The School District of Philadelphia

The Office of Research and Evaluation

Career and Technical Education (CTE) Program Evaluation

Evaluation Report

2015

The School District of Philadelphia
Career and Technical Education (CTE)
Evaluation Report

Prepared for:
The Office of Career and Technical Education

David Kipphut
Deputy, Career and Technical Education

By:
The Office of Research and Evaluation

Theodore Wills, Ph.D
Statistician

Amber Goldberg, M.A.
Program Manager

Tonya Wolford, M.Ed., Ph.D
Deputy

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Executive Summary

Career and Technical Education (CTE) combines a standard high school curriculum with focused professional training. During 2014-2015, The School District of Philadelphia (SDP) offered CTE programs in 29 schools, across 37 professional tracks. These programs provide students the opportunity to acquire skills and credentials in their field, and a pathway toward sustainable employment. Additionally, there is evidence that students enrolled in CTE programs may be more likely to graduate than peers that are enrolled in standard academic programs (Cohen and Besharov, 2002).

In this report, we examine the cohort of SDP students that were first-time 9th graders during the 2011-2012 school year. These students' four-year trajectories, through 2014-2015, were tracked and analyzed with a focus on the effects of participation in CTE. These analyses are organized into two parts. In Part I, we update and replicate analyses that were conducted with the previous cohort (first-time 9th graders in 2010-2011), and presented in a previous report. Part II identifies and analyzes factors that influence persistence within CTE.

Key Findings

- **SDP continues to expand CTE offerings**, with 9 programs added in the last year.
- **For the first time, records of 10th grade CTE course enrollment were available**. This significantly expanded the depth and scope of possible analyses.
- **Students engaged in CTE are more likely to graduate** than those that are not, even when controlling for other relevant student characteristics. This finding holds at almost all levels of analysis.
- **There was a subset of CTE students that dropped CTE after their 10th grade year**. However, persistence in CTE beyond the 10th grade year is a strong predictor of eventual graduation.
- **Non-persistence in CTE is itself strongly predicted** by poor attendance in 9th grade, as well as grades of D or F in Math and English.
    - **Students were also less likely to persist in CTE if their school closed.** When schools that hosted CTE programs closed, their students frequently dropped out of CTE.

Recommendations

Based on these and other findings we make the following recommendations:

1: When students persist with CTE past the 10th grade year, their probability of graduation improves enormously, so **persistence in CTE should be supported**.

- Students in CTE that have a 9th grade ADA below 85%, and have 9th grade failing marks in both English and Math should be classified as High Risk to drop CTE. Once identified, **High Risk CTE students should be given additional supports to successfully navigate the critical 10th grade year**.
- Whenever possible, **existing CTE programs should not be abruptly disbanded or relocated**. If program changes are necessary, it would be preferable to phase them so that students already enrolled can continue without changing schools.

2: Criteria for matching students with CTE programs are not consistent across all schools, and it is not known how these criteria impact success. **New data are required to assess fit between students and their CTE programs**. This information is critical to answer the following:

- Do different placement models at different schools lead to different outcomes? If so, what are the best practices?
- Does a student's satisfaction with their 10th grade placement predict persistence in CTE and/or toward graduation?

3: **Expansion of CTE programs should continue, but must be closely monitored**. It is not known whether the District has reached a saturation point, such that additional seats in CTE programs can only be filled by students that are not intrinsically motivated to take them. Fortunately, the ability to identify 10th grade CTE enrollment and outcomes enables this ongoing evaluation.

Introduction

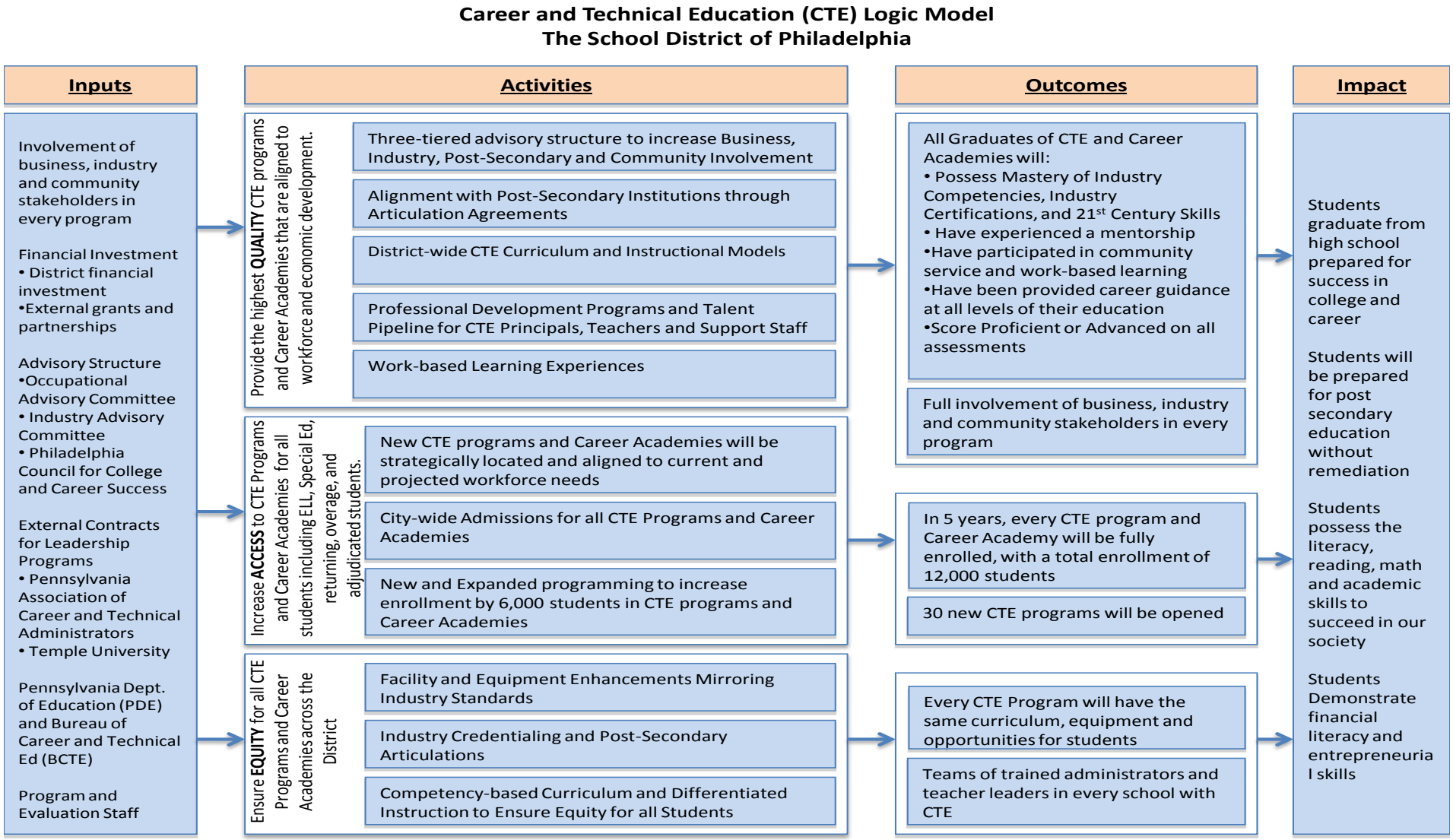
In The School District of Philadelphia (SDP), Career and Technical Education (CTE) programs combine traditional academic preparation with career training. Students enrolled in these programs complete a series of courses that are intended to prepare and position them for a specific career path. In the standard model, students begin these CTE courses in 10th grade, and continue them through 11th and 12th grade. In many programs, the students are then in a position to sit for the National Occupational Competency Testing Institute (NOCTI) exams, which, if passed, provide the students with an industry credential in their chosen fields.

Through the course of study, the CTE student complements academic skills with industry-specific training, as well as familiarity with basic workplace behaviors and expectations. Additionally, CTE programs may have secondary educational benefits. For some students, providing vocational context to education leads to greater engagement with education in general (Cohen and Besharov, 2002). For this reason, CTE programs may serve to reduce drop-out in high risk populations.

This CTE model was implemented in 29 SDP high schools during the 2014-2015 school year. These 29 schools, however, vary in terms of the scope of their offerings. There are five schools that are designated by the District as *all CTE schools*, wherein all students in 10th grade and above are expected to participate in the CTE course progression. Admission to these schools is on a citywide basis, with applicants from across the District being eligible. At the remaining 24 schools, CTE students are integrated with peers that are not pursuing CTE paths. In these schools, the number of CTE programs varies widely, as do the percentage of students who are engaged with those programs, and the admission criteria of the schools themselves.

Though diverse, these programs are unified in the goal of delivering high quality CTE programs that provide necessary academic and technical preparation for competitive high-skill, high-wage, and high-priority occupations. SDP's *Five-Year Strategic Plan for Career and Technical Education* articulates these goals, and how they align with the broader District goal of improving academic outcomes for students in all public and charter schools. The plan also emphasizes the goal to "improve the quality, access, and equity for Career and Technical Education Programs and Career Academies across the entire district." The plan is expressed in a logic model, presented below in Figure 1, which specifies the inputs, activities, outcomes, and desired impacts of SDP's CTE programs.

Figure 1


Career and Technical Education (CTE) Logic Model
The School District of Philadelphia
Inputs
Activities
Outcomes
Impact
Involvement of business, industry and community stakeholders in every program
Financial Investment
• District financial investment
•External grants and partnerships
Advisory Structure
•Occupational Advisory Committee
• Industry Advisory Committee
• Philadelphia Council for College and Career Success
External Contracts for Leadership Programs
• Pennsylvania Association of Career and Technical Administrators
• Temple University
Pennsylvania Dept. of Education (PDE) and Bureau of Career and Technical Ed (BCTE)
Program and Evaluation Staff
Provide the highest QUALITY CTE programs and Career Academies that are aligned to workforce and economic development.
Three-tiered advisory structure to increase Business, Industry, Post-Secondary and Community Involvement
Alignment with Post-Secondary Institutions through Articulation Agreements
District-wide CTE Curriculum and Instructional Models
Professional Development Programs and Talent Pipeline for CTE Principals, Teachers and Support Staff
Work-based Learning Experiences
Increase ACCESS to CTE Programs and Career Academies for all students including ELL, Special Ed, returning, overage, and adjudicated students.
New CTE programs and Career Academies will be strategically located and aligned to current and projected workforce needs
City-wide Admissions for all CTE Programs and Career Academies
New and Expanded programming to increase enrollment by 6,000 students in CTE programs and Career Academies
Ensure EQUITY for all CTE Programs and Career Academies across the District
Facility and Equipment Enhancements Mirroring Industry Standards
Industry Credentialing and Post-Secondary Articulations
Competency-based Curriculum and Differentiated Instruction to Ensure Equity for all Students
All Graduates of CTE and Career Academies will:
• Possess Mastery of Industry Competencies, Industry Certifications, and 21st Century Skills
• Have experienced a mentorship
•Have participated in community service and work-based learning
•Have been provided career guidance at all levels of their education
•Score Proficient or Advanced on all assessments
Full involvement of business, industry and community stakeholders in every program
In 5 years, every CTE program and Career Academy will be fully enrolled, with a total enrollment of 12,000 students
30 new CTE programs will be opened
Every CTE Program will have the same curriculum, equipment and opportunities for students
Teams of trained administrators and teacher leaders in every school with CTE
Students graduate from high school prepared for success in college and career
Students will be prepared for post secondary education without remediation
Students possess the literacy, reading, math and academic skills to succeed in our society
Students Demonstrate financial literacy and entrepreneurial skills

Specific offerings at specific schools continue to evolve and expand. In 2014-2015, SDP offered 120 CTE programs in 37 occupational areas. These programs are offered through the CTE Office, and are further organized into 10 Career Clusters of related occupations, based on commonalities in the knowledge and skills they require.

The School District of Philadelphia's state-approved CTE programs are typically three-year programs of study. A student that fully complies with the model begins their program in 10th grade and continues through 12th. In the process, students accumulate 1,080 hours of instruction and have the opportunity to earn recognized industry certifications via end-of-program assessments (i.e., NOCTI) that are administered in grade 12. Most of SDP's CTE programs follow this model. For example, the *Culinary Arts Program,* which is part of the *Hospitality* cluster*,* consists of the following courses:

Grade	Course
10	Culinary Arts 1
11	Culinary Arts 2
12	Culinary Arts 3

The grid in Figure 2 displays CTE course sequencing by school for 2014-2015. The numbers in the cells indicate how many of the three courses were offered. In most cases, the program offered all three courses ('1-3'). In a few cases, the program only offered the first two courses ('12'), usually because the program is a recent addition, and has not been operating long enough to have a third year cohort. Two additional programs were in planning last year ('++'), but were not implemented.

Figure 2. CTE Program Offerings in 2014-2015 School Year

	Agriculture and Food Products Processing	Horticulture/Horticulture Operations, General	Animal Sciences, General	Management and Policy, Other	Technologies/Techn & Supp	Web Page, Digital/Multimedia & Info. Resources Design	Computer Systems Networking and Telecommunications	Cosmetology/Cosmetologist, General	Barbering/Barber	Baking and Pastry Arts/Baker/Pastry Chef	Institutional Food Workers	Technology/Computer	Technology/Technician,	Architectural Drafting and Architectural CAD/CADD	Other/Advanced	Child Care and Supportive Services Management	Apparel & Textile Marketing Management	Biotechnology	Carpentry/Carpenter	Electrical & Power Transmission Installers, Other	Building/Property Maintenance	Plumbing Technology/Plumber	Construction Trades, Other	Appliance Installation and Repair Technology/Technician	Maintenance	Autobody/Collision & Repair Technology/Technician	Mechanics	Welding Technology/Welder	Commercial and Advertising Art	Cinematography & Film/Video Production	Dental Assisting/Assistant	Health Info/Medical Records Technology/Technician	Technology/Technician (EMT	Health Care Technology	Logistics, Materials & Supply Chain Management	Technology/Technician and	Administrative Assistant and Secretarial Science, General	Sales, Distribution and Marketing Operations, General
	1.0401	**1.0601**	**1.0901**	**3.0299**	**10.9999**	**11.0801**	**11.0901**	**12.0401**	**12.0402**	**12.0501**	**12.0508**	**15.1202**	**15.1301**	**15.1303**	**15.9999**	**19.0708**	**19.0905**	**26.1201**	**46.0201**	**46.0399**	**46.0401**	**46.0503**	**46.9999**	**47.0106**	**47.0201**	**47.0603**	**47.0604**	**48.0508**	**50.0402**	**50.0602**	**51.0601**	**51.0707**	**51.0904**	**51.9999**	**52.0203**	**52.0302**	**52.0401**	**52.1801**
Carver, Eng & Sci															1-3																							
CAPA					1-3																								1-3	1-3								
Dobbins HS								1-3	1-3		1-3						1-3					1-3							1-3								1-3	1-3
Edison HS								1-3			1-3	1-3				1-3				1-3		1-3			1-3	1-3	1-3	1-3	1-3	1-3				1-3	1-3			
Fels, l HS																													1-3	1-3								
Frankford HS											1-3										12																	
Franklin Lrn Cntr																																	1-3			1-3	
Franklin HS											1-3				++																						
Furness HS																																			12		
Bartram HS						1-3																							1-3	1-3				1-3			
Kensington Bus,																																			12	1-3	1-3
Kensington CAPA																													1-3	1-3							
Kensington Health Sci.																															1-3			1-3			
King HS											1-3																1-3		1-3					1-3		1-3	
Lincoln HS		1-3																																1-3		12	1-3	
Mastbaum, HS											1-3								1-3	1-3							1-3	1-3			1-3			1-3			1-3	
Northeast HS					1-3																								1-3	1-3								
Overbrook HS													1-3								12													1-3				
Randolph Tech HS											1-3												1-3	1-3		1-3	1-3	1-3			1-3		1-3	1-3				
Robeson Hum. Serv. HS																																	1-3					
Roxborough HS						1-3												++												1-3							1-3	
Saul HS	1-3	1-3	1-3	1-3																																		
Science Leadership Acad															1															12								
South Phil. HS											1-3	1-3			1-3	1-3			1-3										1-3				1-3		12	1-3	
Strawberry Mansion HS											1-3										12																	
Swenson Arts & Technology HS					1-3		1-3			1-3	1-3				1-3				1-3	1-3		1-3				1-3	1-3	1-3					1-3					
Washington, HS											1-3																									12		1-3
West Phil. HS					1-3		1-3							1-3																								
Workshop HS															1												1-3	1-3										

++	Program under development, but not yet implemented
1-3	Program offers all three years of coursework
1 or 12	Program offered first, or first and second years of coursework

Structure of this Report

This report follows and builds on the 2013-2014 CTE evaluation report produced by the SDP Office of Research and Evaluation (ORE). Findings from that report are updated and replicated in Part I of this report. In Part II, a new, deeper analysis of persistence is presented. In this section, factors that impact a CTE student's successful completion of the program are identified and explored in depth.

PART I: Update and Replication of Year 1 Report

Cohort Definitions and Comparisons

This report focuses on the cohort of District students that were first time 9th grade students in 2011-2012, and therefore expected to graduate in four years at the close of the 2014-2015 school year. To account for comparability and longitudinal data availability, charter schools were excluded, as were several alternative education sites. This resulted in a cohort of 10,380 first time 9th grade students.

This cohort was further divided into CTE and non-CTE students. The standard model for a CTE student is to enroll in a CTE course in 10th grade, and follow this with additional, related courses in 11th and 12th grades. There are, however, many students that participate in CTE during their high school career, but deviate from this ideal model. For this reason, a student was classified as CTE if they took at least one CTE course, or if their last school of record was one of five all-CTE high schools.[1] All remaining students were classified as non-CTE.

Important Note About Changes in Data

This classification strategy mirrors the one that formed the basis of last year's report on first-time 9th grade students in 2010-2011 and their outcomes over four years of high school. However, this year's data is more comprehensive, which results in significant changes to the CTE subgroup.

This is the first year that data about 10th grade CTE course enrollment is available. As such, last year's CTE students were defined based on course participation in 11th and 12th grades. All 10th graders were classified as non-CTE. This year, because of improved course tracking, 10th grade enrollment in a CTE course could be considered and, as a result, the full trajectory of the 9th graders' experience is examined in greater detail.

In addition, last year, a group of 104 students were identified with conflicting records of CTE participation ("CTE non-start"). Improvements in records have reduced this designation, with 60 such students in the current cohort. Of these, 54 were students attributed to an all-CTE school in 9th grade, who then exited the District before 10th grade, and therefore did not begin a CTE course sequence. The remaining six were associated with all-CTE schools at a later time, but did not take a single CTE course.

[1] The five schools are Dobbins, Mastbaum, Randolph, Saul and Swenson.

Similar to last year's analysis, CTE students were subdivided into groups that reflect variations on the standard track. These subgroups have been modified to incorporate the new access to 10th grade CTE course enrollment. Definitions and sample sizes can be found in Table 1.

Table 1: Definitions and totals for CTE subgroups

CTE Trajectory	# Years CTE	CTE course in	# and (%) of CTE students in 2011-2012 1st time 9th grade cohort
CTE On-track	3	2012-2013, 2013-2014, 2014-2015	1,049 (45.9%)
CTE Drop			
CTE Drop- Y1[a]	1	2012-2013	669 (29.3%)
CTE Drop-Y2	2	2012-2013, 2013-2014	284 (12.4%)
CTE Late Start			
Late-start Y2[b]	2	2013-2014, 2014-2015	78 (3.4%)
Late-start Y3	1	2014-2015	39 (1.7%)
CTE Other			
CTE Interrupt	2	2012-2013, 2014-2015	7 (0.3%
CTE Late-Start AND Drop	1	2013-2014	99 (4.3%)
CTE non-start	0	N/A	60 (2.6%)
Overall Totals			
Total CTE students			**2,285 (22%)**
Non-CTE students			**8,095 (78%)**
Totals Obtained Using Only 11th and 12th Grade Enrollment Information			
CTE			**2001 (19%)**
Non-CTE			**8379 (81%)**
Total			**10,380 1st time 2011-2012 9th graders**

[a] Would be classified as non-CTE using only 11th and 12th grade enrollment information

[b] Would be classified as CTE On-track using only 11th and 12th grade enrollment information

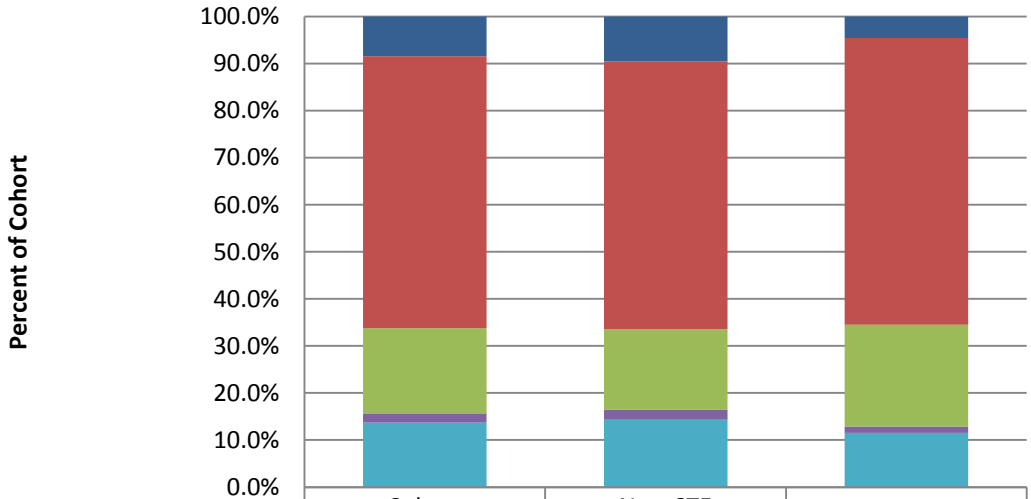
CTE students compared to non-CTE students

Demographics and Prior Performance

The overall first time 9th grade 2011-2012 cohort totaled 10,380 students. Of these students, 2,285 (22%) were classified as CTE students and 8,095 (78%) were classified as non-CTE. For comparison, there were 12,314 students in the 2010-2011 first time 9th grade cohort. With a reduction in the overall number of 9th graders (16%), this represents a sizable increase in the share of the CTE group from the previous year, when the CTE students comprised 16% of the cohort. This increase is likely due to the shift in enrollment, combined with the inclusion of the CTE students who took a course in 10th grade.

Compared with the non-CTE group, the CTE group includes higher percentages of Black/African American and Hispanic/Latino students, and lower percentages of both White and Asian students (see Figure 3). The distributions of the CTE and non-CTE groups are statistically different from each other, $\chi^2(3) = 94.18$, $p < .001$, and these differences are essentially the same as those observed for the 2010-2011 cohort.

Figure 3. Ethnic Profiles of CTE, Non-CTE, and Cohort



	Cohort (n=10,380)	Non-CTE (n=8,095)	CTE (n=2,285)
Asian	8.4%	9.5%	4.6%
Black/African American	57.8%	56.9%	60.9%
Hispanic/Latino	18.1%	17.1%	21.7%
Multi Racial / Other	2.0%	2.1%	1.4%
White	13.7%	14.3%	11.5%

CTE students also differ from non-CTE students on other demographic indicators (see Table 2). CTE students are more likey to be male, are more likely to have English language learner (ELL) status, and are more likely to be classified as free from tape.[2] The subgroups do not differ in terms of IEP status.[3]

Table 2: Demographic characteristics of CTE and non-CTE students

Demographic Indicator	Category	Cohort	Non-CTE	CTE	Chi-Square
Gender	Male	50.4%	48.7%	56.4%	$\chi 2(1) = 42.83$**
	Female	49.6%	51.3%	43.6%	
IEP Status	IEP	16.6%	16.5%	16.9%	$\chi 2(1) = 0.28$, *ns*
	No IEP	83.4%	83.5%	83.1%	
ELL Status	ELL	8.3%	7.9%	9.8%	$\chi 2(1) = 8.14$**
	Not ELL	91.7%	92.1%	90.2%	
Free From Tape	FFT	37.5%	48.1%	57.8%	$\chi 2(1) = 67.87$**
	Not FFT	40.5%	51.9%	42.2%	

* Significant at $p < .05$; ** Significant at $p < .01$

CTE students take courses that are associated with one of ten career clusters. Table 3 presents the breakout of demographics for each cluster in the current cohort, and Table 4 provides a summary of demographic changes from the previous year. The *Human Services* (87.2%) and *Health Care* (72.0%) clusters continue to be predominantly female, though the gender gap in *Health Care* did narrow by 7.4 percentage points. Females continue to be underrepresented in the *Engineering Technology*, *Transportation*, *Construction* and *Information Technology* clusters (ranging from 9.1% to 24.7%). IEP students are again most likely to appear in the *Transportation* cluster, though the *Human Services* cluster saw a substantial increase. ELL students do not pursue the *Agriculture* cluster, but are otherwise distributed fairly evenly, peaking at 14.2% in the *Information Technology* cluster.

In terms of overall changes, the *Communications and Graphics* and *Engineering* clusters stand out. Despite the overall increase in CTE students, enrollment in these clusters was down from the previous year, and *Engineering* showed large demographic shifts with lower minority and female enrollment. The reasons for these shifts are not certain, and it is not yet clear whether they represent an emerging trend or a short-term aberration. It is possible that these changes are the result of disrupted CTE offerings at schools that closed, particularly Bok and Communications Tech, which may have had a disproportionate impact on the *Engineering* and *Communications* clusters, respectively.

[2] Students who are receiving federal assistance such as SNAP or Medicade.
[3] Students enrolled in a special education program with an individualized education plan.

Table 3: CTE student demographics by Career Cluster

Career Cluster	Total Students	Female		IEP		ELL		Black or Latino		Cluster % of all CTE
		#	%	#	%	#	%	#	%	
Agriculture	113	73	64.6%	15	13.3%	1	0.9%	86	76.1%	4.9%
Business and Finance	259	94	36.3%	34	13.1%	31	12.0%	179	69.1%	11.3%
Communications and Graphics	308	134	43.5%	47	15.3%	30	9.7%	255	82.8%	13.5%
Construction	318	50	15.7%	63	19.8%	31	9.7%	289	90.9%	13.9%
Engineering Technology	44	4	9.1%	5	11.4%	5	11.4%	31	70.5%	1.9%
Health Care	328	236	72.0%	54	16.5%	32	9.8%	289	88.1%	14.4%
Hospitality	344	199	57.8%	64	18.6%	24	7.0%	287	83.4%	15.1%
Human Services	125	109	87.2%	26	20.8%	13	10.4%	123	98.4%	5.5%
Information Technology	190	47	24.7%	16	8.4%	27	14.2%	129	67.9%	8.3%
Transportation	196	23	11.7%	44	22.4%	26	13.3%	172	87.8%	8.6%
None (CTE Non-Start)	60	27	45.0%	19	31.7%	3	5.0%	47	78.3%	2.6%

Table 4: Percentage point changes in demographics by Career Cluster

Career Cluster	Total Students	Percentage Point Change				Cluster % of all CTE
		Female	IEP	ELL	Black or Latino	
Agriculture	5	2.6	3.1	0.0	-3.5	-0.7%
Business and Finance	-3	-4.5	4.0	3.6	-6.1	-2.3%
Communications and Graphics	-50	1.9	0.5	1.9	-0.2	-5.2%
Construction	126	3.7	4.7	3.0	5.5	3.9%
Engineering Technology	-36	-5.9	0.1	5.1	-14.5	-2.2%
Health Care	105	-7.4	6.1	-0.6	-1.6	2.7%
Hospitality	68	-4.8	2.7	-0.6	-3.9	0.7%
Human Services	33	1.3	7.8	1.7	-0.5	0.7%
Information Technology	74	2.3	-3.6	-2.2	-2.8	2.3%
Transportation	75	3.5	-2.3	4.2	5.1	2.3%
No Record	-31	-0.1	11.9	-2.7	-1.9	-2.1%

In order to characterize CTE and non-CTE students in academic terms, their 8th grade scores on the Pennsylvania System of School Assessments (PSSA) were compared. Table 5 displays performance levels

for the current cohort, while Table 6 displays changes from the previous cohort. Non-CTE students were, on average, more proficient than the CTE students, and this represents a change from the previous year when the groups were equivalent. Mann-Whitney U tests confirm that the differences between CTE and non-CTE are significant for both the Reading (U=5643008, z=-11.80, p<.001) and Math PSSA (U=6080705, z=-8.15, p<.001).

Table 5: 8th Grade PSSA Performance Levels for CTE and Non-CTE Students

Indicator	Proficiency Level	Cohort (n=8,661)		Non-CTE (n=6,618)		CTE (n=2,043)	
8th Grade PSSA Reading	Below Basic	18.8%	35.6%	18.0%	33.1%	21.3%	43.9%
	Basic	16.8%		15.1%		22.6%	
	Proficient	27.8%	64.4%	26.5%	66.9%	32.0%	56.1%
	Advanced	36.6%		40.4%		24.1%	
	Proficiency Level	**Cohort (n=8,741)**		**Non-CTE (n=6,688)**		**CTE (n=2,053)**	
8th Grade PSSA Math	Below Basic	22.8%	40.6%	22.8%	39.0%	22.8%	45.7%
	Basic	17.8%		16.2%		22.9%	
	Proficient	24.6%	59.4%	22.8%	61.0%	30.4%	54.2%
	Advanced	34.8%		38.2%		23.8%	

Note: 8th grade PSSA data not available for all students

Table 6: Percentage point changes in PSSA Performance Levels from Previous Cohort to Present Cohort

Indicator	Proficiency Level	Cohort		Non-CTE		CTE	
8th Grade PSSA Reading	Below Basic	-7.2	-8.4	-9.0	-10.9	0.3	0.9
	Basic	-1.2		-1.9		0.6	
	Proficient	5.8	8.4	5.5	10.9	3.0	-0.9
	Advanced	2.6		5.4		-3.9	
8th Grade PSSA Math	Below Basic	4.8	7.6	4.8	6.0	7.8	14.7
	Basic	2.8		1.2		6.9	
	Proficient	-6.4	-8.6	-7.2	-6.0	-5.6	-14.8
	Advanced	-2.2		1.2		-9.2	

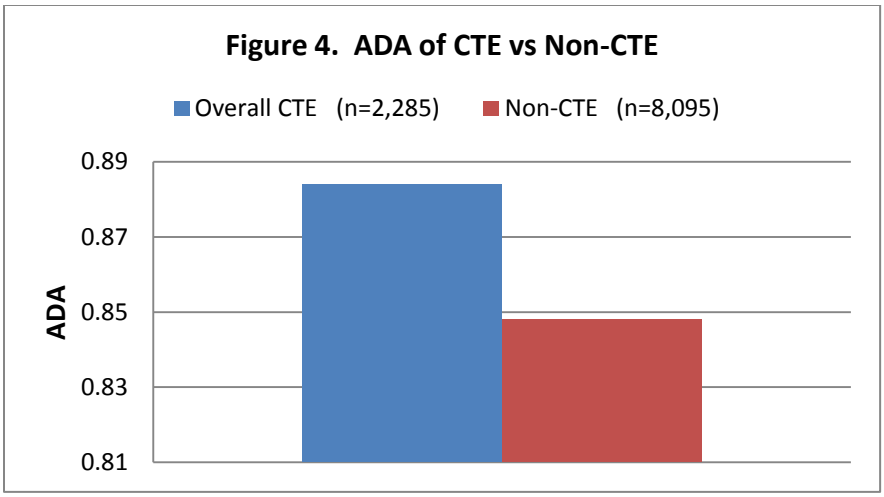
To determine if changes in academic baselines are attributable to CTE classification based on 10th grade courses, and to facilitate direct comparison with last year's report, researchers reconfigured the data. Table 7 shows PSSA baseline data, with CTE Drop-Y1 (10th grade) students broken out. The right-hand (green) columns reproduce the grouping criteria that were in effect for last year. After this adjustment, CTE and non-CTE are more comparable, though the non-CTE group still shows higher proficiency levels for both Reading (U=4709932, z=-6.62, p<.001) and Math (U=5001624, z=-4.00, p<.001). There is, in other words, evidence that this CTE cohort was less academically prepared (compared to their non-CTE peers) than last year's. Put another way, there is certainly no evidence that CTE attracts students that are unusually well-prepared academically, at least as measured by 8th grade PSSA scores.

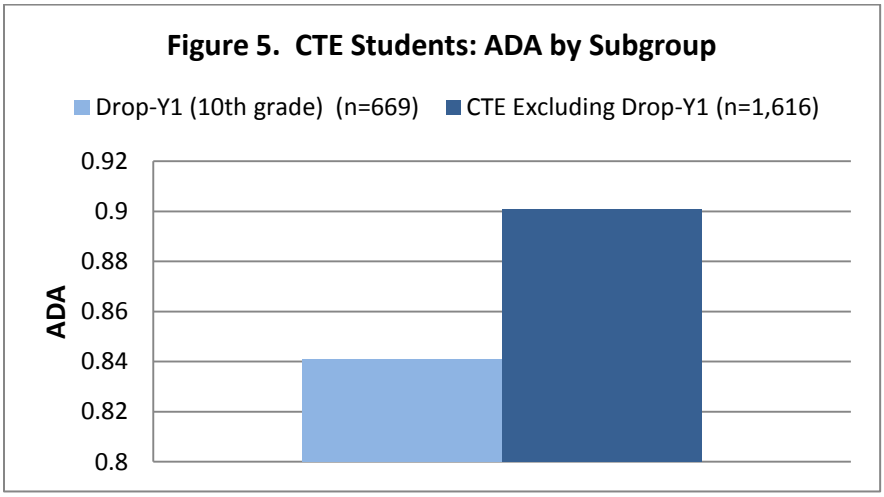
Table 7: PSSA baseline, assigning CTE-Drop Y1 (10th grade) students using last year's criteria

Indicator	Proficiency Level	All CTE		CTE-Drop Y1 (10th grade)		CTE based on 11th and 12th grade courses [comparable to 2010-2011 CTE cohort]		Non-CTE plus CTE Drop Y1 [comparable to 2010-2011 non-CTE cohort]	
		n=2,043		n=581		n=1,462		n=7,199	
8th Grade PSSA **Reading**	Below Basic	21.3%	43.9%	29.9%	51.8%	17.9%	40.8%	19.0%	34.6%
	Basic	22.6%		21.9%		22.9%		15.6%	
	Proficient	32.0%	56.1%	29.1%	48.2%	33.2%	59.3%	26.7%	65.4%
	Advanced	24.1%		19.1%		26.1%		38.7%	
		n=2,053		n=584		n=1,469		n=7,272	
8th Grade PSSA **Math**	Below Basic	22.8%	45.7%	27.7%	52.4%	20.9%	43.1%	23.2%	40.1%
	Basic	22.9%		24.7%		22.2%		16.9%	
	Proficient	30.4%	54.2%	30.3%	47.6%	30.5%	56.9%	23.4%	59.9%
	Advanced	23.8%		17.3%		26.4%		36.5%	

Note: Columns with green labels replicate the CTE and non-CTE inclusion criteria used in the previous year's report on the 2010-2011 9th grade cohort.

Finally, CTE students were evaluated for their pre-existing attendance profiles. Ninth grade average daily attendance (ADA) was chosen as the baseline, as it reflects the most proximal measure prior to standard 10th grade enrollment in CTE. Baseline ADA was .88 for CTE students, and .85 for non-CTE, and this difference was not significant, U=9078115, z=-1.35, p>.10 (see Figure 4). Again, however, Figure 5 shows that if CTE Drop-Y1 (10th grade) students are excluded (ADA=.84), then the remaining CTE students have a baseline ADA of .91, which is reliably higher than the non-CTE pool, U=6100916, z=-4.28, p<.001. Additionally, non-CTE and CTE Drop-Y1 (10th grade) students have similar aggregate ADA, but this apparent similarity is due to a small number of extreme scores. When evaluated on likelihood of having lower or higher scores, CTE Drop-Y1 students are more likely to have lower ADA, U=2097510, z=-9.71, p<.001.





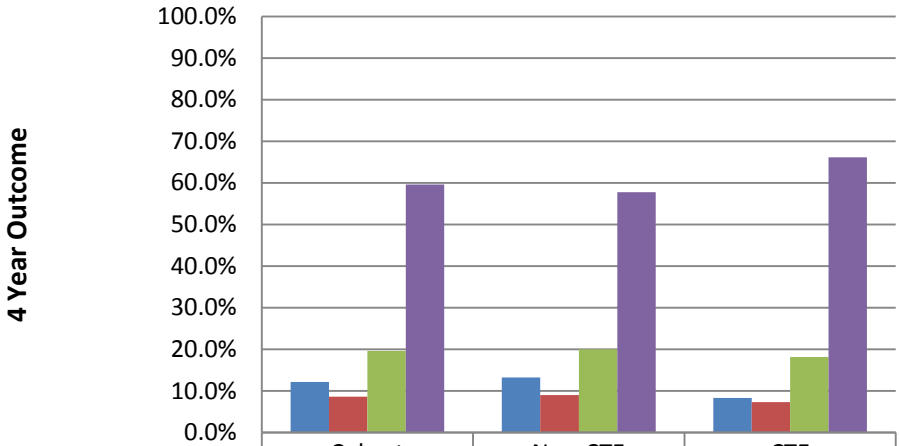
To summarize, CTE students had lower 8th grade PSSA baselines than non-CTE, and comparable attendance profiles. On closer examination, however, the students who started and discontinued participation in CTE in 10th grade, stand out as having significantly lower academic and attendance baselines than either non-CTE or the remaining CTE students. In other words, the CTE cohort includes a subgroup with significant graduation risk factors.

Identification of this subgroup raises new and important questions. First, has a comparable high-risk subgroup been a consistent element of previous CTE cohorts, or are formal or informal District practices surrounding CTE placement expanding this group over time? Second, what are the implications of pre-existing risk factors for persistence in CTE, and toward graduation? The first question requires new information about student placement across the District, but the second can be addressed with existing data, and is explored in depth later in this report.

Four Year Outcomes

In considering SDP's focus on four year graduation, students were classified in terms of their four year outcomes. After four years, a student could have a) graduated on time (desirable outcome); b) dropped out of school; c) continued in school beyond the fourth year; or d) transferred out of the District ("non-drop departure"). For this last group, it is not possible to determine graduation status. Four Year outcomes for the cohort, as well as CTE and non-CTE subgroups, are shown in Figure 6.

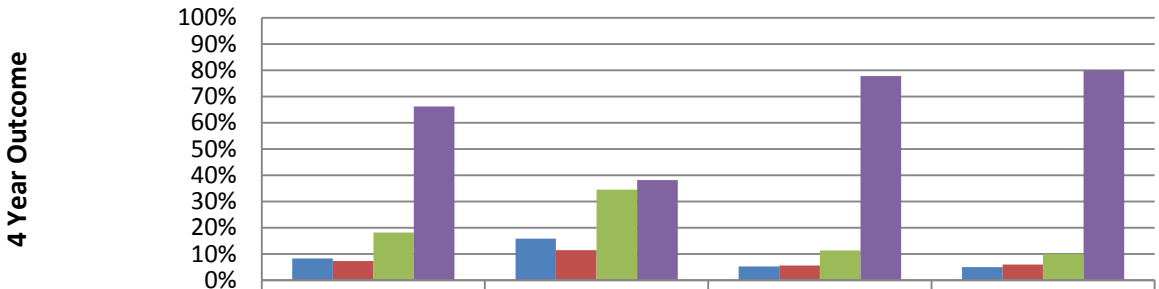
Figure 6. Four Year Outcomes for CTE and Non-CTE



	Cohort (n=10,380)	Non-CTE (n=8,095)	CTE (n=2,285)
Nondrop Departure	12.2%	13.2%	8.3%
Continuing	8.6%	9.0%	7.4%
Dropout	19.6%	20.0%	18.2%
Graduate	59.6%	57.8%	66.2%

CTE students are less likely to leave the District (8.3%) compared with non-CTE (13.2%), $\chi^2(1) = 40.52$, $p < .001$. This was also found for the 2010-2011 9th grade cohort, and is replicated here. For modified data that facilitate comparison between the 2010-2011 and 2011-2012 cohorts, see Figure 7.

Figure 7. Four Year Outcomes: Modified to Facilitate Comparison to Last Year



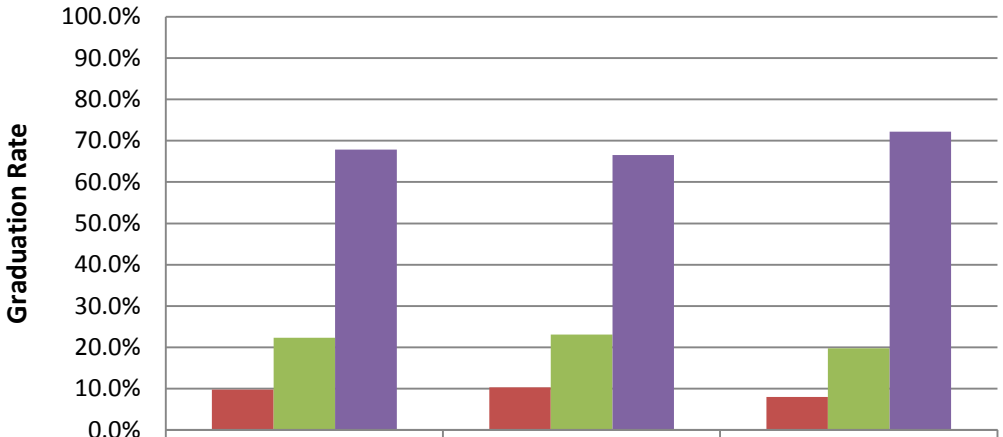
4 Year Outcome	2011-2012 CTE (10th, 11th and 12th grade courses) Overall (n=2,285)	2011-2012 CTE Y1-Drop (10th grade) (n=669)	2011-2012 CTE (11th and 12th grade courses only) (n=1,556)	2010-2011 CTE cohort (11th and 12th grade courses) Overall (n=1,919)
Nondrop Departure	8%	16%	5%	5%
Continuing	7%	12%	6%	6%
Dropout	18%	35%	11%	10%
Graduate	66%	38%	78%	80%

Graduation Rates

Measures of "Graduation Rate" are variable, and may depend on the entity that computes them, the cohort under consideration, or both. The typical District formula for calculating graduation rates disregards students that complete their education outside the District (non-drop departure). For this report, we also excluded non-drop departure students, and only those students with a known four year outcome were considered. Additionally, the District graduation measure for a cohort incorporates students that transfer into the District after 9th grade. However, these students have been specifically excluded from this analysis to ensure that results are confined to students with the full opportunity to participate in (or forego) CTE and to graduate in four years – that is, members of the 2011-2012 first time 9th grade cohort. For this reason, there may be small differences between the graduation rates reported here, and published rates for the District.

As Figure 8 shows, the overall graduation rate for the 2011-2012 first time 9th grade cohort was 67.9%. Non-CTE students graduated at a rate of 66.6%, with CTE students graduating at the higher rate of 72.2%, $\chi^2(1) = 23.24$, $p < .001$. This finding replicates the pattern from the previous year, and is even more pronounced when accounting for the impact of the CTE Drop-Y1 (10th grade) subgroup (see Figure 9).

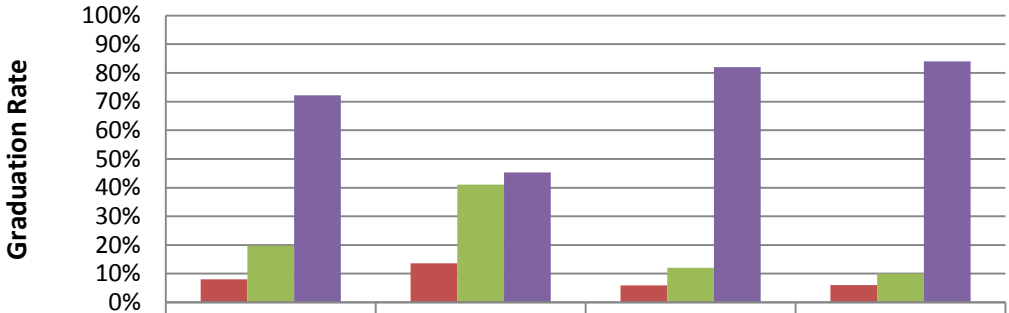
Figure 8. Graduation Rates for Cohort, Non-CTE and CTE



	Cohort (n=9,118)	Non-CTE (n=7,023)	CTE (n=2,095)
Continuing	9.8%	10.4%	8.0%
Dropout	22.3%	23.1%	19.8%
Graduate	67.9%	66.6%	72.2%

Note: Graduation rate excludes non-drop departures from the denominator

Figure 9. Graduation Rates: Modified to Facilitate Comparison to Last Year

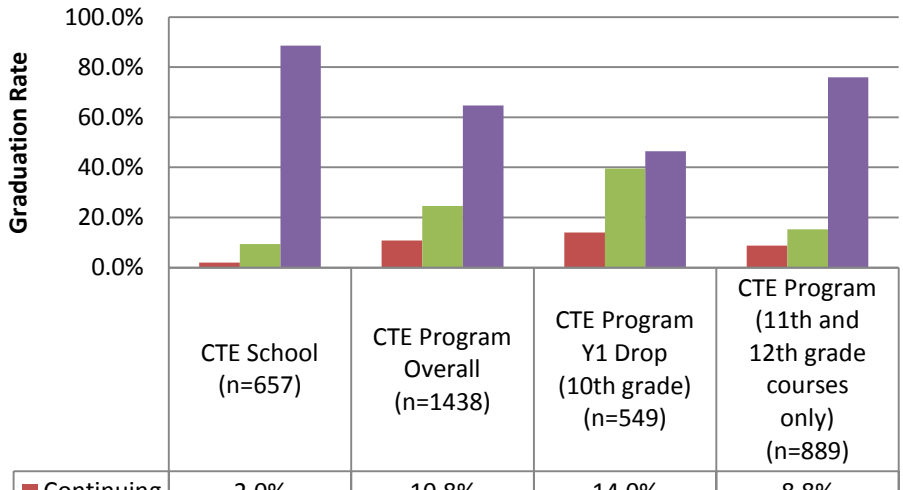


	2011-2012 CTE (10th, 11th and 12th grade courses) Overall (n=2,095)	2011-2012 CTE Y1-Drop (10th grade) (n=563)	2011-2012 CTE (11th and 12th grade courses only) (n=1,532)	2010-2011 CTE cohort (11th and 12th grade courses) Overall (n=1,828)
Continuing	8%	14%	6%	6%
Dropout	20%	41%	12%	10%
Graduate	72%	45%	82%	84%

Note: Graduation rate excludes non-drop departures from the denominator

CTE students were then divided into two groups based on the type of school they were enrolled in as their last school of record. Graduation rates were particularly high at the five all-CTE schools (see Figure 10). This disparity is partially due to the fact that the majority of the Drop-Y1 (10th grade) students (549 of 563, 98%; excluding non-drop departures) were enrolled in CTE programs at other schools.[4] However, even when these students are removed from consideration, CTE schools still show a significantly higher graduation rate than CTE programs at other schools.

Figure 10. Graduation Rates for CTE School and CTE Program

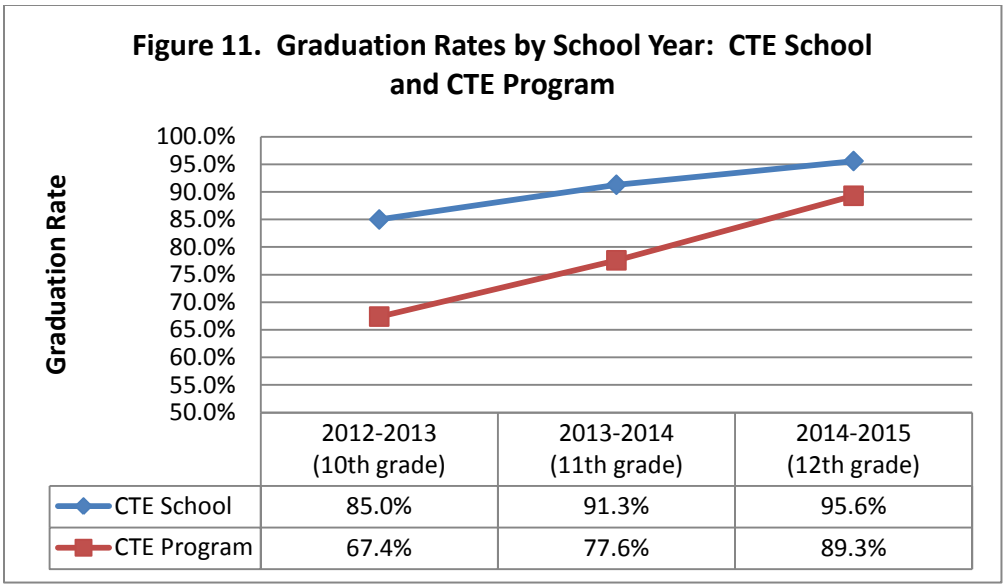


	CTE School (n=657)	CTE Program Overall (n=1438)	CTE Program Y1 Drop (10th grade) (n=549)	CTE Program (11th and 12th grade courses only) (n=889)
Continuing	2.0%	10.8%	14.0%	8.8%
Dropout	9.4%	24.5%	39.5%	15.3%
Graduate	88.6%	64.7%	46.4%	75.9%

Note: Graduation rate excludes non-drop departures from the denominator

To better understand the impact of school type on graduation rate, researchers also took snapshots of student enrollment at the close of each school year. For this comparison, only students that were actively enrolled in CTE during the given year were considered. For example, of those students that were enrolled in a CTE course during SY 2012-2013 (which should have been their 10th grade year), those attending a CTE school *at that time* went on to graduate 85.0% of the time, while those attending a CTE program eventually graduated at a 67.4% rate (see Figure 11). Similarly, comparisons for 2013-2014 and 2014-2015 include only those students that were actively enrolled in CTE during those years. CTE schools show higher graduation rates at all time points, but the key finding is that the persistence patterns are different. Each successive year of CTE enrollment has a bigger impact on the graduation rates of CTE program students compared with those at CTE schools.

[4] It must be noted that some of these numbers are influenced by a series of school closures at the end of the 2012-2013 SY, which disproportionately affected CTE Program students. This is explored in more depth later in the report.

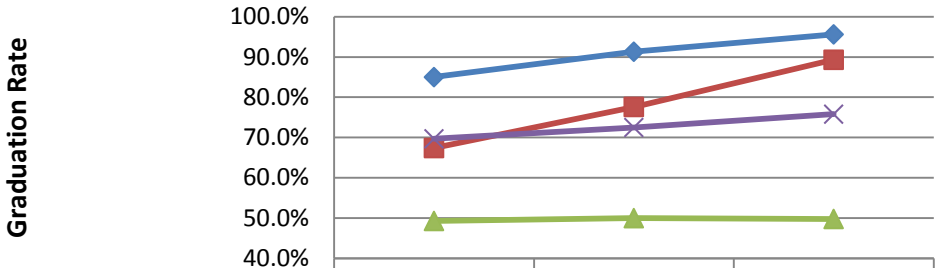


To better understand these graduation rates, two comparison groups were considered (see Figure 12). The first group consists of non-CTE students, but only those that were still enrolled in a District school at the time of each snapshot. This group provides a basis for interpreting the magnitude of year-to-year changes in graduation rates. The data indicate that graduation rates generally improve as students remain enrolled from year to year, but these gains are more pronounced for CTE students.

The second comparison group consists of District students that participated in CTE at some point in their high school career, but not during the snapshot year. This group provides a basis for evaluating the relationship between disrupting progress in CTE and disrupting progress toward graduation. The graduation rates for these students are constant across all years, at values very close to 50%. That is, inconsistent enrollment in CTE is associated with poor graduation rates, even if those students are still enrolled in District schools.

Taken together, these data indicate that the stakes are especially high for CTE students that are not in CTE-only schools. When these students persist in CTE beyond 10th grade, their graduation outcomes improve dramatically. This effect is less pronounced for those in CTE schools (where there is less room for growth), and for those that never take CTE (where growth is more flat).

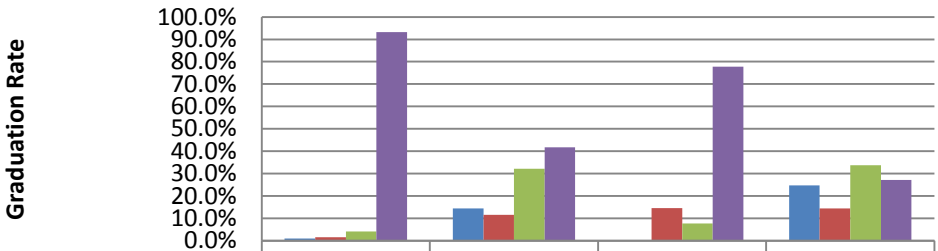
Figure 12. Graduation Rates by School Year



	2012-2013 (10th grade)	2013-2014 (11th grade)	2014-2015 (12th grade)
CTE School	85.0%	91.3%	95.6%
CTE Program	67.4%	77.6%	89.3%
CTE Students Not Actively Enrolled in CTE, but Enrolled in District School	49.3%	50.0%	49.8%
Non-CTE, Enrolled in District School	69.7%	72.5%	75.8%

CTE students were then classified in terms of their specific CTE enrollment trajectories. Table 1 in the Introduction provides detailed definitions and sample sizes for the full range of tracks. These were aggregated to produce four groups reflecting those that maintained their CTE enrollment for all three years (On Track); those that began CTE at their first opportunity (2012-2013), but then discontinued participation prior to 2014-2015 (CTE Drop); those that started late, but otherwise proceeded without disruption (Late Start); and those that did not fit any of these categories (CTE Other). The data reinforce the conclusion that CTE enrollment in the upper grades strongly predicts graduation, as On Track students had the best outcomes, followed by Late Start (see Figure 13).

Figure 13. Graduation Rates by CTE Track



	CTE On Track (n=1049)	CTE Drop (n=953)	CTE Late Start (n=117)	CTE Other (n=166)
Nondrop Departure	1.0%	14.5%	0.0%	24.7%
Continuing	1.5%	11.6%	14.5%	14.5%
Dropout	4.2%	32.1%	7.7%	33.7%
Graduate	93.2%	41.8%	77.8%	27.1%

See Table 1 for details of CTE track definitions

Outcomes for Individual Schools

Table 8 displays four-year outcomes for students in all District schools that hosted at least 10 CTE students. In 24 of the 34 schools, CTE students graduated at a higher rate than non-CTE students in the same school. In these cases, the average school had 48 CTE students, and the difference in graduation rate was 17.4 percentage points. In eight schools with smaller CTE populations (average of 20), the CTE students had a graduation rate that was, on average, 7.4 percentage points lower. In the remaining two schools, graduation rates were the same for CTE and non-CTE students.

Table 8: Outcomes, Attributed to Last School of Record (District or Charter)

School Name	Student Counts			CTE Student Outcomes*				Non-CTE Student Outcomes*			
	CTE	Non-CTE	Total	% Graduated	% Dropped Out	% Continuing	% Non-Drop Departure	% Graduated	% Dropped Out	% Continuing	% Non-Drop Departure
Mastbaum, Jules E. HS	190	0	190	82.7%	16.1%	1.2%	11.6%	N/A	N/A	N/A	N/A
Edison, Thomas A. HS	179	128	307	59.2%	33.8%	7.0%	12.3%	21.5%	60.2%	18.3%	27.3%
Swenson Arts & Technology HS.	177	0	177	92.0%	3.1%	4.9%	7.9%	N/A	N/A	N/A	N/A
Dobbins, Murrell HS	139	0	139	85.8%	14.2%	0.0%	8.6%	N/A	N/A	N/A	N/A
Randolph Tech HS	112	0	112	86.8%	10.4%	2.8%	5.4%	N/A	N/A	N/A	N/A
South Philadelphia HS	106	124	230	74.0%	20.0%	6.0%	5.7%	47.0%	39.0%	14.0%	19.4%
Saul, Walter B. HS	101	0	101	98.9%	1.1%	0.0%	7.9%	N/A	N/A	N/A	N/A
Northeast HS	97	586	683	86.5%	10.1%	3.4%	8.2%	73.3%	18.3%	8.4%	15.0%
Washington, George HS	89	357	446	87.3%	7.6%	5.1%	11.2%	77.3%	17.7%	5.0%	27.2%
Roxborough HS	72	97	169	81.2%	17.4%	1.4%	4.2%	61.2%	22.4%	16.4%	30.9%
King, Martin Luther HS	71	202	273	66.2%	19.1%	14.7%	4.2%	52.7%	28.7%	18.6%	17.3%
Lincoln,Abraham HS	70	339	409	67.7%	22.6%	9.7%	11.4%	63.2%	24.3%	12.5%	15.0%
Overbrook HS	62	128	190	55.8%	32.7%	11.5%	16.1%	49.0%	34.3%	16.7%	20.3%
John Bartram HS	61	190	251	67.3%	25.5%	7.3%	9.8%	57.5%	32.5%	10.0%	15.8%
West Philadelphia HS	46	115	161	73.7%	23.7%	2.6%	17.4%	58.5%	29.8%	11.7%	18.3%
Penn Treaty HS	42	20	62	77.5%	15.0%	7.5%	4.8%	52.6%	31.6%	15.8%	5.0%
Kensington Health Sciences	38	48	86	83.3%	13.9%	2.8%	5.3%	51.4%	22.9%	25.7%	27.1%
Frankford HS	35	315	350	82.4%	14.7%	2.9%	2.9%	50.0%	34.0%	16.0%	16.8%

Only schools with a minimum of 10 CTE students are included.

*The total of % Graduated, % Dropped Out, and % Continuing add up to 100%, as these were calculated as a percentage of the number of students excluding Non-Drop Departures. This also means that in this table % Graduated corresponds to Graduation Rate. The % Non-Drop Departure was calculated as a percentage of all students, prior to removing these students from the denominator.

Table 8 Continued: Outcomes, Attributed to Last School of Record (District or Charter)

School Name	Student Counts			CTE Student Outcomes*				Non-CTE Student Outcomes*			
	CTE	Non-CTE	Total	% Graduated	% Dropped Out	% Continuing	% Non-Drop Departure	% Graduated	% Dropped Out	% Continuing	% Non-Drop Departure
Creative And Performing Arts Hs	31	138	169	93.3%	6.7%	0.0%	3.2%	96.1%	2.3%	1.6%	6.5%
Fels, Samuel Sr. High	31	232	263	76.7%	20.0%	3.3%	3.2%	70.3%	16.7%	13.0%	17.2%
Kensington Bus, Fin & Ent	27	79	106	82.6%	8.7%	8.7%	14.8%	40.7%	44.4%	14.8%	31.6%
Excel South	26	152	178	53.8%	19.2%	26.9%	0.0%	49.3%	22.3%	28.4%	2.6%
Furness, Horace HS	21	115	136	66.7%	22.2%	11.1%	14.3%	67.3%	21.4%	11.2%	14.8%
One Bright Ray - Fairhill	21	100	121	42.9%	28.6%	28.6%	0.0%	59.0%	21.0%	20.0%	0.0%
Robeson - Human Serv HS	21	43	64	95.0%	5.0%	0.0%	4.8%	95.1%	2.4%	2.4%	4.7%
Strawberry Mansion HS	21	79	100	15.8%	47.4%	36.8%	9.5%	26.9%	43.3%	29.9%	15.2%
Franklin Benjamin HS	19	164	183	66.7%	16.7%	16.7%	5.3%	54.5%	22.8%	22.8%	11.6%
Agora Cyber CS	18	61	79	0.0%	50.0%	50.0%	22.2%	0.0%	54.2%	45.8%	21.3%
HS Of Engineering & Science	17	155	172	100.0%	0.0%	0.0%	0.0%	98.6%	0.7%	0.7%	10.3%
El Centro (Big Picture)	14	49	63	42.9%	28.6%	28.6%	0.0%	18.4%	46.9%	34.7%	0.0%
One Bright Ray - Simpson Campus	14	41	55	0.0%	64.3%	35.7%	0.0%	0.0%	72.5%	27.5%	2.4%
Pla North Hunting Park EOP	14	40	54	0.0%	78.6%	21.4%	0.0%	7.5%	90.0%	2.5%	0.0%
Sayre HS	14	128	142	38.5%	30.8%	30.8%	7.1%	49.5%	39.4%	11.1%	22.7%
Overbrook HS - EOP	13	20	33	0.0%	76.9%	23.1%	0.0%	10.0%	70.0%	20.0%	0.0%
Phase 4 Accel SW HS	13	70	83	38.5%	23.1%	38.5%	0.0%	30.9%	44.1%	25.0%	2.9%
OIC Cadi	12	55	67	41.7%	41.7%	16.7%	0.0%	14.8%	66.7%	18.5%	1.8%
Performance Learning Center SW	11	38	49	81.8%	9.1%	9.1%	0.0%	56.8%	24.3%	18.9%	2.6%
Phila Learning Academy North	11	61	72	27.3%	54.5%	18.2%	0.0%	14.0%	64.9%	21.1%	6.6%
Phila Virtual Academy	11	38	49	18.2%	45.5%	36.4%	0.0%	11.1%	47.2%	41.7%	5.3%

Only schools with a minimum of 10 CTE students are included.

*The total of % Graduated, % Dropped Out, and % Continuing add up to 100%, as these were calculated as a percentage of the number of students excluding Non-Drop Departures. This also means that in this table % Graduated corresponds to Graduation Rate. The % Non-Drop Departure was calculated as a percentage of all students, prior to removing these students from the denominator.

Achievement Gap

The analysis of the 2010-2011 9th grade cohort found that graduation rates for CTE students were similar across different races/ethnicities, whereas this was not true for the cohort overall. That finding is replicated for the 2011-2012 9th grade cohort. For the cohort overall, the combined graduation rates of Black/African American and Hispanic/Latino students lag behind the combined rates of White and Asian students by approximately 10 percentage points. For CTE students, however, this gap narrows to 2 percentage points (see Table 9).

Table 9: Graduation Achievement Gap for 2011-2012 9th Grade Cohort, Non-CTE and CTE

Ethnicity	Graduation Rate					
	Cohort		Non-CTE		CTE	
African American	67.6%	65.3%	65.7%	63.2%	73.5%	71.2%
Latino	57.7%		54.3%		66.7%	
White	71.6%	75.7%	71.0%	76.3%	74.0%	73.1%
Asian	82.0%		83.5%		70.8%	

A second finding from last year, however, was only partly replicated with the current cohort. It was previously found that, for the 2010-2011 9th grade cohort, graduation rates of specific ethnic groups were not proportional to their enrollment rates, while rates for CTE students were proportional for all groups. As Table 10 shows, this year's data exhibits disproportional graduation rates for both the cohort and CTE, though the patterns and magnitudes differ in important ways. Compared with the cohort, CTE students in the traditionally disadvantaged groups have more favorable gaps, including a small over-representation of Black/African American graduates.

Table 10: Ethnicity Distribution of Enrollment and Graduation

Ethnicity	% of Cohort Population (n=10,380)	Gap	% of Cohort Graduates (n=6,187)	% of CTE Population (n=2,285)	Gap	% of CTE Graduates (n=1,512)
African American	58%	0	58%	61%	+1	62%
Latino	18%	-3	15%	22%	-2	20%
White	14%	0	14%	12%	0	12%
Asian	8%	+3	11%	5%	0	5%
Multi Racial / Other	2%	0	2%	1%	+1	2%

Academic Experience and Tenacity

As in previous years, SDP administered a District-Wide Survey in the spring of 2015. This administration features some changes from previous years, including changes to the response options, and expanded opportunities to respond electronically. One result of these changes was much higher response rates. In last year's report, data was presented from 197 non-CTE students and 96 CTE students. This year, those totals are 945 and 287, respectively. If respondents are classified on whether they were actively enrolled in CTE at the time of the survey, the totals are 1,028 and 205, respectively.

Table 11 displays survey data, with classification as CTE or non-CTE restricted to the student's status during 2014-2015, when the survey was administered. Mann-Whitney U-Tests were conducted to determine whether CTE and non-CTE students responded differently on each item, and only those items with statistically significant differences are displayed. The results are not, in general, positive for CTE. Non-CTE students provided more favorable responses on 5 of 11 questions related to academic experience, and on 2 of 7 questions related to grit and determination (though in all of these cases the magnitude of the difference is small). There were no items on which CTE students provided higher ratings, and there were no significant differences on any of the 17 items concerning safety of the learning environment.

Table 11: District-Wide Survey Responses by active CTE and non-CTE students in 2014-2015

	Survey Question	Non-CTE		CTE		Sig.
		N	Mean	N	Mean	
Quality of Academic Experience	My teachers want me to succeed.	1007	2.79	199	2.69	.008
	My teachers are willing to provide me with extra help if I need it.	1013	2.55	204	2.40	.010
	In my classes we stay busy and do not waste time.	1016	2.19	205	2.01	.001
	In my classes we learn a lot.	1015	2.27	203	2.04	.000
	My teachers make sure I understand lessons before teaching something new.	1015	2.09	205	1.90	.002
Academic Tenacity	My teachers have high expectations for me in school.	996	2.68	200	2.59	.021
	My teachers encourage me to work hard.	1021	2.60	199	2.50	.023

Responses: Never (0), Rarely (1), Occasionally (2), Most or All of the Time (3)

Multivariate Analyses

The prior report on the 2010-2011 9th grade cohort included two logistic regression analyses, designed to determine whether higher graduation rates for CTE students were attributable to prior student characteristics. One analysis was restricted to CTE students from CTE-only schools, and the other considered only those students in CTE programs at other schools. After controlling for student characteristics, CTE students exhibited higher graduation rates in both analyses.

This analysis of the 2011-2012 9th grade cohort builds on and modifies last year's regression analysis. First, results of both models from last year indicated similar effects of CTE participation, so CTE students were combined, regardless of which type of school they attended. Secondly, we speculate that predictors of graduation may evolve during the progression from 9th to 12th grades, and that different interventions may be indicated for different points on this progression. For this reason, we conduct one analysis of students in 10th grade, and a second that focuses on 11th grade. The 10th grade analysis controls for 8th grade PSSA levels, and 9th grade indicators, and includes only students that were enrolled in the District during the expected 10th grade year (2012-2013). The second analysis controls for 10th grade indicators, and includes only those students that were still enrolled in 2013-2014 (the expected 11th grade year). In order to better isolate the protective influence of CTE, CTE membership is only assigned to students that were actively enrolled in a CTE course during the relevant year. Tables 12 and 13 provide detailed descriptions of the predictors that were used in the analyses.

Table 12: Predictor Variables, On-Time Graduation Rates for Students Enrolled in the District During 2012-2013.

Predictor Variable	Definition	Comments
Student Demographics		
Free from Tape	Most economically disadvantaged category	*English Language Learner status was not significant in any models; therefore it is not included in the final models*
URM (Under Represented Minority)	Not identifying as White or Asian	
Disability	Documented disability	
Male		
8th Grade Proficiency		
Adv/Prof in Math	Scored 'Advanced' or 'Proficient' on 8th Grade PSSA Math exam	*Including this variable decreased the sample significantly; including PSSA Reading would have decreased the sample even further and did not impact the model*
9th Grade Indicators		
ADA	Average Daily Attendance	*Research points to attendance, grades, and behavior as key predictors of graduation; used 9th grade because is most proximal to analyzed year.*
D or F in Math or Reading	Received a D or F as their final grade in Math or English course	
1+ suspension	1 or more out-of-school or in-school suspensions	
Credit Balance	Number of credits above or below the standard milestone for grade promotion.	
CTE status		
CTE Student	Enrolled in a CTE program or CTE comprehensive school during 2012-2013	*Combined this year, because effects of CTE school and program were similar last year.*
Other Factors		
School Closure	Student's school of record for 2012-2013 was closed at the end of that year.	*Included because analyses suggest school closures impacted CTE and non-CTE differently.*

Table 13: Predictor Variables, On-Time Graduation Rates for Students Enrolled in the District During 2013-2014.

Predictor Variable	Definition	Comments
Student Demographics		
Free from Tape	Most economically disadvantaged category	*English Language Learner status was not significant in any models; therefore it is not included in the final models*
URM (Under Represented Minority)	Not identifying as White or Asian	
Disability	Documented disability	
Male		
10th Grade Indicators		
ADA	Average Daily Attendance	*Research points to attendance, and behavior as key predictors of graduation; used 10th grade because is most proximal to analyzed year.*
1+ suspension	1 or more out-of-school or in-school suspensions	
10th Grade Academic Performance		
Credit Balance	Number of credits above or below the standard milestone for grade promotion.	*The model is robust with respect to which measure is chosen as a proxy for performance. Similar results were obtained for D or F in English/Math, and for grade-level status. Credit Balance accounted for the most overall variability.*
D or F in Math or Reading	Received a D or F as their final grade in Math or English course	
CTE status		
CTE Student	Enrolled in a CTE program or CTE comprehensive school during 2013-2014	*Combined this year, because effects of CTE school and program were similar last year.*

Table 14: Predicting On-Time Graduation: CTE vs. non-CTE Students Enrolled in the District During 2012-2013.

Odds Ratios : Exp (B)

	% of students	Model I	Model II	Model III	Model IV[#]	Expanded Model
Student Demographics						
Free from Tape	52.3%	.413**	.451**	.747**	.741**	.726**
URM	75.5%	.677**	.807*	1.105	1.086	1.067
Disability	14.7%	.676**	.963	1.207+	1.215+	1.102
Male	48.8%	.574**	.572**	.553**	.545**	.566**
8th Grade Proficiency						
Adv/Prof in Math	63.0%		2.554**	1.353**	1.365**	1.313**
9th Grade indicators						
ADA (mean)	90.3%			1.091**	1.091**	1.074**
ADA quadratic				1.002**	1.003**	1.003**
ADA cubic				1.000**	1.000**	1.000**
D or F in Math or English	39.6%			.320**	.320**	.512**
1+ suspension	25.0%			.623**	.632**	.717**
Credit Balance (mean)	1.26					1.513**
Credit Balance cubic						.991*
CTE Status						
CTE student	24.3%				1.298**	1.191+
Additional Factors						
School Closure	8.3%					.668**
N= 6,708						
Pseudo R-square (Nagelkerke)		.090	.136	.392	.393	.423
% correctly predicted		74.2	74.7	81.0	81.2	82.2

[#]Comparable to last year's final model + $p<.05$ * $p<.01$ ** $p<.001$

Table 15: Predicting On-Time Graduation: CTE vs. non-CTE Students Enrolled In the District During 2013-2014.

		Odds Ratios : Exp (B)			
	% of students	Model I	Model II	Model III	Final Model
Student Demographics					
Free from Tape	49.2%	.429**	.764**	.795*	.790*
URM	73.9%	.648**	.927	.946	.926
Disability	13.7%	634.**	.979	.935	.938
ELL	7.8%	.664*	.675*	.675*	.664*
Male	48.5%	.539**	.541**	.541**	.531**
10th Grade Indicators					
ADA (mean)	88.3%		1.118**	1.078**	1.079**
ADA quadratic			1.001**	1.001**	1.001**
1 + Suspensions	18.3%		.482**	.756*	.784*
10th Grade Acad. Perf.					
Credit Balance (mean)	1.82			1.396**	1.384**
Credit Balance cubic				.999**	.999**
D or F in Math or English	40.0%			.501**	.494**
CTE Status					
CTE student	20.1%				1.359*
N= 7,129					
Pseudo R-square (Nagelkerke)		.094	.381	.496	.498
% correctly predicted		77.6	82.9	85.8	85.7

* p<.01 **p<.001

Findings

10th Grade Year

The first analysis focuses on students during the expected 10th grade year (2012-2013). After controlling for a variety of factors that are known to influence graduation, we found that students actively enrolled in CTE were significantly more likely to graduate on time than other District students. Table 14 provides detailed results of the logistic regression, displaying the log odds associated with each factor. For this type of analysis, a value that is smaller than 1.000 means that the factor is associated with a *lower* graduation rate, while a value greater than 1.000 is associated with a *higher* graduation rate.

Model IV corresponds closely with the models that appeared in the report on the 2010-2011 9th grade cohort. It is different in that CTE membership is restricted to 10th grade CTE participation (which was not available last year). It also includes quadratic and cubic terms for ADA that better capture the nonlinear relationship between changes in attendance and changes in graduation rate. For example, a change from an ADA of .25 to .30 has much less impact than a change from .85 to .90. Finally, Disability was excluded last year because it was not statistically significant, but reached significance this year and was retained. With these modifications, CTE remains a significant positive predictor of graduation, though the strength of this association is somewhat reduced compared with last year's model.

The ability of the model to predict a student's graduation outcome is reflected by the pseudo R-square value, and the number of correct predictions. Model IV has high values for both of these measures. The pseudo R-square value of .393 can be interpreted as a high-end estimate of how much of a student's graduation probability is predicted by the factors in the model. In this case, the model accounts for 39.3% of each student's likelihood of graduating on time. The "percent correctly predicted" value indicates that the model correctly "guessed" the graduation outcome of 81.2% of the students in the sample. This value should be compared to a base rate of 74.2% when using no predictor variables.

In an effort to improve predictive power, two additional factors were added to the model; 9th grade credit balance[5] and school closure. This analysis appears in Table 14 as the Expanded Model. Statistically, these factors improve the fit of the model, increasing the pseudo R-square value to .423, and prediction rate to 82.2%. After controlling for these additional factors, CTE participation is still associated with increased graduation rates. Further, among all factors with a positive influence on graduation rate, CTE participation in the 10th grade year is exceeded only by a credit balance surplus, proficient/advanced performance on the 8th grade PSSA, or an improvement in ADA of at least 3 points.

[5] The District has a general policy that students can be promoted to 10th grade if they have accumulated 5 credits. This means, for example, that a student with 5 credits at the end of 9th grade would have a credit balance of 0, and a student with only 3 credits would have a balance of -2. The requirement for promotion to 11th grade is 11 credits, which corresponds to a balance of 0 for students at the end of 10th grade.

11th Grade Year

The second analysis focuses on students that were still in the District one year later. Demographic indicators were similar, though ELL status was included because it was significant in some models. ADA, suspensions, grades, and credit balance were included, though these metrics were advanced by one year to capture the most proximal data. Finally, students were only included if they were enrolled in the District in 2013-2014, and were only designated as CTE if they were actively participating in the program during that year.

As Table 15 shows, this model shows very high predictive fit, with a pseudo R-square value of .498, and a successful prediction rate of 85.7% (in this case compared with a baseline rate of 77.6%).[6] Once again CTE participation is associated with higher graduation rates. In this case the only positive factors that have a greater influence than CTE participation are a credit balance surplus, or an increase in ADA of at least 5 points.

[6] It is likely that higher prediction rates are partly the result of modeling the data one year later. With less time between the moment of analysis and the moment of graduation there are fewer opportunities for each student to make unexpected course changes. Also, the higher prediction base rate is directly tied to the baseline graduation rate, and reflects the fact that many students that did not graduate on time had already been removed from the sample by this point.

PART II – Exploration of students that do and do not persist in CTE

CTE Drop-Y1 (10th grade) Analysis

Last year, data was not available to identify students that dropped CTE after the expected 10th grade year. For the 2011-2012 cohort, these students could be identified, and were substantial in number (n = 669). It is now clear that these students differ from the rest of the CTE group both in terms of outcomes, and also in terms of their initial characteristics.

These empirical differences suggest that during the critical 10th grade year there may be two fundamentally different types of CTE student. The first type enters the program in a position to succeed. Perhaps this reflects some combination of academic preparation, personal traits, and an affinity for their chosen CTE program. The second type, for one or more reasons is unlikely to persist. Perhaps they are facing academic deficits, perhaps they lack some essential motivational trait(s), or perhaps they are enrolled in a CTE program for reasons of expedience rather than genuine interest. Some of these possibilities are beyond the scope of available data, but others can be effectively analyzed.

Underlying these considerations is the persistent question of whether CTE students have higher graduation rates because the program disproportionately attracts students that are likely to graduate anyway. Analyses in Part I do not support the idea that they tend to be stronger academically, but they may possess other factors that promote graduation. For example, perhaps these students are more future-oriented, or more driven than their peers. The CTE Drop-Y1 (10th grade) group provides a sample of students that opted into the program initially, but did not persist. They may, therefore, provide clues about what factors *aside* from self-selection are crucial to timely graduation. Are there indicators that predict an early exit from CTE programming? If so, are there students that possess these risk factors, but persist anyway? Is there anything that *those* students have going for them that might explain their persistence?

Researchers explored CTE Drop-Y1 (10th grade) students in more depth, with the intention of addressing the following:

1. When a student discontinues a CTE program, is this associated with poor graduation outcomes? If so, what factors would help to identify and support students that are most likely to drop CTE?
2. Are there students that have a high likelihood of dropping CTE, but persist nonetheless? If so, do these students have additional characteristics that explain why they persist?
3. Can Drop-Y1 (10th grade) students shed light on the more general question of self-selection effects within CTE?

Identifying Risk Factors

Membership in the CTE Drop-Y1 group is associated with significantly worse outcomes than in other CTE subgroups. If these students are to be supported they must be identified early enough to increase their success rate during the 10th grade year. Therefore, researchers explored this group to see how they differed in initial conditions, and whether any of these differences may function as a viable identification and intervention tool. Unfavorable differences in PSSA and ADA baselines have already been explored and reported above, so researchers explored a variety of other possible indicators.

In terms of demographics, the CTE Drop-Y1 group is similar to the rest of the CTE cohort. Free from tape status is the only indicator that is significantly different between the groups [$\chi^2(1) = 40.35$, $p < .001$], with no appreciable differences for gender, ELL status or IEP (see Table 16). Further, as Table 17 shows, the ethnic distributions of the two groups are similar. The CTE Drop-Y1 group has a slightly larger percentage of Black/African American students, and a slightly smaller percentage of Asian, but these differences are not statistically significant, $\chi^2(4) = 6.19$, $p > .10$.

Table 16: Demographic indicators of CTE Drop-Y1 and Other CTE

CTE Group	Graduation Rate	% Male	% ELL	% FFT	% IEP
CTE Drop-Y1 (10th grade) (n=669)	45.3%	57.4%	10.5%	68.0%	18.2%
All Other CTE (n=1,616)	82.0%	56.0%	9.5%	53.6%	16.4%

Table 17: Ethnic Profiles of CTE Drop-Y1 and Other CTE

Ethnicity	CTE Drop-Y1 (n=669)	All Other CTE (n=1,616)
White	11.1%	11.7%
Multi Racial / Other	0.6%	1.7%
Hispanic/Latino	21.7%	21.7%
Black/African American	62.9%	60.1%
Asian	3.7%	4.9%

Similarly, these groups are comparable in terms of 9th grade disciplinary suspensions (see Table 18). Statistically, CTE-Drop Y1 and other CTE students were equally likely to have a recent history of both out-of-school suspensions (OSS), and in-school suspensions (ISS).

Table 18: 9th Grade Suspensions (1 or More) of CTE Drop-Y1 and Other CTE

CTE Group	OSS	ISS	Any Suspension
CTE Drop-Y1 (n=669)	14.6%	8.7%	20.6%
All Other CTE (n=1,616)	16.5%	9.6%	21.1%

Additional exploration of likely 9th grade Drop-Y1 risk factors revealed that the strongest predictors are ADA below 85%, and receiving a final grade of D or F in *both* Math and English. Both of these were also presumed to be general risk factors for poor four year outcomes, and this was confirmed. Tables 19 and

20 display comparisons of CTE and non-CTE students with these risk factors. Not surprisingly, low ADA and poor grades are associated with lower graduation rates, regardless of participation in CTE. Having said this, compared with non-CTE, CTE students with the risk factors are more likely to stay in the District, and those that stay are more likely to graduate. Those students *without* these risk factors perform similarly whether they enroll in CTE or not.

Table 19: Four Year Outcomes and Graduation Rate for Students With D or F in Both English and Math (9th Grade)

	CTE		**Non-CTE**	
% of Sub-Cohort With D or F in Both Subjects	18.3%		17.8%	
	2 D/F (n=400)	0 or 1 D/F (n=1,782)	2 D/F (n=1,167)	0 or 1 D/F (n=5,376)
Non-Drop Departure	10.0%	7.2%	14.0%	7.4%
Drop Out	37.0%	13.3%	37.5%	12.5%
Continuing	14.8%	5.1%	20.8%	4.9%
Graduate	38.3%	74.5%	27.7%	75.1%
Graduation Rate	42.5%	80.2%	32.2%	81.1%

Table 20: Four Year Outcomes and Graduation Rate for Students <85% ADA (9th Grade)

	CTE		**Non-CTE**	
% of Sub-Cohort with ADA <85%	23.6%		29.5%	
	ADA <85% (n=540)	ADA ≥ 85% (n=1,745)	ADA <85% (n=2,386)	ADA ≥ 85% (n=5,709)
Non-Drop Departure	13.0%	6.9%	23.6%	8.9%
Drop Out	37.0%	12.3%	39.8%	11.7%
Continuing	13.9%	5.3%	13.9%	6.9%
Graduate	36.1%	75.5%	22.7%	72.4%
Graduation Rate	41.5%	81.0%	29.7%	79.5%

In summary, the baseline traits associated with an early exit from CTE are essentially the same as those that more generally impede academic progress. Disproportionately, these students enter 10th grade with poor attendance, poor Math and English grades, and socioeconomic challenges.

High Risk of dropping CTE after 10th grade

Having identified the strongest risk factors, researchers then looked at High-Risk students, defined as students with *both* 9th grade ADA below 85% *and* final 9th grade marks of D or F in both English and

Math. This specific combination of risk factors maximizes predictive power while minimizing the number of data points required for computation. For this reason, it has significant potential value as an early warning indicator for dropping CTE. As Table 21 shows, students with this risk profile are comparably represented in CTE (9.2%) and non-CTE (10.7%), which suggests that CTE is attracting a representative share of High Risk students. However, those classified as CTE are more likely to remain in the District, and more likely to graduate.

Table 21: Four Year Outcomes and Graduation Rate for High Risk Students (2x D/F and ADA)

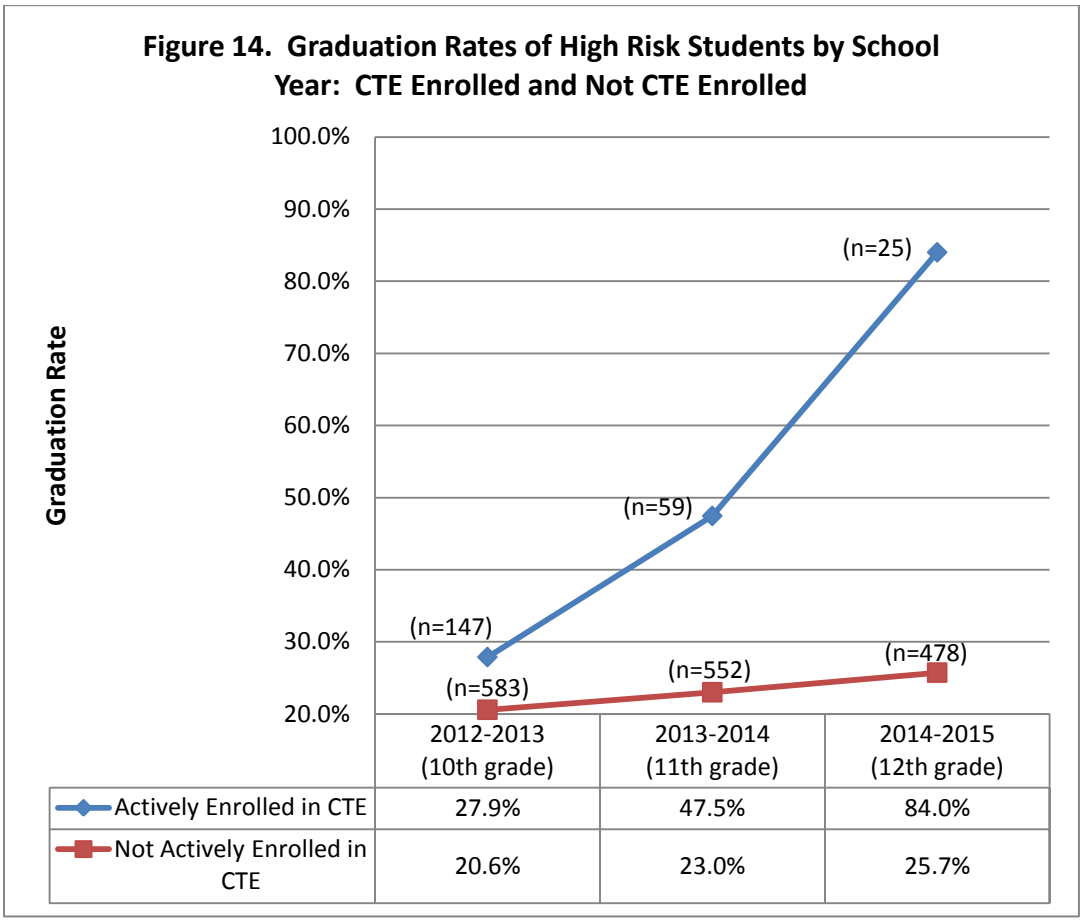
	CTE		**Non-CTE**	
% of Sub-Cohort Classified as High-Risk	9.2%		10.7%	
	High Risk (n=200)	Other (n=1,982)	High Risk (n=702)	Other (n=5,841)
Non-Drop Departure	12.5%	7.2%	16.2%	7.6%
Drop Out	48.0%	14.6%	44.7%	13.7%
Continuing	16.0%	5.9%	21.8%	6.1%
Graduate	23.5%	72.3%	17.2%	72.6%
Graduation Rate	26.9%	77.9%	20.6%	78.6%

High-Risk CTE students are unlikely to graduate, but they are even more unlikely to complete CTE (see Table 22). Fully 83.5% of these High Risk students discontinued CTE prior to completion. Most of those who did complete the program adhered to the full three-year track.

Table 22: High Risk Students Only - Distribution of CTE Tracks

	Discontinued CTE				**Completed CTE With Gaps**			**On Track**
	Drop Y2-1	Drop Y2-2	Drop-Y1	Non-Start	Interrupt	Late-Y2	Late-Y3	
n (200 total)	17	26	124	7	0	3	3	20
%	8.5%	13.0%	62.0%	3.5%	0.0%	1.5%	1.5%	10.0%
Aggregate %	87.0%				3.0%			10.0%

The retention of High Risk students is, by definition, a challenge, but data reported above suggest that when these students are engaged with CTE they are more likely to persist. To determine how early this advantage emerges, data was reconfigured into yearly snapshots, displayed in Figure 14. For each year, all students in District schools were simply divided into those who were actively enrolled in a CTE course, versus those that were not, without regard to prior or subsequent involvement with CTE. High Risk CTE students exhibit a small advantage in graduation immediately in 10th grade. However, there are dramatic increases for those that are enrolled in CTE past the first eligible year, with enormous leaps from grades 10 to 11, and 11 to 12. To some extent these improvements are the result of a shrinking pool, as students drop out and leave behind those that are most likely to persist. However, this same logic would also be expected to apply to students that are not enrolled in CTE, but graduation rates for this group barely improve as a function of school year.



Note: Sample sizes do not include non-drop departures.

Identifying Persistence Indicators

Researchers identified students that were High Risk, and participated in CTE during their first year of eligibility, to identify why some persist. This restricted group allowed comparisons between those that continued in CTE beyond year 1 (CTE Continue-Y1) and those that did not. These groups do not differ in distribution of IEP, ELL, or gender, though there are weak indications that the Drop-Y1 students are more likely to possess FFT status (see Table 23). In terms of ethnicity, Black/African American students are over-represented in the persisting group, and White students are under-represented, $\chi^2(2) = 6.54$, $p < .05$[7] (see Table 24).

[7] Asian and Multi-Racial/Other groups were excluded from the chi-square analysis because they had expected frequencies less than 5.

Table 23: Demographic characteristics of High Risk CTE Drop-Y1 and CTE Continue-Y1

Demographic Indicator	Category	Drop-Y1 (n=124)	Continue-Y1 (n=69)	Chi-Square
Gender	Male	54.0%	60.9%	$\chi 2$ (1) = 0.84, *ns*
	Female	46.0%	39.1%	
IEP Status	IEP	19.4%	15.9%	$\chi 2$ (1) = 0.35, *ns*
	No IEP	80.6%	84.1%	
ELL Status	ELL	8.9%	7.2%	$\chi 2$ (1) = 0.15, *ns*
	Not ELL	91.1%	92.8%	
FFT Status	FFT	83.1%	72.5%	$\chi 2$ (1) = 3.03, $p < .10$++
	Not FFT	16.9%	27.5%	

Excludes CTE non-start; ++ statistically marginal

Table 24: Ethnic Profiles of High -Risk Students Only - CTE Drop-Y1 and CTE Continue-Y1

Ethnicity	CTE Drop-Y1 (n=124)	CTE Continue-Y1 (n=69)
White	10.5%	1.4%
Multi Racial / Other	0.0%	0.0%
Hispanic/Latino	35.5%	31.9%
Black/African American	53.2%	66.7%
Asian	0.8%	0.0%

Note: CTE non-start excluded

Since students that drop and continue are similar in many of their 9th grade characteristics, researchers then investigated a variety of events during 2012-2013 to determine whether persistence depends on 10th grade outcomes. For each metric, the High-Risk group was evaluated to see what percentage of CTE students responded by dropping CTE, and what percentage continued. For comparison, the same evaluation was applied to 10th grade CTE students that were not High-Risk. These comparisons are assembled in Table 25.

For High-Risk students, the overall likelihood that they drop CTE after 2012-2013 was 64.2%. Using this as a baseline, the data indicate that these students were not additionally susceptible to negative events that occurred during that year, at least in terms of dropping CTE. In contrast, the students that were not already at risk based on 9th grade characteristics were highly susceptible to negative 10th grade events. For these students, poor grades, poor attendance, dropping below grade level, and receiving a suspension were all associated with significantly higher rates of dropping CTE. Of these, dropping below grade level had the largest effect, increasing the odds of dropping CTE almost threefold.[8]

[8] It should be noted that the attendance data provide a potentially valuable insight. For the High-Risk students, there is no meaningful difference between an ADA of 90% and an ADA of 85% in terms of predicting the decision to drop CTE (67.2% and 69.1%, respectively), and neither of these are significantly different from the baseline rate. In contrast, for students *not* High-Risk, this difference in ADA is associated with progressively increasing risk of dropping CTE (38.6% and 46.5%, respectively). In other words, for these students, benchmarks of 90% and 85%

Table 25: Percent of Subgroups that Drop or Continue CTE for 10th Grade Events

	10th Grade Event						
	D or F English	**D or F Math**	**D or F Both**	**Newly Below Expected Grade**	**<85% ADA**	**<90% ADA**	**Any Suspension 1 or More**
CTE High-Risk	n=112	n=122	n=94	n=109	n=165	n=180	n=80
Drop-Y1 (n=124; 64.2%)	66.1%	59.8%	66.0%	57.8%	69.1%	67.2%	65.0%
Continue-Y1 (n=69; 35.8%)	33.9%	40.2%	34.0%	42.2%	30.9%	32.8%	35.0%
CTE Not High-Risk	n=451	n=641	n=355	n=32	n=583	n=942	n=402
Drop-Y1 (n=526; 26.8%)	***40.4%***	***34.9%***	***40.3%***	***71.9%***	***46.5%***	***38.6%***	***44.3%***
Continue-Y1 (n=1,436; 73.2%)	***59.6%***	***65.1%***	***59.7%***	***28.1%***	***53.5%***	***61.4%***	***55.7%***
Increased Susceptibility of Not High-Risk Students							
Difference (percentage points)	13.6	8.1	13.5	45.1	19.7	11.8	17.5
Difference (Odds)	1.5:1	1.3:1	1.5:1	2.7:1	1.7:1	1.4:1	1.7:1

Italics: Significant at $p < .05$; ***Bold Italics***: Significant at $p < .01$; ***Underlined Bold Italics***: Significant at $p < .001$

In short, there appears to be a two-layered explanation for why students drop CTE after their expected 10th grade year. One group enters that year with pre-existing attendance and academic characteristics that constitute risk factors. These students are already likely to drop CTE, and are relatively unaffected by additional challenges they encounter during the critical year. The second group does not have the pre-existing risk factors, but is highly susceptible to negative events during the 10th grade year. When these students encounter substantive academic hurdles, demonstrate poor attendance, or receive suspensions, their likelihood of dropping CTE rises significantly.

Finally, researchers investigated how school closures impacted High-Risk students. As Table 26 shows, in the narrow case of high risk students, being in a school that closed after 2012-2013 is not associated with an elevated risk of immediately dropping CTE, presumably because that probability was already quite high. However, for students that did not have the risk factors, a school closure more than doubled the chances of dropping CTE, from 21.4% to 52.2%. Given the magnitude of this effect, school closures are examined in more depth later in this report.

ADA each represent substantive increases in the likelihood of dropping CTE. For students that are already High-Risk, even an ADA as low as 85% does not constitute a new, additional red flag. The same is not true for students that enter 10th grade without the risk indicators.

Table 26: School Closures' Effect on Becoming Drop-Y1 Or Continue-Y1, for Both High- and Non-Risk

High Risk CTE Students	**Category**	**School Closed (n=27)**	**School Did Not Close (n=165)**	**Chi-Square**
	Drop-Y1	67.9%	63.6%	$\chi 2$ (1) = 0.19, *ns*
	Continue-Y1	32.1%	36.4%	
Other CTE Students	**Category**	**School Closed (n=343)**	**School Did Not Close (n=1,618)**	**Chi-Square**
	Drop-Y1	52.2%	21.4%	$\chi 2$ (1) = 136.96, *p*<.001
	Continue-Y1	47.8%	78.6%	
Overall CTE Students	(n=2154)	17.2%	82.8%	

Having explored negative factors that promote the decision to drop CTE, researchers next investigated a range of positive 10th grade achievements that might promote persistence (see Table 27). High-Risk students rarely logged these achievements, as evidenced by the small sample sizes. However, even with the limited samples, high levels of attendance were significantly associated with much higher continuation rates. For students that were not High-Risk, the results are consistent and straightforward; success in 10th grade is strongly associated with continued enrollment in CTE.

Table 27: Percent of Subgroups that Drop or Continue CTE for positive 10th Grade Events

	10th Grade Event					
CTE High-Risk	**A or B English**	**A or B Math**	**A or B Both**	**Newly At Grade Level**	**>= 90% ADA**	**>= 95% ADA**
Drop-Y1 (n=124; 64.2%)	50.0%	41.7%	60.0%	63.6%	***18.8%***	***18.2%***
Continue-Y1 (n=69; 35.8%)	50.0%	58.3%	40.0%	36.4%	***81.3%***	***81.8%***
	n=12	n=12	n=5	n=11	n=16	n=11
CTE Not High-Risk						
Drop-Y1 (n=526; 26.8%)	***19.2%***	***15.6%***	***16.2%***	37.9%	***15.7%***	***12.3%***
Continue-Y1 (n=1,436; 73.2%)	***80.8%***	***84.4%***	***83.8%***	62.1%	***84.3%***	***87.7%***
	n=750	n=692	n=489	n=29	n=1,033	n=472

Italics: Significant at p < .05; ***Bold Italics***: Significant at p < .01; ***Underlined Bold Italics***: Significant at p < .001

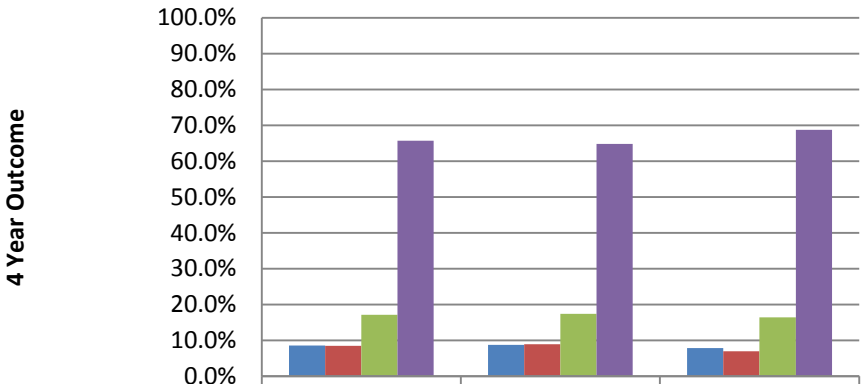
School Closures

At the end of the 2012-2013 school year, when the cohort under investigation would be completing 10th grade, a number of District high schools closed. The schools in question were Charles Carroll, Communications Tech, Edward Bok, Germantown, Robert Lamberton, Stephen A. Douglas, University City, and Vaux.

Students enrolled in one of these eight schools at the end of 2012-2013 were identified, and compared with those that were enrolled in schools that remained open. This analysis excludes all students that did not have a District school of record in 2012-2013, which results in the removal of 1,301 non-CTE students and 31 CTE students. This imbalance is expected, since most CTE students were by definition active in the District during 10th grade. Those few that were removed had atypical trajectories (e.g., CTE non-start, or a late-start student that was in a District school for 9th grade, no record for 10th, returned in 11th).

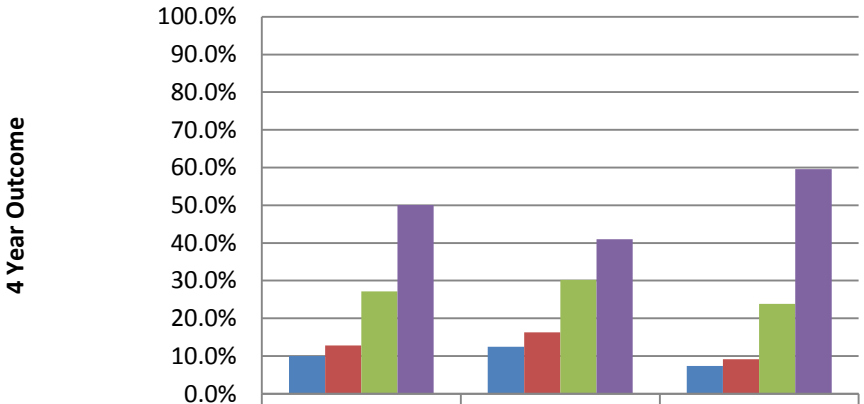
A school closure represents an obstacle to timely graduation. The following figures (15 through 18) display four year outcomes and graduation rates for CTE and non-CTE students depending on whether they were enrolled in one of the schools that closed. School closure impacts both CTE and non-CTE graduation tracks, with on-time graduation decreasing, and all other categories increasing. These changes, however, are more dramatic for the non-CTE students.

Figure 15. Four-Year Outcomes: School Did Not Close After 2012-2013



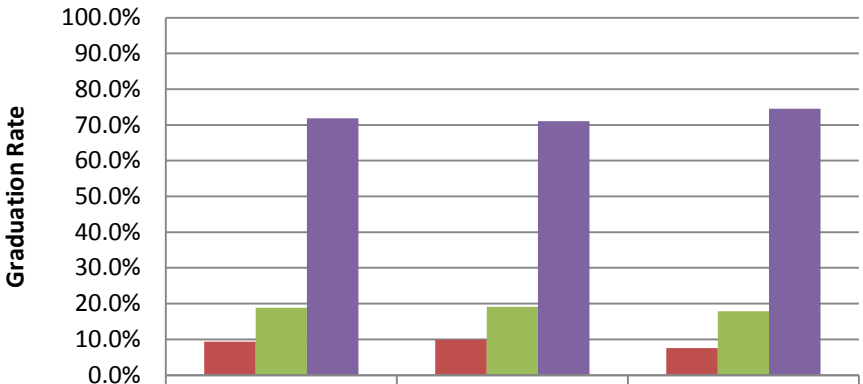
	Cohort (n=8,273)	Non-CTE (n=6,417)	CTE (n=1,856)
Nondrop Departure	8.6%	8.8%	7.9%
Continuing	8.5%	9.0%	7.0%
Dropout	17.2%	17.4%	16.5%
Graduate	65.7%	64.8%	68.7%

Figure 16. Four-Year Outcomes; School Closed After 2012-2013



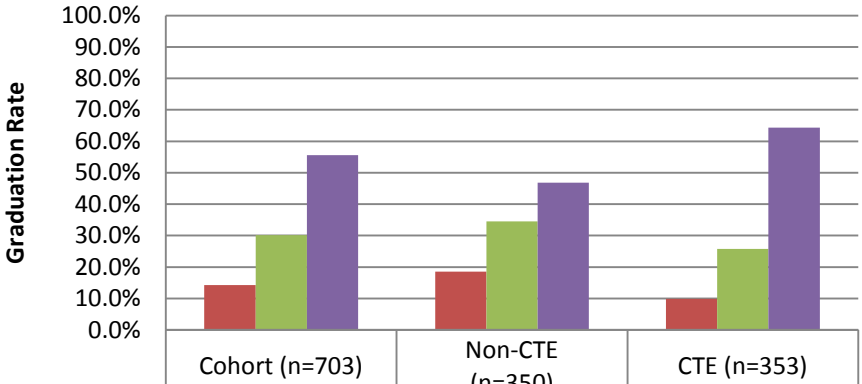
	Cohort (n=781)	Non-CTE (n=400)	CTE (n=381)
Nondrop Departure	10.0%	12.5%	7.3%
Continuing	12.8%	16.3%	9.2%
Dropout	27.1%	30.3%	23.9%
Graduate	50.1%	41.0%	59.6%

Figure 17. Graduation Rates: School Did Not Close After 2012-2013



	Cohort (n=7,539)	Non-CTE (n=5,852)	CTE (n=1,710)
Continuing	9.3%	9.9%	7.5%
Dropout	18.8%	19.1%	17.9%
Graduate	71.8%	71.1%	74.6%

Figure 18. Graduation Rates: School Closed After 2012-2013



	Cohort (n=703)	Non-CTE (n=350)	CTE (n=353)
Continuing	14.2%	18.6%	9.9%
Dropout	30.2%	34.6%	25.8%
Graduate	55.6%	46.9%	64.3%

As Table 28 shows, the proportion of CTE students that were impacted by school closures was disproportionately high (17.0%) compared with non-CTE (5.9%), $\chi^2(1) = 266.34$, $p < .001$. This difference is largely due to sizable CTE populations at Bok and Communications Tech. Within CTE, students that were in a school that closed were much less likely to stay on track, and much more likely to divert into the Drop-Y1 (10th grade) category. Given the numbers, we estimate that school closure moved

approximately 100 students from the on-track category to the Drop-Y1 category. This assumes that if these schools had remained open their students would have had outcomes consistent with other CTE students across the District.

Table 28: Effects of School Closures After 2012-2013 on CTE Trajectories

CTE Category	**Non-Closure**		**Closure**		**Change in Likelihood**
	n	%	n	%	%
Y1 Drop (n=669)	454	24.5%	201	52.8%	28.3%
Interrupt (n=7)	5	0.3%	2	0.5%	0.3%
Y2 Drop (1 Year) (n=99)	81	4.4%	12	3.1%	-1.2%
Y2 Drop (2 Years) (n=284)	230	12.4%	54	14.2%	1.8%
Late Start Y2 (n=78)	69	3.7%	9	2.4%	-1.4%
Late Start Y3 (n=39)	32	1.7%	5	1.3%	-0.4%
Non-Start	33	1.8%	1	0.3%	-1.5%
On Track (n=1,049)	952	51.3%	97	25.5%	-25.8%
	Group n	% Non-Closure	Group n	% Closure	
TOTAL CTE	1856	83.0%	381	17.0%	
Non-CTE	6417	94.1%	400	5.9%	

Appendix A: Changing schools

School closures could be viewed as a special case of the more general phenomenon of leaving a school. Tables A1 and A2 display information about cohort subgroups and the frequency with which they left their schools after 2012-2013 and after 2013-2014. Some patterns of note:

- The majority of CTE On-Track students were enrolled at CTE schools both years, and the overwhelming majority stayed in those schools after both 10th grade (90.1%) and 11th grade (99.0%).
- Most students that dropped CTE before their expected 11th grade year also changed schools (47.8%) or left the system (14.9%) at that time (62.8% total), but those that dropped CTE after their expected 11th grade year were more likely to stay in the same school at that time (58.5%).
- Students who left CTE before their expected 11th grade year did not usually exit the system immediately (14.9%), but a year later this group was disproportionately likely to do so (34.0%, compared with 22.1% for non-CTE). Discontinuing CTE may be a warning sign of eventually exiting the system.

Table A1: School Enrollment Changes From 2012-2013 to 2013-2014

	CTE Type	Stayed in Same School of Type:				Moved to Different School of Type:				Out of System	
		CTE School	District	Charter	Total Stayed	CTE School	District	Charter	Total Moved		
Left CTE Before Y2	Non-Start (n=60)	10.0%	0.0%	0.0%	37.2%	1.7%	0.0%	0.0%	47.8%	88.3%	14.9%
	Drop-Y1 (n=669)	3.6%	34.1%	1.6%		0.1%	43.6%	8.4%		8.5%	
	Interrupt (n=7)	14.3%	57.1%	0.0%		0.0%	28.6%	0.0%		0.0%	
Left CTE after Y2	Drop-Y2 1 Year (n=96)	0.0%	60.4%	0.0%	68.4%	4.2%	34.4%	1.0%	31.6%	0.0%	0.0%
	Drop-Y2 (2 Year) (n=284)	20.8%	50.4%	0.0%		1.1%	26.8%	1.1%		0.0%	
Started CTE Late	Late Start Y2 (n=78)	1.3%	76.9%	0.0%	76.1%	2.6%	19.2%	0.0%	23.1%	0.0%	0.9%
	Late Start Y3 (n=39)	2.6%	69.2%	0.0%		0.0%	23.1%	2.6%		2.6%	
	On Track (n=1,049)	56.7%	33.4%	0.0%	90.1%	1.4%	8.5%	0.0%	9.9%	0.0%	0.0%
	Non-CTE (7,989)	N/A	63.2%	5.5%	68.7%	N/A	13.5%	1.9%	15.4%	15.9%	15.9%

Includes only students with school record for 2012-2013

Table A2: School Enrollment Changes From 2013-2014 to 2014-2015

	CTE Type	Stayed in Same School of Type:				Moved to Different School of Type:				Out of System	
		CTE School	District	Charter	Total Stayed	CTE School	District	Charter	Total Moved		
Left CTE Before Y2	Non-Start (n=60)	10.0%	0.0%	0.0%	49.4%	0.0%	0.0%	0.0%	16.6%	90.0%	34.0%
	Drop-Y1 (n=669)	0.0%	44.3%	8.4%		0.0%	14.3%	3.8%		29.2%	
	Interrupt (n=7)	14.3%	71.4%	0.0%		14.3%	0.0%	0.0%		0.0%	
Left CTE after Y2	Drop-Y2 1 Year (n=96)	0.0%	63.6%	1.0%	58.5%	0.0%	21.2%	5.1%	30.5%	9.1%	11.0%
	Drop-Y2 (2 Year) (n=284)	2.8%	52.8%	0.7%		0.0%	26.1%	6.0%		11.6%	
Started CTE Late	Late Start Y2 (n=78)	3.8%	96.2%	0.0%	98.3%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%
	Late Start Y3 (n=39)	2.6%	92.1%	0.0%		2.6%	2.6%	0.0%		0.0%	
	On Track (n=1,049)	57.5%	41.6%	0.0%	99.0%	0.0%	0.9%	0.1%	1.0%	0.0%	0.0%
	Non-CTE (7,989)	N/A	62.7%	6.0%	68.8%	N/A	7.6%	1.5%	9.1%	22.1%	22.1%

Includes only students with school record for 2013-2014