Bridging the School-to-Work Divide

Interim Implementation and Impact Findings from New York City's P-TECH 9-14 Schools

Rachel Rosen
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TO IMPROVE SOCIAL POLICY

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Overview

The New York City P-TECH Grades 9-14 schools represent an education model that ties together the secondary, higher education, and workforce systems as a way to improve outcomes in both domains. The distinguishing feature of the P-TECH 9-14 model, as it is referred to in this report, is a partnership between a high school, a local community college, and one or more employer partners that focuses on preparing students for both college and careers — not one or the other — within a six-year timeframe.

Education and workforce development are traditionally seen as separate spheres of influence with multiple transition points that students have been left to navigate largely on their own (for example, high school to postsecondary, and postsecondary to the workforce). P-TECH 9-14 is designed to seamlessly assist student navigation of those points — supporting student success and mitigating the potential for students to fall through the cracks. P-TECH 9-14 schools collaborate with local colleges to provide students with an opportunity to earn a high school diploma (within four years) followed by a cost-free, industry-recognized associate's degree. During the six-year program, employer partners support P-TECH 9-14 schools by providing students with work-based learning experiences such as internships, mentoring, and job shadowing. By design, the P-TECH 9-14 model offers students the opportunity to participate in focused and accelerated high school pathways, early college, and career-focused activities.

This study offers initial impact and implementation findings from the first rigorous evaluation of the model, evaluating the first seven P-TECH 9-14 schools that opened in New York City. The study leverages the random lottery process created by the New York City High School Admissions System to identify impacts. The majority of the students in the sample who participated in the admissions lotteries were academically below proficiency in both math and English language arts (ELA) prior to entering high school.

Key Findings

- Students' high school coursework and New York State Regents exams are accelerated, and all schools focus on career and technical education (CTE) programs — classes that teach students specific workplace skills aligned with the labor market and "soft skills" such as good work habits and interpersonal skills.
- College coursework begins largely in tenth grade and the pacing and progress of course taking varies by student. The degree pathways are designed to complement the high school CTE coursework and lead to credentials toward specific careers.
- The specific work-based opportunities available, such as workplace visits, job shadowing, and internships, and levels of participation differed across schools.
- P-TECH 9-14 students earned more total credits than students in other schools, with results driven by credit accumulation in CTE and other nonacademic subjects. These additional credits did not appear to come at the expense of earning academic credits.
- At the end of two years of high school, 42 percent of P-TECH 9-14 students had passed the ELA Regents exam with a score qualifying them for enrollment in City University of New York (CUNY) courses, compared with 25 percent of comparison group students. By the end of three years, the gap was smaller but still favored P-TECH 9-14 students.
- These pass rates indicate that more P-TECH 9-14 students were eligible to dual enroll in CUNY coursework in earlier years than their comparison group counterparts.

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Executive Summary

The New York City P-TECH Grades 9-14 schools represent an approach to career and technical education that aims to move well beyond the traditional vocational programs of the past. Initiated by IBM as a three-way partnership with the New York City Department of Education (NYC DOE) and the City University of New York (CUNY), the P-TECH 9-14 model is a multifaceted pathway program with a strong career focus that begins in high school and extends into college and the workforce.[1] These founding organizations opened the first P-TECH 9-14 school in Brooklyn in 2011. Since then the model has attracted national and international attention. As of 2019 it was being used in 24 countries, with over 200 schools partnering with some 600 businesses. The State of New York has allocated approximately $40 million to fund P-TECH 9-14 expansion, making it a leader in P-TECH 9-14 student enrollment.[2]

This report offers initial impact and implementation findings from the first rigorous evaluation of the model and is funded by a grant from the federal Institute of Education Sciences. It presents the first look at the evaluation findings from the first seven P-TECH 9-14 schools that opened in New York City, provides background on the development of the model, and describes its high school, college, and work-based learning components. This report also discusses some of the ways in which the seven schools in the study vary in their implementation of the model. Furthermore, it provides information about the impact the P-TECH 9-14 model is having on students' high school outcomes. The findings suggest that students are meeting the benchmarks that the P-TECH schools were designed to help them achieve. That may bode well for the future successes of these students, most of whom entered ninth grade with weak academic achievement in both English language arts (ELA) and math.

The P-TECH 9-14 Model

In the United States, education and workforce development are usually seen as separate spheres of influence, with multiple transition points that students have been left to navigate largely on their own (for example, from high school to postsecondary and from postsecondary to the workforce). The innovation of P-TECH 9-14 is that it is both an education model that ties together the secondary and higher education systems, and a workforce model aimed at bridging the school-to-work divide in order to improve outcomes in both domains. P-TECH 9-14 is designed to seamlessly support navigation of those systems, reducing the potential for students to fall through the cracks, particularly those who do not have additional sources of support. This is a distinguishing feature of the P-TECH 9-14 model: the partnership between a high school, a local community college, and one or more employer partners, all focused on preparing students

[1]The New York City Department of Education refers to the model as the "Grades 9-14 Schools" and the City University of New York refers to the model as the "9-14 Early College and Career" or "NYC P-TECH" model. These terms distinguish this model from other early college model schools operating within New York City. For the purposes of this report, the authors refer to the model as "P-TECH 9-14."

[2]Only two of the seven P-TECH 9-14 schools in this report operating in New York City receive state funding.

for both college and careers — not one or the other — within a six-year timeframe. P-TECH 9-14 schools collaborate with local colleges to give students an opportunity to earn a high school diploma (within four years), followed by a cost-free, industry-recognized associate's degree. During the six-year program, employer partners support P-TECH 9-14 schools in various ways, most commonly by providing students with work-based learning (WBL) experiences such as internships, mentoring, and job shadowing. Thus, the P-TECH 9-14 model offers students the opportunity to participate in focused and accelerated high school pathways, early college, and career-focused activities.

What Does P-TECH 9-14 Look Like on the Ground?

This report describes how the schools are developed, the P-TECH 9-14 high school experience, the six-year integrated education programming, college coursework, and work-based learning (WBL) opportunities for students, as illustrated in Figure ES.1. The findings are based on site visits, interviews, and a school leader survey.

- The P-TECH 9-14 model relies on a partnership between a high school, a college, and one or more employers. The NYC DOE and CUNY Early College Initiative offices support these partnerships and provide structured opportunities for collaboration.

- All of the components have been implemented at all seven study schools, but many of the specific elements vary.

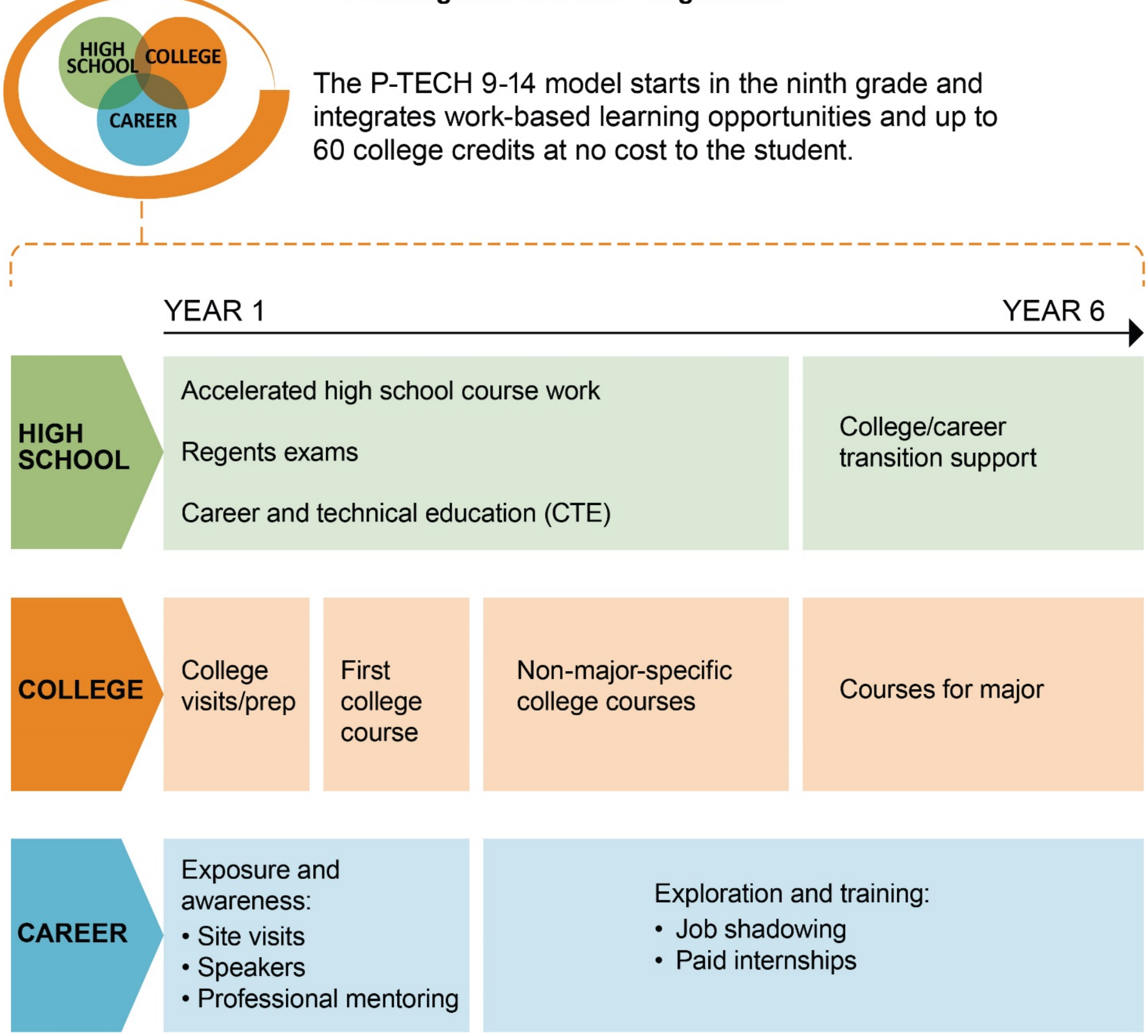
- Students' high school coursework and the New York State Regents exams are accelerated, and all schools focus on career and technical education (CTE) programs (classes that teach students specific workplace skills such as architecture and civil engineering or electrical engineering that are aligned with the labor market), as well as "soft" skills such as good work habits and interpersonal skills.

- College coursework begins largely in tenth grade; pacing and progress of course taking varies by student. The degree pathways are designed to complement the high school CTE coursework and lead to credentials for specific careers.

- P-TECH 9-14 students participate in WBL activities such as workplace visits, job shadowing, and internships. The specific WBL opportunities available to students and the levels of student participation vary from school to school.

Figure ES.1

An Integrated Six-Year Progression



How Has P-TECH 9-14 Affected Students?

The P-TECH 9-14 theory of action shows the benefit of students participating in a school model that creates a partnership between high school and college and employer partners from the fields of science, technology, engineering, and mathematics (STEM). This partnership provides opportunities for students to participate in CTE coursework and offers early exposure to college readiness exams (in this case, the Regents exams), as well as work-based learning opportunities. These activities should increase attendance, Regents exam pass rates, and college credit-earning during high school (dual enrollment); fill skills gaps; decrease the need for postsecondary remedial classes; and improve students' preparedness to meet employer needs. In the long term, increases are expected in high school graduation rates, college enrollment and college credits earned, associate degree receipt, and rates of employment, as well as a reduction in the cost of higher education attainment.

This report examines the early impacts of the P-TECH 9-14 model on student outcomes in their first three years of high school, including course credit accumulation in academic and CTE-related courses, Regents exam attempts and pass levels, and attendance. Given the elements of the model, one would expect P-TECH 9-14 students to take more CTE courses than other students, as well as to attempt to pass Regents exams with CUNY-qualifying scores earlier than their peers, in order to be eligible to take college level or dual-enrollment courses that are part of the model.

This study used admissions lotteries created by the New York City High School Application Processing System (HSAPS) to form two groups of comparable students, akin to a random assignment study; the group that won admission to a P-TECH 9-14 school is referred to as the program group, while those who did not win a seat in one are referred to as the comparison group. This means that participation in the P-TECH 9-14 program caused the impact results discussed in this report. Overall, students in the study sample were mostly Black and Hispanic, from lower income neighborhoods, and underprepared academically for high school. Approximately 70 percent of the students were below proficient in eighth grade ELA and more than 70 percent were below proficient in eighth-grade math.

The report provides evidence that the P-TECH 9-14 students in the study sample are achieving positive outcomes compared with a group of similar students in other schools and that the P-TECH 9-14 schools are, on average, setting students up to accomplish the milestones that the model is designed to help them achieve.

- By the end of both the second and third years of high school, **P-TECH 9-14 students earned more total credits than students in other schools, with results driven by credit accumulation in CTE and other nonacademic subjects.** By the end of three years in high school, P-TECH 9-14 students had earned an average of two additional credits more than students in the comparison group. These additional credits did not appear to come at the expense of earning academic credits, the accumulation of which remained statistically equivalent between groups for all three years of high school.

- **Students in P-TECH 9-14 schools were much more likely to earn nonacademic credits in work-based learning, technology, engineering, and human service subjects.** They earned fewer credits in arts, physical education, and health. The subjects where students accumulated more credits are aligned with the career and industry themes associated with the seven P-TECH 9-14 schools.

- **P-TECH 9-14 students attempted more Regents exams than the comparison students in other schools, and a higher percentage of them passed the**

ELA Regents exam with a score qualifying them for enrollment in CUNY coursework in each of the first three years of high school. At the end of two years of high school, 42 percent of P-TECH 9-14 students had passed the ELA Regents with a CUNY-qualifying score, compared with 25 percent of comparison group students. By the end of three years, the gap was smaller but still favored P-TECH 9-14 students.

- **The CUNY-qualifying-score pass rates in ELA indicate that more P-TECH 9-14 students were eligible to dual enroll in CUNY coursework in earlier years** than their comparison group counterparts, which is in line with the early college aspect of this school model.

These early findings are encouraging and indicate that P-TECH 9-14 schools are having a positive effect on students' potential for transitioning to college and career settings. In particular, the increased accumulation of CTE and other nonacademic credits suggests that students are getting greater levels of career-related exposure than students in other schools. Furthermore, the various types of CTE courses being offered indicate that these schools are providing different and potentially more modern career experiences. They are helping students succeed in ways that do not appear to come at the expense of earning academic credits. Students are doing better at accumulating credits in fields related to the careers the P-TECH schools aim to prepare them for.

The positive findings on ELA Regents exam pass rates both at CUNY-qualifying levels and in earlier years than for comparison group students indicate that the P-TECH 9-14 model is successfully preparing students to take advantage of dual-enrollment opportunities at earlier points in high school. In addition, P-TECH 9-14 students ended their third year of high school with more Regents exams passed at the high school graduation level of 65 (a lower standard than a CUNY-qualifying score), and with better overall credit accumulation, leaving fewer credits to be earned in the fourth year of high school. This indicates that more P-TECH 9-14 students may be prepared to reach high school graduation than students in the comparison group.

The P-TECH 9-14 model appears to be meeting the needs of academically low-performing students, including those that entered the schools in eighth grade with the lowest levels of academic success. Overall, these interim findings are encouraging and provide evidence about how P-TECH 9-14 is supporting student success. Later reports from this study will focus on whether these findings foreshadow additional improvements in student outcomes related to high school graduation and college success.

Chapter 1

Introduction

This is the first of several reports to be published by MDRC based on its evaluation of the New York City P-TECH Grades 9-14 model (hereafter referred to as P-TECH 9-14), an approach to career and technical education that aims to move well beyond traditional vocational programs of the past.[1] Initiated by IBM as a three-way partnership with the New York City Department of Education (NYC DOE) and the City University of New York (CUNY), the P-TECH 9-14 model is designed to be a multifaceted pathway program with a strong career focus that begins in high school and extends into college and the workforce. As of this publication, New York City operates nine P-TECH 9-14 schools. A distinguishing feature of the model is the partnership between a high school, a local community college, and one or more employer partners that focuses on preparing students for both college and careers — not one or the other — within a six-year timeframe. P-TECH 9-14 schools collaborate with local colleges to provide students with an opportunity to earn a high school diploma (within four years) followed by a cost-free, industry-recognized associate's degree. During the six-year program, employer partners support P-TECH 9-14 schools in various ways, most commonly by providing students with work-based learning experiences such as internships, mentoring, and job shadowing.

P-TECH 9-14 was conceived of as an antidote to a changing economy — one in which technology is placing new demands on workers, companies, and educational systems, and where companies can struggle to fill positions requiring technical knowledge, skills, and work experience. The model also reflects a commitment by participating employers to provide skill-building opportunities that address equity in education and the workforce.[2] In an increasingly bifurcated U.S. labor market, well-paying jobs often require a college education, and workers with less formal education are often relegated to service-sector jobs.[3] This public-private partnership model aims to develop and provide opportunities for a middle-skills workforce that has more than a high school diploma but less than a four-year college degree. It seeks to close the global gap in science, technology, engineering, and math (STEM) skills, focused on but not limited to technology, engineering, health care, and advanced manufacturing.[4]

Since the founding partners opened the first P-TECH 9-14 school in New York City in 2011, the model has attracted national and international attention, including being mentioned by

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[1]The New York City Department of Education refers to the model as the "Grades 9-14 Schools" and the City University of New York refers to the model as the "9-14 Early College and Career" or "NYC P-TECH" model. These terms distinguish this model from other early college model schools operating within New York City. For the purposes of this report, the authors refer to the model as "P-TECH 9-14."

[2]Business Roundtable (2019).

[3]Autor, Katz, and Kearney (2008).

[4]Unlike in other P-TECH partnerships across the United States, advanced manufacturing is not a focal area in the New York City schools.

President Barack Obama in his 2013 State of the Union address.[5] As of 2019, the model was operating in 24 countries and more than 200 schools, in partnership with 600 businesses. The State of New York has allocated approximately $40 million to expand the program, making it a leader in P-TECH 9-14 student enrollment.[6] This report examines the first seven P-TECH 9-14 schools that opened in New York City and shows positive early findings on high school credit accumulation, most of which is driven by an increase in career and technical education (CTE) course taking — classes that teach specific workplace skills aligned with the labor market. The findings also show positive outcomes for students taking New York State Regents exams — standardized tests that New York City public school students must pass to earn a high school diploma. The report also provides insight into how the model operates across the various schools.

Launching P-TECH 9-14 in New York City

The P-TECH 9-14 model originated in 2010 when Stanley Litow — at the time the president of the IBM International Foundation and a former NYC deputy schools chancellor — approached then-NYC Schools Chancellor Joel Klein about creating a new educational model linking high school, college, and industry.[7] That first school, called Pathways in Technology Early College High School (P-TECH), opened in Brooklyn the following year. The school was defined by six key design principles[8] that featured elements of quality CTE programs as well as "early college" programs that allowed high school students to graduate from high school with up to two years of college credit at no cost to students and their families:

- A private-public partnership involving secondary education, a community college, and one or more lead employer or industry collaborators
- A six-year integrated education program in which high school and college coursework are seamlessly integrated, allowing students to begin taking college courses during their high school years
- Student exposure to work-based learning (WBL), including hands-on experience in the form of internships and other opportunities
- Open enrollment to promote access for all regardless of grade or testing requirements, with a focus on students from historically underrepresented groups
- Student access to a cost-free associate's degree recognized by industry, to help remove financial barriers associated with financing a college education

[5]Kanter and Malone (2013).
[6]Only two of the P-TECH 9-14 schools operating in New York City receive state funding.
[7]Kanter and Malone (2013).
[8]See ptech.org. These are the design principals that IBM advocates for schools.

- Employer partner commitment that P-TECH 9-14 graduates will be first in line for job interviews with that employer

The P-TECH 9-14 model does not necessarily shorten the length of time it takes to obtain an associate's degree; it is specifically designed to place students on a path to a college credential in a high-demand field within a six-year timeframe. The model also aims to prepare students for employment in "middle-skills" jobs — those that require more than a high school diploma but less than a bachelor's degree. Initially conceived of as a way for IBM to address its future hiring needs, the model was also envisioned from the start as one that could expand on a large scale to include other employer partners.[9]

Several factors made the original P-TECH school in Brooklyn a compelling model for its founders.[10] On the industry side, IBM was finding it hard to fill positions that required STEM skills and was rethinking whether jobs traditionally requiring a bachelor's degree could be filled by associate's degree holders with appropriate training.[11] At the same time, the wider U.S. labor market needed workers with strong content knowledge and technical skills in STEM fields that required some form of postsecondary education or training. CUNY, which has offered pathways to the middle class for generations of New York City's low-income students, was poised to assume that postsecondary partner role; the university viewed the P-TECH 9-14 model as an iteration of its own successful early college initiatives. Finally, both CUNY and the NYC DOE had experience with CTE programs and small schools of choice,[12] in addition to early college models, and were open to innovation.

The timing couldn't have been better. New models of CTE were gaining traction nationwide as viable alternatives to the "four-year college for all" approach to preparing students for jobs with middle-class wages.[13] Whereas traditional vocational education had been criticized for pushing low-income and minority students into remedial tracks that led to dead-end jobs, these new CTE models focused on preparing students for high-skill, high-wage work. The conditions were ripe for P-TECH 9-14's expansion in New York City.

Two years after the first school launched, NYC DOE and CUNY opened two new P-TECH 9-14 schools in 2013: Health, Education and Research Occupations Early College High School (HERO), and Energy Tech High School. A year later, Business Technology Early College High School (B-TECH), Manhattan Early College High School for Advertising (MECA), and

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[9]While the original program was aligned with IBM's historical commitment to corporate social responsibility and education improvement, the company did not intend to control its future expansion. Rather, IBM aimed to serve as an industry partner for one school in New York City, the first P-TECH school to open, which is one of the seven schools included in this evaluation. As P-TECH 9-14 has scaled nationally and internationally, founding partner IBM remains a strong champion and ambassador for the model. The company is still paired with the first P-TECH 9-14 school, in addition to several other schools outside of New York City that are not included in this evaluation.

[10] Kanter and Malone (2013).

[11]IBM eventually restructured some of its positions to accommodate those at the associate degree level.

[12]Small schools of choice are small, nonselective high schools in New York City. Bloom and Unterman (2013).

[13]Rosen, Visher, and Beal (2018).

Inwood Early College for Health and Information Technologies opened their doors to their first class of ninth-grade students. In 2015, City Polytechnic High School of Engineering, Architecture and Technology (City Poly) transitioned from an already existing five-year, early-college high school to a P-TECH 9-14 school.[14] These seven schools, the focus of this evaluation, are each partnered with an individual CUNY college and one or more employer collaborators representing technology, engineering, and health care.[15] See Figure 1.1 for more details about the P-TECH 9-14 schools included in this study and their partners.

The Evaluation and this Report

As noted above, the P-TECH 9-14 model includes elements of other large-scale high school reform efforts, including small schools of choice and early college high schools. In addition, it builds on the career academies model, which assigns students to small learning communities, combines academic and technical curricula around a career theme, and establishes partnerships with local employers to provide WBL opportunities. All of these models have been rigorously evaluated and found to produce large, positive impacts on student outcomes, including high school graduation, college enrollment, and earnings.[16] While some individual P-TECH 9-14 schools have reported positive student outcomes, this study is the first to rigorously assess the impact of the model on student outcomes by comparing those of students who randomly won the opportunity to attend P-TECH 9-14 schools through the New York City high school admissions lottery with students who randomly lost the same opportunity. This is also the first study to conduct systematic research focused on the model's implementation and to estimate the cost of operating these schools. As the first study of its type, it will contribute to building reliable and actionable research evidence about the efficacy of the P-TECH 9-14 model.

This interim report focuses exclusively on early implementation and impact findings during students' first three years of high school. Chapter 2 provides early insights into how the model operates and how it was implemented across the seven study schools during the 2017-18 and 2018-19 school years. The implementation findings are based on a school leader survey and interviews the study team conducted with school administrators, staff, students, and partners. The implementation research was designed to answer questions about the context in which the schools operate, dosage (or exposure to the P-TECH 9-14 model), and fidelity (or alignment to the model).

[14]The CUNY Early College Initiative (ECI) oversees 10 early college high schools throughout the city beyond the P-TECH 9-14 schools. These schools differ from the P-TECH 9-14 model in that they educate students in grades 6-12, 9-12, and 9-13; offer a general liberal arts curriculum rather than a STEM-focused career path; and do not necessarily have an employer partner.

[15] P-TECH 9-14 has continued to expand. As of this writing, NYC DOE has opened two additional schools and a third is in the planning phase. While the first seven schools are included in this study, these newer schools are not. In New York State, where millions of dollars have been invested in the scale-up effort, P-TECH 9-14 represents an important policy priority. Forty-two P-TECH 9-14 schools are in operation at the state level.

[16]Bloom and Unterman (2014); Kemple (2008); Berger et al. (2013); Edmunds et al. (2012).

Figure 1.1

New York City P-TECH 9-14 Schools and Partners

SEVEN NEW YORK CITY P-TECH 9-14 SCHOOLS FOR THIS STUDY

1 P-TECH High School (Pathways in Technology Early College High School)
2 Energy Tech High School
3 HERO High School (Health, Education and Research Occupations High School)
4 Inwood Early College for Health and Information Technologies
5 MECA High School (Manhattan Early College School for Advertising)
6 B-TECH High School (Business Technology Early College High School)
7 City Polytechnic High School of Engineering, Architecture, and Technology

High School	CUNY Partner College	Anchor Employer Partner(s)
1 P-TECH	New York City College of Technology	IBM
2 Energy Tech	LaGuardia Community College	Con Edison, National Grid
3 HERO	Hostos Community College	Montefiore Medical Center
4 Inwood	Bronx Community College	Microsoft, New York Presbyterian Hospital
5 MECA	Borough of Manhattan Community College	American Association of Advertising Agencies (4A's)
6 B-TECH	Queensborough Community College	SAP
7 City Poly	New York City College of Technology	Metropolitan Transportation Authority

Chapter 3 presents findings from the impact study, which takes advantage of lotteries in NYC DOE's high school choice admissions process to conduct an experimental study using retrospective data for several cohorts of students enrolled in the study schools. The analyses look at the P-TECH 9-14 model's impact on student outcomes during the first three years of high school, including New York State Regents exam attempts and passage, engagement in high school CTE and academic course work, and high school attendance. The report concludes with a discussion of policy implications and next steps in the evaluation.

Chapter 2

The New York City P-TECH 9-14 Model and Early Implementation Findings

New York City's P-TECH 9-14 model, which creates a partnership between a high school, college, and employer partner, is aligned with the design principles described above.[1] Of particular note, all of the city's P-TECH 9-14 schools are open enrollment, and students taking college coursework do not pay for classes or textbooks. This section describes the P-TECH 9-14 theory of action and how the schools are developed, as well as the high school experience, college coursework, and work-based learning (WBL) opportunities. It is based on findings from the study team's site visits, interviews, and school leader survey.

The P-TECH 9-14 schools' theory of action shows the benefit of students participating in a school model based on a partnership between a high school, a college, and one or more employer partners in the science, technology, engineering and math (STEM) fields. This partnership provides opportunities for students to participate in career and technical education (CTE) classes as a part of integrated high school and college coursework, early exposure to college readiness exams (in this case, the standardized New York State Regents exams, described in more detail below), and exposure to WBL opportunities. These activities should increase attendance, Regents exam pass rates, dual-enrollment credits, and students' preparedness to meet employer needs and fill skills gaps, and decrease the need for postsecondary remedial classes. In the long term, increases in high school graduation rates, postsecondary enrollment and college credits earned, associate's degree receipt, and rates of employment are also expected, as well as a reduction in the cost of higher education attainment. This report will explore early impacts on three indicators in the theory of action: high school credit accumulation toward graduation, Regents exam performance, and attendance.

Figure 2.1 provides an overview of the P-TECH 9-14 model. As shown in the "High School" row of this figure, P-TECH 9-14 students' experience includes taking state Regents exams and CTE coursework beginning early in their high school career. As shown in the "College" row, students begin connecting with their school's partner college very early in their high school career, and they can begin taking college classes as early as tenth grade, with their coursework becoming increasingly specialized over time. Finally, as shown in the "Career" row, students' WBL activities shift from a focus on career exposure and awareness in the early grades to more intensive career exploration and training opportunities in the later grades.

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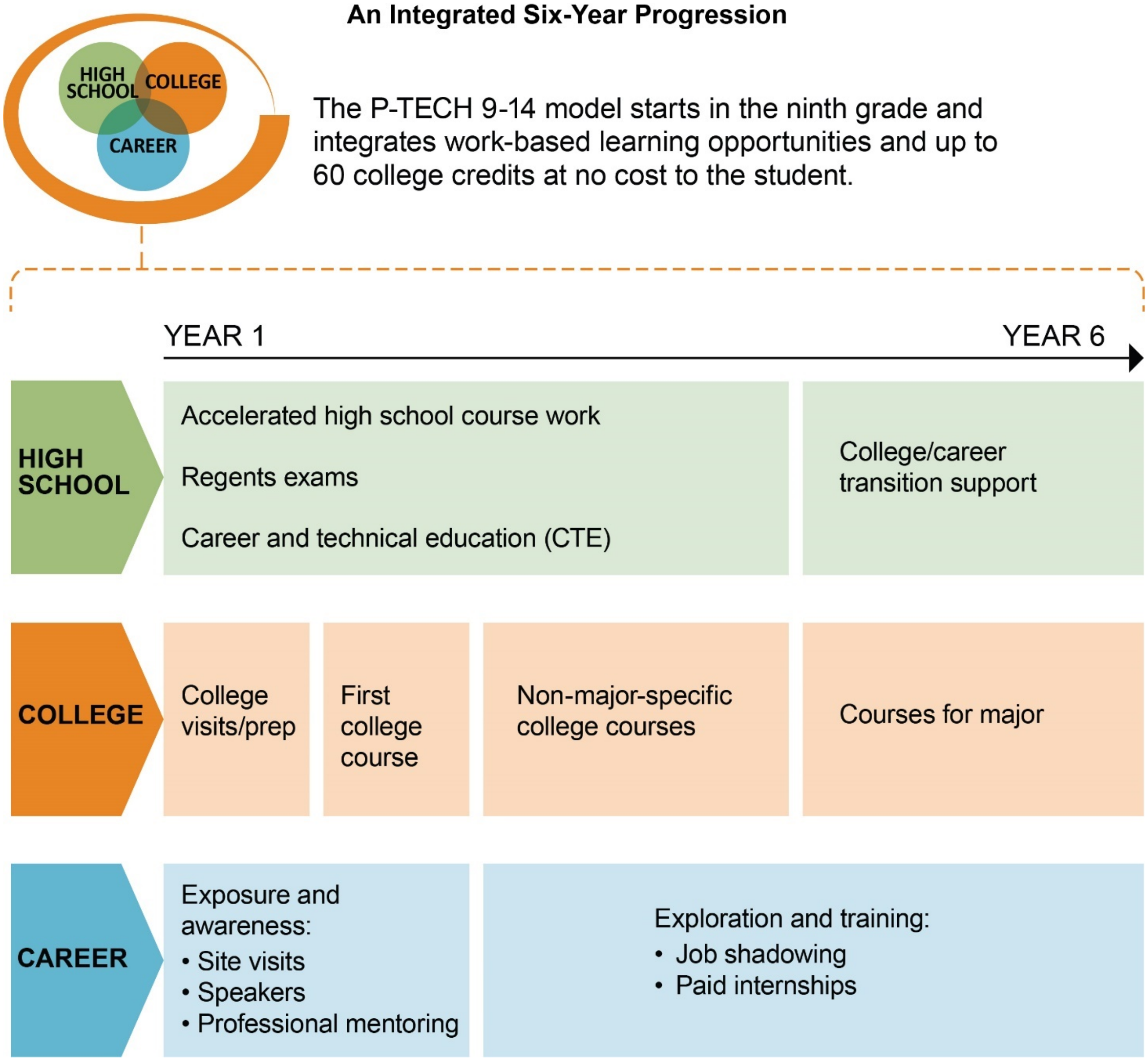
[1]P-TECH 9-14 schools in New York City do not require industry partners to commit to putting graduates first in line for jobs.

Figure 2.1

An Integrated Six-Year Progression



Highlights from this chapter include:

- Each P-TECH 9-14 school relies on a partnership between the high school, college partner, and employer partner(s). The New York City Department of Education (NYC DOE) and the Early College Initiative of the City University of New York (CUNY) support these partnerships and provide structured opportunities for collaboration.
- Overall, while these components are being implemented in all of the study schools, there is also variation in many of the specific elements.

- Students' high school coursework and Regents exam taking are accelerated and all schools focus on CTE and "soft" skills.

- College coursework begins largely in tenth grade, and the pacing and progress varies by student. The degree pathways are designed to complement the high school CTE coursework and lead to credentials tied to specific careers.

- P-TECH 9-14 students participate in WBL activities such as site visits, job shadowing, and internships. The specific WBL opportunities available to students and the levels of student participation can differ from school to school.

The high school, college, and WBL sections below focus primarily on common aspects of the model across the P-TECH 9-14 schools. Subsequent reports will examine dual enrollment, provide additional information on the schools' high school, college, and career elements, and delve more deeply into variation both across and within the P-TECH schools.

P-TECH 9-14 Partnerships

P-TECH 9-14 schools require coordination and cooperation among three key partners: high schools and their school districts, college institutions and systems, and partner employers. Successful implementation hinges on a commitment to change, and each group brings specific histories, cultures, standards, approaches, and goals to bear on the partnership. In New York City, the P-TECH 9-14 school development process is co-led by CUNY's Early College Initiative (ECI) and NYC DOE's Office of Postsecondary Readiness (OPSR). Together they identify employer partners and provide support and oversight of model implementation.

During the startup of a school, ECI and OPSR help analyze labor market trends to identify potentially sustainable career pathways, map out necessary skills, convene partners, and assist in hiring the school principal. ECI and OPSR also work with individual P-TECH 9-14 partner teams to create the scope and sequence of high school and college course offerings.

After startup, P-TECH 9-14 schools meet regularly with ECI and OPSR staff representatives, who conduct professional development gatherings for school staff members, participate in steering committees made up of representatives from each partner organization, and convene principals from across the schools at least twice a year. Each college and employer partner work with the high school to monitor implementation and make adjustments as necessary, so students have as cohesive an experience as possible. In addition to contributing to the vision of the school, the employer partners also provide work-based learning supports to the students, which may include providing professional mentors, giving workplace tours, advising on class projects, and offering paid internships. Though IBM is an advocate for the model and is partnered with the first New York City P-TECH 9-14 school, its affiliation does not involve providing monetary support, oversight or quality control for P-TECH 9-14 schools more broadly.

P-TECH 9-14 High School Experience

P-TECH 9-14 students, like other public high school students in New York City, are expected to meet NYC DOE's high school requirements within four years for on-time graduation, in order to receive a high school diploma.[2] However, there are a few distinguishing features specific to the P-TECH 9-14 experience, including early Regents exam taking, CTE classes, and soft skills instruction, as described below.

Accelerated High School Schedule

P-TECH 9-14 students are on an accelerated timeline with their coursework, and their high school classes are frontloaded. Principals reported that they wanted to make sure that students would not become overwhelmed with college classes in their later high school years and be unable to complete their standard high school requirements on time. Although some students may finish their required high school coursework early, P-TECH 9-14 students who have met New York City's requirements still receive their diplomas at the end of twelfth grade.

Given the many layers of the high school experience, students need advising and guidance support. Many of the P-TECH 9-14 schools in this study also provide a summer bridge experience, to get their students ready for high school in the summer before ninth grade. Principals reported needing extra guidance and advising staff in order to support students through the multifaceted P-TECH 9-14 program. Four of the schools have students meet with counselors to start discussing college and career in ninth grade, while two start in tenth grade, and one school varies its starts by student. The schools are still exploring the best way to create cohesive, individualized college and career plans for each student.

Regents Exams

As a core element of the P-TECH 9-14 model, New York State Regents exams — a suite of standardized tests covering a range of subjects — are taken early. Subjects include English Language Arts (ELA) and various math, science, and social studies tests, with core subject exams required for high school graduation. Statewide, the exams are offered three times a year, and students may take them multiple times until they pass. However, there is no state policy specifying when students must take particular exams, which gives schools flexibility over when they encourage their students to take them. In general, CUNY requires P-TECH 9-14 school students to achieve a college-ready score (which is higher than the score required for high school graduation) in ELA and one math subject before they can begin taking college classes toward a degree, although some CUNY campuses allow students to take one entry-level

[2]Students in the New York City school system can graduate with either a Regents Diploma or an Advanced Regents Diploma, both of which require 44 credits to graduate. Students earning a Regents Diploma need to pass five Regents exams, while students aiming for an Advanced Regents Diploma need to pass nine Regents exams (New York City Department of Education, 2020).

course before meeting the college-ready benchmark.[3] In order to prepare students to begin dual-enrollment coursework at CUNY, P-TECH 9-14 students can begin taking Regents exams as early as the summer before ninth grade and are encouraged to have attempted them by the end of their tenth-grade year; the timing of students' first Regents exam varies across these schools.

Career and Technical Education

The P-TECH 9-14 high schools are all considered CTE-designated high schools by the NYC DOE, as all students are enrolled in a CTE program of study.[4] Students must participate in one of their school's specified CTE pathways. A CTE pathway is a scope and sequence of classes that build technical skills to prepare for a specific postsecondary focus or career. Almost all P-TECH 9-14 schools in the city require students to take more than four sequential CTE courses, which build on each other, in order to complete the average CTE pathway. These focused pathways and high school course completion requirements indicate the depth of the CTE experience offered at P-TECH 9-14 schools.[5]

Soft and Professional Skills

In addition to CTE coursework, there is also an explicit focus on "soft skills" such as social-emotional skills, staying organized, and working well with a team.[6] Related professional skills such as writing a resume and interviewing for a job are also taught in the P-TECH 9-14 school model and are meant to complement the WBL experiences, preparing students to obtain work and perform satisfactorily in the workplace. Almost all of the schools teach these skills in advisory periods for which students may or may not earn credits; the offerings vary across schools

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[3]In New York State, a passing score on these exams for a Regents high school diploma is 65 or higher (Higher Education Services Corporation, 2019). However, CUNY has higher score requirements for ELA and math Regents exams in order to demonstrate college readiness and qualify to skip remedial classes before starting an associate's degree program; the score requirements vary by exam and by the year of the study. The content of the Regents exams also changed during the course of this study. In June 2014, the ELA and algebra exams were changed to incorporate the Common Core Standards. Those standards were also added to geometry (June 2015) and algebra 2 (June 2016). The City University of New York (2019).

[4]A CTE program of study is a sequence of classes based on industry and New York State Education Department (NYSED) learning standards to develop technical skills for a specific career pathway. A CTE program of study includes WBL experiences, a three-part technical assessment, and an articulated agreement with a postsecondary institution for advanced standing or college credit for students who successfully complete the technical assessment. NYSED has an endorsement process in place to evaluate and approve formal CTE programs of study offered in New York state schools. Students who complete all aspects of a NYSED-approved CTE program of study are eligible to graduate with a CTE-endorsed diploma and use the program's technical assessment as one of the alternate assessment options for graduation. Two of the seven P-TECH 9-14 schools currently have NYSED-approved CTE programs of study and the others are in the process of applying for program approval.

[5]By comparison, the federal Perkins V act, which governs CTE, only requires two sequential courses to be considered a "CTE concentrator."

[6]Soft skills may also be referred to as twenty-first-century skills, professional skills, or career skills. Soft skills may encompass social-emotional skills related to communication and social interactions, as well as skills such as interviewing, resume writing, and project management that are meant to prepare students for college and career.

and school years.[7] Five schools also have classes explicitly designed to build college and career skills and three have integrated this skills training into academic and CTE classes. Two schools also have WBL coordinators who have created soft and professional skills curricula, and most have received input from their employer partner on which skills students should be taught before they enter the workplace.

P-TECH 9-14 College Coursework

P-TECH 9-14 students can begin taking college coursework free of charge before earning their high school diploma at the end of twelfth grade. In most cases, P-TECH 9-14 students will earn degrees that already exist at their partner CUNY school; in at least one case, however, the partner college created a new degree pathway after discussions with the P-TECH school and the employer partner about the growth of a specific labor demand within the industry. Each high school has a college liaison who splits time between the high school and college campuses and provides a variety of supports including course scheduling and advising, connecting students to tutoring opportunities, and advocating on students' behalf with professors.

College Opportunities

All seven schools reported that P-TECH 9-14 students can begin taking college classes in tenth grade. As described above, the first class often does not require the CUNY Regents exam benchmarks and acts as an introduction to college coursework. For later classes taken toward a student's major, in addition to meeting the CUNY Regents exam benchmarks, some schools also require students to have a good attendance record, a counselor recommendation, or a minimum GPA before they can take college classes. These additional requirements are often developed in collaboration with the college partner.[8] If students do not meet the required benchmarks, they continue with their regular high school coursework. Although there are multiple opportunities to meet benchmarks and begin taking college courses, schools did report that there are students who never become eligible for early college coursework; this may highlight a tension between the open-enrollment and early-college-ready elements of the model.

Once college courses have begun, coursework and sequences are pre-set within the degree pathways, of which all of the schools offer at least two. Students are working mostly toward Associate of Applied Science degrees (AAS), although three schools also offer Associate of Science degrees (AS), and one offers only AS degrees. These degrees complement the high school CTE coursework, and the combined scope and sequence builds students' experience and credentials toward specific careers. Students begin taking college courses exclusively with other P-TECH 9-14 students. At almost all of the P-TECH 9-14 schools, students begin with college instructors who come to their school to teach the classes. As students advance, they take an

[7]Advisory periods are dedicated times for teachers to meet with small groups of students and advise on a range of aspects, including social-emotional needs, academic best practices, and college and career planning.

[8]Interviews with school staff suggest that the CUNY Regents benchmarks—not the additional requirements schools put in place such as attendance and recommendation letters—are the primary impediment to students taking college pathway coursework.

increasing number of classes on the college campus that may include a mix of P-TECH 9-14 and other students. Regardless of the location and mix of students, study schools reported that the content and expectations are the same as in a standard college class.

Students who are dual-enrolled in this way begin taking their early college classes simultaneously with their high school coursework, rather than completing all of their high school credits first.[9] Students' progress and the pacing of their college course-taking throughout their time as a P-TECH 9-14 student varies. For example, one student might take an introductory college course before passing the Regents exam but may need to refrain from taking major-specific courses before passing the requisite exams. Another student might begin college courses but start to fall behind in their high school classes, requiring them to stop taking the college courses in order to focus more fully on high school graduation requirements. A small number of students have been able to complete the high school and college coursework in less than the six years of the model and receive both their high school and college diplomas in that time. The fluidity of the experiences underscores the importance of P-TECH 9-14 students having advisors: Students frequently need individualized advising to determine the combination of high school and college coursework that will best meet their needs.

P-TECH 9-14 Work-Based Learning Activities

One of the distinguishing characteristics of P-TECH 9-14 schools is the focus on providing students with opportunities to engage in WBL activities that are aligned with their high school and college coursework. In this report, WBL can refer to career-related activities both in the school building and at the workplace, though all involve direct involvement with industry employers. Each school's employer partner plays an active role in helping to cultivate WBL opportunities. An industry liaison, employed by the employer partner, spends at least some of their time working in this capacity, sometimes visiting the school to collaborate and plan with school staff. While all schools reported that their founding employer partner provided at least some WBL opportunities, the schools also had other sources of support for these activities. Specifically, staff members from nearly all the schools actively sought connections with employers outside the program to create a more robust set of WBL opportunities for their students and reported that staff from the NYC DOE and/or CUNY helped identify or facilitate internship opportunities. Additional employer partners can be necessary to host the full number of students participating in internships and provide different types of opportunities for students with broader sets of interests. See Box 2.1 for additional details on the role of employer partners.

[9]For purposes of this report, "dual-enrolled" means that a student is taking college classes and earning college credit. It does not mean that they are earning high school credit for the college credits that they earn.

Box 2.1

Role of Employer Partners

Employer partners are an essential part of the P-TECH 9-14 model. Founding employer partners work with the New York City Department of Education (NYC DOE) and the City University of New York (CUNY) from the beginning of a school's start-up. Having been identified as a company in an industry that can provide a middle-income job ladder, the employer partner collaborates with NYC DOE and CUNY to work backward: first, identifying the skills and credentials needed for their industry and then building a high school and college scope and sequence to teach students those skills and provide them with the necessary credentials. Companies may partner with a P-TECH 9-14 school for a variety of reasons, including wanting to create a pipeline of talent for their company or industry or to give back to the community. It is important that the right representative from the company takes part in these early conversations. For example, corporate responsibility representatives may be able to initiate the relationship, but the human resources department must be included to ensure that there is a realistic path to a career awaiting students at the end of the model.

Once the school is open, employer partners provide work-based learning opportunities to students, first exposing them to the workplace and then providing opportunities for participation. Companies commit at varying levels depending on their own capacity; activities can range from weekly workplace visits to hosting students for summer internships. Though it is one of the original P-TECH 9-14 design principles, not all employer partners can commit to graduates being first in line for job interviews. Employer partnerships are most successful when the school and employer have shared expectations for the relationship. Regular steering committee meetings with the high school, college, and employer partners are designed to keep these expectations current and the communication channels clear.

WBL Opportunities and Sequencing

The WBL activities most commonly available at P-TECH 9-14 schools include workplace visits, job shadowing, internships, and guest speaking and mentoring by an industry professional. Early in students' high school careers, WBL focuses mostly on providing exposure to work in a particular industry and activities that build awareness of industry roles. As discussed below, this is followed in the later grades by more intensive and hands-on career exploration and training opportunities. Most WBL is embedded within CTE classes, though there are also stand-alone WBL experiences for which students may earn credits, also discussed below. For example, a P-TECH 9-14 school may require an engineering class with a project-based learning component in which students must solve an engineering problem as a team and present their final product to industry professionals. Larger one-off events, such as a workplace visit or a professional speaker, also often happen during CTE class time, which teachers may supplement with activities such as reflection discussions. Throughout these activities, students get the opportunity to practice soft skills such as adaptability, critical thinking and problem solving, as well as the chance to use skills such as resume writing and interviewing in a real-world setting.

Career Exposure and Awareness

P-TECH 9-14 students' earliest WBL opportunities include activities such as career-focused speakers and workshops. In most of the schools, a significant number of ninth-graders have the opportunity to visit a job site to learn about the company's work and the types of jobs available. Visits are primarily to the school's designated employer partner, but some schools reported that students also visit other companies. In three schools, tenth-graders also participate in workplace visits as frequently as ninth-graders.

All P-TECH 9-14 schools reported bringing in career-focused speakers as part of the early career exploration activities. In many of the schools, students also engage in projects and/or present their work to industry professionals. For example, at one school, students have the opportunity to visit the employer partner as often as once a week for activities with employees on site. At another school, students develop business plans and present them to employees from the partner company.

Industry mentoring is another component of students' WBL activities at most P-TECH 9-14 schools. In some, students participate in either one-on-one or small- group mentoring beginning in ninth grade, and participation in mentoring continues for multiple years (though students do not typically have the same mentor for more than one year). In three of the schools, opportunities for mentoring have been less consistent: One school offers mentoring to a subset of female students in engineering to provide them with female role models in the industry; another school is in the process of piloting a new mentoring program; and a third school has no mentoring program.

Career Exploration and Training

As students progress in their high school careers, they may also engage in more intensive WBL activities such as paid internships and job shadowing, in which they observe an industry professional doing their job.[10] However, most schools are unable to provide these opportunities for all of their students. Specifically, while one school reported that most of their ninth- to eleventh-graders engage in job shadowing, at other schools, job shadowing opportunities are more limited.

Finally, paid internships, which are often considered the pinnacle of WBL activities, are available in some form at all P-TECH 9-14 schools. However, there is substantial variation in the levels of student participation across schools, both during the summer and the school year, as reported by principals. Of the seven P-TECH 9-14 schools, three reported that only a handful of students per grade participated in paid summer internships, though one of those schools said up to a third of their students participated in internships in the summer after twelfth grade in particular. The remaining four schools reported greater levels of student participation, especially in the summers after eleventh and twelfth grades, with roughly one quarter to one half of eleventh- and twelfth -graders participating in paid summer internships. Internships during the school year were

[10]Schools also continue to provide students with the exposure-focused WBL opportunities described above.

also most frequently available for eleventh- and twelfth-graders. All but one of the schools reported that students participated in paid internships during the school year. Three schools reported higher participation, with approximately 20 to 40 percent of eleventh- and twelfth-graders participating. These three schools also had high numbers of summer internships. Despite this variation in later grades, one consistent finding was that students in all seven schools were less likely to participate in paid internships in grades nine and ten than in grades eleven and twelve.

While these data suggest that paid internships are available to many P-TECH 9-14 students, it is also clear that ultimately, many students do not participate in them. All schools have requirements for who is able to take part. Some are set by the school and may include a minimum GPA (set either by the school or employer), attendance and behavioral requirements, or a recommendation from a school staff member. Some requirements are set by the employer partner. For example, schools with health care employer partners require students to complete health screenings in order to be cleared to work, and schools with engineering employer partners require interns to be a certain age. The final report will include additional details on which students participate in various WBL activities and why, as well as the content of students' internships and other WBL opportunities.

Chapter 3

The Impact Study

This chapter examines the early impacts of P-TECH 9-14 on students' outcomes in their first three years of high school. The chapter begins by providing an overview of the study design — including how the New York City high school admissions system works, and how it provides an opportunity for rigorous evaluation — as well as the characteristics of students in the study. Specifically, this study uses admissions lotteries created by the New York City High School Application Processing System (HSAPS) to form two groups of comparable students, akin to a random assignment study.

The chapter discusses the effects of the P-TECH 9-14 model on students' interim high school outcomes, including their course credit accumulation in both academic and career and technical education (CTE) and other nonacademic courses; Regents exam attempts and pass levels; and attendance within the first three years in high school. Given the elements of the model, one would expect P-TECH 9-14 students to take more CTE courses than other students, as well as to attempt to pass Regents exams with CUNY-qualifying scores earlier than other students, in order to be eligible for the dual-enrollment courses that are part of the model.[1] Impacts on high school graduation or postsecondary outcomes (including those related to dual enrollment) will be examined in subsequent reports.

Overall, the report provides evidence that students in the P-TECH 9-14 study sample, more than two-thirds of whom entered ninth grade below a proficient level in both English language arts (ELA) and math, are, on average, accomplishing many of the milestones that the model is designed to help them achieve. In particular:

- By the end of both the second and third years of high school, P-TECH 9-14 students earned more total credits than students in other schools, with results driven by credit accumulation in CTE and other nonacademic subjects. By the end of three years in high school, P-TECH 9-14 students had earned an average of two credits more than students in the comparison group. These additional credits did not appear to come at the expense of earning academic credits, the accumulation of which remained statistically equivalent between groups for all three years of high school.

- Students in P-TECH 9-14 schools were much more likely to earn nonacademic credits in work-based learning, technology, engineering, and human service subjects. They earned fewer credits in arts, physical education, and health.

[1]All data for the impacts section of this report come from the longitudinal file of New York City Department of Education (NYC DOE) administrative data records, housed and maintained by the Research Alliance for New York City Schools.

These subjects are aligned with the career and industry themes associated with the seven P-TECH 9-14 schools.

- In each of the first three years of high school, P-TECH 9-14 students attempted more Regents exams than students in comparison schools, and more P-TECH 9-14 students passed the ELA Regents exam with a score qualifying them for enrollment in CUNY coursework than comparison students. At the end of two years of high school, 42 percent of P-TECH 9-14 students had passed the ELA Regents with a CUNY-qualifying score, compared with 25 percent of comparison group students. By the end of year three, the gap was smaller but still favored P-TECH 9-14 students.
- The CUNY-qualifying-score pass rates indicate that more P-TECH 9-14 students were eligible to dual enroll in CUNY coursework in earlier years than their comparison group counterparts, which is in line with the early college aspect of this school model.

How the New York City High School Lottery Works

In New York City, eighth-grade students apply to a centralized system to apply to high school. Students are allowed to rank up to 12 schools they are interested in attending, and an algorithm matches students to schools based on whether they meet the admissions criteria for a given school and the order of preference listed by the student. In some cases, when more students meet a school's admissions priority categories than there are available seats in a school, a process similar to a lottery occurs in which some students randomly win admission to a particular school, while other students randomly lose the opportunity to attend the school. (For a more detailed description of this admission process, please see Appendix A.) During the admissions years covered by this study, all seven P-TECH 9-14 schools were oversubscribed, meaning there were random lotteries for at least a subset of seats in each of the schools. This random process for allocating seats provides an opportunity for a natural experiment, akin to a random assignment study, in which two comparable groups are created. In this report, the group that won admission to a P-TECH 9-14 school is referred to as the program group, while those who did not win a seat in one of the schools are referred to as the comparison group.

Importantly, not all students who were assigned a seat in the P-TECH 9-14 schools were admitted by lottery. Each school establishes admissions priority categories: The first students admitted are those who meet priority category one, followed by those who meet category two, and so on. Since P-TECH 9-14 schools do not have academic or attendance criteria for admissions, these categories include such things as whether students live in the same New York City borough as where the school is located, and whether the student made contact with the school through a high school fair or other means prior to applying.[2] In some cases, there were fewer students who

[2]These admission categories were part of a NYC DOE school designation known as "Limited Unscreened." During the cohort years included in this study, all P-TECH 9-14 schools were Limited Unscreened. However,

met a school's top one or two priority categories than there were seats for the entering ninth-grade cohort, so students who met those top criteria were admitted without a lottery. The remaining seats in lower-priority categories were then assigned by lottery. By the same token, if more students who met a school's top priority categories applied, then all seats were allocated randomly. For purposes of this study, only the students who were placed in their first lottery process for school admission are included in the analytic sample.

While this process provides a rigorous set of comparable groups of students, contextualizing the findings presented here also requires understanding whether there are differences between students admitted via lotteries and those who gained admission and enrolled in these schools via non-lottery placements. In this case, just over half (53 percent) of students who were offered admission to the P-TECH 9-14 schools during the study years were admitted via a lottery.[3]

In addition, while the students in the program group were concentrated in the seven P-TECH 9-14 schools, those students who did not win a seat in one of these schools ended up receiving admissions offers from one of a total of 399 other high schools across New York City, which is almost all other high schools in the city. One hundred of these schools were either dedicated CTE high schools or academic high schools offering some CTE programing. Thirty-eight percent of comparison group students were enrolled in the schools that offered some kind of CTE; the rest of the comparison group students attended academic high schools without significant CTE offerings. In addition, using data from the Office of Civil Rights, the report team found that in the 2015-2016 school year, approximately 26 percent of students in the comparison group attended schools that offered dual-enrollment or dual-credit experiences.[4] Overall, the total number of comparison students enrolled in any single non-P-TECH 9-14 school of any kind does not exceed 39 (or 2 percent of the comparison sample), and in many cases is as low as a single student. For these reasons, the comparison group can be thought of as "students who experienced any non-P-TECH 9-14 school in New York City." This is a very broad comparison that represents a wide range of student high school experiences.

Finally, because this study design is like a student level random assignment study, results should also be interpreted at the student level — that is, the estimates presented here are the average impact for the average student who applied to any P-TECH 9-14 school and who was admitted via first lottery between 2013-2017.

NYC DOE eliminated the Limited Unscreened designation beginning in the 2019-20 school year, and all P-TECH 9-14 schools became what are known as Education Options schools, which have different admissions priorities.

[3]For more information about how the students in the analytic sample compare to the overall population of P-TECH 9-14 admitted students, please see Appendix Table A.4.

[4]Civil Rights Data Collection (CRDC) data from the 2015-16 school year survey were accessed (U.S. Department of Education Office for Civil Rights, 2016). Dual-enrollment or dual-credit programs are described in the CRDC school survey as providing "opportunities for high school students to take college-level courses offered by colleges, and earn concurrent credit toward a high school diploma and a college degree while still in high school," and exclude Advanced Placement (AP) and International Baccalaureate (IB) programs.

Who is in the Sample?

The seven P-TECH schools in this study opened on a rolling basis between 2011-2016. The sample for the analyses includes ninth-grade cohorts of students who were offered admission to the schools between 2013-2017 — the years for which it was possible to identify admissions lotteries for the schools. In addition, lotteries are not included for any school in its first year of operation, because it is unclear whether students had full knowledge of the program they were applying to in each of the school's inaugural years.

Students in the study sample are followed for up to three follow-up years (first, second, and third year of high school). The staggered nature of the school openings — as well as the fact that the sample includes more recent cohorts — means that some students can only be followed for one or two years. Therefore, the sample of students with follow-up data gets smaller from one year to the next. The Year 1 sample includes a total of 3,161 students who were included in lotteries for all seven P-TECH 9-14 schools between 2013-17; the Year 2 sample includes 2,164 students who applied to all seven schools between 2013-16; and the Year 3 sample includes 1,203 students who applied to six of the seven schools between 2013-15. To maximize the sample size for the analyses, the impact findings for any given follow-up year are based on all students whose outcomes could be measured that year.[5] However, to confirm that the pattern of effects across years is not confounded with changes in the student sample, impacts were also examined for the subsample of "stable" students in each year across all three follow-up years. These findings are presented in Appendix A.

It is also worth noting that the students in the analysis sample are not evenly distributed across P-TECH 9-14 schools. Because some schools have been open longer than others, there are more cohorts from some schools than others. Only one school had lotteries in all five years that are analyzed, two schools had four years of lotteries, three schools had three years of lotteries, and one school had two years of lotteries. This means that the findings are more likely to represent the effect of the model for students who attended the subset of P-TECH schools with both more and larger lotteries.

Characteristics of Students in the Study Sample

Table 3.1 reveals that the population of students who apply to P-TECH 9-14 schools are predominantly Black and Hispanic, and come from families who live in census tracts where the median household income is approximately half a standard deviation below the average income level for the city as a whole. More than 70 percent of the sample had eighth-grade math and ELA scores that did not meet grade level standards. Additionally, approximately 10 percent of the sample were classified as English Language Learners (ELLs) before high

[5]For a description of the school lottery years and sample sizes, please see Appendix Table A.1.

Table 3.1

Baseline Characteristics of P-TECH 9-14 Analytic Sample

Characteristic	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Race/ethnicity (%)					
Hispanic	44.8	47.3	-2.6	-0.05	0.150
Black	40.2	39.6	0.6	0.01	0.720
White	4.7	3.9	0.8	0.05	0.271
Asian	8.6	7.7	0.9	0.04	0.369
Other	1.7	1.5	0.2	0.02	0.689
Female (%)	37.7	42.2	-4.5 **	-0.09	0.013
Median HH income of neighborhood[a]	-0.5	-0.5	0.0	-0.01	0.849
Missing median HH income (%)	2.6	2.4	0.2	0.01	0.807
8th-grade ELA test performance level[b]					
Did not meet standards (level 1) (%)	26.1	24.5	1.6	0.04	0.339
Partially met standards (level 2) (%)	44.8	43.7	1.0	0.02	0.618
Fully met standards (level 3) (%)	21.6	23.0	-1.4	-0.03	0.385
Met standards with distinction (level 4) (%)	4.1	4.5	-0.4	-0.02	0.598
Missing test information (%)	3.5	4.3	-0.8	-0.04	0.315
8th-grade math test performance level[b]					
Did not meet standards (level 1) (%)	36.9	36.9	0.1	0.00	0.977
Partially met standards (level 2) (%)	35.1	35.2	-0.1	0.00	0.966
Fully met standards (level 3) (%)	11.7	11.7	0.0	0.00	0.993
Met standards with distinction (level 4) (%)	3.2	4.1	-0.8	-0.05	0.255
Missing test information (%)	13.0	12.2	0.9	0.03	0.541
Flagged as English Language Learner (%)	10.3	9.9	0.4	0.01	0.752
Missing English Language Learner (%)	6.6	6.0	0.7	0.03	0.481
Enrolled in a charter school in spring of grade 8 (%)	8.1	8.0	0.2	0.01	0.889
Sample size (total=3,161)	1,479	1,682			
Number of lotteries (total=42)					

(continued)

school.[6] Finally, students attended charter schools at similar levels across groups in the eighth-grade year, as seen in Table 3.1.

[6]New York City began providing free lunch for all students during the 2017-18 school year, so all students are marked in data as receiving free meals in that year. Thus, for consistency across all years of data, instead of using eligibility for subsidized meals as an income proxy (a common measure of income in education research), the research team obtained data on median household income by census tract from the U.S. Census Bureau. Income levels were standardized across tracts, within students' baseline eighth-grade year. Estimates are presented in standard deviation units.

Table 3.1 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers.

The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and comparison group members.

The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

An F test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting p-value is not statistically significant (p-value = 0.625).

[a]Median household income has been z-scored to standardize across census tract and cohort year.

[b]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

income of neighborhood, eighth-grade academic performance, or status as English language Learners. Although there are statistically fewer female students in the program group, the size of the difference (4.5 percentage points) is relatively small.[7] Importantly, an omnibus test also indicates that across all characteristics, there is no systemic difference between the program and comparison groups. For these reasons, the groups are comparable, and differences in outcomes can be attributed to the P-TECH 9-14 program, and not to other factors or student characteristics.[8]

While the baseline equivalency of the analytic sample is important for understanding whether the program and comparison groups are, in fact, comparable, it is also important to know whether the sample of students admitted to the P-TECH 9-14 schools via lottery was representative of the overall population of students in the schools. A comparison of the analytic sample of program group students to the sample of students who were admitted to a P-TECH 9-14 school through a non-lottery process (that is, students who met the admissions criteria without oversubscription) was also conducted. Results indicate that program group students in the analytic sample were more likely to have been classified as ELL students and had lower math and ELA test scores in eighth grade than students admitted to the P-TECH 9-14 schools without a lottery. They were also somewhat less likely to have attended a charter school in eighth grade, but were no more or less likely to be special education students.[9] The implications of this are that the results of this

[7]Baseline equivalency was also measured for the stable sample of students who are included in all three years of outcomes. A table of these results can be found in Appendix Table A.2. The observed gender imbalance is driven by several small lotteries in the early years and appear to be results of random bad draws for gender, since the HSAPS lottery does not consider student gender as a factor in the placement algorithm.

[8]In addition, to account for this difference, the study team included gender in the regression model as a covariate. For more information on the model, please see Appendix A.

[9]Please see Appendix Table A.4 for results of this comparison.

study apply to the lowest-performing students who were offered seats in P-TECH 9-14 schools at baseline. Although the results may not be generalizable to the full sample of students enrolled in P-TECH 9-14 schools, they provide a policy-relevant set of analyses that address the impacts for students who may often be considered more academically precarious than their higher-performing peers.

Understanding the Results

The estimates presented in this report are what are known as intention-to-treat (ITT) estimates; that is, each group is made up of students who were assigned to either the program or comparison group by the lottery.[10] All students who were assigned a seat in high school through a lottery for admission to a P-TECH 9-14 school were included in the sample. This does not mean that all students included in the program group actually *enrolled* in either the P-TECH 9-14 school to which they received an offer of admission, or the non-P-TECH 9-14 school to which they were assigned. The students in the sample are literally those for whom the assignments were "intended." The reason for this is that the ITT estimate is the experimental estimate in which groups can be assumed to be comparable because, on average, they look similar and were similar in motivation in wanting to attend these schools; the only difference is whether they won or lost the lottery. In addition, this estimate is sometimes thought of as the policy-relevant estimate because it describes the effect of the intervention that policy makers can control; that is, policy makers can provide seats in particular kinds of schools, but they cannot force students to enroll in those schools. Thus, these results can be thought of as representing the best estimates of what can be expected, on average, to a community of students when a school or set of schools is opened and made available to them, rather than estimates of the average effects of student enrollment in the program.[11] However, it is also worth noting that most students *did* comply with their intended group assignment (that is, most students assigned to P-TECH 9-14 schools enrolled in these schools), so the ITT estimates are roughly similar to the effects of enrolling in a P-TECH 9-14 school.

Impacts on School Choice

In New York City, students participate in the high school admissions lottery during the winter of their eighth-grade year, with admissions offers usually sent out sometime during March of that year; students know what high school they have been admitted to prior to the end of middle school, and each student receives only one admission offer. Importantly, the lottery only includes

[10]Please see the Appendix A for the regression model equations.

[11]In order to understand the impacts for those students who actually enrolled in the schools to which they were assigned, the study team also calculated what are known as Complier Average Causal Estimates (CACE), or the estimates for those students who "complied" with their lottery assignment. However, because there was fairly high compliance with lottery placements in the study sample, these estimates do not differ greatly from the ITT estimates presented here. For information on compliance rates and the CACE estimates, please see Appendix Tables A.5 and A.6.

admissions for high schools run directly by NYC DOE and does not include public charter schools, which have their own admissions processes later in the spring.[12]

One unexpected outcome of the P-TECH 9-14 story is related to school choice. In particular, there is a statistically significant difference between program and comparison group students in terms of the proportion of those who chose to enroll in a charter high school for ninth grade, rather than the NYC DOE school to which they were assigned. In particular, 9.5 percent of comparison group students chose to enroll in a charter school rather than their assigned school, compared with only 5 percent of students who won the P-TECH 9-14 lottery, for a statistically significant difference of 4.6 percentage points (see Table 3.2). Additionally, the difference in school enrollment choice primarily occurred for the ninth-grade year and persisted, with very few students leaving NYC DOE schools for charter schools in later years (or returning to the district from charter schools). These findings are despite the fact that students in the program and comparison groups were enrolled in charters at similar rates during the baseline eighth-grade year. This finding is interesting because it indicates that students assigned to P-TECH 9-14 schools initially appear to have been more satisfied with their school assignments than those assigned to other schools, as evidenced by the fact that they were less motivated to find alternative schooling after receiving their assignment to a P-TECH 9-14 school.

Table 3.2 also shows the percentage of students who left the New York City public school system (marked as "inactive" in the system). The proportion of inactive students is similar in the program and comparison groups. While the number of students who exited the public system increases across follow-up years, the exit rate is similar across the two lottery assignment groups. This indicates that, unlike charter school enrollment, assignment to a P-TECH 9-14 school did not have an effect on student or family decisions to leave the public school system.

The charter school finding has implications for some of the analyses. Namely, students who attended charter schools are missing more attendance and course enrollment outcome data than students enrolled in NYC DOE schools (Regents data are unaffected).[13] More students in the comparison group attended charter schools, so a higher proportion of students in the comparison group have missing attendance and credit data. By extension, this means that there could be a difference in the characteristics of students in the program and comparison groups with non-missing data. Additional analyses suggest that the two groups are similar in their observed characteristics at baseline.[14] However, they could differ in unobserved ways, and these differences could be confounded with the effects of P-TECH 9-14 on attendance and credit

[12]By law, New York City charter schools must accept applications until at least April 1st. Admissions lotteries for charter schools are then held after April 1, which is after NYC DOE HSAPS lottery admissions notifications are sent to students.

[13]Regents data are collected and reported at the state level, while course and attendance level are collected and reported at the district level. Since charter schools do not report the same data to the district in the same way other schools do, these data appear not to have been reported to the district by most charter schools.

[14]Analyses results are available upon request by emailing information@mdrc.org.

Table 3.2

Charter and Inactive Students for P-TECH 9-14 Analytic Sample

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 1					
Newly enrolled in a charter school Y1 (%)	4.9	9.5	-4.6 *	-0.15	0.064
Left the NYC public school system Y1 (%)	5.3	5.6	-0.3	-0.01	0.741
Sample size (total=3,161)	1,479	1,682			
Number of lotteries (total=42)					
Year 2					
Newly enrolled in a charter school Y2 (%)	0.5	0.6	-0.1	-0.01	0.674
Continuing enrollment in a charter school Y2 (%)	3.7	8.1	-4.5 **	-0.17	0.045
Left the NYC public school system Y2 (%)	7.1	7.9	-0.9	-0.03	0.417
Sample size (total=2,164)	1,090	1,074			
Number of lotteries (total=29)					
Year 3					
Newly enrolled in a charter school Y3 (%)	0.6	0.1	0.5	0.07	0.239
Continuing enrollment in a charter school Y3 (%)	3.0	7.0	-4.0 *	-0.16	0.094
Left the NYC public school system Y3 (%)	8.5	11.4	-2.9	-0.09	0.119
Sample size (total=1,203)	529	674			
Number of lotteries (total=15)					

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

accumulation. Appendix A discusses various sensitivity tests that were conducted to explore whether these missing data patterns are introducing bias into the results. Only those results for which there is confidence in the interpretation are discussed in the main text.

Early Impacts on Credit Accumulation, Regents Exams, and Attendance

This report primarily presents a first look at the impact of the P-TECH 9-14 model on students' experiences after one, two, and three years of high school.[15] The early impacts presented here demonstrate that P-TECH 9-14 students achieved early high school benchmarks:

- P-TECH 9-14 students were more likely to earn CTE and other nonacademic course credits than their comparison school counterparts.
- These extra credits translated into overall higher credit accumulation and did not appear to come at the expense of core academic credit accumulation.
- More P-TECH 9-14 students also took and passed Regents exams with scores qualifying them for CUNY dual enrollment earlier in high school than students in the comparison group.

Annual attendance, which is a common proxy for student engagement and success in school, was also measured. However, due to confounded issues with missing data patterns as described above, these estimates are less reliable than those presented for the other outcomes. The interim outcomes measured in this report provide important insights into whether key features of the P-TECH 9-14 experience might be expected to lead to later impacts in outcomes such as high school graduation, college enrollment, and degree attainment that the model was designed to improve.

Academic and CTE Credits

The credit outcomes examined include accumulation of academic high school credits necessary for students to move toward high school graduation, as well as CTE and other nonacademic credits that are emphasized as part of the P-TECH 9-14 model.

Table 3.3 illustrates the impacts on the cumulative total credits earned; academic credits; and CTE and other nonacademic credits for students in P-TECH 9-14 schools[16] This last measure counts all credit-bearing courses, including arts and health, and excluding math, English, science,

[15]The study team measures outcomes for specific numbers of high school years after the lottery assignment, rather than grades. This is done to account for the fact that some students in the sample repeat grades, and a ninth-grade repeater, for example, would have two years of exposure to the program but still have the same grade designation as a new freshman. Thus, each of the years corresponds to years enrolled in high school, rather than high school grade designation.

[16]In NYC DOE administrative records, 1 credit = 1 semester.

Table 3.3

Credits Impacts for P-TECH 9-14 Analytic Sample

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 1					
Cumulative Total Credits Attempted Y1[a]	13.7	12.9	0.8 *	0.16	0.059
Cumulative Total Credits Earned Y1[a]	11.7	11.2	0.5	0.10	0.113
Cumulative Academic Credits Attempted Y1	9.6	10.0	-0.4	-0.11	0.424
Cumulative Academic Credits Earned Y1	8.1	8.6	-0.5	-0.13	0.148
Cumulative CTE/Other Credits Attempted Y1[a]	2.7	1.6	1.1 ***	0.76	0.002
Cumulative CTE/Other Credits Earned Y1[a]	2.5	1.4	1.1 ***	0.74	0.001
Sample size (total=3,161)	1,479	1,682			
Number of lotteries (total=42)					
Year 2					
Cumulative Total Credits Attempted Y2[a]	27.6	25.7	1.9 **	0.21	0.031
Cumulative Total Credits Earned Y2[a]	22.8	21.4	1.3 **	0.14	0.039
Cumulative Academic Credits Attempted Y2	19.6	20.2	-0.6	-0.08	0.419
Cumulative Academic Credits Earned Y2	15.8	16.5	-0.8	-0.10	0.130
Cumulative CTE/Other Credits Attempted Y2[a]	5.6	3.1	2.6 ***	1.00	<.0001
Cumulative CTE/Other Credits Earned Y2[a]	5.0	2.7	2.3 ***	0.94	<.0001
Sample size (total=2,164)	1,090	1,074			
Number of lotteries (total=29)					
Year 3					
Cumulative Total Credits Attempted Y3[a]	42.2	38.3	4.0 ***	0.27	0.004
Cumulative Total Credits Earned Y3[a]	33.6	31.6	2.0 **	0.13	0.023
Cumulative Academic Credits Attempted Y3	30.0	29.6	0.4	0.04	0.733
Cumulative Academic Credits Earned Y3	23.2	24.0	-0.8	-0.07	0.295
Cumulative CTE/Other Credits Attempted Y3[a]	8.4	5.0	3.4 ***	0.87	<.0001
Cumulative CTE/Other Credits Earned Y3[a]	7.3	4.4	2.8 ***	0.74	<.0001
Sample size (total=1,203)	529	674			
Number of lotteries (total=15)					

(continued)

Table 3.3 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th Grade ELA test score, Missing rate of z-scored 8th Grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

Sample sizes are from the ITT random assignment sample; each measure's data availability can be found in Table A.8.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Attempted credits measures include credits for all courses for which the student received either a passing or failing grade (so does not include courses awarded no grade).

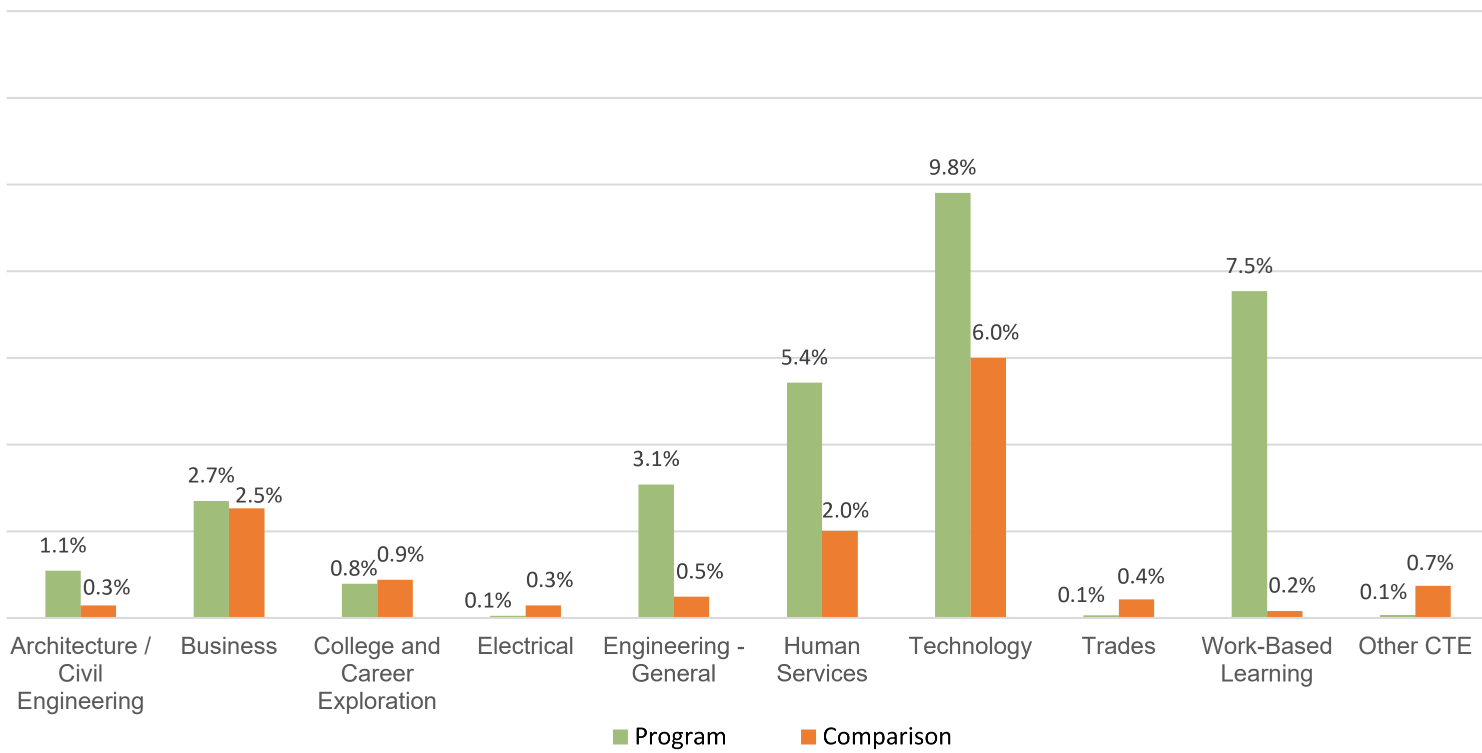
[a]Cumulative Total Credits measures include all credits attempted or earned including Physical Education and Functional Code credits, while Cumulative CTE/Other Credits measures exclude Physical Education and Functional Code credits.

social studies, foreign language, and physical education.[17] By the end of both the second and third years of high school, P-TECH 9-14 students earned more total credits than students in other schools, with results driven entirely by credit accumulation in CTE and other nonacademic subjects. By the end of three years in high school, P-TECH 9-14 students had earned an average of two total credits more than students in the comparison group, a finding being driven by students earning almost three more credits in CTE and other nonacademic courses. With an average of 34 total credits earned by P-TECH 9-14 students by the end of the third year, these students are on track to earn 10 credits in their final year of school to reach the 44 credits required to graduate, while the students in the comparison group, who have earned an average of 32 credits by the end of year three, will need to earn 12 credits in the fourth year of high school in order to graduate on time. Notably, the additional accumulation of CTE and other credits does not appear to come at the expense of academic credits earned during the same time periods. During each of the years examined, there were not statistically significant differences in the average number of core academic credits either attempted or earned by students in the program group and in the comparison group.

Although nonacademic credits were earned in both CTE and non-CTE subjects, Figure 3.1 illustrates the differences in CTE course types that students in each of the groups were

[17]Because the CTE and other credit outcome does not include physical education credits, the estimates from the academic credits and CTE and other credits attempted outcomes do not sum to the estimates for total credits attempted outcomes.

Figure 3.1
P-TECH 9-14 Analytic Sample:
Program/Comparison Differences in % CTE/Other Courses Attempted



SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) enrollment files from the 2013-2017 school years.

engaged in. Not only did P-TECH 9-14 students earn more career-related course credits overall than the students in the comparison group, many of the kinds of courses the P-TECH 9-14 students were enrolled in were different from the CTE courses taken by comparison group students. For example, P-TECH students earned far more credits in engineering, technology, work-based learning, and human services than students in the comparison group.[18] Additional analyses (see Appendix Table A.11) indicate that P-TECH 9-14 students made room for these kinds of courses in their schedules primarily by taking fewer arts, physical education, and health classes. While these subjects account for a relatively large portion of nonacademic credits earned by both groups of students, they were a much larger portion of total credits earned by comparison group students. For example, physical education and health comprised fully 51 percent of the nonacademic credits earned by students in the comparison group, but just 41 percent of credits earned by P-TECH 9-14 students. Likewise, while 21 percent of nonacademic credits earned by comparison group students were in the arts, just 15 percent were for P-TECH 9-14 students. By contrast, 31 percent of nonacademic credits earned by P-TECH 9-14 students were in CTE fields, versus just 14 percent for comparison group students.

Overall, not only were P-TECH 9-14 students earning more nonacademic credits than their comparison group counterparts, they were earning them in subjects aligned with the science, technology, engineering and mathematics (STEM) areas of focus associated with their schools' themes, as well as in the work-based learning component of the model. By contrast, even when comparison group students did engage in CTE course work, the only area where they earned comparatively more credits than P-TECH 9-14 students was in courses in electrical work and other trades, which are more related to older models of vocational education than the newer models of CTE that are showcased in the P-TECH 9-14 model.[19]

Regents Exams

Given that part of the P-TECH 9-14 model is an "early college" model that encourages dual enrollment in CUNY coursework, the study team examined whether students took New York State Regents exams more frequently, and whether they passed those exams with scores that qualified them for CUNY enrollment earlier in their high school careers and at higher levels than students in the comparison group.[20] Table 3.4 illustrates the findings for Regents attempts and pass rates. In each of the first three years of high school, P-TECH 9-14 students attempted more Regents exams than students in comparison schools, and more of them passed the ELA Regents exam with a score qualifying them for enrollment in CUNY coursework than comparison

[18] The human services category largely applies to courses in health care careers.

[19] Rosen, Visher, and Beal (2018).

[20] In New York State, all public high school students must take and pass five Regents exams in order to graduate high school. These exams must be in English language arts, a math subject, science, social studies, and one other in a subject of choice. There is one pass score level required to graduate high school, but CUNY requires a higher passing score on ELA and math exams for students to be eligible to enroll in college-level course work. Any Regents exams taken prior to ninth grade were dropped from the analysis.

Table 3.4

Regents Exam Impacts for P-TECH 9-14 Analytic Sample

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 1					
Cumulative Regents Attempted Y1	2.6	1.9	0.7 ***	0.50	0.003
Cumulative Regents Passed, score of 65+ Y1	1.3	1.1	0.2	0.16	0.142
Passed Math Regents to CUNY standard Y1 (%)	34.4	31.5	2.9	0.07	0.408
Passed ELA Regents to CUNY standard Y1 (%)	8.2	1.4	6.8 *	0.32	0.051
Sample size (total=3,161)	1,479	1,682			
Number of lotteries (total=42)					
Year 2					
Cumulative Regents Attempted Y2	6.4	4.8	1.6 ***	0.54	<.0001
Cumulative Regents Passed, score of 65+ Y2	3.0	2.7	0.4 ***	0.18	0.005
Passed Math Regents to CUNY standard Y2 (%)	42.7	40.0	2.6	0.05	0.448
Passed ELA Regents to CUNY standard Y2 (%)	42.0	25.2	16.8 ***	0.42	<.0001
Sample size (total=2,164)	1,090	1,074			
Number of lotteries (total=29)					
Year 3					
Cumulative Regents Attempted Y3	9.7	7.7	1.9 ***	0.40	0.000
Cumulative Regents Passed, score of 65+ Y3	4.4	4.0	0.4 **	0.14	0.040
Passed Math Regents to CUNY standard Y3 (%)	47.6	40.8	6.8	0.14	0.137
Passed ELA Regents to CUNY standard Y3 (%)	58.4	50.6	7.8 ***	0.16	0.006
Sample size (total=1,203)	529	674			
Number of lotteries (total=15)					

(continued)

Table 3.4 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th Grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

Sample sizes are from the ITT random assignment sample; each measure's data availability can be found in Table A.8.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Regents attempts variables only include Regents exams for which the student received a grade and does not include exams where the student was absent, ill, cheated, or the school misadministered the exam.

students in the same time period. At the end of two years of high school, 42 percent of P-TECH 9-14 students had passed the ELA Regents with a CUNY-qualifying score, compared with 25 percent of comparison group students. By the end of the third year, the gap was smaller but still favored P-TECH 9-14 students.[21] Overall, P-TECH 9-14 students did pass more Regents exams than other students, although this appears to be a function of attempting the tests more frequently. Beginning in the first year of high school, 87 percent of P-TECH 9-14 students attempted at least one Regents exam, compared with 79 percent of comparison group students.[22] However, the greater level of attempts may be due to students retaking exams after passing at the minimum 65 level, in an effort to reach the higher CUNY benchmarks and qualify for dual enrollment. On average, 27 percent of P-TECH 9-14 students retook a math or ELA Regents exam after receiving a 65, compared with 11 percent of comparison students.

Because of these extra attempts, on average, P-TECH 9-14 students passed a smaller proportion of the exams they took. Specifically, they passed 47 percent of exams attempted by the end of the second year, compared with an average of 56 percent of exams taken by comparison group students in the same time period.[23] It's worth noting that despite the STEM focus in the P-TECH 9-14 schools, there are not statistically significant differences in pass rates between P-TECH students and the comparison group on math Regents exams at CUNY-qualifying levels. To be sure, students in this sample had very low baseline math achievement, which may make early attainment of college level math readiness a particular stretch. That said, by the end of the

[21] Any Regents exams taken prior to ninth grade were dropped from the outcome, as these attempts occurred preprogram.

[22] The calculation is available upon request by emailing information@mdrc.org

[23] Figures are derived from Table 3.4, where the average of exams passed at the 65 level is divided by the average of exams attempted for each group.

third year, P-TECH 9-14 students had passed slightly more math Regents exams at the base level score of 65 needed for high school graduation than students in the comparison sample (see Appendix Table A.10)

The ELA Regents tell a different story. According to CUNY staff, most students find passing the ELA tests easier; the pattern of higher ELA pass rates in this sample is similar to that of pass rates for incoming CUNY students overall. These findings indicate that statistically significantly more P-TECH 9-14 students are more prepared to enroll in college-level course work in ELA even by the end of one year of high school, and that difference increased by the end of two years of high school, as seen in Table 3.4. This is important because it indicates that at the end of two years of high school, far more P-TECH 9-14 students were eligible to dual enroll at CUNY than students in the comparison group during the same time period. [24]

Attendance

During the first year of high school, P-TECH 9-14 students do not appear to have attended school more days than students in other schools (see Table 3.5). Although the main impact estimate does appear statistically significant, the result does not hold up to the sensitivity tests that were conducted to explore whether the findings could be confounded by differences in missing data across the program and comparison group (see Appendix A). However, by the end of the second year of high school, P-TECH 9-14 students were statistically significantly more likely to attend high school for more days. In a 180-day school year, P-TECH 9-14 students on average attended three to five more days of school during the second year.[25] By the end of the third year there is no longer a robust, statistically significant difference between groups on attendance.

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[24]Policies related to eligibility shifted over the time periods included in this study, which may impact student overall eligibility for enrollment in CUNY courses in math. For example, in 2015, CUNY required both a passing Regents score and completion of algebra 2 or trigonometry. Students could also have earned eligibility with a 500 or higher math SAT score, a 21 or higher math ACT score, or another CUNY math assessment. In 2017, the policy changed to just include exam passing scores, but not course completion.

[25]The estimates are 1.8 to 3.1 more of a school year. The report team translated this into days by taking 1.8 percent of a 180-day school year, which is 3.24 days at the low end; and 3.1 percent of 180 school days, or 5.58 days at the high end.

Table 3.5

Attendance Impacts for P-TECH 9-14 Analytic Sample

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference		Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 1						
Attendance (180 days) Y1 (%)	78.5	76.6	1.9 *	†	0.08	0.082
Sample size (total=3,161)	1,479	1,682				
Number of lotteries (total=42)						
Year 2						
Attendance (180 days) Y2 (%)	74.3	71.2	3.1 ***		0.11	0.004
Sample size (total=2,164)	1,090	1,074				
Number of lotteries (total=29)						
Year 3						
Attendance (180 days) Y3 (%)	70.6	66.8	3.8 **	†	0.12	0.037
Sample size (total=1,203)	529	674				
Number of lotteries (total=15)						

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners.Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

Sample sizes are from the ITT random assignment sample; each measure's data availability can be found in Table A.8.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

† This result is not robust to the upper-bound test in the bounding exercise. See Technical Appendix for further discussion.

Chapter 4

Discussion and Next Steps

This report provides an early look at the implementation and interim impacts from the evaluation of the New York City P-TECH 9-14 schools, the first rigorous study of the model. It provides background on the development of the model and describes its high school, college, and work-based learning (WBL) components. The report also begins to describe the variations in implementation across the seven schools in the study. The impact findings suggest that students in these schools are meeting the benchmarks the schools are designed to help them achieve. The findings may provide insight into what could predict future successes for these students, many of whom entered ninth grade with weak academic achievement in both English language arts (ELA) and math.

The seven P-TECH 9-14 schools in the report have several features in common, including accelerated schedules, opportunities for college coursework, and WBL activities in an integrated six-year scope and sequence. At the same time, based on interviews with school staff members, it is clear that there is variation across schools in the implementation of the P-TECH 9-14 model. Beyond focusing on different career and technical education (CTE) subjects and college majors, the schools have different ways of supporting and advising their students,.

The schools also have internal variations. Two students in the same school may have very different experiences, depending on the extent and timing of their college courses and their participation in WBL activities. School requirements may also be obstacles to opportunity. Some are structural and set by institutions outside of the P-TECH 9-14 school, such as the need for students to pass Regents exams in order to take college courses, or to have proper paperwork to qualify for a paid internship. Other requirements are more arbitrary and set by the individual high school. For example, students may need a letter of recommendation to take college classes, or they may be required to complete an extensive internship application process. Many of these requirements are in place to ensure that students have the greatest chance of succeeding when they enter the high-stakes environment of an internship or college. However, the requirements also have equity implications, as this means that individual students may have different access to opportunities. The final study report will explore these variations in detail, along with the facilitators and barriers to implementation of the many elements of a P-TECH 9-14 school. It will also examine the differences between P-TECH 9-14 schools and those attended by comparison group students.

The results of this interim report present encouraging early findings about the ways P-TECH 9-14 schools are affecting students' high school experiences and the potential transition to college and career settings.

In particular, the increased accumulation of CTE and other nonacademic credits is evidence that these schools are providing students with greater levels of career-related exposure than students enrolled in other schools. Furthermore, the variety of CTE courses in P-TECH 9-14 schools suggests that these schools are providing different and potentially more modern career experiences. Additionally, the schools are helping students succeed in CTE in ways that do not appear to be at the expense of earning academic credits. The tradeoff that students are making appears to be that they are earning fewer credits in the arts, physical education, and health than their counterparts in other schools, indicating that P-TECH 9-14 students are using their time in high school to accumulate credits in fields related to their target careers.

Positive findings on students passing ELA Regents exams sooner and at CUNY-qualifying levels indicate that the P-TECH 9-14 model is successfully preparing them to take advantage of dual-enrollment opportunities at earlier points in high school than their counterparts in other schools. In addition, P-TECH 9-14 students ended their third year of high school with more Regents passed at the high school graduation level of 65. They also had higher overall credit accumulation, with fewer credits left to earn during the fourth year of high school. This indicates that more P-TECH 9-14 students may be prepared to reach high school graduation than students in the comparison group.

Importantly, these successes are found for a sample representing the lowest- performing students enrolled in their schools, including those that entered with the lowest levels of academic success in eighth grade. The findings indicate that the P-TECH 9-14 school model appears to be meeting the needs of academically low-performing students.

Although this report provides encouraging early evidence about the ability of the P-TECH 9-14 schools to prepare students for the transition to college and career, these are not definitive findings about the overall efficacy of the P-TECH 9-14 model or the success of the students who attend these schools. For example, as of this publication, two of the ninth-grade cohorts included in the analysis sample have yet to complete high school. So while it is encouraging to learn that P-TECH 9-14 students are outperforming their peers on several of the measures most closely tied to the P-TECH 9-14 experience, it is not yet clear how these outcomes will affect dual-enrollment take-up or success, high school graduation, or college degree completion. These questions will be explored in subsequent reports.

From a policy perspective, the findings do highlight ways in which a different kind of high school design can have a positive impact on important secondary school milestones, particularly as they relate to the potential for smoother transitions to college and careers. The final report will also include a cost analysis that estimates how the cost of these schools compares to other programs that may or may not achieve the same results.

Finally, these results should be viewed within the New York City context, which may have implications for the ability to generalize the findings. For example, New York City's rich and varied labor market, as well as its robust public transit system, may give P-TECH 9-14 students and schools access to a larger variety of employer partners and WBL opportunities and the means to take advantage of them than students in other locations.

Future impact and implementation research planned for this study will present a more in-depth comparison of outcome measures across schools, as well as a deeper look at the kinds of school settings experienced by the comparison students. The cost study will provide practical perspective on how these schools use resources toward achieving their desired outcomes.

Appendix A

Additional Information About the Study

More Information About the NYC Public School Lottery

MDRC has a long history of conducting rigorous studies using data from the New York City high school admissions lottery, most notably through an ongoing study of students admitted to the city's "small schools of choice," which have nonselective admissions and serve many disadvantaged young people. Much of the background for this report relies on the understanding of the mechanics of the lottery system that was described and written about in those earlier studies as well as work done by the creators of the New York City high school admissions algorithm.[1]

Students may be entered into a lottery by the admissions algorithm in several ways. For example, if a student lists a P-TECH 9-14 school as their first choice and they meet an admissions category for which they are eligible, that student will be placed into the lottery for the given school that they ranked first if there are more students who meet those criteria than there are available seats.

However, students may also be placed into a lottery if they ranked a P-TECH 9-14 school lower down on their choice list. This can happen in several ways: (1) The student may have been placed into lotteries for higher-ranked schools and lost those lotteries; (2) the student did not compete in any lotteries for the higher-ranked schools because, for example, they were ineligible for admission based on the school's preference categories, such as meeting the GPA or attendance criteria; (3) all the schools ranked higher on the student's list were full by the time the algorithm reached that particular student. Like other researchers who have written extensively about using the New York City high school admissions lottery for rigorous research purposes, the study team included in the analytic sample for this study only students for whom the P-TECH 9-14 lottery was the first one they were placed into and who did not compete in any other lotteries prior to that one. This is because in order for the program and comparison students to be truly comparable in a way that makes the random assignment valid between groups, all students in both groups needed to have the same probability of selection for the analytic sample. Students who competed in earlier lotteries for higher-ranked schools would have different probabilities of being placed into the lotteries of interest for this study, dependent on their chances of admission in the previous lottery. Each prior lottery changes the probability of being placed in the P-TECH 9-14 lottery sample, and thus changes the random nature of the lottery sample. For this reason, students who were placed in other lotteries prior to being placed into the P-TECH 9-14 lottery were not included in the analytic sample.

Sample Exclusions

To create the analytic sample, several categories of students were dropped from the data. Specifically, students who applied to the lottery from private schools in eighth grade were not included, and students who were placed into lotteries with fewer than five students were also dropped from the analysis. This was done because overly small lotteries are more likely to be extremely

[1]Abdulkadiroğlu, Agarwal, and Pathak (2015); Abdulkadiroğlu, Angrist, Narita, and Pathak (2017); Bloom and Unterman (2013); Bloom and Unterman (2014).

unbalanced in terms of the number of students who end up in each assignment condition. Dropping the small lotteries provided assurance that the same lotteries would remain in the analyses and not drop out due to differences in missing outcome data within lotteries. Other students dropped from the sample include those who opted out of the lottery process and those who were ineligible for programs they applied for.

Baseline Equivalence Between the Program and Comparison Group

Based on the slight gender imbalance that was observed across program and comparison groups in the baseline equivalence table, the data were investigated and it appears that this statistically significant difference was primarily driven by several of the special education (SPED) lotteries and one general education lottery that have significant imbalances in male and female admissions, high enough to matter for the overall gender balance of the sample.

When these lotteries were dropped from baseline equivalency analyses, the p-value on the gender difference became nonsignificant. While there does appear to be an imbalance in acceptance rates along gender lines in these lotteries, the imbalance is likely due to random chance as a function of the New York City matching algorithm (which does not consider gender in student assignment), rather than intentional bias. The lotteries in question had gender applicants and acceptances as follows:

Type	Female Applicants	Male Applicants	% of Female Applicants Accepted	% of Male Applicants Accepted
Gen Ed	52	149	7.7%	16.1%
SPED	37	283	8.1%	27.6%

School Cohorts, Sample Sizes, and Stable Sample Analyses

Appendix Table A.1 provides a visual representation of the lottery cohorts by year that were included in the analytic sample. Each cell provides the sample size for each school and year lottery.

P-TECH 9-14 Schools and Cohorts Included in the Analytic Samples

Because of the shifting nature of these cohorts, baseline equivalency analysis on the stable sample was also conducted. The stable sample is defined as the subsample of students that can be followed across all three years of outcomes. This sample is identical to the sample of students included in the Year 3 analysis in the main report. This was done to provide additional assurance that this subsample was balanced, and that the baseline equivalency was not

Appendix Table A.1
P-TECH 9-14 Schools and Cohorts Included in the Analytic Samples

									Analytic Cohorts		
9th- Grade Year	School 1	School 2	School 3	School 4	School 5	School 6	School 7	Total	Year 1 Results	Year 2 Results	Year 3 Results
2013-14	13							13			
2014-15	194	130	154					478			
2015-16	268	179	36	99	121	9		712			
2016-17	183	169	117	117	112	45	218	961			
2017-18	248	141	121	112	171	21	183	997			
Total	906	619	428	328	404	75	401	3161			

found only within the sample of students for whom only one year of outcome data were available, as seen in Appendix Table A.2.

Within this subsample, the same imbalance in female participation is found as in the overall sample, but this is not surprising given that the imbalance was found in a few early year lotteries, as described in the main text. Again, an omnibus test was not significant, providing confidence that the sample is balanced over time.

In addition, to ensure that the impacts on outcomes presented for the Year 1 and Year 2 samples were not driven entirely by impacts from the subsample of students that is stable across all years, impact analyses for Year 1 and Year 2 outcomes were also conducted using the stable sample, as seen in Appendix Table A.3.

Within Year 1 for the stable sample, there are statistically significant differences on both Regents attempts and pass rates at the base pass level, as well as at levels qualifying students for CUNY in both math and English language arts (ELA). There are also statistically significant impacts for both taking and passing career and technical education (CTE) credits.

In Year 2 for this sample, there are statistically significant impacts on all Regents outcomes except passing the math Regents with a CUNY-qualifying score. In Year 2 there are also statistically significant differences in accumulation of CTE credits. Finally, in Year 2 there is also an observed impact for attendance, in which P-TECH 9-14 students have an average attendance rate of 75.4 percent, compared to 71 percent for comparison group students.

The results of the stable sample analysis are similar to those presented for the full sample for each of the individual year cohorts, indicating that the results are not unique to the stable

Appendix Table A.2

Baseline Characteristics of P-TECH 9-14 Analytic Sample: Stable Sample (Cohorts 2013-2015)

Characteristic	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Race/ethnicity (%)					
Hispanic	46.3	47.0	-0.6	-0.01	0.826
Black	41.8	41.7	0.1	0.00	0.985
White	3.4	2.6	0.8	0.05	0.443
Asian	7.0	6.5	0.5	0.02	0.706
Other	1.5	2.3	-0.8	-0.06	0.407
Female (%)	41.8	50.2	-8.4 ***	-0.17	0.005
Median HH income of neighborhood[a]	-0.5	-0.5	0.0	-0.06	0.354
Missing median HH income (%)	0.6	1.2	-0.7	-0.06	0.409
8th-grade ELA test performance level[b]					
Did not meet standards (level 1) (%)	34.2	30.9	3.3	0.07	0.266
Partially met standards (level 2) (%)	50.1	49.2	0.9	0.02	0.784
Fully met standards (level 3) (%)	12.3	14.9	-2.6	-0.07	0.271
Met standards with distinction (level 4) (%)	1.9	1.2	0.7	0.06	0.371
Missing test information (%)	1.5	3.9	-2.4 **	-0.15	0.027
8th-grade Math test performance level[b]					
Did not meet standards (level 1) (%)	39.9	42.2	-2.3	-0.05	0.462
Partially met standards (level 2) (%)	38.4	33.6	4.8	0.10	0.135
Fully met standards (level 3) (%)	9.6	11.6	-2.0	-0.07	0.330
Met standards with distinction (level 4) (%)	1.7	1.9	-0.2	-0.01	0.845
Missing test information (%)	10.4	10.6	-0.2	-0.01	0.909
Flagged as English Language Learner (%)	10.6	10.7	-0.1	0.00	0.966
Missing English Language Learner (%)	0.2	0.1	0.1	0.02	0.744
Enrolled in a charter school in spring of Grade 8 (%)	4.0	3.7	0.3	0.01	0.860
Sample size (total=1,203)	529	674			
Number of lotteries (total=15)					

(continued)

Appendix Table A.2 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2014 school years, as well as data from NYC DOE enrollment files from the 2012-2015 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2015 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

An F test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting p-value is not statistically significant (p-value = 0.206).

[a]Median household income has been z-scored to standardize across census tract and cohort year.

[b]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

sample and are not confounded with the inclusion of additional cohort members in each of the years of outcomes. The exception to this is the stable sample result in Year 1 for passing the math Regents exam to the CUNY standard. This finding indicates that CUNY-standard pass rates in math appear to have been slightly stronger for earlier cohorts of students than for later cohorts.

Students in the Study Sample Compared to All Enrolled Students

Tests were also conducted comparing the sample of students who enrolled in P-TECH 9-14 schools after winning the lottery to the sample of students who received admissions offers to P-TECH 9-14 schools either through a noncompetitive process or through a lottery that was not the first one they competed in.[2]

Appendix Table A.4 indicates that students who enrolled in P-TECH 9-14 after receiving a placement via lottery look somewhat different from students who enrolled in P-TECH 9-14 either not having been placed by lottery or having been placed through a later lottery. Specifically, these students performed significantly lower in both math and ELA in eighth grade. They were more likely to have received the lowest score of “Did Not Meet Standards” on both exams in eighth grade than other students enrolled in the schools. They were more likely to have been an English language learner (ELL) student, and less likely to have been enrolled in a charter school prior to ninth grade.

[2]Note that only 209 students were placed via a lottery that was not their first-choice lottery. The other 1,114 students in this sample received placements through a noncompetitive process.

Appendix Table A.3

Impacts for P-TECH 9-14 Analytic Sample: Stable Sample (Cohorts 2013-2015)

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 1					
Attendance (180 days) Y1 (%)	79.8	77.8	2.0	0.08	0.200
Cumulative Total Credits Attempted Y1[a]	14.3	13.0	1.3 **	0.27	0.015
Cumulative Total Credits Earned Y1[a]	12.0	11.3	0.8 **	0.15	0.044
Cumulative Academic Credits Attempted Y1	9.9	10.1	-0.2	-0.06	0.745
Cumulative Academic Credits Earned Y1	8.0	8.7	-0.6	-0.16	0.159
Cumulative CTE/Other Credits Attempted Y1[a]	3.2	1.6	1.5 ***	0.97	<.0001
Cumulative CTE/Other Credits Earned Y1[a]	2.9	1.4	1.4 ***	0.95	<.0001
Cumulative Regents Attempted Y1	3.0	1.8	1.2 ***	0.92	0.003
Cumulative Regents Passed, score of 65+ Y1	1.4	1.0	0.4 **	0.39	0.029
Passed Math Regents to CUNY standard Y1 (%)	24.2	17.3	6.9 *	0.16	0.076
Passed ELA Regents to CUNY standard Y1 (%)	12.1	-0.5	12.6 **	0.58	0.011
Newly enrolled in a charter school Y1 (%)	3.4	8.2	-4.8 *	-0.18	0.084
Left the NYC public school system Y1 (%)	4.3	5.5	-1.1	-0.05	0.379
Sample size (total=1,203)	529	674			
Number of lotteries (total=15)					

(continued)

Appendix Table A.3 (continued)

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 2					
Attendance (180 days) Y2 (%)	75.4	71.0	4.3 ***	0.15	0.003
Cumulative Total Credits Attempted Y2[a]	28.8	26.0	2.9 ***	0.30	0.004
Cumulative Total Credits Earned Y2[a]	23.6	21.6	2.0 ***	0.20	0.005
Cumulative Academic Credits Attempted Y2	20.4	20.3	0.1	0.01	0.920
Cumulative Academic Credits Earned Y2	16.2	16.6	-0.3	-0.04	0.605
Cumulative CTE/Other Credits Attempted Y2[a]	6.0	3.2	2.8 ***	1.06	<.0001
Cumulative CTE/Other Credits Earned Y2[a]	5.3	2.8	2.5 ***	0.99	<.0001
Cumulative Regents Attempted Y2	6.8	4.8	2.1 ***	0.70	<.0001
Cumulative Regents Passed, score of 65+ Y2	3.1	2.5	0.6 ***	0.29	0.002
Passed Math Regents to CUNY standard Y2 (%)	37.1	31.4	5.6	0.12	0.238
Passed ELA Regents to CUNY standard Y2 (%)	45.0	23.3	21.7 ***	0.54	<.0001
Newly enrolled in a charter school Y2 (%)	0.2	0.5	-0.4	-0.05	0.314
Continuing enrollment in a charter school Y2 (%)	3.0	7.8	-4.7 *	-0.18	0.054
Left the NYC public school system Y2 (%)	6.4	8.7	-2.3	-0.08	0.138
Sample size (total=1,203)	529	674			
Number of lotteries (total=15)					

(continued)

Appendix Table A.3 (continued)

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference		Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 3						
Attendance (180 days) Y3 (%)	70.6	66.8	3.8 **	†	0.12	0.037
Cumulative Total Credits Attempted Y3[a]	42.2	38.3	4.0 ***		0.27	0.004
Cumulative Total Credits Earned Y3[a]	33.6	31.6	2.0 **		0.13	0.023
Cumulative Academic Credits Attempted Y3	30.0	29.6	0.4		0.04	0.733
Cumulative Academic Credits Earned Y3	23.2	24.0	-0.8		-0.07	0.295
Cumulative CTE/Other Credits Attempted Y3[a]	8.4	5.0	3.4 ***		0.87	<.0001
Cumulative CTE/Other Credits Earned Y3[a]	7.3	4.4	2.8 ***		0.74	<.0001
Cumulative Regents Attempted Y3	9.7	7.7	1.9 ***		0.40	0.000
Cumulative Regents Passed, score of 65+ Y3	4.4	4.0	0.4 **		0.14	0.040
Passed Math Regents to CUNY standard Y3 (%)	47.6	40.8	6.8		0.14	0.137
Passed ELA Regents to CUNY standard Y3 (%)	58.4	50.6	7.8 ***		0.16	0.006
Newly enrolled in a charter school Y3 (%)	0.6	0.1	0.5		0.07	0.239
Continuing enrollment in a charter school Y3 (%)	3.0	7.0	-4.0 *		-0.16	0.094
Left the NYC public school system Y3 (%)	8.5	11.4	-2.9		-0.09	0.119
Sample size (total=1,203)	529	674				
Number of lotteries (total=15)						

(continued)

Appendix Table A.3 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Sample sizes are from the ITT random assignment sample; each measure's data availability can be found in Table A.8.

Attempted credits measures include credits for all courses for which the student received either a passing or failing grade (so does not include courses awarded no grade).

Regents attempts variables only include Regents exams for which the student received a grade and does not include exams where the student was absent, ill, cheated, or the school misadministered the exam.

[a]Cumulative Total Credits measures include all credits attempted or earned including Physical Education and Functional Code credits, while Cumulative CTE/Other Credits measures exclude Physical Education and Functional Code credits.

† This result is not robust to the upper-bound test in the bounding exercise. See Technical Appendix for further discussion.

These differences mean that the results of this study should be interpreted with some caution and are only valid for the population of students included in the analytic sample, not for the population of students enrolled in P-TECH 9-14 schools overall.

The Model

The same impact model was used for all outcomes described in the report. The primary equation for doing so was:

$$Y_i = \sum_{j=1}^{J} \pi_j \cdot I_{ji} + \beta_0 \cdot T_{ji} + \theta_M \cdot S_{Mi} + \theta_R \cdot S_{Ri} + \theta_G \cdot S_{Gi} + \varepsilon_i \qquad (1)$$

where Y_i is a relevant outcome for student *i*; *T* is a lottery winner indicator equal to 1 if student *i* wins lottery *j* and 0 otherwise; *I* is a vector of lottery indicators equal to 1 for lottery *j* and 0 otherwise;[3] S_{Mi} and S_{Ri} are student *i*'s eighth-grade scores on New York State tests of math and reading (included for precision); S_{Gi} is an indicator for student gender and ε_i is a random

[3]Lotteries with fewer than five lottery winners or lottery losers were dropped from the sample. In addition, because each school reserves a certain number of seats for special education students, students with special education status are admitted through separate lotteries. For each school and year, lotteries for both general and special education were identified separately, and both were included in the model.

Appendix Table A.4

Baseline Characteristics of P-TECH 9-14 Analytic Sample Who Competed in a First Lottery vs. Other P-TECH 9-14 Offer Students

Characteristic	P-TECH Lottery Winners	Other P-TECH Offerees[a]	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Race/ethnicity (%)					
Hispanic	44.8	41.8	2.9	0.06	0.153
Black	40.2	42.8	-2.6	-0.05	0.184
White	4.7	4.5	0.2	0.01	0.836
Asian	8.6	9.7	-1.1	-0.04	0.383
Other	1.7	1.1	0.6	0.04	0.341
Female (%)	37.7	39.4	-1.7	-0.03	0.412
Median HH income of neighborhood[b]	-0.5	-0.4	0.0	-0.06	0.131
Missing median HH income (%)	2.6	3.4	-0.8	-0.05	0.283
8th-grade ELA test performance level[c]					
Did not meet standards (level 1) (%)	26.1	16.1	10.0 ***	0.24	<.0001
Partially met standards (level 2) (%)	44.8	44.7	0.0	0.00	0.994
Fully met standards (level 3) (%)	21.6	28.5	-7.0 ***	-0.16	0.000
Met standards with distinction (level 4) (%)	4.1	6.1	-2.1 **	-0.10	0.038
Missing test information (%)	3.5	4.5	-0.9	-0.05	0.282
8th-grade math test performance level[c]					
Did not meet standards (level 1) (%)	36.9	24.9	12.0 ***	0.25	<.0001
Partially met standards (level 2) (%)	35.1	38.8	-3.7 *	-0.08	0.094
Fully met standards (level 3) (%)	11.7	15.4	-3.7 **	-0.11	0.015
Met standards with distinction (level 4) (%)	3.2	4.0	-0.7	-0.04	0.392
Missing test information (%)	13.0	16.8	-3.8 **	-0.11	0.020
Flagged as English Language Learner (%)	10.3	7.5	2.8 **	0.09	0.040
Missing English Language Learner (%)	6.6	8.4	-1.8	-0.07	0.121
Flagged as Special Education (%)	18.2	17.3	0.9	0.02	0.613
Enrolled in a charter school in spring of Grade 8 (%)	8.1	11.7	-3.6 ***	-0.12	0.008
Sample size (total=2,802)	1,479	1,323			
Number of cohorts (total=24)					

(continued)

Appendix Table A.4 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and other P-TECH 9-14 offerees are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each cohort plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and other P-TECH 9-14 offerees. The value for other P-TECH 9-14 offerees equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and other P-TECH 9-14 offerees.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

An F test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting p-value is statistically significant (p-value <.0001).

[a]Other P-TECH offerees includes students who won competitive lotteries for P-TECH 9-14 programs which were not their first lottery competed in, and students who matched to P-TECH 9-14 programs without going through a competitive lottery.

[b]Median household income has been z-scored to standardize across census tract and cohort year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

error that is clustered by the school that students entered after their lottery. The coefficient β_0 identifies the effect of winning a lottery on student outcomes. The standard error of $\hat{\beta}_0$ and the associated t-statistic identify statistical significance.[4] Standard errors were clustered by student's grade 9 school.

In addition to the ITT analysis, Complier Average Causal Estimate (CACE) analyses were also conducted, in which the estimates were scaled by the number of compliers in the treatment group.

To estimate impacts for students who actually enroll in P-TECH 9-14, a two-stage least squares analyses (2SLS) was conducted. The 2SLS model included a separate instrument for each lottery. In effect, this model uses 2SLS to estimate the effect of ever enrolling in P-TECH for each lottery and pools resulting estimates across lotteries. This approach has been used for past analyses of randomized experiments and lottery-based studies.[5]

The first stage will be specified as:

$$E_i = \sum_{j=1}^{J} \pi_j \cdot I_{ji} + \sum_{j=1}^{J} \gamma_j \cdot T_i \cdot I_{ji} + \theta_M \cdot S_{Mi} + \theta_R \cdot S_{Ri} + w_i \qquad (2)$$

[4] A linear probability model was employed for both the binary and continuous outcomes.

[5]Abdulkadiroğlu et al. (2011); Bloom and Unterman (2013); Gennetian, Morris, Bos, and Bloom (2005); Ludwig and Kling (2007)

where Ei is a P-TECH 9-14 enrollment indicator equal to 1 if student i ever enrolled in P-TECH 9-14 and 0 otherwise, and all other terms are defined as in equation (1). Notably, as described, there is a separate instrument for each lottery.

The second stage equation will be specified as:

$$Y_i = \sum_{j=1}^{J} \alpha_j \cdot I_{ji} + \delta \cdot \hat{E}_i + \phi_M \cdot S_{Mi} + \phi_R \cdot S_{Ri} + e_i \quad (3)$$

where $\hat{E}_i$ equals the fitted value of the enrollment outcome from the first-stage equation, and e_i is a random error that is clustered by the school that students entered after their lottery. The estimated value of δ is a consistent estimate of the average effect of enrolling in a P-TECH 9-14 for target P-TECH 9-14 enrollees.

Note, however, that the crossover rates from control to treatment were low among the sample of students. For each year, approximately three percent of the control sample was able to enroll in a P-TECH 9-14 school, as seen in Appendix Table A.5.

The CACE estimates, which utilize a two-stage least squares model (2SLS), shown in Appendix Table A.6, had a robust first stage, with 42 instruments (one for each lottery) and resulted in an F-Test of > 1000, which far exceeds the threshold recommended by the What Works Clearinghouse for instrument strength.[6]

Variables Used in Analysis

Appendix Table A.7 provides information on how variables used in the model were coded.

Missing Data Robustness Checks

As described in the main report, there were nonrandom patterns of missing data associated with charter school enrollment for some variables which were systematically not reported to the district for students in charter schools; thus they are not included in the administrative records that were used for these analyses. For outcomes that were affected by these missing data, in addition to the impact analysis, the study team also conducted some bounding exercises, in which the highest and lowest possible values for each outcome were imputed for all charter school students who were missing outcomes data, in order to obtain high and low "bounds" around what the impact estimate could be.

At the high end, all charter students were assumed to have earned the modal number of credits earned by students in the analysis sample, and at the low end, the assumption was that these same students had earned no credits in any years of high school. For the attendance outcomes, at the high end, all charter school students with missing data were assumed to have had

[6]What Works Clearinghouse (2017).

Appendix Table A.5

Active Student Sample Crossover Rates for P-TECH 9-14 Analytic Sample

Outcome	P-TECH Lottery Winners	Comparison Group Members
Year 1		
Compliance rate (%)	83.4	97.2
Crossover rate (%)	16.6	2.8
Sample size (total=2,985)	1,400	1,585
Number of lotteries (total=42)		
Year 2		
Compliance rate (%)	83.9	96.6
Crossover rate (%)	16.1	3.4
Sample size (total=1,996)	1,013	983
Number of lotteries (total=29)		
Year 3		
Compliance rate (%)	85.1	96.7
Crossover rate (%)	14.9	3.3
Sample size (total=1,067)	484	583
Number of lotteries (total=15)		

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) enrollment files from the 2012-2017 school years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Sample sizes reflect the total active student sample for each year, as compliance and cross-over rates are calculated based on students active within each year only.

Appendix Table A.6

CACE Estimates for P-TECH 9-14 Analytic Sample

Outcome	CACE[a] Estimated Difference	P-TECH Winners N Obs[b]	Comparison Group N Obs[b]
Year 1			
Attendance (180 days) Y1 (%)	2.4	1,406	1,523
Cumulative Total Credits Attempted Y1[c]	0.9	1,414	1,538
Cumulative Total Credits Earned Y1[c]	0.6	1,414	1,538
Cumulative Academic Credits Attempted Y1	-0.5	1,414	1,538
Cumulative Academic Credits Earned Y1	-0.7	1,414	1,538
Cumulative CTE/Other Credits Attempted Y1[c]	1.4	1,414	1,538
Cumulative CTE/Other Credits Earned Y1[c]	1.3	1,414	1,538
Cumulative Regents Attempted Y1	0.9	1,479	1,682
Cumulative Regents Passed, score of 65+ Y1	0.2	1,479	1,682
Passed Math Regents to CUNY standard Y1 (%)	3.6	1,479	1,682
Passed ELA Regents to CUNY standard Y1 (%)	8.4	1,479	1,682
Sample Size (total=3,161)			
Number of lotteries (total=42)			
Year 2			
Attendance (180 days) Y2 (%)	3.9	1,044	983
Cumulative Total Credits Attempted Y2[c]	2.3	1,054	1,000
Cumulative Total Credits Earned Y2[c]	1.7	1,054	1,000
Cumulative Academic Credits Attempted Y2	-0.7	1,054	1,000
Cumulative Academic Credits Earned Y2	-1.0	1,054	1,000
Cumulative CTE/Other Credits Attempted Y2[c]	3.2	1,054	1,000
Cumulative CTE/Other Credits Earned Y2[c]	2.9	1,054	1,000
Cumulative Regents Attempted Y2	2.0	1,090	1,074
Cumulative Regents Passed, score of 65+ Y2	0.5	1,090	1,074
Passed Math Regents to CUNY standard Y2 (%)	3.3	1,090	1,074
Passed ELA Regents to CUNY standard Y2 (%)	20.8	1,090	1,074
Sample Size (total=2,164)			
Number of lotteries (total=29)			

(continued)

Appendix Table A.6 (continued)

Outcome	CACE Estimated Difference	P-TECH Winners N Obs	Comparison Group N Obs
Year 3			
Attendance (180 days) Y3 (%)	4.6	511	624
Cumulative Total Credits Attempted Y3[c]	4.8	515	640
Cumulative Total Credits Earned Y3[c]	2.4	515	640
Cumulative Academic Credits Attempted Y3	0.5	515	640
Cumulative Academic Credits Earned Y3	-0.9	515	640
Cumulative CTE/Other Credits Attempted Y3[c]	4.2	515	640
Cumulative CTE/Other Credits Earned Y3[c]	3.5	515	640
Cumulative Regents Attempted Y3	2.4	529	674
Cumulative Regents Passed, score of 65+ Y3	0.5	529	674
Passed Math Regents to CUNY standard Y3 (%)	8.4	529	674
Passed ELA Regents to CUNY standard Y3 (%)	9.5	529	674
Sample Size (total=1,203)			
Number of lotteries (total=15)			

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Attempted credits measures include credits for all courses for which the student received either a passing or failing grade (so does not include courses awarded no grade).

Regents attempts variables only include Regents exams for which the student received a grade and does not include exams where the student was absent, ill, cheated, or the school misadministered the exam.

[a]Complier Average Causal Estimate (CACE) analyses are estimates scaled by the number of compliers in the treatment group.

[b]Number of Observations.

[c]Cumulative Total Credits measures include all credits attempted or earned including Physical Education and Functional Code credits, while Cumulative CTE/Other Credits measures exclude Physical Education and Functional Code credits.

Appendix Table A.7

List of Covariates and Outcomes for Baseline and Impacts Models

Covariates				
Variable	Definiton	Range	Mean	Deviation
Female	Flag for female gender	0,1	0.37	0.48
Asian Race/Ethnicity	Flag for Asian race/ethnicity	0,1	0.07	0.25
Black Race/Ethnicity	Flag for Black race/ethnicity	0,1	0.45	0.50
Hispanic Race/Ethnicity	Flag for Hispanic race/ethnicity	0,1	0.43	0.50
Other Race/Ethnicity	Flag for Other race/ethnicity	0,1	0.02	0.13
White Race/Ethnicity	Flag for White race/ethnicity	0,1	0.03	0.18
Median HH income of neighborhood	Standardized (z-scored) median household income from ACS data	-1.7 - 4.9	-0.47	0.65
Missing Median HH income	Missing Median Household income from ACS data	0,1	0.03	0.17
ELA Level 1	Flag for 8th Grade ELA standardized test performance Level 1: Did not meet standards	0,1	0.28	0.45
ELA Level 2	Flag for 8th Grade ELA standardized test performance Level 2: Partially met standards	0,1	0.46	0.50
ELA Level 3	Flag for 8th Grade ELA standardized test performance Level 3: Fully met standards	0,1	0.22	0.41

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
ELA Level 4	Flag for 8th Grade ELA standardized test performance Level 4: Met standards with distinction	0,1	0.04	0.19
Missing ELA test	Flag for Missing 8th Grade ELA standardized test information	0,1	0.04	0.20
Math Level 1	Flag for 8th Grade Math standardized test performance Level 1: Did not meet standards	0,1	0.45	0.50
Math Level 2	Flag for 8th Grade Math standardized test performance Level 2: Partially met standards	0,1	0.39	0.49
Math Level 3	Flag for 8th Grade Math standardized test performance Level 3: Fully met standards	0,1	0.12	0.33
Math Level 4	Flag for 8th Grade Math standardized test performance Level 4: Met standards with distinction	0,1	0.04	0.19
Missing Math test	Flag for Missing 8th Grade Math standardized test information	0,1	0.13	0.34
English Language Learner (ELL)	Flag for English language learner	0,1	0.11	0.31
Missing ELL status	Flag for Missing English language learner status	0,1	0.06	0.24
Enrolled in Charter School	Flag for enrolled in a charter school in spring of 8th Grade	0,1	0.09	0.29
Attendance, percent of 180 days, Year 1	Attendance rate as percent days attended out of 180 days in first program year	0 - 97.2	77.2	24.0
Attendance, percent of 180 days, Year 2	Attendance rate as percent days attended out of 180 days in second program year	0 - 95	72.2	27.2

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
Attendance, percent of 180 days, Year 3	Attendance rate as percent days attended out of 180 days in third program year	0 - 97.8	67.3	31.0
Cumulative Total Credits Attempted, Year 1	Total credits attempted, cumulative through first program year	0 - 25.2	13.4	4.5
Cumulative Total Credits Attempted, Year 2	Total credits attempted, cumulative through second program year	0 - 46.1	26.9	8.8
Cumulative Total Credits Attempted, Year 3	Total credits attempted, cumulative through third program year	0 - 69	39.8	14.1
Cumulative Total Credits Earned, Year 1	Total credits earned, cumulative through first program year	0 - 21	11.4	4.9
Cumulative Total Credits Earned, Year 2	Total credits earned, cumulative through second program year	0 - 43.5	21.9	9.7
Cumulative Total Credits Earned, Year 3	Total credits earned, cumulative through third program year	0 - 64.4	31.8	14.7
Cumulative Academic Credits Attempted, Year 1	Academic credits attempted, cumulative through first program year	0 - 22	9.8	3.7
Cumulative Academic Credits Attempted, Year 2	Academic credits attempted, cumulative through second program year	0 - 35	19.7	6.7
Cumulative Academic Credits Attempted, Year 3	Academic credits attempted, cumulative through third program year	0 - 53	29.2	10.6
Cumulative Academic Credits Earned, Year 1	Academic credits earned, cumulative through first program year	0 - 18	8.2	3.9

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
Cumulative Academic Credits Earned, Year 2	Academic credits earned, cumulative through second program year	0 - 32	15.7	7.4
Cumulative Academic Credits Earned, Year 3	Academic credits earned, cumulative through third program year	0 - 42	22.8	11.0
Cumulative CTE/Other Credits Attempted, Year 1	CTE/Other credits attempted, cumulative through first program year	0 - 8	2.3	1.8
Cumulative CTE/Other Credits Attempted, Year 2	CTE/Other credits attempted, cumulative through second program year	0 - 14.5	4.7	3.1
Cumulative CTE/Other Credits Attempted, Year 3	CTE/Other credits attempted, cumulative through third program year	0 - 20	6.8	4.6
Cumulative CTE/Other Credits Earned, Year 1	CTE/Other credits earned, cumulative through first program year	0 - 8	2.1	1.8
Cumulative CTE/Other Credits Earned, Year 2	CTE/Other credits earned, cumulative through second program year	0 - 14.5	4.1	3.0
Cumulative CTE/Other Credits Earned, Year 3	CTE/Other credits earned, cumulative through third program year	0 - 20	5.9	4.4
Cumulative Regents Exams Attempted, Year 1	Total Regents exams attempted, cumulative through first program year	0 - 14	2.2	1.7
Cumulative Regents Exams Attempted, Year 2	Total Regents exams attempted, cumulative through second program year	0 - 25	5.5	3.4

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
Cumulative Regents Exams Attempted, Year 3	Total Regents exams attempted, cumulative through third program year	0 - 34	8.5	5.2
Cumulative Regents Exams Passed, Year 1	Total Regents exams passed (score of 65+), cumulative through first program year	0 - 7	1.2	1.2
Cumulative Regents Exams Passed, Year 2	Total Regents exams passed (score of 65+), cumulative through second program year	0 - 13	2.7	2.2
Cumulative Regents Exams Passed, Year 3	Total Regents exams passed (score of 65+), cumulative through third program year	0 - 17	4.0	3.0
Passed Math Regents to CUNY Standard, Year 1	Flag for passed 1+ Math Regents to the CUNY admission standard, cumulative through first program year	0,1	0.31	0.46
Passed Math Regents to CUNY Standard, Year 2	Flag for passed 1+ Math Regents to the CUNY admission standard, cumulative through second program year	0,1	0.41	0.49
Passed Math Regents to CUNY Standard, Year 3	Flag for passed 1+ Math Regents to the CUNY admission standard, cumulative through third program year	0,1	0.45	0.50
Passed ELA Regents to CUNY Standard, Year 1	Flag for passed 1+ ELA Regents to the CUNY admission standard, cumulative through first program year	0,1	0.06	0.24
Passed ELA Regents to CUNY Standard, Year 2	Flag for passed 1+ ELA Regents to the CUNY admission standard, cumulative through second program year	0,1	0.31	0.46
Passed ELA Regents to CUNY Standard, Year 3	Flag for passed 1+ ELA Regents to the CUNY admission standard, cumulative through third program year	0,1	0.52	0.50

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
Newly enrolled in a Charter School, Year 1	Flag for newly enrolled in a charter school in first year in the program	0,1	0.08	0.26
Newly enrolled in a Charter School, Year 2	Flag for newly enrolled in a charter school in second year in the program	0,1	0.01	0.08
Newly enrolled in a Charter School, Year 3	Flag for newly enrolled in a charter school in third year in the program	0,1	0.00	0.07
Continuing enrollment in a Charter School, Year 2	Flag for continuous enrollment a charter school by second year in the program	0,1	0.06	0.23
Continuing enrollment in a Charter School, Year 3	Flag for continuous enrollment a charter school by third year in the program	0,1	0.05	0.22
Inactive, Year 1	Flag for inactive status in NYC DOE in first year in the program	0,1	0.06	0.23
Inactive, Year 2	Flag for inactive status in NYC DOE in second year in the program	0,1	0.08	0.27
Inactive, Year 3	Flag for inactive status in NYC DOE in third year in the program	0,1	0.11	0.32
Missing Attendance, percent of 180 days, Year 1	Flag for missing attendance rate as percent days attended out of 180 days in first program year	0,1	0.12	0.33
Missing Attendance, percent of 180 days, Year 2	Flag for missing attendance rate as percent days attended out of 180 days in second program year	0,1	0.14	0.34
Missing Attendance, percent of 180 days, Year 3	Flag for missing attendance rate as percent days attended out of 180 days in third program year	0,1	0.16	0.37

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
Missing Cumulative Total Credits Attempted, Year 1	Flag for missing total credits attempted, cumulative through first program year	0,1	0.12	0.33
Missing Cumulative Total Credits Attempted, Year 2	Flag for missing total credits attempted, cumulative through second program year	0,1	0.11	0.31
Missing Cumulative Total Credits Attempted, Year 3	Flag for missing total credits attempted, cumulative through third program year	0,1	0.10	0.30
Missing Cumulative Total Credits Earned, Year 1	Flag for missing total credits earned, cumulative through first program year	0,1	0.12	0.33
Missing Cumulative Total Credits Earned, Year 2	Flag for missing total credits earned, cumulative through second program year	0,1	0.11	0.31
Missing Cumulative Total Credits Earned, Year 3	Flag for missing total credits earned, cumulative through third program year	0,1	0.11	0.31
Missing Cumulative Academic Credits Attempted, Year 1	Flag for missing academic credits attempted, cumulative through first program year	0,1	0.12	0.33
Missing Cumulative Academic Credits Attempted, Year 2	Flag for missing academic credits attempted, cumulative through second program year	0,1	0.11	0.31
Missing Cumulative Academic Credits Attempted, Year 3	Flag for missing academic credits attempted, cumulative through third program year	0,1	0.10	0.30
Missing Cumulative Academic Credits Earned, Year 1	Flag for missing academic credits earned, cumulative through first program year	0,1	0.12	0.33
Missing Cumulative Academic Credits Earned, Year 2	Flag for missing academic credits earned, cumulative through second program year	0,1	0.11	0.31

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
Missing Cumulative Academic Credits Earned, Year 3	Flag for missing academic credits earned, cumulative through third program year	0,1	0.11	0.31
Missing Cumulative CTE/Other Credits Attempted, Year 1	Flag for missing CTE/Other credits attempted, cumulative through first program year	0,1	0.13	0.33
Missing Cumulative CTE/Other Credits Attempted, Year 2	Flag for missing CTE/Other credits attempted, cumulative through second program year	0,1	0.11	0.32
Missing Cumulative CTE/Other Credits Attempted, Year 3	Flag for missing CTE/Other credits attempted, cumulative through third program year	0,1	0.12	0.32
Missing Cumulative CTE/Other Credits Earned, Year 1	Flag for missing CTE/Other credits earned, cumulative through first program year	0,1	0.13	0.33
Missing Cumulative CTE/Other Credits Earned, Year 2	Flag for missing CTE/Other credits earned, cumulative through second program year	0,1	0.12	0.32
Missing Cumulative CTE/Other Credits Earned, Year 3	Flag for missing CTE/Other credits earned, cumulative through third program year	0,1	0.12	0.33
Missing Cumulative Regents Exams Attempted, Year 1	Flag for missing total Regents exams attempted, cumulative through first program year	0,1	0.00	0.00
Missing Cumulative Regents Exams Attempted, Year 2	Flag for missing total Regents exams attempted, cumulative through second program year	0,1	0.00	0.00
Missing Cumulative Regents Exams Attempted, Year 3	Flag for missing total Regents exams attempted, cumulative through third program year	0,1	0.00	0.00

(continued)

Appendix Table A.7 (continued)

Covariates				
Variable	Definiton	Range	Mean	Deviation
Missing Cumulative Regents Exams Passed, Year 1	Flag for missing total Regents exams passed (score of 65+), cumulative through first program year	0,1	0.00	0.00
Missing Cumulative Regents Exams Passed, Year 2	Flag for missing total Regents exams passed (score of 65+), cumulative through second program year	0,1	0.00	0.00
Missing Cumulative Regents Exams Passed, Year 3	Flag for missing total Regents exams passed (score of 65+), cumulative through third program year	0,1	0.00	0.00

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

the average attendance rate for those schools, which is published by the New York State Education Department[7] and which was matched at the school level; at the low end, it was assumed that these students never attended school. For the CTE course-credit outcomes, at the high end, the charter students were assumed to have earned the modal value of these courses taken by program group students, and at the low end it was assumed that charter school students took no CTE courses.

For outcomes where the high-bound estimate was not statistically significant but the standard estimate (that is, the estimate with the missing outcomes data) was, for purposes of discussion in the main text the result was not considered significant, and the results in the tables in the main text include a symbol to flag these results. However, in cases where both the high-bound estimate and the standard estimate are both significant, the result is considered significant.

Statistically significant differences in missing data rates for students in program and comparison groups were not found for the Year 1 sample. In the Year 2 sample there are statistically significant differences in missing data rates for attendance, and in both academic and CTE and other nonacademic credits. Specifically, for attendance, 4.7 percentage points more comparison group students were missing attendance data than students in the program group. For the credit outcomes, the difference was 4.4 percentage points. For the Year 3 sample across groups there was a statistically significant difference in missing attendance data rates of 7.8 percentage points; according to the What Works Clearinghouse Handbook, tolerable levels of missing data for 15 percent attrition or less are between five and six percent. However, the figures discussed here (Appendix Table A.8) are for missing data rates for students who remained in New York City public schools of some kind (that is, regular public and charter), and should be combined with the "inactive rates" for each sample reported in the main text, for purposes of understanding the potential for attrition bias.[8]

Results of the bounding exercises are presented in Appendix Table A.9.

Additional Regents Exam Analysis

The main narrative presents analyses of Regents exam taking that includes the following outcomes: the number of Regents exams taken and passed with a 65 or higher; and the percentage of students who pass the Regents math and ELA exams with a CUNY-qualifying score. Additional analyses were also conducted that show the number of exams both taken and passed in each of the three follow-up years, by math and ELA subject. Results are displayed in Appendix Table A.10.

[7]Attendance data were sourced from the annual School Report Card database. NYSED (2019)
[8]What Works Clearinghouse (2017)

Appendix Table A.8

Outcome Impacts Missing Rates for P-TECH 9-14 First Lottery Participants: Intent to Treat Sample

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 1					
Missing Attendance (180 days) Y1 (%)	9.4	13.1	-3.7	-0.11	0.154
Missing Cumul.Total Credits Attempted Y1 (%)	9.7	13.7	-4.0	-0.11	0.123
Missing Cumul. Total Credits Earned Y1 (%)	9.7	13.7	-4.0	-0.11	0.123
Missing Cumul. Academic Credits Attempted Y1 (%)	9.7	13.7	-4.0	-0.11	0.123
Missing Cumul. Academic Credits Earned Y1 (%)	9.7	13.7	-4.0	-0.11	0.123
Missing Cumul. CTE/Other Credits Attempted Y1 (%)	9.7	13.7	-4.0	-0.11	0.123
Missing Cumul. CTE/Other Credits Earned Y1 (%)	9.7	13.7	-4.0	-0.11	0.123
Missing Cumul. Regents Attempted Y1 (%)	0.0	0.0	0.0	.	.
Missing Cumul. Regents Passed, score of 65+ Y1 (%)	0.0	0.0	0.0	.	.
Sample size (total=3,161)	1,479	1,682			
Number of lotteries (total=42)					

(continued)

CTE Course Subjects and Coding

Appendix Table A.11 offers descriptive analysis of the CTE and other nonacademic courses that students in the program and comparison groups enrolled in, by subject.

Appendix Table A.8 (continued)

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 2					
Missing Attendance (180 days) Y2 (%)	11.0	15.7	-4.7 *	-0.13	0.068
Missing Cumul.Total Credits Attempted Y2 (%)	8.3	12.8	-4.4 **	-0.13	0.046
Missing Cumul. Total Credits Earned Y2 (%)	8.3	12.8	-4.4 **	-0.13	0.046
Missing Cumul. Academic Credits Attempted Y2 (%)	8.3	12.8	-4.4 **	-0.13	0.046
Missing Cumul. Academic Credits Earned Y2 (%)	8.3	12.8	-4.4 **	-0.13	0.046
Missing Cumul. CTE/Other Credits Attempted Y2 (%)	8.3	12.8	-4.4 **	-0.13	0.046
Missing Cumul. CTE/Other Credits Earned Y2 (%)	8.3	12.8	-4.4 **	-0.13	0.046
Missing Cumul. Regents Attempted Y2 (%)	0.0	0.0	0.0	.	.
Missing Cumul. Regents Passed, score of 65+ Y2 (%)	0.0	0.0	0.0	.	.
Sample size (total=2,164)	1,090	1,074			
Number of lotteries (total=29)					

(continued)

Appendix Table A.8 (continued)

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference		Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 3						
Missing Attendance (180 days) Y3 (%)	11.2	18.9	-7.8	***	-0.19	0.007
Missing Cumul.Total Credits Attempted Y3 (%)	7.6	11.4	-3.9		-0.12	0.125
Missing Cumul. Total Credits Earned Y3 (%)	7.6	11.4	-3.9		-0.12	0.125
Missing Cumul. Academic Credits Attempted Y3 (%)	7.6	11.4	-3.9		-0.12	0.125
Missing Cumul. Academic Credits Earned Y3 (%)	7.6	11.4	-3.9		-0.12	0.125
Missing Cumul. CTE/Other Credits Attempted Y3 (%)	7.6	11.4	-3.9		-0.12	0.125
Missing Cumul. CTE/Other Credits Earned Y3 (%)	7.6	11.4	-3.9		-0.12	0.125
Missing Cumul. Regents Earned Y3 (%)	0.0	0.0	0.0		.	.
Missing Cumul. Regents Passed, score of 65+ Y3 (%)	0.0	0.0	0.0		.	.
Sample size (total=1,203)	529	674				
Number of lotteries (total=15)						

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Appendix Table A.9

Impacts for P-TECH 9-14 Analytic Sample: Bounded Estimates

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	P-Value for Estimated Difference	P-TECH Winners N Obs[a]	Comparison Group N Obs[a]
Year 1						
Attendance (180 days) Y1 (%)	78.5	76.6	1.9 *	0.082	1,406	1,523
High imputed estimate	79.3	78.2	1.2	0.216	1,474	1,670
Low imputed estimate	74.9	70.2	4.7 *	0.056	1,474	1,670
Cumulative Total Credits Attempted Y1[b]	13.7	12.9	0.8 *	0.059	1,414	1,538
High imputed estimate	13.7	13.0	0.7 *	0.077	1,479	1,682
Low imputed estimate	13.1	11.8	1.2 **	0.045	1,479	1,682
Cumulative Total Credits Earned Y1[b]	11.7	11.2	0.5	0.113	1,414	1,538
High imputed estimate	11.8	11.4	0.4	0.151	1,479	1,682
Low imputed estimate	11.2	10.3	0.9 *	0.061	1,479	1,682
Cumulative Academic Credits Attempted Y1	9.6	10.0	-0.4	0.424	1,414	1,538
High imputed estimate	9.6	10.0	-0.4	0.468	1,479	1,682
Low imputed estimate	9.2	9.2	0.0	0.998	1,479	1,682
Cumulative Academic Credits Earned Y1	8.1	8.6	-0.5	0.148	1,414	1,538
High imputed estimate	8.2	8.7	-0.6	0.145	1,479	1,682
Low imputed estimate	7.7	7.9	-0.2	0.669	1,479	1,682
Cumulative CTE/Other Credits Attempted Y1[b]	2.7	1.6	1.1 ***	0.002	1,414	1,538
High imputed estimate	2.7	1.6	1.1 ***	0.004	1,479	1,682
Low imputed estimate	2.6	1.5	1.1 ***	0.003	1,479	1,682
Cumulative CTE/Other Credits Earned Y1[b]	2.5	1.4	1.1 ***	0.001	1,414	1,538
High imputed estimate	2.5	1.5	1.0 ***	0.002	1,479	1,682
Low imputed estimate	2.4	1.3	1.1 ***	0.002	1,479	1,682
Sample size (total=3,161)	1,479	1,682				
Number of lotteries (total=42)						

(continued)

Appendix Table A.9 (continued)

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	P-Value for Estimated Difference	P-TECH Winners N Obs	Comparison Group N Obs
Year 2						
Attendance (180 days) Y2 (%)	74.3	71.2	3.1 ***	0.004	1,044	983
High imputed estimate	75.1	73.1	2.0 **	0.047	1,084	1,069
Low imputed estimate	71.6	65.2	6.4 ***	0.002	1,084	1,069
Cumulative Total Credits Attempted Y2[b]	27.6	25.7	1.9 **	0.031	1,054	1,000
High imputed estimate	27.2	24.9	2.3 **	0.020	1,090	1,074
Low imputed estimate	26.7	23.9	2.8 **	0.015	1,090	1,074
Cumulative Total Credits Earned Y2[b]	22.8	21.4	1.3 **	0.039	1,054	1,000
High imputed estimate	22.5	20.9	1.6 **	0.023	1,090	1,074
Low imputed estimate	22.0	19.8	2.2 **	0.015	1,090	1,074
Cumulative Academic Credits Attempted Y2	19.6	20.2	-0.6	0.419	1,054	1,000
High imputed estimate	19.6	20.1	-0.6	0.434	1,090	1,074
Low imputed estimate	18.9	18.7	0.2	0.780	1,090	1,074
Cumulative Academic Credits Earned Y2	15.8	16.5	-0.8	0.130	1,054	1,000
High imputed estimate	15.6	16.1	-0.5	0.336	1,090	1,074
Low imputed estimate	15.2	15.3	-0.1	0.862	1,090	1,074
Cumulative CTE/Other Credits Attempted Y2[b]	5.6	3.1	2.6 ***	<.0001	1,054	1,000
High imputed estimate	5.5	3.0	2.5 ***	<.0001	1,090	1,074
Low imputed estimate	5.4	2.8	2.6 ***	<.0001	1,090	1,074
Cumulative CTE/Other Credits Earned Y2[b]	5.0	2.7	2.3 ***	<.0001	1,054	1,000
High imputed estimate	4.9	2.6	2.3 ***	<.0001	1,090	1,074
Low imputed estimate	4.8	2.5	2.3 ***	<.0001	1,090	1,074
Sample size (total=2,164)	1,090	1,074				
Number of lotteries (total=29)						

(continued)

Appendix Table A.9 (continued)

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	P-Value for Estimated Difference	P-TECH Winners N Obs	Comparison Group N Obs
Year 3						
Attendance (180 days) Y3 (%)	70.6	66.8	3.8 **	0.037	511	624
High imputed estimate	71.5	69.0	2.5	0.171	527	666
Low imputed estimate	68.5	62.1	6.4 ***	0.006	527	666
Cumulative Total Credits Attempted Y3[b]	42.2	38.3	4.0 ***	0.004	515	640
High imputed estimate	41.5	36.8	4.7 ***	0.003	529	674
Low imputed estimate	41.1	36.0	5.1 ***	0.004	529	674
Cumulative Total Credits Earned Y3[b]	33.6	31.6	2.0 **	0.023	515	640
High imputed estimate	33.1	30.5	2.6 ***	0.010	529	674
Low imputed estimate	32.7	29.7	3.0 **	0.010	529	674
Cumulative Academic Credits Attempted Y3	30.0	29.6	0.4	0.733	515	640
High imputed estimate	29.4	28.4	1.0	0.407	529	674
Low imputed estimate	29.2	27.8	1.4	0.301	529	674
Cumulative Academic Credits Earned Y3	23.2	24.0	-0.8	0.295	515	640
High imputed estimate	22.8	23.1	-0.3	0.711	529	674
Low imputed estimate	22.6	22.5	0.1	0.937	529	674
Cumulative CTE/Other Credits Attempted Y3[b]	8.4	5.0	3.4 ***	<.0001	515	640
High imputed estimate	8.3	4.9	3.4 ***	<.0001	529	674
Low imputed estimate	8.2	4.6	3.6 ***	<.0001	529	674
Cumulative CTE/Other Credits Earned Y3[b]	7.3	4.4	2.8 ***	<.0001	515	640
High imputed estimate	7.1	4.2	2.9 ***	<.0001	529	674
Low imputed estimate	7.1	4.1	2.9 ***	0.000	529	674
Sample size (total=1,203)	529	674				
Number of lotteries (total=15)						

(continued)

Appendix Table A.9 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th Grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Attempted credits measures include credits for all courses for which the student received either a passing or failing grade (so does not include courses awarded no grade).

High imputed estimates: Imputed estimates were created for active charter school attendees. For Attendance, school-level mean attendance values were imputed where available, else values of 100% were imputed. For all credits variables, the modal values among records with data were imputed.

Low imputed estimates: Imputed estimates were created for active charter school attendees. For Attendance, values of 0% were imputed. For all credits variables, 0 values were imputed.

[a]Number of Observations.

[b]Cumulative Total Credits measures include all credits attempted or earned including Physical Education and Functional Code credits, while Cumulative CTE/Other Credits measures exclude Physical Education and Functional Code credits.

Appendix Table A.10

Regents Attempted and Earned by Subject: Impacts for P-TECH 9-14 Analytic Sample

Outcome	P-TECH Lottery Winners	Comparison Group Members	Estimated Difference	Effect Size of Estimated Difference	P-Value for Estimated Difference
Year 1					
Cumulative Math Regents Attempted Y1	1.3	0.9	0.4 ***	0.58	0.001
Cumulative Math Regents Passed, score of 65+ Y1	0.6	0.5	0.1	0.18	0.102
Cumulative ELA Regents Attempted Y1	0.4	0.0	0.4 *	1.07	0.056
Cumulative ELA Regents Passed, score of 65+ Y1	0.2	0.0	0.2 **	0.69	0.050
Sample size (total=3,161)	1,479	1,682			
Number of lotteries (total=42)					
Year 2					
Cumulative Math Regents Attempted Y2	2.5	1.8	0.6 ***	0.50	<.0001
Cumulative Math Regents Passed, score of 65+ Y2	0.9	0.9	0.1	0.11	0.191
Cumulative ELA Regents Attempted Y2	1.3	0.4	0.9 ***	1.36	<.0001
Cumulative ELA Regents Passed, score of 65+ Y2	0.8	0.3	0.5 ***	0.87	<.0001
Sample size (total=2,164)	1,090	1,074			
Number of lotteries (total=29)					
Year 3					
Cumulative Math Regents Attempted Y3	3.5	2.6	0.9 ***	0.53	<.0001
Cumulative Math Regents Passed, score of 65+ Y3	1.3	1.1	0.2 **	0.24	0.023
Cumulative ELA Regents Attempted Y3	2.0	1.0	1.0 ***	1.05	0.001
Cumulative ELA Regents Passed, score of 65+ Y3	1.1	0.7	0.4 ***	0.64	0.001
Sample size (total=1,203)	529	674			
Number of lotteries (total=15)					

(continued)

Appendix Table A.10 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) state test data for eighth-graders from the 2012-2016 school years, as well as data from NYC DOE enrollment files from the 2012-2017 school years, and American Community Survey (ACS) data by census tract for median household income from the 2012-2017 calendar years.

NOTES: Values for P-TECH 9-14 lottery winners are the simple means for all lottery winners. Values for the difference between P-TECH 9-14 lottery winners and comparison group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean outcome for lottery winners and comparison group members. The value for comparison group members equals the corresponding value for P-TECH 9-14 lottery winners minus the estimated difference between lottery winners and comparison group members.

Model includes adjustment for select baseline covariates (Female, z-scored 8th-grade ELA test score, Missing rate of z-scored 8th-grade ELA test score, z-scored 8th-grade math test score, Missing rate of z-scored 8th-grade math test score).

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: *** = 1 percent; ** = 5 percent; * = 10 percent.

Sample sizes are from the ITT random assignment sample; each measure's data availability can be found in Table A.8.

Regents attempts variables only include Regents exams for which the student received a grade and does not include exams where the student was absent, ill, cheated, or the school misadministered the exam.

Appendix Table A.11

P-TECH 9-14 First Lottery Participants: Full Category List of Treatment/Comparison Differences in CTE/Other Courses Attempted

Other/CTE Course Category	P-TECH Lottery Winners	Comparison Group Members
Advisory	0.1%	0.4%
Architecture / Civil Engineering	1.1%	0.3%
Arts	14.7%	21.3%
Business	2.7%	2.5%
College and Career Exploration	0.8%	0.9%
Electrical	0.1%	0.3%
Engineering - General	3.1%	0.5%
Guidance	11.9%	13.0%
Human Services	5.4%	2.0%
Other CTE	0.1%	0.7%
Physical Education & Health	41.4%	50.9%
Technology	9.8%	6.0%
Trades	0.1%	0.4%
Undefined/Functional Codes	1.3%	0.5%
Work-Based Learning	7.5%	0.2%
Total Other/CTE Courses	100%	100%

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (NYC DOE) enrollment files from the 2013-2017 school years.

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Over the years, MDRC has brought its unique approach to an ever-growing range of policy areas and target populations. Once known primarily for evaluations of state welfare-to-work programs, today MDRC is also studying public school reforms, employment programs for ex-prisoners, and programs to help low-income students succeed in college. MDRC's projects are organized into five areas:

- Promoting Family Well-Being and Children's Development
- Improving Public Education
- Raising Academic Achievement and Persistence in College
- Supporting Low-Wage Workers and Communities
- Overcoming Barriers to Employment

Working in almost every state, all of the nation's largest cities, and Canada and the United Kingdom, MDRC conducts its projects in partnership with national, state, and local governments, public school systems, community organizations, and numerous private philanthropies.