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# Impacts of Career and Technical Schools on Postsecondary Outcomes:

## A Case Study of a Large Urban School District

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JOHNS HOPKINS
U N I V E R S I T Y

**School of Education**
CENTER FOR SOCIAL ORGANIZATION
OF SCHOOLS

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# EXECUTIVE SUMMARY

Within the past decade, public investments and private donors have sought to remake the high school in various ways: by organizing them around unifying themes, creating improved curricula for students who enter high school underprepared, developing standards and end-of-course exams, breaking larger schools into smaller units, and creating small autonomous schools. Despite this flurry of activity, there has been relatively little discussion about the role of Career and Technical Education (CTE) schools in preparing students to enter higher education and the workforce, although career and technical l high schools have been part of the American educational landscape since at least the 1930s. For many years, these schools were called "vocational schools," but have acquired the more general "career and technical" designation in an effort to re-brand them as providing preparation for postsecondary education and the world of work.

A result of the lack of research on CTE schools is that there has been no gathering of evidence on their effects on a variety of student outcomes, including academic achievement, labor market outcomes, and postsecondary enrollment. This report addresses that gap by presenting evidence on the impact of CTE schools in one city – Philadelphia, Pa., – on postsecondary enrollment, persistence, and degree attainment. These analyses follow up on a previous report on CTE schools and high school attainment and achievement outcomes.

The research questions for this report are:

- What is the effect of CTE schools on **enrollment** in two-year or four-year degree-granting institutions of higher education?

- What is the effect of CTE schools on **persistence** in two-year or four-year degree-granting institutions of higher education?

- What is the effect of CTE schools on **two-year or four-year degree attainment**?

This report presents findings from a case study of five CTE schools in the School District of Philadelphia. Three cohorts of students – the Classes of 2003, 2004, and 2005 – are the focus. Students in these cohorts were admitted to the CTE schools through a lottery that admitted students through random selection, taking into account student race/ethnicity to achieve court-ordered racial balance in the schools. This study takes advantage of this so-called "natural experiment" by comparing outcomes for applicants who were admitted with those for students who did not receive an acceptance. Three types of estimates are created for each outcome: 1) an *Intent-to-Treat (ITT) estimate*, which compares outcomes for students who were accepted to CTE schools to outcomes for students who were not accepted; 2) a *Local Average Treatment Effect (LATE) estimate*, which takes into account the actual "take up" of the offer of admission by students; and 2) a *Dosage estimate*, which compares students who attended a CTE school to students who did not attend.

**Key findings include:**

- **CTE schools had a positive impact on postsecondary enrollment**, although the effects were not consistent across cohorts. For the Class of 2003, there were positive ITT, LATE, and Dosage impacts of CTE schools on enrollment in two-year colleges. For the Classes of 2004 and 2005, there were positive impacts on enrollment in four-year colleges. For the Classes of 2003 and 2004, there were positive impacts of enrolling in either a two-year or a four-year college. We conclude that there appear to be positive CTE impacts on postsecondary enrollment, although they are not as consistent across cohorts as we might want to see.

- **The positive effects of CTE schools on postsecondary enrollment** were not driven by a single school or a single cohort.

- **CTE impacts on postsecondary enrollment were mediated by high school graduation.** When postsecondary outcomes are examined for high school graduates only, there is no significant CTE impact.

A descriptive analysis of mean outcomes by cohort and CTE school indicates that while the magnitude of the differences between treatment and control students varies from school to school, the impacts are not being driven by a single CTE school or subset of schools.

**The Context of Career and Technical Education in Philadelphia**

During the school years that are the focus of this study (999-2000 through 2004-2005), the School District of Philadelphia had four high schools where the primary focus was on providing career and technical training for students who hoped either to pursue postsecondary education or enter the workforce immediately after high school. A fifth high school was given CTE status for the Class of 2005. These high schools served students from across the district.

There were many more applicants in each cohort than the CTE schools could serve, and they admitted students using a lottery that took into account only student race/ethnicity (to achieve racial balance) and how highly each student had prioritized the school on his application form. For the Class of 2003, CTE schools entered all applicants into their lotteries, regardless of their prior achievement, attendance, or behavior. For the Classes of 2004 and 2005, each of the CTE schools screened applicants for school-related performance. After removing students with weaker records from the applicant pool, the schools conducted their lotteries. As a result of this screening, the CTE Classes of 2004 and 2005 entered high school with stronger academic performance than the Class of 2003.

Career and technical courses were offered at most of the approximately 40 public high schools in Philadelphia. Some of the larger neighborhood high schools had a variety of CTE courses of study that rivaled those of the CTE schools. But in general, the greatest variety of occupationally focused courses was to be found at the career and technical high schools. Across both CTE and neighborhood high schools, 1999-2005 saw a gradual decrease in the variety of CTE schools, including a decline in the number of single-class courses of study (e.g. child care). At the same time, the number of students across the district who enrolled in any CTE course during high school rose slightly.

During the administration of Superintendent Paul Vallas (2002-2007), and under pressure from Perkins III requirements, the district began to emphasize courses of CTE study that allowed students to earn certificates, corresponded to areas of job growth and opportunity in the local labor market, and enabled partnerships with local companies and city government (e.g. firefighting). During the time that the Classes of 2003 through 2005 were attending high school, however, this focusing and aligning programs of study with local industry was just beginning. It is important to be clear that, in general, the CTE programs that Philadelphia's students experienced did not garner any award or notice for being exemplary, nor were they cutting edge models of excellence (Philadelphia Workforce Innovation Board, 2008; Philadelphia Youth Network. 2009). It is also noteworthy, however, that the career and technical high schools operated within a district that supported high school choice and that encouraged all high schools to offer college preparatory courses in mathematics, science, and foreign language.

**How were CTE impacts measured?**

This study relies entirely on student record data kept by the School District of Philadelphia. These data include enrollment and graduation status, transcript information (including course grades), test scores, attendance, special education status, English language

learner status, and school(s) attended, from eighth grade forward, in addition to applications to high schools and high school admissions decisions.

Two strategies are used to model Intent-to-Treat estimates. The first strategy, which uses a multilevel model, allows students to be represented in the data set multiple times, with the frequency equivalent to the number of CTE schools applied to. Students are nested within a specific lottery/cohort combination. In this model, the treatment and control groups resulting from each school's lottery for each cohort are compared. By comparing students within the same lottery, we eliminate any bias that might have resulted from different CTE schools using different criteria to screen applicants into their lottery; this is of concern for the Classes of 2004 and 2005. A disadvantage of this model is that it potentially underestimates the impact of CTE schools as a whole because some students who are considered "treatment" students at one CTE school are considered "controls" at another CTE school.

Our second modeling technique uses fixed effects, with controls for the school(s) to which the student applied and their cohort. Students are represented once in the data set. The advantage of this modeling strategy is that it will not produce an underestimate of CTE effects as serious as the multilevel strategy described above; its disadvantage is that it does not directly compare students who were accepted and not accepted to particular CTE schools.

The statistical significance of the estimates and direction of the effects produced by these two Intent-to-Treat strategies are consistent across most outcomes.

The Dosage estimate uses the multilevel modeling strategy described above but introduces a control for the proportion of the time a student attended a CTE school while enrolled in a Philadelphia public high school.

All models controlled for student race/ethnicity as empirical analysis demonstrated that the probability of acceptance at particular CTE schools in particular cohorts varied according to racial/ethnic background.

**Implications**

This research is a case study of the effects of CTE schools in a particular large city school district during a particular time period that spanned Perkins III and Perkins IV. As with any case study, a full interpretation of the results must take into account how the city's social and educational context affects how the community and district staff perceive CTE schools. While this report does not present an exhaustive analysis of how parents and students view Philadelphia's CTE schools, the empirical data demonstrate that in Philadelphia, these schools were highly sought after. Large percentages of eighth-graders applied to at least one CTE school for high school.

Further, while the CTE schools in Philadelphia were rather ordinary in terms of their occupational focus and curriculum, they were subject to school district efforts to increase college-preparatory course taking in all high schools. Thus, there were many opportunities for

students at Philadelphia's CTE schools to take college-preparatory mathematics, science, and foreign language. The high percentages of CTE students who earned credits in these courses supports the argument that, in this context, CTE schools did not behave as a "dead end" school or a "school of last resort." One of the clear messages of this report, then, is that *it is not always or necessarily the case that CTE schools are associated with weaker academic outcomes for students.* In some situations – Philadelphia being one of them – academic outcomes for CTE schools may equal or exceed those of other schools in the district. That these impacts were observed in a research study that used randomized design strengthens the validity of this assertion.

It is beyond the scope of this study to establish the mechanisms by which CTE schools come to have the impacts we observe. Several differing, but not mutually exclusive, mechanisms could be hypothesized. Perhaps there is something powerful about CTE education, including the possibility that it helps students to see more clearly the connections between school and workplace success. Or, there may be nothing intrinsically important about CTE as a school focus; instead, the important factor may just be that the school had a focus, in contrast to neighborhood high schools, which try to be all things to all students. There may be peer effects associated with bringing together students who have the personal advantages and prior achievement, demonstrated by participating in school choice and being screened into the lottery (for the Classes of 2004 and 2005). Students may perceive CTE schools as special and work to maintain their grades and behavior so as not to be "returned" to their neighborhood high schools for inadequate performance.

It would be a mistake to conclude - purely from this empirical analysis - that an approach to high school curriculum that emphasizes career and technical education is superior to other curricular focuses. On the other hand, it would be equally mistaken to dismiss career and technical education schools as *necessarily*, in all educational contexts, reducing the probability that students will graduate from high school and earn credits in courses needed for admission to and success in postsecondary education.

# SECTION I: INTRODUCTION

This report describes the results of an analysis of postsecondary education outcomes for Philadelphia public school students who applied to attend at least one of the city's career and technical (CTE) high schools. Specifically, we examine patterns of enrollment and persistence in, and graduation from, two-year or four-year degree-granting institutions. As an exploratory analysis, we report on students' use of Pell grants to support education at private postsecondary trade and technical schools that do not offer Associates or Bachelors degrees.

This report focuses on members of Philadelphia's high school cohorts whose on-time (four-year) high school graduation dates were June 2003, June 2004, or June 2005. For each of these cohorts, the city's public CTE high schools were substantially oversubscribed, and applicants to these schools were selected for admission by random lottery. As a result, a strong argument can be made that the treatment and comparison groups differ at the mean only on whether they were selected by chance process to attend a CTE school. Lottery selection means that the comparability of treatment and control groups extends to both observable and unobservable characteristics, which should be distributed randomly across both treatment and control groups.

A previous report compared high school achievement and attainment outcomes for CTE students and other students in these cohorts (Neild, Boccanfuso, & Byrnes, 2013). Using student record data from the School District of Philadelphia, accepted and non-accepted applicants to CTE schools were compared on on-time graduation rates, five- and six-year graduation rates, achievement growth in mathematics and literacy, completion of two or more sequenced CTE courses, and completion of college preparatory coursework in mathematics, science, and foreign language. Two types of comparisons were made: 1) accepted applicants versus non-accepted (the "Intent to Treat" comparison), and 2) students who actually attended a CTE school versus those who did not (the "Dosage" comparison).

In sum, our previous report on high school education outcomes found that there were substantial positive impacts of CTE on high school graduation; mixed effects on college preparatory course-taking, with some advantages for CTE students and some advantages for comparison group students; and no impact on achievement growth in mathematics and literacy. The key impact of CTE schools appeared to be on the acquisition of high school diplomas.

This report extends the previous set of analyses by examining postsecondary educational outcomes for CTE students. Specifically, we track the percentage of students who enroll in a two-year or four-year degree-granting institution; their persistence in postsecondary education once enrolled; and acquisition of a two-year or four-year degree. For this analysis, we use data from the National Student Clearinghouse, obtained from the School District of Philadelphia and merged with student record data from the district. As an exploratory analysis, we use data on receipt of Pell Grants to examine the extent to which CTE students chose postsecondary trade or technical training over two-year or four-year degree-granting institutions.

## The Philadelphia Context

The district context for this study was described in greater detail in a previous report (Neild, Boccanfuso, & Byrnes, 2013). Here we provide a summary of this context to orient the reader to the general, relevant features of the city and school district that are the focus of this study.

The School District of Philadelphia serves a population of mostly minority students from low-income families. During 2004-05 (one of the focal years for this study), 86 percent of the students in Philadelphia's schools were members of minority groups, and 69 percent were eligible for free or reduced-price lunch (Garofano & Sable, 2008). Approximately 65 percent of the students were African American, 15 percent were Latino, 5 percent were Asian, and 15 percent were White (Balfanz, Herzog, & MacIver, 2007).

*High School Choice*

At the high school level, school choice is a notable feature of the School District of Philadelphia. Each fall, the high school choice process begins for Philadelphia eighth-graders who plan to attend public high schools or who are considering the public schools as an option. The high percentage of eighth-graders who apply to one or more high schools indicates that school choice has become a normal part of the transition to high school in Philadelphia. Among students who were eighth-graders in the Philadelphia public schools during 1998-99 (potential members of the Class of 2003), 70 percent applied to at least one high school outside of their attendance zone. For eighth-graders in 1999-00 (the Class of 2004) and 2000-01 (the Class of 2005), the percentages were 69 percent and 62 percent, respectively. Research on subsequent cohorts of Philadelphia's incoming ninth-grade students indicated that this downward trend was an aberration, as rates of students applying to schools outside of their attendance zones have increased, reaching 65 percent for the class of 2007, and 73 percent for the class of 2010 (Gold et al, 2009).

A notable feature of the high school choice program is that students were permitted to apply to multiple schools or programs. The number of schools to which students were permitted to apply varied from cohort to cohort. For the Classes of 2004 and 2005, we observe in our data that some students applied to as many as 10 high schools. For the Class of 2003, some students applied to as many as 16 choices. This large number of applications for the Class of 2003 was due in part to a feature of the application process that year that permitted students to apply to multiple lottery-based programs within the same school.

Students who chose to apply to multiple high schools were asked to rank their choices by preference. All else being equal, a student who indicated that a particular school was his first choice had a better chance of being admitted than a student who indicated that the school was a lower-ranked choice on his list of preferred schools.

When the Classes of 2003-2005 were applying to high school, there were three primary types of public high schools in Philadelphia:

- **Neighborhood high schools** served students living in particular geographical areas. Each student had a "default" neighborhood high school based on residence. Students who did not gain admission to another school via the high school choice process were assigned to their "default" high school. Students from outside the catchment area of a particular neighborhood high school could apply to attend a program at that school, and if there were excess seats the school, the student could be admitted. About 75 percent of the students in the Classes of 2003-2005 attended a neighborhood high school.

- **Special admissions high schools** served students from across the school district and were permitted to select students based on their seventh- and eighth-grade course marks, attendance, disciplinary records, and test scores, as well as an interview or audition. When the cohorts that are the focus of this report were applying to high schools, special admissions schools included competitive exam schools that were founded in the mid-19th century (Central and Girls' High School); schools that were established more recently and offered themes such as engineering, international study, or the arts; and schools without a specific theme that offered college-preparatory curricula. The minimum achievement levels and other criteria required for admission varied from school to school. About 13 percent of the students in the Classes of 2003-2005 attended one of these special admissions schools.

- **Career and Technical (CTE) high schools** provided career-related training in addition to the traditional academic subjects. These schools had no residential catchment areas but served students from across the city. For the Classes of 2003 and 2004, students could apply to one or more of four CTE schools: Bok, Dobbins, Mastbaum, and Saul. The Class of 2005 could apply to one or more of these four schools, plus an additional school (Swenson) that had become an independent entity and accepted students from throughout the city. For the Class of 2003, all CTE applicants were entered into the CTE lottery regardless of their prior achievement, attendance, or disciplinary records. For the Classes of 2004 and 2005, the CTE schools were permitted to shape their entering freshman classes by first screening applicants for previous achievement and attendance, and then conducting the lottery. About 12 percent of the students in the Classes of 2003-2005 attended one of these CTE schools.

Among eighth-graders during the 1998-99 school year (and who, therefore, were potential members of the Class of 2003), 43 percent (6,647 students) applied to at least one CTE high school; among those who applied to any school (including special admit schools and neighborhood high schools), 61 percent applied to a CTE school. The percentages were similar for the Classes of 2004 and 2005: 42 percent (8,825 students) and 43 percent (5,371 students) of all eighth-graders, respectively, applied to at least one CTE school.

*The High Schools' Admissions Decisions*

After student high school application forms were submitted, individual schools and the district began the process of determining which students would receive offers of admission. Students were admitted to high schools through several processes. The way in which an admissions decision was reached depended on the categories of schools to which students applied. **Special admissions schools** made their own admissions decisions based on student achievement and behavior; **lottery-based programs** – such as the CTE schools that are the focus of this study - made admissions decisions randomly from their pool of applicants.

**Special admissions schools**. Although admissions materials state that these schools screened applicants on the basis of previous academic achievement, attendance, and school behavior, and sometimes an interview and/or audition, almost nothing is known publicly about how school or district personnel weighed this information to come to an admissions decision. What we do know is that students who applied to multiple special admissions schools could receive more than one offer of admission. For example, if an academically top-notch student applied to four special admissions schools, she could have received four offers of admission.

**Lottery admissions schools.** For the Class of 2003, all students who applied to a lottery-based school were entered into the lottery, regardless of prior academic achievement, attendance, or behavior; there was no screening to make sure that applicants in the lottery pool met any particular criteria. The lottery was conducted using a computer algorithm that took into account student racial/ethnic background in order to promote racial balance (see below). A lottery for each school was first conducted for students who ranked that school as their first choice. Students who were admitted to their first-choice school or program were taken out of the lottery for any subsequent choices they listed; **students could receive only one offer of admission to a lottery-based school or program.** After this first round of the lottery was conducted, any student who did not receive admission at their first-choice school and who had indicated a second-choice school was entered into a second round of the lottery. If a student was not a "winner" in the second round, then the lottery tried to place students in their third-choice school. This process was repeated for as many choices as students had made, up to the maximum number allowed (in years when a maximum was stipulated).

For the Classes of 2004 and 2005, the admissions process for at least some **lottery schools** had two stages. The CTE schools that are the focus of this paper used this two-stage process. The first stage was the *crafting of the lottery pool*. Applicants were screened by the individual schools for requisite academic, attendance, and behavioral characteristics and, sometimes, based on their interest in the career fields offered and/or performance in an interview. In the second stage, *the lottery was conducted for students who had been "screened in" to the lottery*. The lottery for each school was conducted first for students who had indicated that the school was their first choice, then for students who had indicated that the school was their second choice, and so on.

The number of acceptances that students received depended in part on whether they applied only to lottery admissions schools. These students could be accepted only to one program; in the end, their choice about which school to attend was between their neighborhood

high school and the one other school to which they had been accepted. Students who applied to multiple special admissions schools, or to at least one special admissions school and at least one lottery-based school, however, had the possibility of being accepted to more than one school.

In the previous report on CTE educational outcomes, we presented evidence to show that the CTE lotteries for each school and each class appear to have been random lotteries with some consideration given to racial balance. Variables for student race/ethnicity were the only ones on which accepted and non-accepted students consistently differed statistically. As a result, to improve the specificity of our models, we control for student race/ethnicity.

*Students' Choices*

Students who received an acceptance to one high school could decide to attend that school or to remain at their neighborhood high school. Students with two or more acceptances needed to decide which of their three or more choices (including their neighborhood high school) they most preferred. In other words, being accepted to a school was not the same thing as being assigned to that school. As a result, there were some students who were accepted to a CTE school who chose not to attend that school. It is for this reason that we conducted both Intent-to-Treat analyses (which compare those who were accepted to a CTE school and those who were not) and Dosage analyses (which compare those who attended a CTE school and those who did not).

## Data

This study relies entirely on 1) student record data from the School District of Philadelphia, 2) data on postsecondary enrollments and graduation from the National Student Clearinghouse (NSC), and 3) data on receipt of Pell grants. The school district and NSC data sets were merged by the NSC, using student names, birthdates, and (in some cases) social security numbers provided by the School District of Philadelphia. Pell grant data were merged with student record data using student names and birthdates.

*Student Record Data*

Student record data sets from the School District of Philadelphia provide individual information about students: their courses, course grades, progress toward high school graduation, attendance, test scores, schools attended, and high school choice participation and outcomes. These data sets cover the 1998-99 school year through the 2004-05 school year (the on-time graduation date of the Class of 2005). The files contain a unique identifier for each student so that their data can be combined into a longitudinal data set. Comparisons of the data observed in the administrative data sets to publicly available data sources for overlapping measures provided confidence that the data were accurately recorded and reported.

The types of student record data sets and the associated variables for each are as follows:

- Courses taken, course grades, and credits earned. For each school year, the course-taking file provides a list of courses in which each student was enrolled; the final grade (A-F) for each course; the number of credits that the student earned for the course; and the academic area in which the student earned that credit. Academic areas include core subjects required for graduation (mathematics, English, social studies, and science) and elective credits.

- Enrollment, graduation, and withdrawal from school. For each school year, these files contain two key variables that indicate whether the student's *last known status for that school year* was "enrolled," "withdrawn," or "unclear." Students who were no longer listed on the district's enrollment rolls for any reason were listed as "withdrawn." A second variable provides detail on the reason for a student's withdrawal from the school district. For example, a student could have been removed from the school rolls because he or she graduated, dropped out, died, or transferred to another school district, among other reasons.

- Attendance. For each school year, the number of days present at school and the number of days enrolled in school are available. These two variables permit a calculation of the attendance rate.

- High school choice variables. This file identifies each high school to which the student applied; whether each school was the student's first choice, second choice, and so on; the outcome of that student's application (accepted or not accepted to each school); and if the student was not accepted, the reason why (for example, GPA or attendance was too low to meet the school's standards for admission).

- Miscellaneous student data. These files include demographic data, including race/ethnicity, gender, and birth date; coding for exceptionalities, including receiving special education and/or English-Language-Learner services; and the *last* school attended for that school year.

- School data. These data include percentage of students who are low income at the school and whether the school is a CTE school, neighborhood high school, or special admissions school.

*National Student Clearinghouse Data*

The National Student Clearinghouse (NSC) is a non-profit organization that collects and organizes student-level postsecondary enrollment and degree completion information. It reports that 3,300 institutions of higher learning provide data on student enrollment and graduation to the NSC, and that these institutions enroll 92 percent of all higher education students in the United States. School districts can use the NSC data to track the progress of their graduates through postsecondary education, employers can use the data to verify degrees, and colleges and universities can use the data to examine patterns of transfer into and out of their institution.

All institutions offering two-year and four-year degrees, as well as postsecondary trade or training schools (also called private licensed schools) offering certifications, are eligible to report their data to the NSC. Postsecondary trade schools are authorized by their states to offer certifications in areas such as bartending, truck driving, cosmetology, or medical assistance. Further, for an additional fee, the NSC will provide data on whether the student has earned an industry certification, primarily in areas such as computer software. However, our review of the NSC files for Philadelphia students indicated that the files contained information only on students at schools offering two-year or four-year degrees. We did not request additional data on industry certifications. *Therefore, the NSC data should be understood as providing information only on enrollment in, and graduation from, two-year and four-year institutions.*

The NSC data on postsecondary enrollment and graduation that we used for this analysis were obtained by the School District of Philadelphia, which pays for the option of receiving these postsecondary data for its graduates. The data merge is conducted by the NSC, using names, birthdates, and, in some cases, social security numbers of district graduates. The NSC data files extended from the fall 2003 semester through the spring 2010 semester.

NSC data on enrollment and graduation are provided by semester, including summer. If a student does not appear in the database for a given semester, the inference is that he/she was not enrolled at one of the participating institutions. Students who are enrolled at two or more participating institutions in a single semester will be represented in the data set multiple times for that semester.

It is important to note that not all students in the NSC data set are seeking a degree. Some may be taking a course here or there to obtain a certification or to "try out" college. In the NSC data set, however, we have no way to distinguish those who are seeking a degree from those who intend only to take a course or two. Further, the NSC data do not provide information on students' course enrollments, grades, or placement into developmental or remedial courses.

Variables available for each semester from NSC data are:

- The characteristics of the institution at which the student is enrolled. These include the name of the institution; the city and state in which it is located; and whether it is a two-year or four-year degree-offering institution.

- Full-time, half-time, or part-time status.  For each institution, whether the student is enrolled full-time or has some other type of enrollment is indicated.

- Graduation and major.  If a student has graduated with a two-year or four-year degree, the institution from which he/she earned a degree is indicated, as well as the semester during which the degree was awarded. In most cases, a major is indicated. Data on sub-degree certifications are not provided in the NSC data.

*Pell Grant Data*

Because the NSC data did not include information on enrollment in private license schools, we added data on receipt of a Pell Grant, obtained from the U.S. Department of Education. These data are available for calendar years 2004 through 2008. Pell Grants for postsecondary education are federal grants available to individuals of all ages who demonstrate high financial need and would not otherwise be able to enroll in higher education. Most importantly for this analysis, Pell Grants can be used not only at two-year and four-year colleges but also at accredited private license schools as long as the individual is working toward a professional licensure, such as a beautician/barber license (Bennett, n.d.). Thus, the Pell Grant data set is one of the best options for learning more about the extent to which CTE students pursue additional education at private license schools rather than at institutions that offer a two-year or four-year degree.

There are notable limitations to the conclusions that can be drawn from the Pell Grant data set. First, as all students attending private license schools do not qualify for Pell Grants, any analysis that uses Pell Grant receipt to estimate the percentage of students attending private license schools almost certainly produces an undercount. Second, the Pell Grant data set does not include information on whether students received the professional license toward which they had been working. Finally, for students attending schools that offer varied types of licenses, we cannot identify the particular license toward which they were working.

It is important to note that this is an exploratory analysis and allows us only to produce aggregate estimates of the percentage of CTE applicants who received a Pell Grant, the types of institutions at which their Pell Grant was spent, and the semester(s) during which each student used a Pell Grant at these institution(s).

Variables available for each semester from the Pell Grant data set are:

- The name of the institution at which the Pell Grant was spent; and

- The city and state in which the institution was located.

From these variables, we created a variable indicating whether the student had ever used a Pell Grant at a private license school. To do this, we screened out cases where the student had clearly attended a two-year or four-year school. For the remaining schools, we coded them as private license schools if their names clearly indicated that their key purpose was to provide training for licensure in a particular occupation not requiring a college degree (for example, cosmetology/barbering schools, truck driving schools, LPN nursing schools). For any schools where the name did not make clear what credentials were offered, we searched the Internet for information that would allow us to categorize them. Any school that offered a two-year degree in addition to professional licenses was *not coded* as a private license school.

We did not use the Pell data to create the variable for whether students enrolled in a two-year or four-year institution. That determination was made from the NSC data.

# Methods

*Types of analysis*

This analysis of postsecondary outcomes includes three broad types of estimates: 1) an Intent-to-Treat effect of CTE schools; 2) a Local Average Treatment Effect (or LATE), which adjusts effect estimates for the percentage of students assigned to a condition who actually experienced the condition; and 3) a Dosage analysis, which adjusts for the number of years students attended a CTE school.

While related, these analyses ask slightly different questions, which can be summed up as asking about the effect of *assignment to the intervention* versus the effect of *experiencing the intervention*.

- The **Intent-to-Treat (ITT) analysis** asks, "What is the effect of program assignment on the outcome?" In this case, the ITT question is, "What is the effect of being accepted to a CTE school on postsecondary outcomes?"

- The **Local Average Treatment Effect (LATE)** analysis asks, "What is the average effect of the treatment per person induced to receive it?"

- The **Dosage analysis** asks, "What is the effect of experiencing more of the treatment - in this case, attending a CTE school for a longer period of time?" (For a discussion of various effect estimates, see Bloom, 2005.)

*Establishing the treatment and control groups for ITT, LATE, and Dosage analyses*

Students who are included in this analysis had three things in common. **First**, they attended Philadelphia public schools (not including charter schools) for eighth grade and enrolled in a Philadelphia public high school for ninth grade during the next school year. **Second**, they entered high school as members of the Class of 2003, 2004, or 2005. **Third**, when they were in eighth grade, they applied to attend one or more CTE high schools.

Once the universe of students who applied to CTE schools had been established based on their high school application records, we created treatment and control groups. For the ITT analysis, treatment and control groups are defined in two ways and, as we show below in the *Estimation Methods* section, we use two different methods to estimate the ITT impacts of CTE schools.

- The first way that we define ITT treatment and control groups is by school; that is, for each CTE school, the applicants are divided into those who were accepted and those who were not. Students who applied to more than one CTE school and were accepted to one but not to another could be coded as part of the treatment group for one CTE school and part of the control group for another school. A reason for creating treatment and control groups by school is that there were observable differences between schools in the

characteristics of their applicants, suggesting that impacts should be estimated by school and then averaged for an overall effect.

- The second way that ITT treatment and control groups are defined is a simple binary variable, with "1" equal to having been accepted to a CTE school and "0" for not having been accepted.

For the Dosage analysis, the treatment group consisted of students who had attended a CTE high school for any length of time, regardless of whether there was a record of the student actually being accepted to a CTE high school. The control group is comprised of students who did not attend a CTE school. Some students in the control group were not accepted to a CTE school, while some were accepted but did not attend.

*Estimation methods*

For Intent-to-Treat estimates, we used two modeling strategies. The first strategy is a **mixed model** that allows students to be represented in the data set multiple times. The number of times that students appear in the data set is equal to the number of CTE schools to which he or she applied. We used a two-level model (Raudenbush & Bryk, 2002), with students nested within lotteries. Because students who were entered into the lottery at more than one CTE school are represented in the data set more than once, we use robust standard errors to correct for the non-independence of some observations (White, 1982). Separate models were estimated for the three different cohorts. In essence, this estimation strategy allows us to find the CTE effect for each lottery and create an average across all CTE lotteries for a given cohort.

While this modeling strategy deals with the bias inherent in comparing outcomes for students who participated in different lotteries (where participation is non-random), it produces conservative estimates of the overall impact of CTE schools. This is because a student who applied to multiple CTE schools and attended one of them will be included as a "treatment" student once for the lottery to which he or she was accepted and as a "control" one or more times for other lotteries to which the student applied but was not accepted. The potential of this modeling strategy to underestimate any positive effects of CTE is particularly acute for the Class of 2005, for which between approximately one-quarter and one-third of the rejected applicants enrolled at other CTE schools.

Given the potential of this modeling strategy to underestimate the overall effects of CTE schools, we produced a set of fixed-effects estimates in which students are represented only once in the data set. The dependent variable is a dummy variable for whether the student was accepted to *any* CTE school. Instead of nesting students within lotteries, we included a set of four dummy variables (five variables for the Class of 2005, which had five CTE school options) indicating whether the student was included in a lottery for a specific school. This modeling strategy has the disadvantage of not being able to control for the ranking that a student gave a specific school on his/her application (which we know had an impact on a student's probability of being accepted, and potentially indicated more or less serious interest in CTE education), nor does it

compare students to others who were not accepted to a <u>particular</u> school. It has the advantage, however, of not including in the treatment groups any students who attended CTE schools.

To achieve racial balance in the schools, the lottery took into account student race or ethnicity. Further, students who identified a particular school as a top choice had a higher probability of being admitted to the school than students who gave it a low ranking. Therefore, we control for race/ethnicity in both types of models; we control for the ranking given to each school in the first model.

The equation we use for the **Intent-to-Treat mixed model** is as follows. This equation is for continuous variables such as scores on standardized tests; for binary dependent variables, we use a multilevel logit model.

**Level One**

$$Y_{ij} = \beta_{0j} + \beta_{1j} \text{ (Accepted to Lottery l in year y)}_{ij} +$$

$$\beta_{2j}(African\ American)_{ij} + \beta_{3j}(Asian)_{ij} + \beta_{4j}(Latino)_{ij} +$$

$$\beta_{5j}(Other\ ethnicity)_{ij} + \beta_{6j}(Ranking\ given\ to\ school)_{ij} + r_{ij}$$

**Level Two**

$$\beta_{0j} = \gamma_{00j} + u_{0k}$$
$$\beta_{1j} = \gamma_{01j}$$
$$\beta_{2j} = \gamma_{02j}$$
$$\beta_{3j} = \gamma_{03j}$$
$$\beta_{4j} = \gamma_{04j}$$
$$\beta_{5j} = \gamma_{05j}$$

The equation for the **Intent-to-Treat fixed-effects estimates** of predictors of continuous dependent variables is as follows. Binary dependent variables were modeled with a logit model.

$$Y = \beta_0 + \beta_1(Accepted) + \beta_2(White) + \beta_3(Asian) + \beta_4(Latino) +$$

$$\beta_5 \text{ (In School A Lottery)} + \beta_6(In\ School\ B\ Lottery) +$$

$$\beta_7(In\ School\ C\ Lottery) + \beta_8(In\ School\ D\ Lottery) + r$$

For estimates of **Dosage effects,** we used a mixed-model approach, with each student potentially represented multiple times in the data set. This model introduces a control for the proportion of the first four years of high school that a student actually attended a CTE school, as well as controls for race/ethnicity, gender, the number of CTE schools applied to, receipt of special education in eighth grade, receipt of English Language Learner services in eighth grade,

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whether the student entered high school overage, and eighth-grade GPA. The Dosage equation for continuous dependent variables is as follows. Binary dependent variables were modeled with a multilevel logit model.

**Level One**

$Y_{ij} = \beta_{0j} + \beta_{1j}$ *(Proportion of Years Attended a CTE School)$_{ij}$ +*

$\beta_{2j}$*(African American)$_{ij}$ + $\beta_{3j}$(Asian)$_{ij}$ + $\beta_{4j}$(Latino)$_{ij}$ +*

$\beta_{5j}$*(Number of CTE Schools Applied to)$_{ij}$ +*

$\beta_{6j}$*(Ranking given to school)$_{ij}$ + $\beta_{7j}$(Female)$_{ij}$ +*

$\beta_{8j}$*(Special Education)$_{ij}$ + $\beta_{9j}$(English Language Learner)$_{ij}$ +*

$\beta_{10j}$*(Overage)$_{ij}$ + $\beta_{11j}$(GPA in 8$^{th}$ grade)$_{ij}$ + $r_{ij}$*

**Level Two**

$\beta_{0j} = \gamma_{00j} + u_{0j}$
$\beta_{1j} = \gamma_{01j}$
$\beta_{2j} = \gamma_{02j}$
$\beta_{3j} = \gamma_{03j}$
$\beta_{4j} = \gamma_{04j}$
$\beta_{5j} = \gamma_{05j}$
$\beta_{6j} = \gamma_{06j}$
$\beta_{7j} = \gamma_{07j}$
$\beta_{8j} = \gamma_{08j}$
$\beta_{9j} = \gamma_{09j}$
$\beta_{10j} = \gamma_{10j}$
$\beta_{11j} = \gamma_{11j}$

*Calculation of Local Average Treatment Effect (LATE)*

We calculate the LATE estimate by finding the difference between the mean ITT Treatment Group value and the mean ITT Control Group value, and dividing this value by the mean difference in treatment receipt rates between the Treatment and Control Groups. In essence, this estimate adjusts for the percentage of individuals assigned to a particular condition who actually participated in that condition. This estimate is equivalent to an Instrumental Variables estimate as described by Angrist, Imbens, and Rubin (1996).

## SECTION II:  ENROLLMENT IN POSTSECONDARY EDUCATION

## Descriptive Comparisons of Enrollment in Postsecondary Education

This section presents descriptive information about enrollment in two-year colleges, four-year colleges or universities, and *either* two-year or four-year institutions. These percentages are intended to orient the reader to the overall levels of postsecondary attendance, but as they have not been adjusted for student characteristics, they should not be seen as the best estimates of the impact of CTE schools. The best estimates are regression-adjusted estimates, which appear in Tables 7-10.

*Enrollment in Two-Year Colleges by Spring 2010*

Table 1 provides descriptive data on the percentages of students who enrolled in a two-year college by spring 2010, comparing the values for students who were accepted to a CTE school and those who were not. The subsequent table compares enrollment rates for students who attended CTE schools and those who did not. Each table includes information for all the CTE applicants in each cohort, as well as enrollment rates for race/ethnic and gender subgroups and students who received special education services at any point during high school. These tables represent the entire cohort, including both high school graduates and dropouts. The fact that enrollment data are current as of spring 2010 means that we are able to observe enrollment for seven years after the on-time graduation date for the Class of 2003, six years for the Class of 2004, and five years for the Class of 2005.

Roughly speaking, about 20 percent of each cohort enrolled in a two-year college by spring 2010. Unadjusted enrollment rates for the Classes of 2004 and 2005 were higher than for the Class of 2003, which likely is explained by the "pre-screening" of CTE applicants before conducting the lottery for these two latter classes. Two-year college enrollment was slightly higher among females than males in each cohort, regardless of whether they had been accepted to a CTE school. For the Classes of 2004 and 2005, differences in two-year college enrollment between accepted and non-accepted CTE applicants, including differences within subgroups, are quite small.

Compared to those who attended CTE schools, members of the Classes of 2003 or 2004 who attended other schools had a lower rate of enrollment in two-year colleges (Table 2). For the Class of 2003, 19 percent of students who attended CTE schools enrolled in a two-year college, compared to 14 percent of those who did not attend a CTE school. This difference diminished for the Class of 2004 and disappeared for the Class of 2005. Indeed, for the Class of 2005, those who did not attend CTE schools enrolled in two-year colleges at a slightly higher rate than those who attended CTE schools (18.9 percent versus 18.0 percent, respectively). Within the subgroups presented in Table 2, the college-going advantage was typically to the students attending CTE schools for the Class of 2003, but for the Class of 2005 that advantage either had eroded or reversed.

**Table 1:     Percentage Enrolling in Two-Year Colleges for Accepted and Non-Accepted CTE Applicants, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school |
| *All students* | *17.5%* | *14.1%* | *19.4%* | *19.2%* | *18.3%* | *19.3%* |
| **Male** | 13.8 | 11.5 | 16.0 | 16.0 | 16.7 | 18.5 |
| **Female** | 21.0 | 16.5 | 22.2 | 22.2 | 19.2 | 20.2 |
| **White** | 15.5 | 10.3 | 17.5 | 17.5 | 16.8 | 14.7 |
| **Black** | 18.4 | 15.0 | 19.8 | 20.1 | 18.9 | 19.4 |
| **Asian** | 19.5 | 15.0 | 24.0 | 24.8 | 22.1 | 31.0 |
| **Latino** | 15.7 | 12.1 | 17.7 | 12.3 | 15.2 | 17.1 |
| **White Male** | 11.0 | 9.1 | 17.1 | 11.7 | 16.4 | 12.0 |
| **White Female** | 21.0 | 11.8 | 17.9 | 24.2 | 17.2 | 17.7 |
| **Black Male** | 14.5 | 11.7 | 14.9 | 16.8 | 17.5 | 19.5 |
| **Black Female** | 21.6 | 17.8 | 23.7 | 22.8 | 19.8 | 19.3 |
| **Asian Male** | 20.0 | 24.7 | 24.2 | 16.3 | 16.2 | 23.8 |
| **Asian Female** | 19.1 | 6.3 | 23.7 | 32.7 | 27.8 | 38.1 |
| **Latino Male** | 12.4 | 8.0 | 17.2 | 14.2 | 14.0 | 16.3 |
| **Latino Female** | 18.9 | 15.8 | 18.1 | 10.2 | 16.1 | 17.6 |
| **Special Education** | 10.6 | 9.7 | 11.0 | 12.9 | 15.7 | 16.1 |
| **High School Graduate** | 25.5 | 22.5 | 24.8 | 27.4 | 21.8 | 24.5 |

SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

**Table 2:** **Percentage Enrolling in Two-Year Colleges for Students Who Attended CTE Schools and Students Who Did Not, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** |
| *All students* | *19.2%* | *14.3%* | *21.1%* | *18.4%* | *18.0%* | *18.9%* |
| **Male** | 16.0 | 11.3 | 18.5 | 14.7 | 16.5 | 17.8 |
| **Female** | 22.3 | 17.1 | 23.6 | 21.5 | 19.1 | 19.7 |
| **White** | 16.7 | 10.9 | 16.7 | 18.0 | 12.7 | 18.4 |
| **Black** | 19.6 | 15.3 | 21.8 | 19.0 | 19.2 | 18.9 |
| **Asian** | 20.0 | 16.1 | 22.2 | 24.7 | 26.0 | 25.3 |
| **Latino** | 19.3 | 11.8 | 21.7 | 11.6 | 14.0 | 16.6 |
| **White Male** | 12.1 | 9.0 | 17.7 | 14.6 | 15.1 | 15.5 |
| **White Female** | 22.6 | 13.0 | 15.8 | 21.2 | 10.1 | 20.7 |
| **Black Male** | 16.9 | 11.5 | 18.4 | 14.3 | 17.5 | 18.6 |
| **Black Female** | 22.1 | 18.5 | 25.1 | 22.5 | 20.5 | 19.1 |
| **Asian Male** | 25.0 | 22.9 | 13.3 | 22.0 | 20.0 | 18.8 |
| **Asian Female** | 15.4 | 9.7 | 28.6 | 27.8 | 32.0 | 31.5 |
| **Latino Male** | 14.3 | 8.2 | 21.1 | 12.7 | 11.3 | 16.5 |
| **Latino Female** | 25.0 | 15.0 | 22.3 | 10.5 | 16.2 | 16.7 |
| **Special Education** | 12.1 | 9.5 | 12.0 | 11.7 | 18.3 | 14.5 |
| **High School Graduate** | 26.2 | 22.9 | 26.2 | 25.6 | 21.5 | 23.4 |

SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

*Enrollment in Four-Year Colleges by Spring 2010*

Among students who had been accepted to a CTE school, enrollment in a four-year college by spring 2010 was about 17 percent for the Class of 2003, 21 percent for the Class of 2004, and 25 percent for the Class of 2005 (Table 3). The overall four-year college-going rates of students who were not accepted to a CTE school were quite similar to those of the accepted students. On the whole, enrollment in four-year colleges was quite similar for subgroups of students in each cohort. Exceptions are the Asian, Asian Male, Asian Female subgroups, where differences between accepted and non-accepted students and across cohorts were sometimes dramatic. The small number of cases in these subgroups, however, contributes to the volatility of these percentages across years.

**Table 3:**   **Percentage Enrolling in Four-Year Colleges for Accepted and Non-Accepted CTE Applicants, by Cohort**

|  | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
|  | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school |
| *All students* | *16.7%* | *17.1%* | *20.8%* | *20.0%* | *24.6%* | *23.9%* |
| **Male** | 14.4 | 13.8 | 17.7 | 17.7 | 22.6 | 19.1 |
| **Female** | 19.0 | 20.2 | 23.5 | 22.2 | 26.0 | 27.5 |
| **White** | 10.1 | 13.4 | 18.2 | 14.0 | 15.8 | 18.2 |
| **Black** | 18.7 | 18.0 | 21.9 | 21.1 | 26.5 | 26.4 |
| **Asian** | 20.7 | 30.0 | 33.6 | 21.8 | 33.6 | 19.1 |
| **Latino** | 12.5 | 11.0 | 13.1 | 15.7 | 22.0 | 18.7 |
| **White Male** | 6.3 | 11.7 | 15.7 | 13.0 | 15.6 | 18.7 |
| **White Female** | 14.7 | 15.3 | 20.3 | 15.2 | 16.0 | 17.7 |
| **Black Male** | 17.3 | 14.2 | 18.3 | 19.1 | 24.4 | 21.4 |
| **Black Female** | 19.8 | 21.3 | 24.8 | 22.8 | 27.9 | 29.6 |
| **Asian Male** | 16.0 | 24.7 | 36.4 | 18.4 | 29.4 | 11.9 |
| **Asian Female** | 26.2 | 34.7 | 30.5 | 25.0 | 37.5 | 26.2 |
| **Latino Male** | 9.1 | 9.3 | 8.2 | 11.3 | 21.3 | 12.2 |
| **Latino Female** | 15.8 | 12.6 | 17.5 | 20.4 | 22.4 | 23.0 |
| **Special Education** | 13.8 | 14.4 | 6.0 | 5.9 | 26.0 | 17.7 |
| **High School Graduate** | 27.2 | 31.5 | 30.7 | 32 | 33.4 | 36.2 |

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

In each cohort, four-year college enrollment was higher for students who did not attend CTE schools (Table 4). For example, among members of the Class of 2005, 27 percent of those who did not attend CTE schools enrolled in a four-year college, compared to 21 percent of students who attended a CTE school. This advantage for Class of 2005 students who did not attend CTE schools was particularly notable for some subgroups. Among White students, for example, those who did not attend CTE schools were two or three times more likely than those who did attend CTE schools to enroll in a four-year college.

**Table 4:** **Percentage Enrolling in Four-Year Colleges for Students Who Attended CTE Schools and Those Who Did Not, by Cohort**

|  | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
|  | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** |
| *All students* | *14.1%* | *17.7%* | *15.6%* | *22.9%* | *21.0%* | *26.6%* |
| **Male** | 11.8 | 14.6 | 13.0 | 20.2 | 18.0 | 24.2 |
| **Female** | 16.3 | 20.7 | 18.0 | 25.2 | 22.9 | 28.4 |
| **White** | 8.1 | 13.5 | 13.4 | 19.3 | 7.9 | 21.1 |
| **Black** | 16.1 | 18.8 | 16.5 | 24.2 | 23.6 | 28.3 |
| **Asian** | 8.0 | 28.9 | 22.2 | 29.5 | 18.0 | 31.0 |
| **Latino** | 10.3 | 11.8 | 12.0 | 15.5 | 18.4 | 22.7 |
| **White Male** | 4.6 | 11.4 | 9.8 | 17.8 | 7.6 | 22.1 |
| **White Female** | 12.8 | 15.9 | 16.7 | 20.7 | 8.3 | 20.3 |
| **Black Male** | 14.8 | 15.4 | 14.4 | 21.2 | 21.1 | 25.5 |
| **Black Female** | 17.2 | 21.7 | 18.4 | 26.3 | 25.6 | 30.0 |
| **Asian Male** | 0.0 | 23.7 | 26.7 | 29.0 | 12.0 | 25.9 |
| **Asian Female** | 15.4 | 33.9 | 19.1 | 30.0 | 24.0 | 36.0 |
| **Latino Male** | 6.5 | 10.0 | 6.7 | 11.3 | 16.3 | 21.1 |
| **Latino Female** | 14.7 | 13.4 | 17.0 | 19.6 | 20.2 | 23.9 |
| **Special Education** | 7.5 | 15.7 | 4.7 | 6.8 | 15.0 | 28.1 |
| **High School Graduate** | 20.5 | 32.8 | 22.1 | 36.2 | 26.5 | 40.2 |

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

*Enrollment in Two-Year OR Four-Year Colleges*

When enrollment in two-year and/or four-year colleges is considered together, accepted CTE applicants have similar college-going rates to those of non-accepted applicants (Table 5). For the Class of 2003, 34 percent of students who were accepted to CTE schools enrolled in a two-year or four-year institution, in comparison with 31 percent of those who were not accepted. For the Classes of 2004 and 2005, enrollment rates for accepted and non-accepted students were within approximately 1 percentage point of each other.

Within subgroups of students in some cohorts, there are some notable differences in enrollment rates, but these differences are rarely consistent in direction and magnitude across all three cohorts. One exception is the difference for Latino students, where those who were accepted to a CTE school have higher enrollment rates, although the magnitude of the difference diminishes over the three cohorts. This difference appears to be driven by both Latino males and Latino females.

**Table 5:** **Percentage Enrolling in Two-Year and/or Four-Year Colleges for Accepted and Non-Accepted CTE Applicants, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school |
| *All students* | *34.2%* | *31.2%* | *40.2%* | *39.1%* | *42.9%* | *43.2%* |
| **Male** | 28.1 | 25.3 | 33.7 | 33.6 | 39.3 | 37.7 |
| **Female** | 40.0 | 36.7 | 45.7 | 44.4 | 45.2 | 47.7 |
| **White** | 25.6 | 23.7 | 35.8 | 31.5 | 32.7 | 32.9 |
| **Black** | 37.0 | 32.9 | 41.7 | 41.3 | 45.3 | 45.7 |
| **Asian** | 40.2 | 45.0 | 57.6 | 46.5 | 55.7 | 50.0 |
| **Latino** | 28.2 | 23.1 | 30.7 | 27.9 | 37.1 | 35.8 |
| **White Male** | 17.3 | 20.8 | 32.9 | 24.7 | 32.0 | 30.7 |
| **White Female** | 35.7 | 27.1 | 38.2 | 39.4 | 33.2 | 35.3 |
| **Black Male** | 31.8 | 25.9 | 33.2 | 35.9 | 42.0 | 40.9 |
| **Black Female** | 41.4 | 39.1 | 48.5 | 45.5 | 47.6 | 48.9 |
| **Asian Male** | 35.6 | 49.4 | 60.6 | 34.7 | 45.6 | 35.7 |
| **Asian Female** | 45.2 | 41.1 | 54.2 | 57.7 | 65.3 | 64.3 |
| **Latino Male** | 21.5 | 17.3 | 25.4 | 25.5 | 35.4 | 28.6 |
| **Latino Female** | 34.7 | 28.3 | 35.6 | 30.6 | 38.5 | 40.5 |
| **Special Education** | 24.4 | 24.1 | 16.9 | 18.7 | 41.7 | 33.7 |
| **High School Graduate** | 52.7 | 54 | 55.5 | 59.4 | 55.2 | 60.6 |

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

Unadjusted comparisons of college-going for students who attended CTE schools and those who attended other schools show that, for the Classes of 2004 and 2005, CTE students were less likely than students who attended other schools to enroll in a two-year or four-year school (Table 6). For the Class of 2004, there was a 4 percentage-point difference in favor of students who did not attend a CTE school, and for the Class of 2005, the difference was 6.5 percentage points. The lower college-going rates for the Classes of 2004 and 2005 were replicated in almost every gender, racial, and ethnic subgroup. In addition, within some subgroups the difference between CTE and non-CTE students in college-going was quite substantial. For example, White members of the Class of 2005 who attended CTE schools were about half as likely to enroll in college as White students who attended other schools. There was little difference between CTE students and other students in college-going for the Class of 2003.

**Table 6:** **Percentage Enrolling in Two-Year and/or Four-Year Colleges for Students Who Attended CTE Schools and Those Who Did Not, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | Attended a CTE school | Did Not Attend a CTE school | Attended a CTE school | Did Not Attend a CTE school | Attended a CTE school | Did Not Attend a CTE school |
| *All students* | *33.2%* | *32.0%* | *36.7%* | *41.2%* | *39.0%* | *45.5%* |
| Male | 27.7 | 25.9 | 31.5 | 34.9 | 34.4 | 42.0 |
| Female | 38.6 | 37.8 | 41.6 | 46.7 | 41.9 | 48.1 |
| White | 24.8 | 24.3 | 30.1 | 37.3 | 20.6 | 39.5 |
| Black | 35.7 | 34.1 | 38.3 | 43.2 | 42.8 | 47.3 |
| Asian | 28.0 | 45.0 | 44.4 | 54.2 | 44.0 | 56.3 |
| Latino | 29.7 | 23.7 | 33.7 | 27.1 | 32.4 | 39.3 |
| White Male | 16.7 | 20.4 | 27.5 | 32.4 | 22.7 | 37.6 |
| White Female | 35.3 | 28.9 | 32.5 | 41.9 | 18.4 | 41.0 |
| Black Male | 31.7 | 26.9 | 32.8 | 35.4 | 38.7 | 44.1 |
| Black Female | 39.3 | 40.1 | 43.5 | 48.8 | 46.2 | 49.1 |
| Asian Male | 25.0 | 46.6 | 40.0 | 51.0 | 32.0 | 44.7 |
| Asian Female | 30.8 | 43.6 | 47.6 | 57.8 | 56.0 | 67.4 |
| Latino Male | 20.8 | 18.2 | 27.8 | 24.0 | 27.5 | 37.6 |
| Latino Female | 39.7 | 28.4 | 39.4 | 30.1 | 36.4 | 40.6 |
| Special Education | 19.5 | 25.3 | 16.7 | 18.5 | 33.3 | 42.6 |
| High School Graduate | 46.6 | 55.7 | 48.3 | 61.9 | 48 | 63.6 |

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

## Estimates of Impact on College Enrollment

To assess the impact of CTE schools on enrollment in two-year and four-year, degree-granting institutions, we produced Intent-to-Treat, LATE, and Dosage estimates. Intent-to-Treat estimates are presented in Table 7, and LATE and Dosage estimates are shown in Table 8. The Intent-to-Treat estimates include all cohort members, regardless of whether they had earned a high school diploma, dropped out, or were still enrolled.

For the Class of 2003, estimates from the two ITT modeling strategies (the mixed model and fixed effects) tell a consistent story: students accepted to a CTE school had higher odds than students who were not accepted of ever enrolling in a two-year, degree-granting institution, and there was no difference in the odds of enrolling in a four-year institution. For this class, the net effect was positive, with CTE students having higher odds of enrolling in either a two-year or four-year institution.

For the Class of 2004, the mixed models and fixed effects models have some consistent estimates and some that are inconsistent. The models are consistent in their estimates of "no difference" in enrollment at a two-year college. The mixed model indicates a positive effect for CTE schools of enrolling in a four-year college, but the fixed effects estimates suggest "no difference."

The general pattern of ITT results for the Class of 2005 is that of "no difference." The sole significant difference is the mixed model estimate for enrollment in a four-year institution.

When the estimates are combined across cohorts, there are small effects for enrollment at a two-year college, although this effect is driven by the Class of 2003. Likewise, the mixed model shows an impact of CTE schools on enrollment in a four-year college and on enrollment in a two-year and/or four-year college. Given the strengths of the mixed model – namely, its ability to compare applicants to a given CTE school only to other applicants to *that* school – we give more credence to the mixed model estimates than those from the fixed effects model.

**Table 7:** **Impacts of CTE Schools on Enrollment in Two-Year and/or Four-Year Colleges, ITT Estimates**

* - Statistically significant difference at the α <.05 level. P-values in parentheses.

| EVER ENROLLED IN A: | Class of 2003 | | Class of 2004 | | Class of 2005 | | All Cohorts | |
|---|---|---|---|---|---|---|---|---|
| | Mixed Model | Fixed Effects | Mixed Model | Fixed Effects | Mixed Model | Fixed Effects | Mixed Model | Fixed Effects |
| Two-year college | **1.25** (.001*) | **1.38** (.000*) | 1.03 (.648) | 1.04 (.663) | 0.98 (.811) | 1.01 (.424) | **1.12** (.037*) | **1.09** (.046*) |
| Four-year college | 1.10 (.128) | .96 (.597) | **1.36** (.000*) | 1.05 (.551) | **1.16** (.041*) | 0.86 (.099) | **1.18** (.001*) | .99 (.831) |
| Two- or four-year college | **1.22** (.000*) | **1.20** (.001*) | **1.26** (.000*) | .98 (.804) | 1.11 (.106) | .90 (.150) | **1.19** (.001*) | 1.06 (.134) |

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

The LATE and Dosage estimates for college enrollment (Table 8) are broadly similar to the ITT estimates. **First**, there are more positive CTE effects for the Classes of 2003 and 2004 than for the Class of 2005. LATE and Dosage estimates for two-year college enrollment among the Class of 2003 place CTE students' odds at 60 percent to 70 percent higher than students who attended other schools, but for the Classes of 2004 and 2005, there was either no statistically significant effect or a negative impact of CTE. Likewise, for the Classes of 2004 and 2005, the LATE effect of CTE on enrollment in a four-year college was positive and approached statistical significance. **Second**, when estimates are combined across three cohorts, there is an overall positive effect for CTE schools on enrollment in two-year and/or four-year colleges. The estimates in Table 8 indicate that students attending CTE schools have odds of enrollment in a two-year or four-year college that are 20 percent (Dosage) to 60 percent (LATE) higher than those of students attending other schools.

**Table 8:**    **Impacts of CTE Schools on Enrollment in Two-Year and/or Four-Year Colleges, LATE and Dosage Estimates**

* - Statistically significant difference at the α <.05 level. P-values in parentheses.

| | Class of 2003 | | Class of 2004 | | Class of 2005 | | All Cohorts | |
|---|---|---|---|---|---|---|---|---|
| | LATE | Dosage | LATE | Dosage | LATE | Dosage | LATE | Dosage |
| **EVER ENROLLED IN A:** | | | | | | | | |
| Two-year college | **1.70** (.001*) | **1.60** (.000*) | 1.10 (.648) | † | 0.93 (.811) | 0.68 (.051) | **1.35** (.037*) | **1.50** (.000*) |
| Four-year college | 1.26 (.128) | 0.93 (.387) | **2.51** (.000*) | 0.91 (.389) | **1.79** (.041*) | 0.82 (.307) | **1.57** (.001*) | **0.89** (.004*) |
| Two- or four-year college | **1.62** (.000*) | **1.32** (.000*) | **2.00** (.000*) | **1.30** (.004*) | 1.49 (.106) | **0.65** (.007*) | **1.61** (.001*) | **1.21** (.000*) |

† - Regression did not converge
SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

*CTE Impact on Postsecondary Enrollment Not Driven By One School*

One of Philadelphia's CTE schools – Saul – accepted students by lottery just as the other CTE schools did but was widely believed by parents across the city to be a "quasi-magnet" school that provided strong college preparation. Because the outcomes for students who applied to Saul were stronger than those of the other three schools, we re-ran the analyses without Saul to confirm that we were not observing the effect of a single school. Table 9 presents both ITT (mixed model) results and Dosage results, *not including Saul*. For parsimony, we present the results combined across cohorts. The positive impact of CTE persists for both ITT and Dosage analyses, as does the magnitude of the impact, despite removing Saul students from the analysis.

**Table 9:** **Impacts of CTE Schools on Enrollment in Two-Year and/or Four-Year Colleges, ITT and DOSAGE Estimates: SAUL HIGH SCHOOL REMOVED**

| | ITT (mixed methods) | DOSAGE |
|---|---|---|
| **EVER ENROLLED IN A:** | | |
| **Two-year college** | 1.06 (.241) | **1.46 (.000\*)** |
| **Four-year college** | **1.16 (.002\*)** | 0.89 (.084) |
| **Two- or four-year college** | **1.14 (.004\*)** | **1.19 (.001\*)** |

\* - Statistically significant difference at $\alpha < .05$. P-values in parentheses.
SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

*Dosage Estimates of Impact on College Enrollment for High School Graduates Only*

In an earlier report on high school academic outcomes for CTE students, we showed that students who attended CTE schools were more likely to graduate from high school than students at other schools. To explore whether the higher percentage of students earning a diploma could explain the higher enrollment rates in postsecondary education, we examined the odds of enrollment only for students who had graduated from high school. The Dosage estimates are presented in Table 10. We present only Dosage estimates (not ITT or LATE) for this analysis because, by including only a subgroup of students with different post-assignment outcomes, we already have broken the randomization.

The estimates for high school graduates only are similar to those for all students (including dropouts and students who were still enrolled in high school), except that the magnitude of the CTE advantage is less for enrollment in two-year colleges and the magnitude of the CTE disadvantage is greater for enrollment in four-year colleges. Specifically, among graduates, the estimates combined across cohorts indicate that high school graduates who attended CTE schools had higher odds of attending a two-year college and lower odds of attending a four-year college, in comparison to graduates who attended other high schools. The

net effect is that, for high school graduates in the Classes of 2003 and 2004 and for all cohorts combined, there was no difference in odds of enrolling in any degree-granting institution.

Comparison of estimates for all students and those limited to graduates suggests that a key way in which the CTE schools operate to increase enrollment in postsecondary education is by increasing high school graduation rates.

**Table 10:** **Impacts of CTE Schools on Enrollment in Two-Year and/or Four-Year Colleges, Dosage Estimates: HIGH SCHOOL GRADUATES ONLY**

| | Class of 2003 | Class of 2004 | Class of 2005 | All Cohorts |
|---|---|---|---|---|
| **EVER ENROLLED IN A:** | | | | |
| **Two-year college** | **1.33** **(.000*)** | † | **0.66** **(.040*)** | **1.28** **(.000*)** |
| **Four-year college** | **0.77** **(.002*)** | **0.77** **(.022*)** | 0.82 (.295) | **0.76** **(.000*)** |
| **Two- or four-year college** | 1.02 (.703) | 1.04 (.688) | **0.65** **(.006*)** | 0.98 (.546) |

\* - Statistically significant difference at α <.05.  P-values in parentheses.
† - Regression did not converge
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

*Combined Cohort Estimates of Impact of CTE Schools on College Enrollment by Key Subgroups*

Tables 11 and 12 show estimates of how CTE schools had an impact on enrollment in a two-year and/or four-year college, by gender (Table 11) and race/ethnicity (Table 12). Both tables present ITT, LATE, and Dosage impact estimates. For parsimony, we combine estimates from all three cohorts.

Table 11 shows that, for enrollment in a two-year OR four-year college, effects for males and females are similar: the ITT mixed model indicates higher odds of enrolling in postsecondary education, while the fixed effects estimate also suggests higher odds but is not statistically significant. The ITT estimates also indicate that among males, those who attended CTE schools had similar odds of enrolling in a two-year school relative to other students, but were more likely to enroll in four-year colleges. Among females, CTE attenders were more likely to enroll in a two-year college, with no difference in their likelihood of enrolling in a four-year college.

For the Dosage estimates, the model that includes all cohort members indicates that both males and females who attended CTE schools had higher odds of enrolling in a postsecondary institution. Importantly, the Dosage estimate for high school graduates only indicates no difference between those who attended CTE schools and those who attended other schools.

Among both male and female graduates, CTE students were more likely than students who attended other types of high schools to enroll in a two-year college and less likely to enroll in a four-year college.

**Table 11:    Impacts of CTE Schools on Enrollment in Two-Year and/or Four-Year Colleges, ITT and Dosage Estimates, by Gender**

| | Intent-to-Treat | | LATE | Dosage | |
| --- | --- | --- | --- | --- | --- |
| | Mixed Model | Fixed Effects | | All Cohort Members | High School Graduates Only |
| **Males** | | | | | |
| *Enrolled in Two-Year College* | 1.07 (.391) | 1.05 (.520) | 1.17 (.391) | **1.56 (.000*)** | **1.34 (.000*)** |
| *Enrolled in Four-Year College* | **1.33 (.000*)** | 1.06 (.392) | **2.05 (.000*)** | 0.85 (.016*) | 0.74 (.000*) |
| *Enrolled in Two-Year or Four-Year College* | **1.23 (.000*)** | 1.07 (.210) | **1.69 (.000*)** | 1.19 (.003*) | 0.99 (.875) |
| **Females** | | | | | |
| *Enrolled in Two-Year College* | **1.15 (.014*)** | **1.12 (.046*)** | **1.50 (.014*)** | 1.47 (.000*) | 1.26 (.000*) |
| *Enrolled in Four-Year College* | 1.10 (.068) | 0.95 (.314) | 1.32 (.068) | **0.91 (.027*)** | **0.78 (.000*)** |
| *Enrolled in Two-Year or Four-Year College* | **1.17 (.005*)** | 1.04 (.399) | **1.58 (.005*)** | 1.22 (.000*) | 0.98 (.491) |

\* - Statistically significant difference at α <.05.  P-values in parentheses.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

The evidence from Philadelphia also suggests positive impacts of CTE schools on the odds of postsecondary enrollment among African American and Latino students.  The ITT and Dosage estimates both suggest higher odds of enrolling in either a two-year or a four-year college.  Among high school graduates, the Dosage estimates indicate no effect of CTE, further suggesting that the CTE impact is mediated through the CTE schools' higher graduation rate.

The overall impact of CTE schools for Whites appears to be either no impact or a negative impact on college enrollment.  Both Dosage estimates suggest that White students who attended CTE schools are less likely to enroll in four-year schools than White students who attended other types of schools.

**Table 12:** Impacts of CTE Schools on Enrollment in Two-Year and/or Four-Year Colleges, ITT and Dosage Estimates, by Race/Ethnicity

| | Intent-to-Treat | | LATE | Dosage | |
|---|---|---|---|---|---|
| | Mixed Model | Fixed Effects | | All Cohort Members | High School Graduates Only |
| **Asian** | | | | | |
| *Enrolled in Two-Year College* | 0.99 (.942) | 0.93 (.720) | 0.96 (.942) | **3.15 (.000*)** | **3.08 (.001*)** |
| *Enrolled in Four-Year College* | 1.37 (.106) | 1.23 (.240) | 3.67 (.106) | 0.72 (.390) | 0.60 (.182) |
| *Enrolled in Two-Year or Four-Year College* | 1.30 (.061) | 1.13 (.434) | 3.00 (.061) | **2.21 (.035*)** | 1.76 (.153) |
| **African American** | | | | | |
| *Enrolled in Two-Year College* | 1.11 (.057) | 1.09 (.089) | 1.32 (.057) | **1.46 (.000*)** | **1.28 (.000*)** |
| *Enrolled in Four-Year College* | **1.20 (.000*)** | 0.99 (.968) | **1.60 (.000*)** | 0.95 (.251) | **0.83 (.001*)** |
| *Enrolled in Two-Year or Four-Year College* | **1.20 (.000*)** | 1.06 (.164) | **1.61 (.000*)** | **1.22 (.000*)** | 1.03 (.309) |
| **Latino** | | | | | |
| *Enrolled in Two-Year College* | **1.33 (.037*)** | 1.26 (.125) | **2.03 (.037*)** | **1.89 (.000*)** | **1.44 (.004*)** |
| *Enrolled in Four-Year College* | 1.31 (.135) | 1.02 (.896) | 1.96 (.135) | **0.69 (.004*)** | **0.52 (.000*)** |
| *Enrolled in Two-Year or Four-Year College* | **1.39 (.006*)** | 1.17 (.190) | **2.27 (.006*)** | **1.30 (.017*)** | 0.88 (.199) |
| **White** | | | | | |
| *Enrolled in Two-Year College* | 1.29 (.077) | 1.23 (.157) | 1.91 (.077) | 1.44 (.075) | 1.11 (.608) |
| *Enrolled in Four-Year College* | 0.97 (.824) | 0.81 (.148) | 0.93 (.824) | **0.54 (.001*)** | **0.43 (.000*)** |
| *Enrolled in Two-Year or Four-Year College* | 1.16 (.216) | 1.01 (.946) | 1.45 (.216) | 0.91 (.545) | **0.66 (.002*)** |

* - Statistically significant difference at α <.05.  P-values in parentheses.

SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

**Table 13:** **Impacts of CTE Schools on Enrollment in Two-Year and/or Four-Year Colleges, ITT and Dosage Estimates, Controlling for Course Taking Patterns**

| | Intent-to-Treat | | LATE | Dosage | |
|---|---|---|---|---|---|
| | Mixed Model | Fixed Effects | | All Cohort Members | High School Graduates Only |
| **Controlling for Completion of Algebra 1, Algebra 2, and Geometry** | | | | | |
| Enrolled in Two-Year College | 1.06 (.230) | 1.01 (.814) | 1.17 (.230) | **1.28 (.000*)** | **1.24 (.000*)** |
| Enrolled in Four-Year College | 1.02 (.714) | **0.78 (.000*)** | 1.05 (.714) | **0.58 (.000*)** | **0.58 (.000*)** |
| Enrolled in Two-Year or Four-Year College | 1.05 (.233) | **0.85 (.000*)** | 1.16 (.233) | **0.81 (.000*)** | **0.79 (.000*)** |
| **Controlling for Completion of Science Sequence** | | | | | |
| Enrolled in Two-Year College | 1.10 (.058) | 1.06 (.222) | 1.28 (.058) | **1.40 (.000*)** | **1.31 (.000*)** |
| Enrolled in Four-Year College | **1.14 (.023*)** | 0.93 (.102) | **1.41 (.023*)** | **0.82 (.000*)** | **0.78 (.000*)** |
| Enrolled in Two-Year or Four-Year College | **1.17 (.001*)** | 0.99 (.935) | **1.52 (.001*)** | 1.10 (.054) | 1.02 (.749) |
| **Controlling for Completion of Two Years of the Same Foreign Language** | | | | | |
| Enrolled in Two-Year College | 1.06 (.224) | 1.03 (.570) | 1.17 (.224) | **1.25 (.000*)** | **1.20 (.001*)** |
| Enrolled in Four-Year College | 1.07 (.145) | **0.86 (.001*)** | 1.19 (.145) | **0.68 (.000*)** | **0.66 (.000*)** |
| Enrolled in Two-Year or Four-Year College | **1.10 (.048*)** | **0.92 (.028*)** | **1.29 (.048*)** | **0.89 (.013*)** | **0.84 (.001*)** |
| **Controlling for Total CTE Courses Taken** | | | | | |
| Enrolled in Two-Year College | 1.08 (.116) | 1.00 (.996) | 1.23 (.116) | **1.19 (.005*)** | **1.17 (.009*)** |
| Enrolled in Four-Year College | **1.12 (.022*)** | .92 (.063) | **1.35 (.022*)** | **0.73 (.000*)** | **0.72 (.000*)** |
| Enrolled in Two-Year or Four-Year College | **1.13 (.015*)** | 0.94 (.130) | **1.38 (.015*)** | **0.90 (.044*)** | **0.89 (.030*)** |

\* - Statistically significant difference at α <.05.  P-values in parentheses.

SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

## SECTION III: PERSISTENCE IN POSTSECONDARY EDUCATION

       This section examines CTE impacts on persistence in college. As an indicator of student persistence, we use the number of semesters that students were enrolled in postsecondary education, whether part-time or full-time, whether in a two-year college or a four-year college. We are able to calculate the total semesters enrolled from the National Student Clearinghouse data. While this variable is an imperfect measure of advancement toward a degree (additional semesters of enrollment could simply indicate course failure or inadequate advising), when seen in combination with graduation rates, it provides us a partial insight into the success that students experienced in postsecondary education.

### Descriptive Comparisons of Enrollment in Postsecondary Education

       Tables 14 and 15 present unadjusted mean semesters enrolled in postsecondary education on a full-time or half-time basis, by cohort and key subgroups, for all students in the cohort. Students who never enrolled in postsecondary education are coded as enrolling in zero semesters of postsecondary education. Table 14 compares these means for students who were accepted to CTE schools versus those who were not accepted, and Table 15 compares these means for students who attended CTE schools versus those who attended other schools.

       For most comparisons between students who were accepted to a CTE school and those who were not, the differences were negligible in the number of semesters enrolled in postsecondary education (Table 14). Differences are larger between those who attended CTE schools and those who did not (Table 15). Most of these differences point to a greater number of semesters enrolled for students who did not attend CTE schools. It is important to remember that those who did not attend CTE schools are a "mixed bag" of students, including some who were not admitted to the schools and others who were admitted but chose to attend another public high school, including the city's academically selective college-preparatory high schools. Further, these are unadjusted differences that do not control for race/ethnicity, gender, or any prior academic outcomes.

**Table 14:** **Mean Semesters Enrolled in Two-Year and/or Four-Year Colleges†, for Accepted and Non-Accepted CTE Applicants, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school |
| *All students* | 2.53 | 2.64 | 2.77 | 2.73 | 2.61 | 2.82 |
| **Male** | 2.08 | 1.94 | 2.23 | 2.08 | 2.32 | 2.32 |
| **Female** | 2.92 | 3.24 | 3.26 | 3.29 | 2.80 | 3.14 |
| **White** | 2.04 | 2.56 | 2.93 | 2.69 | 2.38 | 2.86 |
| **Black** | 2.62 | 2.59 | 2.68 | 2.71 | 2.54 | 2.67 |
| **Asian** | 4.35 | 5.23 | 5.90 | 4.58 | 4.52 | 4.49 |
| **Latino** | 1.78 | 1.85 | 1.93 | 1.89 | 2.34 | 2.34 |
| **White Male** | 1.37 | 2.05 | 2.50 | 2.26 | 2.31 | 2.76 |
| **White Female** | 3.09 | 2.81 | 3.31 | 3.10 | 2.44 | 2.95 |
| **Black Male** | 2.30 | 1.81 | 2.05 | 2.13 | 2.28 | 2.06 |
| **Black Female** | 2.88 | 3.25 | 3.17 | 3.17 | 2.72 | 3.07 |
| **Asian Male** | 3.54 | 4.74 | 5.74 | 2.50 | 3.75 | 3.67 |
| **Asian Female** | 5.14 | 5.71 | 6.07 | 6.48 | 5.22 | 5.27 |
| **Latino Male** | 1.09 | 1.37 | 1.24 | 1.31 | 2.02 | 2.05 |
| **Latino Female** | 2.49 | 2.23 | 2.60 | 2.62 | 2.60 | 2.53 |
| **Special Education** | 1.47 | 2.26 | .72 | .74 | 2.81 | 2.62 |
| **High School Graduate** | 3.42 | 3.76 | 3.76 | 3.64 | 3.32 | 3.87 |

†This table includes all students in the cohorts.  Students who never enrolled in a two-year or four-year postsecondary institution are coded as enrolling for zero semesters.  Enrollment is as of spring 2010.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

**Table 15:** **Mean Semesters Enrolled in Two-Year and/or Four-Year Colleges†, for Students Who Attended CTE Schools and Those Who Did Not, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** |
| *All students* | 2.01 | 2.78 | 2.07 | 3.17 | 2.07 | 3.06 |
| **Male** | 1.65 | 2.11 | 1.59 | 2.54 | 1.89 | 2.64 |
| **Female** | 2.36 | 3.33 | 2.52 | 3.66 | 2.14 | 3.35 |
| **White** | 1.48 | 2.77 | 2.12 | 3.40 | 1.23 | 3.28 |
| **Black** | 2.17 | 2.73 | 2.06 | 3.05 | 2.15 | 2.88 |
| **Asian** | 2.71 | 5.18 | 3.46 | 5.75 | 2.48 | 5.13 |
| **Latino** | 1.57 | 1.91 | 1.76 | 2.04 | 2.10 | 2.50 |
| **White Male** | .80 | 2.27 | 1.70 | 2.97 | 1.51 | 3.07 |
| **White Female** | 2.34 | 3.26 | 2.50 | 3.78 | .92 | 3.45 |
| **Black Male** | 1.97 | 2.00 | 1.64 | 2.38 | 2.36 | 2.06 |
| **Black Female** | 2.35 | 3.32 | 2.47 | 3.51 | 2.23 | 3.20 |
| **Asian Male** | 2.50 | 4.55 | 3.21 | 4.62 | 1.68 | 4.38 |
| **Asian Female** | 2.91 | 5.81 | 3.62 | 6.97 | 3.28 | 5.81 |
| **Latino Male** | .82 | 1.43 | .95 | 1.50 | 1.55 | 2.35 |
| **Latino Female** | 2.4 | 2.30 | 2.59 | 2.61 | 2.54 | 2.61 |
| **Special Education** | 1.12 | 2.21 | .77 | .70 | 1.75 | 3.31 |
| **High School Graduate** | 2.67 | 3.93 | 2.82 | 4.20 | 2.62 | 4.13 |

†This table includes all students in the cohorts.  Students who never enrolled in a two-year or four-year postsecondary institution are coded as enrolling for zero semesters.  Enrollment is as of spring 2010.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

## Estimates of Impact on Persistence

Table 16 presents the estimates of impact of CTE schools on postsecondary persistence, again defined as the number of semesters enrolled. The various estimates point in different directions (with some giving the advantage to CTE schools and others suggesting a disadvantage) so it is important to be clear about the nature of the question addressed by each type of estimate.

The Intent-to-Treat estimates are inconsistent between the two modeling strategies (mixed model and fixed effects): while the mixed model suggests a small but statistically significant advantage for those who attended CTE schools, the fixed effects estimate indicates either no effect or a small negative effect, depending on the cohort. Taken together, these estimates suggest that the effect of offering CTE schools in Philadelphia does not have a substantial impact, either positive or negative, on applicants' postsecondary persistence.

The LATE estimates, which address the question of the impact of offering CTE schools while accounting for the "take up" of the offer by those who were accepted, indicate a more positive outcome for CTE schools. For the three cohorts combined, there was a CTE impact of about three-fourths of a semester; for the Classes of 2004 and 2005, the impact was more than one additional semester enrolled.

The Dosage estimates, which address the impact of CTE schools on those who actually attended, suggest a moderate and statistically significant negative effect on postsecondary persistence for CTE schools. That is, postsecondary persistence rates were lower among those who actually attended CTE schools than among those who did not. The effects ranged from about half a semester to one semester.

How should we understand these discrepant results? One possibility is to consider the role of CTE schools in this district. In Philadelphia, magnet schools are generally considered the "best" type of high school to attend, followed by CTE schools, and lastly by most neighborhood high schools. For the Dosage comparison, students who attended CTE schools were compared to those 1) who were not accepted and 2) those who were accepted but chose not to attend. Many of these students in the second category chose to attend a "better option" than the CTE schools, which would include the academically selective magnet schools or the "better" neighborhood high schools. In other words, some students may have used CTE schools as a "backup" in case they were not admitted to a college-preparatory school. The fact that the Dosage estimate is not randomized means that a subset of comparison students may have had more fervent ambitions to enroll in college and have intentionally chosen not to attend a CTE school. For the Intent-to-Treat and LATE estimates, students who were accepted and attended CTE schools *as well as those who were accepted and attended magnet or other schools* are the "treatment group," while the non-accepted students are the comparison group. Many of these non-accepted students had no alternative other than to enroll in their local high school. As a result, the ITT and LATE estimates are comparing outcomes for students who had better school options (accepted students) versus those who often had no other options.

**Table 16:    Impact of CTE Schools on Mean Number of Semesters Enrolled in a Two-Year/or Four-Year College†, by Cohort and For All Cohorts Combined**

| | Intent-to-Treat | | LATE | Dosage |
|---|---|---|---|---|
| | Mixed Model | Fixed Effects | | |
| **Class of 2003** | 0.15 | -.01 | .36 | **-.44** |
| | (.203) | (.940) | (.203) | **(.001*)** |
| **Class of 2004** | **0.54** | -.13 | **1.64** | -.14 |
| | **(.000*)** | (.371) | **(.000***)** | (.437) |
| **Class of 2005** | **0.29** | **-.35** | **1.16** | **-.90** |
| | **(.022*)** | **(.024*)** | **(.022*)** | **(.001*)** |
| **All Cohorts** | **0.29** | -.12 | **0.78** | **-.40** |
| | **(.001*)** | (.147) | **(.001**)** | **(.000*)** |

†This table includes only students who ever enrolled in a two-year or four-year postsecondary institution. Enrollment is as of spring 2010.
* - Statistically significant difference at α <.05.  P-values in parentheses.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

# SECTION IV: POSTSECONDARY DEGREE ATTAINMENT

This section addresses the impact of CTE schools on postsecondary degree completion. We present impact results for each cohort and combined across cohorts. The postsecondary data that we used for these analyses is current as of spring 2010, which means that on-time high school graduates from the Class of 2003 would have had seven years after high school to complete a degree. The Classes of 2004 and 2005 would have had correspondingly fewer years in which to be counted as degree recipients in this analysis.

## Descriptive Comparisons of Postsecondary Degree Attainment

Tables 17 and 18 provide unadjusted percentages of students who completed two-year or four-year postsecondary degrees, comparing accepted and non-accepted students (Table 17) and those who attended CTE schools and others (Table 18). Both tables present postsecondary degree completion rates for two sets of students: 1) all students in the cohort and 2) only students who ever enrolled in postsecondary education. Tables of degree completion rates by key subgroups appear in Appendix A.

Overall, across both CTE and comparison groups, rates of postsecondary degree completion were very low: no more than 10 percent of the students in any of the cohorts had earned a postsecondary degree (either two-year or four-year) by the end of spring semester 2010. Among those who ever enrolled in an institution of higher education, however, completion rates were higher, particularly among students who enrolled in four-year institutions.

A comparison of unadjusted degree completion rates between applicants who were accepted to CTE schools and those who were not (Table 17) indicates no consistent advantage to either CTE schools or other schools. For example, for the Class of 2003, a slightly higher percentage of students who were not accepted to CTE schools completed a two-year or four-year degree; for the Class of 2004, the opposite was true; and for the Class of 2005, the percentages were exactly the same. Combined two-year and four-year completion rates for those who ever enrolled in postsecondary education varied between 18 percent and 28 percent, depending on the cohort and CTE acceptance status.

**Table 17:** **Percentage Completing Postsecondary Degree, for Accepted and Non-Accepted CTE Applicants, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | **Accepted to any CTE School** | **Not Accepted to a CTE school** | **Accepted to any CTE School** | **Not Accepted to a CTE school** | **Accepted to any CTE School** | **Not Accepted to a CTE school** |
| **Earned a two-year degree†** | 1.7% | 1.6% | 2.4% | 1.3% | 1.3% | 1.6% |
| **Earned a two-year degree, *for those who enrolled in a two-year college*** | 9.9 | 11.1 | 12.5 | 6.9 | 7.1 | 8.3 |
| **Earned a four-year degree†** | 6.1 | 7.1 | 8.7 | 5.8 | 6.3 | 6.0 |
| **Earned a four-year degree, *for those who enrolled in a four-year college*** | 36.5 | 41.3 | 41.6 | 29.0 | 25.6 | 25.3 |
| **Earned a two-year and/or four year degree†** | 7.8 | 8.6 | 11.1 | 7.1 | 7.6 | 7.6 |
| **Earned a two-year or four-year degree, *for those who enrolled in any college*** | 22.9 | 27.7 | 27.6 | 18.2 | 17.7 | 17.7 |

†This analysis includes all students in the cohort, regardless of whether they graduated from high school or enrolled in postsecondary education

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

Unadjusted comparisons of postsecondary degree completion for those who attended CTE schools versus those who attended other schools show more consistent and substantial differences (Table 18). Students who attended CTE schools and subsequently enrolled in four-year institutions had degree completion rates that were from 7 to 12 percentage points lower (depending on the cohort) than those of students who did not attend CTE schools. Degree completion rates for students who entered two-year colleges were much more similar, with the advantage sometimes to CTE and sometimes to other schools. The impact of the four-year completion rate difference was such that when two-year and four-year degree completion rates were combined, for those who enrolled in a postsecondary institution, the percentage of students who attended CTE schools and earned postsecondary degrees was from 5 to 10percentage points lower than comparison students. The direction of this difference is consistent with the greater number of semesters enrolled in higher education by students who did not attend CTE schools.

**Table 18:  Percentage Completing Postsecondary Degree, for Students Who Attended CTE Schools and Those Who Did Not, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** |
| **Earned a two-year degree†** | 1.7% | 1.6% | 2.4% | 1.3% | 1.3% | 1.6% |
| **Earned a two-year degree,** *for those who enrolled in a two-year college* | 9.9 | 11.1 | 12.5 | 6.9 | 7.1 | 8.3 |
| **Earned a four-year degree†** | 4.1 | 7.4 | 4.5 | 8.9 | 4.3 | 7.4 |
| **Earned a four-year degree,** *for those who enrolled in a four-year college* | 29.4 | 41.7 | 28.7 | 38.9 | 20.7 | 27.9 |
| **Earned a two-year and/or four year degree†** | 6.0 | 8.9 | 7.0 | 10.6 | 5.4 | 9.0 |
| **Earned a two-year or four-year degree,** *for those who enrolled in any college* | 18.1 | 27.9 | 19.2 | 25.6 | 13.8 | 19.8 |

†This analysis includes all students in the cohort, regardless of whether they graduated from high school or enrolled in postsecondary education
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

## Estimates of Impact on Postsecondary Degree Attainment

Tables 19-21 present, respectively, Intent-to-Treat, LATE, and Dosage impact estimates of CTE schools on postsecondary degree completion. **The overall picture across each of these types of estimates is of no consistent impact of CTE schools – positive or negative - on degree completion.** While some combined indicators show positive (or negative results), these appear to be driven by a single cohort (the Class of 2004).

For the Classes of 2003 and 2005, there are no statistically significant Intent-to-Treat effects for earning a two-year degree and/or a four-year degree. There are substantial effects for the Class of 2004 (both mixed model and fixed effects), and this cohort drives the effects for the three combined cohorts. With one cohort driving this combined impact, however, the evidence for a broader, consistent impact of CTE schools on postsecondary degree attainment is not strong. The ITT estimates suggest that there is no consistent positive or negative impact of CTE schools on this outcome.

**Table 19:**  **Impacts of CTE Schools on Degree Attainment from Two-Year and/or Four-Year Colleges, ITT Estimates**

| EVER RECEIVED A: | Class of 2003 | | Class of 2004 | | Class of 2005 | | All Cohorts | |
|---|---|---|---|---|---|---|---|---|
| | Mixed Model | Fixed Effects | Mixed Model | Fixed Effects | Mixed Model | Fixed Effects | Mixed Model | Fixed Effects |
| Two-year degree | 1.09 (.634) | 1.15 (.475) | **2.01 (.001*)** | **1.71 (.028*)** | 1.09 (.762) | .76 (.343) | 1.32 (.052) | 1.22 (.135) |
| Four-year degree | 1.01 (.940) | .90 (.291) | **1.79 (.000*)** | 1.28 (.052) | 1.13 (.294) | .93 (.653) | **1.24 (.032*)** | 1.03 (.641) |
| Two- or four-year degree | 1.03 (.739) | .94 (.526) | **1.89 (.000*)** | **1.38 (.005*)** | 1.13 (.315) | .89 (.396) | **1.28 (.010*)** | 1.07 (.260) |

†Regression did not converge.
* - Statistically significant difference at α <.05.  P-values in parentheses.
 All students in the cohorts are included in these analyses, regardless of whether they ever enrolled in postsecondary education.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

LATE estimates tell a similar story (Table 19). While there are substantial impacts for the Class of 2004, this is the only cohort with impacts that are statistically significant, and these impacts are the drivers of the combined positive impacts for four-year degree attainment. This four-year degree attainment in turn drives the positive effects for the variable that combines two-year or four-year degree attainment. As with the ITT estimates, we conclude that there is no consistent effect of CTE schools on postsecondary degree completion.

The Dosage effects (Table 20) similarly show no statistical difference between those who attended CTE schools and those who did not in attainment of a two-year OR four-year degree. This finding of "no difference" appears to be related to a more positive CTE impact for the Class of 2004 combined with negative impacts for the Classes of 2003 and 2005.  However, there is a consistent negative association between attending a CTE school and completing a four-year degree. There is a statistically significant negative effect (lower odds) for members of the Class of 2003, and a negative effect that is close to statistical significance for the Class of 2005; the regression for the Class of 2004 did not resolve but probably contributes to the negative association. The combined effect across cohorts suggests a positive effect for completion of a two-year degree, but this may be driven primarily by the Class of 2004.

**Table 20:** Impacts of CTE Schools on Degree Attainment from Two-Year and/or Four-Year Colleges, LATE Estimates

| | Class of 2003 | Class of 2004 | Class of 2005 | All Cohorts |
|---|---|---|---|---|
| **EVER RECEIVED A:** | | | | |
| **Two-year degree** | 1.23 (.634) | **8.32 (.001**\*)** | 1.43 (.762) | 2.13 (.052) |
| **Four-year degree** | 1.02 (.940) | **5.85 (.000**\*\*\*)** | 1.67 (.294) | **1.78 (.032*)** |
| **Two- or four-year degree** | 1.07 (.739) | **6.85 .000**\*\*\*)** | 1.60 (.315) | **1.93 (.010*)** |

\* - Statistically significant difference at α <.05.  P-values in parentheses.
All students in the cohorts are included in these analyses, regardless of whether they ever enrolled in postsecondary education.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

**Table 21:** Impacts of CTE Schools on Degree Attainment from Two-Year and/or Four-Year Colleges, Dosage Estimates

| | Class of 2003 | Class of 2004 | Class of 2005 | All Cohorts |
|---|---|---|---|---|
| **EVER RECEIVED A:** | | | | |
| **Two-year degree** | 1.29 (.223) | † | 0.76 (.746) | **1.70 (.003*)** |
| **Four-year degree** | **0.74 (.019*)** | † | 0.48 (.061) | **0.72 (.000*)** |
| **Two- or four-year degree** | 0.84 (.122) | 1.26 (.137) | 0.52 (.068) | 0.90 (.201) |

† Regression did not converge.
\* Statistically significant difference at α <.05.  P-values in parentheses.
All students in the cohorts are included in these analyses, regardless of whether they ever enrolled in postsecondary education.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

*CTE Impact on Degree Attainment Not Driven By One School*

As with postsecondary enrollment, we examined whether the CTE impacts on degree attainment that we observed were being driven by a single school. Saul High School, one of the CTE schools, accepts students by lottery but is widely considered to be a college-preparatory high school. ITT (mixed model) and Dosage results are presented in Table 22. For parsimony, results are combined across cohorts.

Results of analyses that exclude Saul applicants indicate that the basic pattern remains similar to analyses for the full cohorts. The ITT results point to a positive CTE effect, but they miss statistical significance. Although the estimates for the full cohort also were positive and gave the advantage to CTE schools, these effects were driven by the Class of 2004. The Dosage effects without the Saul students also are similar to the effects for the full cohort – namely, a positive combined effect for attainment of two-year degrees (this driven by the Class of 2004); a negative effect for receipt of four-year degrees; and no difference for receipt of any postsecondary degree.

**Table 22:     Impacts of CTE Schools on Degree Attainment, ITT and DOSAGE Estimates: SAUL HIGH SCHOOL REMOVED**

|  | ITT (mixed model) | DOSAGE |
|---|---|---|
| **EVER RECEIVED A:** | | |
| **Two-year degree** | 1.20 (.299) | **1.48 (.021\*)** |
| **Four-year degree** | 1.19 (.100) | **0.72 (.005\*)** |
| **Two- or four-year degree** | 1.21 (.056) | 0.87 (.140) |

\* - Statistically significant difference at α <.05.  P-values in parentheses.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

*The Importance of High School Graduation*

While Tables 19-21 presented estimates for the entire cohort of students (including those who never enrolled in postsecondary education and those who never graduated from high school), this analysis examines the association between attending a CTE school and completing a postsecondary degree for high school graduates only. In this way, we examine the extent to which high school graduation acts as a moderator of postsecondary outcomes.

Table 23 presents CTE Dosage impact estimates for earning a two-year degree, a four-year degree, or any postsecondary degree. Although there is a combined positive impact of attending a CTE school on attainment of a two-year degree, this appears to be driven by the Class of 2004 (where the regression did not resolve). Among high school graduates, those who attended CTE schools were less likely to complete a four-year degree. For students in the Class

of 2003, the odds were about 40 percent lower for graduates of CTE schools, and for the Class of 2005, the odds were more than 50 percent lower (approaching statistical significance at p=.057). Overall, CTE high school graduates had odds of attaining any postsecondary degree that were 20 percent lower than graduates of other schools.

These findings are consistent with those for postsecondary enrollment of high school graduates.  When all cohort members are considered, CTE students are more likely to enroll in postsecondary education, but among high school graduates there is no statistically significant difference between CTE graduates and graduates of other schools.  In other words, a key way in which CTE schools impacted postsecondary enrollment was through producing more high school graduates who went on to enroll in college.  Once they got to college, however, CTE graduates were less likely to earn a four-year degree, with a finding of no difference (except for the Class of 2004) in two-year degree completion.

**Table 23:**     **Impacts of CTE Schools on Degree Attainment from Two-Year and/or Four-Year Colleges, Dosage Estimates: HIGH SCHOOL GRADUATES ONLY**

|  | Class of 2003 | Class of 2004 | Class of 2005 | All Cohorts |
|---|---|---|---|---|
| **EVER RECEIVED A:** |  |  |  |  |
| **Two-year degree** | 1.10<br>(.626) | † | 0.74<br>(.722) | **1.48**<br>**(.026*)** |
| **Four-year degree** | **0.63**<br>**(.001**)** | † | 0.47<br>(.057) | **0.63**<br>**(.000***)** |
| **Two- or four-year degree** | **0.71**<br>**(.003**)** | 1.09<br>(.578) | 0.51<br>(.063) | **0.78**<br>**(.003**)** |

† Regression did not converge.
* Statistically significant difference at α <.05.  P-values in parentheses.
All students in the cohorts are included in these analyses, regardless of whether they ever enrolled in postsecondary education.
SOURCE:  Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

# SECTION V:  RECEIPT OF PELL GRANTS

The National Student Clearinghouse data that we received did not include enrollment in so-called "private license schools" or "postsecondary trade and technical schools" – that is, educational entities that offer technical training that leads to a certificate or license but not Associates or Bachelors degrees.  It is unfortunate that the NSC data do not provide information on this type of post-high school education, because students who are interested in trade or technical training may continue their career and technical training through these venues. As it stands, we have no information on CTE students' enrollment in postsecondary technical training other than through large national studies that follow students from high school to young adulthood.

To gain a sense of the frequency with which students from CTE schools enrolled in a postsecondary trade or technical school, we examined the percentage of students who used Pell grants to finance their study at one of these institutions. Pell grants, administered by the federal government, are available to low-income students and can be used at approved postsecondary trade and technical schools or at institutions that offer two-year or four-year degrees.  Students are required to demonstrate that they can benefit from postsecondary education but do not necessarily have to be a high school graduate to receive Pell funding.

Table 24 shows a) the percentage of students who used Pell grants to finance any postsecondary study (either at a college or postsecondary trade school), by cohort and CTE attendance and b) the percentage of students who used Pell grants to finance study at postsecondary trade or technical institutions. These percentages should be considered an underestimate of the percentage of students who actually attended college or a postsecondary institution. Because Pell grants are means-tested, a student who enrolled in a postsecondary trade or technical school but was from a higher-income family would not be counted as having attended a postsecondary institution in these tables.

While approximately 40 percent of the students in each cohort used Pell grants to finance postsecondary study, a far smaller percentage used Pell financing to pursue a certificate or license from an approved postsecondary trade or technical school. For example, in the Class of 2003, 7percent of those who attended CTE schools later received a Pell grant for a trade or technical education. Among the members of the Class of 2005, the percentage of students using Pell monies for a postsecondary technical or trade education had fallen to 3percent for those who attended CTE schools and 4percent for those who attended other schools.

There is just one statistically significant difference between CTE students and those who attended other schools in the use of Pell grants, but this difference is quite small.  The main point to take from these tables is that there is relatively little use among CTE students or other students of postsecondary trade or technical schools. Among students eligible for Pell grants, they almost entirely seek schools that offer Associates or Bachelors degrees.

**Table 23:** **Percentage of Students Using Pell Grants to Finance Postsecondary Study, by CTE Attendance and Cohort**

| | % Using a Pell Grant at Any Postsecondary Institution | | % Using a Pell Grant at a Postsecondary Trade or Technical School | |
|---|---|---|---|---|
| | Attended a CTE school | Did Not Attend a CTE school | Attended a CTE school | Did Not Attend a CTE school |
| **Class of 2003** | 39% | 38% | 7% | 5% |
| **Class of 2004** | **40** | **44\*** | 5 | 4 |
| **Class of 2005** | 40 | 40 | 3 | 4 |
| **All cohorts** | 39 | 40 | 5 | 5 |

\* Statistically significant difference at α <.05.

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

# APPENDIX

**Table A.1:** **Percentage Earning a Two-Year Degree, for Accepted and Non-Accepted CTE Applicants, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | **Accepted to any CTE School** | **Not Accepted to a CTE school** | **Accepted to any CTE School** | **Not Accepted to a CTE school** | **Accepted to any CTE School** | **Not Accepted to a CTE school** |
| *All students* | 1.7% | 1.6% | 2.4% | 1.3% | 1.3% | 1.6% |
| **Male** | 1.4 | 0.8 | 1.9 | 0.3 | 1.3 | 1.4 |
| **Female** | 2.1 | 2.3 | 2.9 | 2.2 | 1.3 | 1.8 |
| **White** | 1.2 | 1.0 | 2.9 | 2.1 | 2.2 | 0.7 |
| **Black** | 1.8 | 1.5 | 2.0 | 1.1 | 1.2 | 1.5 |
| **Asian** | 3.5 | 4.4 | 4.8 | 4.0 | 1.4 | 6.0 |
| **Latino** | 1.6 | 1.7 | 3.5 | 1.0 | 0.5 | 0.8 |
| **White Male** | 0.0 | 0.4 | 2.9 | 1.3 | 2.7 | 0.0 |
| **White Female** | 2.6 | 1.8 | 2.9 | 3.0 | 1.9 | 1.5 |
| **Black Male** | 1.6 | 0.6 | 1.4 | 0.3 | 1.3 | 1.2 |
| **Black Female** | 2.0 | 2.2 | 2.4 | 1.8 | 1.2 | 1.6 |
| **Asian Male** | 4.4 | 5.9 | 3.0 | 0.0 | 0.0 | 7.1 |
| **Asian Female** | 2.4 | 3.2 | 6.8 | 7.7 | 2.8 | 4.8 |
| **Latino Male** | 0.8 | 0.9 | 2.2 | 0.0 | 0.0 | 0.0 |
| **Latino Female** | 2.4 | 2.4 | 4.7 | 2.0 | 1.0 | 1.4 |
| **Special Education** | 0.6 | 1.3 | 1.0 | 0.0 | 1.1 | 2.4 |
| **High School Graduate** | 2.9 | 2.7 | 3.6 | 2.1 | 1.6 | 2.6 |
| **Students who ever enrolled in a two-year college** | 9.9 | 11.1 | 12.5 | 6.9 | 7.1 | 8.3 |

SOURCE: Analysis of School District of Philadelphia student records data and National Student Clearinghouse data

**Table A.2:** **Percentage Earning a Two-Year Degree, for Students Who Attended CTE Schools and Those Who Did Not, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** |
| *All students* | 1.8% | 1.6% | 2.5% | 1.7% | 1.0% | 1.7% |
| **Male** | 1.4% | 0.9% | 2.0% | 0.8% | 1.4% | 1.2% |
| **Female** | 2.4% | 2.1% | 3.0% | 2.4% | 0.7% | 1.9% |
| **White** | 2.2% | 0.7% | 3.3% | 2.2% | 1.5% | 2.1% |
| **Black** | 1.7% | 1.6% | 1.9% | 1.4% | 1.0% | 1.5% |
| **Asian** | 4.0% | 4.1% | 2.6% | 4.8% | 0.0% | 4.0% |
| **Latino** | 2.7% | 1.4% | 4.8% | 1.0% | 0.5% | 0.7% |
| **White Male** | 0.0% | 0.3% | 4.4% | 1.2% | 2.9% | 1.3% |
| **White Female** | 5.0% | 1.0% | 2.4% | 3.2% | 0.0% | 2.8% |
| **Black Male** | 1.6% | 0.8% | 1.3% | 0.7% | 1.3% | 1.2% |
| **Black Female** | 1.7% | 2.2% | 2.5% | 1.9% | 0.8% | 1.7% |
| **Asian Male** | 8.3% | 5.1% | 0.0% | 2.0% | 0.0% | 3.5% |
| **Asian Female** | 0.0% | 3.2% | 4.3% | 8.0% | 0.0% | 4.5% |
| **Latino Male** | 1.3% | 0.7% | 3.3% | 0.0% | 0.0% | 0.0% |
| **Latino Female** | 4.2% | 2.0% | 6.3% | 2.0% | 1.0% | 1.1% |
| **Special Education** | 1.1% | 1.1% | 6.7% | 4.5% | 0.3% | 2.1% |
| **High School Graduate** | 2.1% | 2.0% | 2.7% | 2.0% | 1.0% | 1.8% |
| **Students who ever enrolled in a two-year college** | 9.91 | 10.9 | 12.2 | 8.9 | 5.8 | 8.3 |

**Table A.3:** Percentage Earning a Four-Year Degree, for Accepted and Non-Accepted CTE Applicants, by Cohort

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school | Accepted to any CTE School | Not Accepted to a CTE school |
| *All students* | 6.1% | 7.1% | 8.7% | 5.8% | 6.3% | 6.0% |
| **Male** | 4.9 | 4.7 | 6.6 | 5.1 | 5.4 | 5.3 |
| **Female** | 7.2 | 9.3 | 10.4 | 6.4 | 7.0 | 6.4 |
| **White** | 5.2 | 7.7 | 9.9 | 7.0 | 6.7 | 7.0 |
| **Black** | 6.2 | 6.7 | 7.9 | 5.6 | 5.7 | 6.3 |
| **Asian** | 14.9 | 20.0 | 22.4 | 10.9 | 8.6 | 6.0 |
| **Latino** | 3.6 | 4.2 | 5.3 | 3.9 | 7.3 | 2.4 |
| **White Male** | 3.1 | 5.7 | 7.1 | 6.5 | 6.2 | 10.7 |
| **White Female** | 7.6 | 10.0 | 12.2 | 7.6 | 7.1 | 2.9 |
| **Black Male** | 5.9 | 4.2 | 5.7 | 5.3 | 5.0 | 5.0 |
| **Black Female** | 6.5 | 8.9 | 9.7 | 5.9 | 6.2 | 7.1 |
| **Asian Male** | 6.7 | 12.9 | 25.8 | 8.2 | 2.9 | 2.4 |
| **Asian Female** | 23.8 | 26.3 | 18.6 | 13.5 | 13.9 | 9.5 |
| **Latino Male** | 1.7 | 3.1 | 1.5 | 1.9 | 7.3 | 2.0 |
| **Latino Female** | 5.5 | 5.3 | 8.7 | 6.1 | 7.3 | 2.7 |
| **Special Education** | 4.8 | 7.6 | 0.5 | 0.0 | 8.8 | 5.1 |
| **High School Graduate** | 7.3% | 9.1% | 9.6% | 6.9% | 6.7% | 6.6% |
| **Students who ever enrolled in a four-year college** | 36.5 | 41.3 | 41.6 | 29.0 | 25.6 | 25.3 |

**Table A.4:** **Percentage Earning a Four-Year Degree, for Students Who Attended CTE Schools and Those Who Did Not, by Cohort**

| | Class of 2003 | | Class of 2004 | | Class of 2005 | |
|---|---|---|---|---|---|---|
| | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** | **Attended a CTE school** | **Did Not Attend a CTE school** |
| *All students* | 4.1% | 7.4% | 4.3% | 9.1% | 4.2% | 7.7% |
| **Male** | 3.2% | 5.2% | 3.4% | 7.5% | 3.3% | 7.1% |
| **Female** | 5.0% | 9.4% | 5.2% | 10.4% | 4.8% | 8.1% |
| **White** | 2.2% | 8.3% | 6.6% | 10.9% | 2.7% | 9.6% |
| **Black** | 4.7% | 7.0% | 3.8% | 8.5% | 4.1% | 7.2% |
| **Asian** | 8.0% | 19.4% | 7.7% | 19.3% | 4.0% | 8.6% |
| **Latino** | 2.7% | 4.4% | 3.8% | 5.3% | 5.7% | 6.4% |
| **White Male** | 0.0% | 6.4% | 3.5% | 9.2% | 2.9% | 11.3% |
| **White Female** | 5.0% | 10.5% | 9.4% | 12.4% | 2.5% | 8.4% |
| **Black Male** | 4.7% | 4.8% | 3.7% | 6.7% | 3.4% | 6.4% |
| **Black Female** | 4.7% | 8.9% | 3.9% | 9.8% | 4.7% | 7.6% |
| **Asian Male** | 0.0% | 11.9% | 12.5% | 19.2% | 0.0% | 3.5% |
| **Asian Female** | 15.4% | 26.6% | 4.3% | 19.3% | 8.0% | 13.5% |
| **Latino Male** | 0.0% | 3.3% | 0.0% | 2.7% | 4.4% | 7.3% |
| **Latino Female** | 5.6% | 5.3% | 7.3% | 7.9% | 6.8% | 5.7% |
| **Special Education** | 2.8% | 7.6% | 0.7% | 0.0% | 3.9% | 9.9% |
| **High School Graduate** | 4.6% | 9.6% | 4.7% | 10.7% | 4.3% | 8.5% |
| **Students who ever enrolled in a four-year college** | 29.4 | 41.7 | 28.7 | 38.9 | 20.7 | 27.9 |

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