completer/Concentrator	84.2%	81.9%
Completer	82.9%	81.7%
All CTE	83.7%	81.4%
Non-CTE	83.2%	81.2%
Total	**83.5%**	**81.3%**

Source: ERDC datasets for the 2012 and 2013 graduating classes.

Compared to non-CTE students, CTE students had higher rates of participation in apprenticeship programs, employment and community and technical college enrollment

Once we identified CTE and non-CTE graduates in our data, we compared them in terms of specific and measureable achievements after high school. (See sidebar for the achievement criteria.)

Exhibits 8 and **9** (on the following page) illustrate how, among achievers, CTE student outcomes differed from non-CTE student outcomes. For both the 2012 and 2013 graduating classes, CTE students were more likely to be enrolled in a community or technical college or be employed in a living wage job. Non-CTE students were more likely to have received a degree or certificate from a community or technical college and/or be enrolled at a four-year university. CTE and non-CTE students in the 2012 graduating class were more likely to have completed an associate's degree or certificate or be employed than 2013 graduates, most likely because they had an extra year to make these achievements. Note that some students had more than one type of achievement and each was counted.

Exhibit 8 – Distribution of achievements by CTE status as of 2015

2012 graduates

CTE Status	Four-year Enrollment	Community & technical colleges		Apprenticeship	Employment
		Enrollment	Completion		
All CTE*	29.1%	33.0%	17.4%	1.1%	19.4%
Non-CTE	37.3%	27.5%	20.3%	0.6%	14.3%

*Note: * "All CTE" includes students who were completers, concentrators and completer/concentrators.*

Source: ERDC datasets for the 2012 graduating class.

For the purposes of this audit, we defined CTE students as students who were completers, concentrators or both as follows:

Career Concentrators are high school students who have enrolled in two or more preparatory CTE courses in a single career cluster.

Program Completers are high school students who have completed a CTE instructional program with 360 hours of instruction, in a single career cluster, with grades of "D" or better.

Graduates were designated as achievers if they:

- Attended a two- or four-year college for at least half the period we have data for or received a degree or certificate from a community or technical college
- Entered into an apprenticeship and did not have status of 'cancelled'
- Had a job we defined as 'living wage' for at least half the period we have data for

Exhibit 9 – Distribution of achievements by CTE status as of 2015

2013 graduates

CTE Status	Four-year Enrollment	Community and technical colleges		Apprenticeship	Employment
		Enrollment	Completion		
All CTE*	33.3%	40.1%	9.5%	0.9%	16.2%
Non-CTE	40.0%	34.2%	13.9%	0.5%	11.4%

*Note: * "All CTE" includes students who were completers, concentrators and completer/concentrators.*

Source: ERDC datasets for the 2013 graduating class.

Among high school graduates who did not enroll in higher education, CTE students had significantly higher levels of achievement than non-CTE students

Numerous researchers, legislators and educators view the preparation gained in high school career and technical education as an alternative to attending a four-year college or university. For this reason, we also compared CTE outcomes to non-CTE outcomes for students in our two graduating classes who did not enroll in post-secondary education.

Those who did not attend any post-secondary education

After removing from our data set all CTE and non-CTE students who enrolled in any post-secondary education, we compared the achievement levels between all remaining CTE and non-CTE students. We found that among these students, CTE graduates in 2012 were 35 percent more likely to enter into an apprenticeship or find employment in a living wage job than non-CTE students. (2013 graduates were 37 percent more likely to have these achievements.)

Those who did not attend a four-year university

Similarly, after removing from our data set only CTE and non-CTE students who enrolled in a four-year school, we compared the achievement levels between all remaining CTE and non-CTE students. Among these students who graduated in 2012, we found that CTE students were 11 percent more likely to enter into an apprenticeship, enroll in a community or technical college, or find employment in a living wage job than non-CTE students. (2013 graduates were 5 percent more likely to have these achievements.)

Differences in specific outcomes between CTE and non-CTE achievers for those who did not attend a four-year university

The main difference between CTE and non-CTE achievers who did not go on to a four-year university is that CTE achievers are more likely than non-CTE achievers to be employed in a living wage job, and less likely to have received a degree or certificate from a community or technical college. **Exhibits 10** and **11** show these differences in achievement between CTE and non-CTE students who did not enroll in a four-year school.

Exhibit 10 – Differences between CTE and non-CTE achievements for students who did not enroll in a four-year university as of 2015

2012 graduation class

Achievement	CTE	Non-CTE
In an apprenticeship program	2%	1%
Enroll in a community or technical college	47%	47%
Employed	30%	27%
Receive a degree or certificate from a community or technical college	21 %	25%

Source: ERDC datasets for the 2012 graduating class.

Exhibit 11 – Differences between CTE and non-CTE achievements for students who did not enroll in four-year university as of 2015

2013 graduation class

Achievement	CTE	Non-CTE
In an apprenticeship program	1%	1%
Enroll in a community or technical college	61%	60%
Employed	25%	20%
Receive a degree or certificate from a community or technical college	13 %	19%

Source: ERDC datasets for the 2013 graduating class.

Statistical analysis shows that basic student characteristics account for very little of the difference between CTE and non-CTE achievement

We used regression analysis to try to identify the factors that account for differences in student achievement following high school graduation. Our analysis looked at the effects on achievement of: low-income status, gender, race, enrollment in special education, disability status, language, immigrant status, or having an industry certification. Although many of the variables we considered were statistically significant, altogether they were not strong predictors of success. This suggests that there are additional influences on whether or not an individual succeeds.

Other researchers have examined the many elements most likely to have a positive influence on student achievement. They identified:

- Positive learning environment in the home
- Education level of the parents, especially the student's mother
- Reading on or above grade level in the 3rd grade
- Teacher quality

These factors were not available in the data we used for our analysis.

In our analysis of CTE student outcomes, we were only able to examine post-secondary outcome data through 2015, which makes our results a snapshot in time. Differences between CTE and non-CTE student outcomes may change over time and can be further assessed as more years of outcome data after 2015 become available. As time goes on, the data should be more representative of long-term student outcomes and better explain the experiences of students in the groups that we examined.

Using student outcomes data to analyze CTE program performance is a leading practice

Both the National Research Center for Career and Technical Education and the Council of Chief State School Officers acknowledge that state school systems need accurate employment and student outcomes data to analyze whether their CTE programs are producing students who are ready for 21st-century careers.

Educational researchers in other states use student data to analyze CTE program performance

Consistent with leading practices, several educational studies have attempted to measure the effect that CTE courses have on student outcomes. Often these studies focus on the achievements or accomplishments of secondary students before they graduate from high school. Independent variables include: math and reading scores of CTE students, completion of college preparatory curriculum, absences, GPA and other measures. Other studies have looked at the post-secondary achievements of CTE students after high school, such as attending college, attaining a college degree, employment and wages.

Whatever their measures, most studies that look at the effects of secondary CTE courses on student outcomes compare CTE students to non-CTE students. They typically use statistical techniques such as regression models to help account for other observable factors that could influence student outcomes. An unavoidable limitation of such studies is the absence of an experimental design. Because students are not randomly assigned to CTE courses or schools, unobservable or unquantifiable factors almost certainly influence their decision to pursue CTE course work and affect their post-secondary outcomes and attainments.

Our analysis shows that making student data available to Washington's school districts could help them improve their CTE programs

While conducting our analyses into student outcomes, we identified ways that student data can be used to assess CTE program quality, and noted several state datasets that can be used to help school districts as they continuously improve their CTE programs. We found that ERDC-managed datasets provide valuable insights into the success of Washington students and the paths they pursue after graduating from high school. We also found that these datasets can highlight important differences about the achievement and CTE status of students. Without this data, districts may not recognize whether their programs are successful at preparing students for the post-secondary world or if those programs require improvement.

ERDC currently makes some of this data available to districts in the form of online reports at both the school and district levels, which include information about the higher education enrollment of high school graduates. The reports are provided free of charge and were developed with input from the K-12 stakeholder community. According to ERDC, the reports are produced on an annual basis, with an expectation to modify and expand them based on data availability and school district needs.

Finding efficient ways to make more ERDC data available to districts and address student privacy concerns would help districts improve CTE program performance

Adding more detailed data, such as the material we used to make our assessment of CTE student outcomes, to ERDC's existing reports could help school districts make even more precise assessments of their programs. This is important as some school districts are too small to invest the time and staff resources necessary to meet ERDC requirements for accessing this data. However, even larger districts may not have employees able to perform the necessary analysis to draw conclusions from the data once they have access to it. Furthermore, ERDC's own limited staff and competing priorities may restrict its ability to make this data easier and more available to use. A reasonable starting point is to expand the annual reports to be consistent with the intent ERDC has already expressed. However, OSPI has a shared interest in overcoming these difficulties. Its greater resources could allow it to help coordinate data requests from districts to avoid overwhelming ERDC with multiple but very similar requests. These resources might also allow OSPI to offer assistance to districts that need help analyzing and applying their data effectively.

ERDC must also balance the privacy rights of students with the needs of data users. Before ERDC agrees to allow access to any outside party, all of the agency partners whose data could be shared must agree to the release. It only releases data that excludes student names, addresses, birthdates, and any observable characteristic that can be directly tied to a specific student. These protective restrictions to acquiring data may be difficult to overcome and school districts, especially small ones, may be unable or unwilling to attempt the process. As a consequence, districts wishing to study the effects of their CTE programs are limited to what they already know about their students from data they report to OSPI (one of ERDC's partners), or the information included in ERDC's annual reports.

The student outcome data we explored in this report could help districts improve the alignment between education and employers' needs. In our next performance audit, we will examine how the state's CTE programs align with these needs.

Recommendations

We recommend the Office of the Superintendent of Public Instruction (OSPI) work with the Education Research and Data Center (ERDC) to make student data more accessible for school districts to improve their CTE programs. Our suggestions include:

- Obtain and reformat ERDC data sets for easy use by school districts
- Make ERDC data openly available online in a format that conforms with ERDC privacy restrictions
- Help districts request ERDC data and complete data access agreements when more extensive data is requested

We also recommend OSPI consider ways it can support school districts' analyses of student outcomes data.

Agency Response

The agency informed us that it has decided that a formal response is not needed for this audit. Agency officials extended their appreciation for the collaborative working relationship with audit staff, and look forward to the next CTE performance audit.

Appendix A: Initiative 900

Initiative 900, approved by Washington voters in 2005 and enacted into state law in 2006, authorized the State Auditor's Office to conduct independent, comprehensive performance audits of state and local governments.

Specifically, the law directs the Auditor's Office to "review and analyze the economy, efficiency, and effectiveness of the policies, management, fiscal affairs, and operations of state and local governments, agencies, programs, and accounts." Performance audits are to be conducted according to U.S. Government Accountability Office government auditing standards.

In addition, the law identifies nine elements that are to be considered within the scope of each performance audit. The State Auditor's Office evaluates the relevance of all nine elements to each audit. The table below indicates which elements are addressed in the audit. Specific issues are discussed in the Results and Recommendations section of this report.

I-900 element		Addressed in the audit
1.	Identify cost savings	**No.** The audit focused on an assessment of CTE program outcomes.
2.	Identify services that can be reduced or eliminated	**No.** The audit focused on an assessment of CTE program outcomes.
3.	Identify programs or services that can be transferred to the private sector	**No.** The audit focused on an assessment of CTE program outcomes.
4.	Analyze gaps or overlaps in programs or services and provide recommendations to correct them	**Yes.** The audit identified ways districts could use student, college enrollment, college completion and employment data available in the state to improve CTE programs.
5.	Assess feasibility of pooling information technology systems within the department	**No.** The audit focused on an assessment of CTE program outcomes.
6.	Analyze departmental roles and functions, and provide recommendations to change or eliminate them	**Yes.** The audit considered the roles and responsibilities of OSPI and ERDC to identify ways they could work together to provide additional data on student outcomes to school districts.
7.	Provide recommendations for statutory or regulatory changes that may be necessary for the department to properly carry out its functions	**No.** The audit focused on an assessment of CTE program outcomes.
8.	Analyze departmental performance, data performance measures, and self-assessment systems	**Yes.** The audit identified sources of in-state data that OSPI and school districts could use to better assess the quality of the state's CTE programs.
9.	Identify relevant best practices	**Yes.** Leading practices recommend making student data more available so school systems can improve their CTE programs.

Appendix B: Methodology

The first audit of workforce development cataloged the system and identified areas of potential risk. In this audit, we used data analyses to examine all of the school districts in Washington that provided secondary education for two years of high school graduates (246 districts in 2012 and 245 districts in 2013). We focused on state-sponsored CTE programs, which are composed of courses that have been officially approved by OSPI. We examined the post-secondary outcomes of high school graduates who participated in secondary CTE programs.

Data sources and data reliability testing

Our analysis required access to multiple data sets. The Education Research and Data Center (ERDC) was our primary source for student demographic and post-secondary outcomes data. The data that we used for our analysis was originally compiled by ERDC for federal reporting purposes. We requested information for all Washington graduates in the 2011/12 and 2012/13 school years.

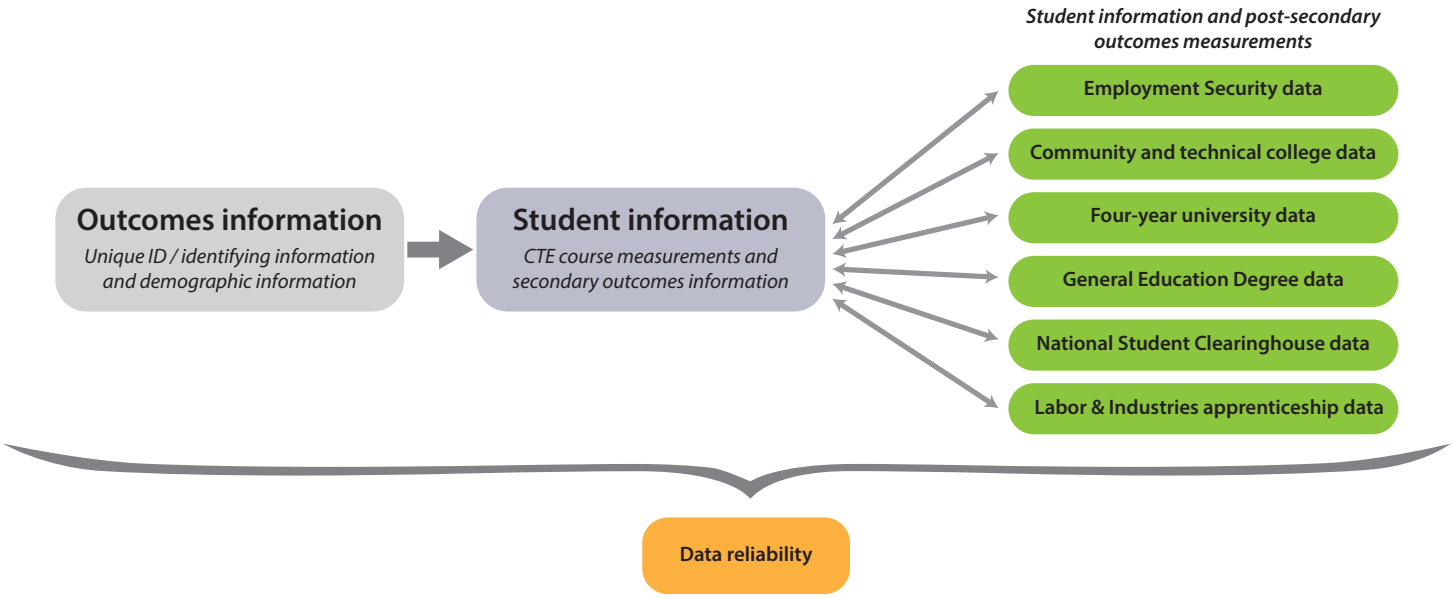
For these graduates, we used data from the Office of Superintendent of Public Instruction, the State Board for Community and Technical Colleges, four-year universities, the Employment Security Department, the Department of Labor and Industries, and the National Student Clearinghouse.

The datasets we used in our evaluation included the following:

- Student demographic data containing basic student characteristics and experiences, including school district, gender, race, GPA, bilingual program status, disability status, special education program status, low-income status, immigrant program status and completion of an industry certification
- Student-level CTE course data
- Data on community and technical college enrollment, degrees and certificate completion
- Four-year university enrollment data
- National Student Clearinghouse enrollment data for out-of-state four-year universities and two-year colleges, and for in-state private two-year and four-year colleges
- Employment Security Department wage data
- Department of Labor and Industries apprenticeship program registration

Figure 1 (on the following page) illustrates the types of data we used for our analysis:

Figure 1 – Data used in our analysis



Data reliability testing

Before using the data provided by ERDC, we tested the reliability of the data that we received by:

- Conducting a preliminary evaluation of each file's integrity and condition
- Testing data fields for expected, missing and inappropriate values

Comparing student achievement levels

After testing the data for reliability, we used the data files from ERDC to create high level student profiles, which included achievement variables for each student. We created five different measures of achievement.

Students were considered an achiever if they:

- Attended a post-secondary education institution for at least half of the period that we have data for each graduating class following high school graduation
- Received a degree or certificate from a community or technical college
- Entered into an apprenticeship and did not have a status of "cancelled"
- Had a "living wage job" for at least half of the period that we had data for each graduating class following graduation. We considered a student to have a "living wage job" in any given quarter if they made at least 150 percent of the federal poverty level for a one person household (for example $17,235 annually, quarterly wage of $4,309 in 2013) and made a corresponding hourly wage ($8.29 in 2013).

We also created variables to designate students with a certain CTE status. Students were designated as either CTE (a completer, a concentrator or a completer/concentrator) or as non-CTE. We then combined the CTE designations with the achievement variables, then merged the CTE and achievement variables with student demographic information.

We tested the sensitivity of our achievement variables to see how the number of achievers fluctuated when we modified our definition of achievement for the CTC and four-year university attendance achievements, as well as the employment achievement. We found that the range of achievement counts were similar for both groups of graduates. The number of achievements for the variables we tested were also similar between both groups of graduates. We also tested the normality of achievement data across school districts and found that achievements were mostly normally distributed.

Achievement analysis

After rolling up student information to the district level, we created an overview of the demographics and achievements attained by CTE and non-CTE students at the state level. **Figures 2** and **3** show demographic information and achievement levels by CTE status for both groups of high school graduates.

Figure 2 – Comparison of CTE and non-CTE students

2012 graduates

Variables	CTE	Non-CTE	Total
Percent of students in the bilingual program	2.2%	2.4%	2.3%
Percent of students that are free and reduced price lunch	37.8%	34.8%	36.4%
Percent female	48.8%	53.5%	50.9%
Percent of students with an industry certification	6.8%	1.8%	4.5%
Percent race = American Indian or Alaska Native	1.3%	1.4%	1.3%
Percent race = Asian	7.1%	9.4%	8.1%
Percent race = Black or African American	4.1%	4.7%	4.3%
Percent race = Caucasian or White	66.5%	66.4%	66.4%
Percent race = Hispanic or Latino	15.6%	13.1%	14.5%
Percent race = Native Hawaiian or Other Pacific Islander	0.7%	0.8%	0.7%
Percent race = More than one race	4.8%	4.2%	4.5%
Percent of students that are immigrant	1.9%	1.4%	1.7%
Percent of students that are enrolled in special education	8.7%	8.5%	8.6%
Percent of students with an accommodation for a disability under a Section 504 plan	3.2%	2.7%	3.0%
Average GPA	2.83	2.95	2.88
Percent of students found in any of our post-secondary datasets	83.7%	83.2%	83.5%
Percent of students with an achievement	40.9%	42.2%	41.4%

Source: ERDC datasets for the 2012 graduating class.

Figure 3 – Comparison of CTE and non-CTE students

2013 graduates

Variables	CTE	Non-CTE	Total
Percent of students in the bilingual program	2.1%	2.5%	2.3%
Percent of students that are free and reduced price lunch	38.3%	34.8%	36.9%
Percent female	49.1%	54.1%	51.0%
Percent of students with an industry certification	7.7%	2.2%	5.6%
Percent race = American Indian or Alaska Native	1.2%	1.2%	1.2%
Percent race = Asian	7.4%	9.4%	8.2%
Percent race = Black or African American	4.3%	4.6%	4.4%
Percent race = Caucasian or White	64.9%	65.8%	65.2%
Percent race = Hispanic or Latino	16.3%	13.7%	15.2%
Percent race = Native Hawaiian or Other Pacific Islander	0.7%	0.6%	0.7%
Percent race = More than one race	5.3%	4.7%	5.1%
Percent of students that are immigrant	N/A	N/A	N/A
Percent of students that are enrolled in special education	8.7%	8.6%	8.7%
Percent of students with an accommodation for a disability under a Section 504 plan	3.3%	3.0%	3.2%
Average GPA	2.87	3.02	2.93
Percent of students found in any of our post-secondary datasets	81.4%	81.2%	81.3%
Percent of students with an achievement	40.8%	42.6%	41.5%

Source: ERDC datasets for the 2013 graduating class.

Though CTE students as an overall group were more likely to be low income, receive accommodations for a disability under a Section 504 plan and have a lower GPA than non-CTE students, we found a bigger difference in these characteristics on average for both graduating classes between high-achieving students and low-achieving students, regardless of CTE status. This is demonstrated by comparing the results of Figures 2 and 3 above with the results of **Figures 4** and 5 below. Non-achieving students were also more likely than achieving students to be enrolled in special education. CTE students were still more likely to have a disability, even when taking achievement into consideration. As shown in Figures 4 and 5, they were also more likely to graduate high school with an industry certification.

Figure 4 – Comparison of achievers and non-achievers by CTE status

2012 graduates

CTE status	Free/reduced price lunch	Special education program	Disability program	GPA	Industry certification
Non-CTE achiever	29.9%	3.1%	2.6%	3.15	2.0%
CTE achiever	32.1%	4.8%	3.0%	3.03	7.3%
Achiever total	**31.1%**	**4.1%**	**2.8%**	**3.08**	**4.9%**
Non-CTE non-achiever	38.4%	12.3%	2.8%	2.80	1.6%
CTE non-achiever	41.7%	11.3%	3.3%	2.70	6.4%
Non-achiever total	**40.2%**	**11.8%**	**3.1%**	**2.74**	**4.3%**

Source: ERDC datasets for the 2012 graduating class.

Figure 5 – Comparison of achievers and non-achievers by CTE status

2013 graduates

CTE status	Free/reduced price lunch	Special education program	Disability program	GPA	Industry certification
Non-CTE achiever	30.7%	3.3%	2.7%	3.20	2.5%
CTE achiever	32.9%	4.7%	3.2%	3.08	7.9%
Achiever total	**32.0%**	**4.1%**	**3.0%**	**3.13**	**5.7%**
Non-CTE non-achiever	37.9%	12.6%	3.2%	2.88	2.0%
CTE non-achiever	42.0%	11.4%	3.4%	2.73	7.6%
Non-achiever total	**40.4%**	**11.9%**	**3.3%**	**2.79**	**5.5%**

Source: ERDC datasets for the 2013 graduating class.

Relationship between higher education and achievement

Overall, we found that although the achievement rates appear similar between CTE and non-CTE students in the 2012 and 2013 graduating classes, CTE students in the 2012 graduating class were around 5 percent less likely to achieve than non-CTE students. However among graduates who did not attend four-year university, CTE students were around 11 percent more likely to achieve, and 37 percent more likely to achieve among high school graduates who did not go on to any postsecondary education. CTE students in the 2013 graduating class were around 7 percent less likely to achieve than non-CTE students. However among graduates who did not attend a four-year university, CTE students were around 6 percent more likely to achieve, and 35 percent more likely to achieve among high school graduates who did not go on to any post-secondary education.

Relationship between CTE students and achievement

We examined the relationship between achievement and CTE status for the 2012 and 2013 graduating classes. We ran correlations between the percent of achievement for each school district (percent of students that had attained at least one achievement) and the percent of CTE students in each district. Our analysis found a positive relationship between the percent of CTE students in a school district and the percent of successful outcomes for all students, however the statistical significance of these results may have been influenced by outliers in the data.

The effect of student experiences and characteristics on student achievement

After creating our dataset of student achievement variables, we used regression analysis to examine how certain student characteristics and experiences accounted for post-secondary achievement in our two graduating classes of students. The dependent variable for the regression analysis was "Achievement," the independent variables included disability status, gender, race, special education status, immigrant status, low-income status and bilingual program participation, as well as other characteristics such as student GPA, CTE status, CTE credits earned and attainment of an industry certification. We found some collinearity among our independent variables when we compared them using correlation analysis, but we believe this was not large enough to significantly impact our results.

We ran multiple regression models with different combinations of our independent variables. The model that appeared to account for the most variance for each of our graduating classes is presented in F**igure 6**. Several of the variables in our model were statistically significant (variables that were significant at greater than the 99 percent confidence level are highlighted in yellow). GPA appeared to account for most of the variance in our final model, however our low pseudo R2 values for both classes of graduates suggest that much of the variation we observed in terms of achievement is explained by variables other than the ones we had available to us in our dataset.

Figure 6 – Achievement regression analysis

2012 and 2013 graduates

Independent variable	2012 graduates		2013 graduates	
	Odds ratio	P-value	Odds ratio	P-value
Disability accommodation under a Section 504 plan	0.94	0.235	0.93	0.121
Title Immigrant status	1.13	0.077	Omitted	
Industry certification	1.15	0.001	1.06	0.126
Female	0.86	0.000	0.91	0.000
Bilingual program	0.87	0.029	0.93	0.246
Concentrator*	0.97	0.334	0.93	0.039
Completer/Concentrator*	1.00	0.874	0.98	0.657
Non-CTE*	1.00	0.929	1.00	0.996
CTE credits earned	1.01	0.325	1.02	0.004
Free and Reduced price lunch	0.86	0.000	0.85	0.000
Asian**	2.10	0.000	2.41	0.000
Black or African American**	1.17	0.074	1.41	0.000
Hispanic or Latino*	1.41	0.000	1.38	0.000
Caucasian or White**	1.14	0.098	1.18	0.050
Native Hawaiian or Other Pacific Islander**	0.78	0.071	0.90	0.469
Of more than one race**	1.11	0.242	1.23	0.026
Enrollment in Special Education	0.45	0.000	0.44	0.000
GPA	1.98	0.000	1.68	0.000
Pseudo R2	0.0578		0.0503	
N (population)	60,419		61,225	

** The CTE status variable was categorical, Completer status was used as the comparison value.*

*** The Race variable was categorical, American Indian or Alaska Native was used as the comparison value.*

Source: ERDC datasets for the 2012 and 2013 graduating classes.