Philadelphia Education Research Consortium

The *When* and *How* of Keystone Exams in the School District of Philadelphia

April 2024

Introduction

To meet statewide graduation requirements and receive a diploma, Pennsylvania high school students now need to demonstrate career or postsecondary preparedness through graduation requirements outlined in Pennsylvania's Act 158, which went into effect starting with the Class of 2023. Two of the five graduation pathways—the Keystone proficiency and Keystones composite pathways—require demonstrating proficiency on Pennsylvania's end-of-course subject exams for Algebra I, Biology, and Literature, or "Keystone Exams."[1] In December 2020, in anticipation of this policy shift and the need for additional Keystone performance monitoring and support, the School District of Philadelphia's (SDP) School Board adopted and began monitoring the goal to increase the share of students who are proficient on all three state high school assessments by the end of their 11th-grade year to 52% by August 2026.

To better understand District Keystone proficiency rates and to improve them, it would help to know more about *when students take Keystone-associated courses and exams* and *how they fare*. When do District students typically enroll in these courses? When do most students take their Keystone-associated exams? And how do students do in their courses and upon their first exam attempts?

This brief aims to address these foundational descriptive questions about the "when" and "how" of Keystone exams in the District and is the third in a series of PERC research on the implications of Act 158 for the School District of Philadelphia. In our first report, we outlined the new graduation requirements defined by Act 158, described the evolution of the policy, and summarized some relevant research about high-stakes graduation requirements and their equity implications. In our second report, we applied the policy requirements to historical cohorts to show the potential implications of the policy for the District, finding that less than half of students were close to meeting the graduation requirements through the Keystone proficiency or composite pathways, with wide variations by student characteristics (e.g. race/ethnicity, economic status) and across schools. In this third report, we describe the timing and circumstances in which students have historically taken their Keystone exams to help inform the strategies for when exams are taken to support more students to achieve proficiency.

[1] For students that cannot meet Keystone requirements, the policy articulates "alternative pathways" to graduation, e.g., obtaining an industry-based competency certification, successful completion of a service-learning project, or completion of an internship or cooperative education program, among others. See more about the policy in the PERC brief published in 2022: https://phledresearch.org/changing-requirements-brief/

Research Question

This brief asks the question: **Historically, what have been the circumstances within which students take and pass their Keystone exams?** In more detail, this brief explores:

- When do students first take Keystone associated courses (see definition in box below) and how do they fare?
- What share of students attempt Keystone exams?
- How common is it for students to attempt a Keystone exam in the same year as their first attempt at the associated course?
- How common is it for students to pass Keystone exams on their first attempt?

These descriptive analyses offer a critical first step in understanding patterns of when and how students arrive at the Keystone exams and how successful they are in those exams.

Data and Methods

To answer this question, we examined historical School District of Philadelphia's student administrative data from the ninth-grade cohorts expected to graduate in 2017-18 or 2018-19. These students were in school prior to the new Act 158 policy requirements that tie performance on the Keystone exams to graduation requirements. Future research will examine the extent to which patterns of course and exam taking have changed since the implementation of the policy.

We limited the study sample to students for whom we had a record of enrollment in a Keystone associated course either in the same year or prior to their first Keystone exam attempt (samples are subject-specific).[2] For some analyses, we also include those who took the associated course but never took the exam. With records limited to those with course taking data, we then conducted descriptive analyses to understand when students first attempted Keystone-associated courses and exams and how they performed in each.

Key Terminology

- **Keystone exams** – Standardized tests designed to be end-of-course evaluations for three subject areas: Algebra, Biology, and Literature.
- **Associated course** – Courses for which the Keystone exam is designed to serve as an end-of-course evaluation. Specifically, Algebra 1 (for the Algebra exam), Biology (for the Biology exam), and English 2 (for the Literature exam).
- **Keystone Proficiency/Passing** - A student is considered having passed a Keystone exam or achieved "Keystone proficiency" if they receive a score of *Proficient* or *Advanced* on the exam.
- **Act 158** – State law which specified new requirements for high school graduation. Students in the Classes of 2023 onwards must satisfy at least one of five defined pathways to earn their high school diploma. Two of the five pathways rely exclusively on Keystone exam performance. See here for more information.

[2] This limitation was an attempt to remove from the sample students who first took the associated course at a non-SDP school (e.g. a charter school or a school outside of Philadelphia) because we were interested in understanding when students first took the course and how they performed but we did not have data on course taking or course grades from non-SDP schools. It is not a foolproof method, since a student may have attempted the course elsewhere, but not attempted the exam.

What the Study Found

The Keystone exams are designed as statewide end-of-course assessments of proficiency in three high school courses: Algebra I, Literature, and Biology. This study examines when students first take Keystone-associated courses, the share of students that pass courses upon first attempt, and the Keystone exam-taking patterns of students who pass and fail the associated courses. These descriptive findings are important to understand as District leaders and school-based staff work to advance the School Board's goal to improve District Keystone performance.

When do students first take Keystone associated courses and how do they fare?

Students can take the Keystone exams in the same school year as they take the Keystone associated course or in subsequent school years (or both). But when do most students take their Keystone associated courses and exams? To understand the full picture of when and how students get to the exams, the findings below first focus on students' course-taking patterns.[3] Table 1 shows that **most students first attempted Keystone-associated courses in 9th or 10th grade,** though the share of students in each grade differed by exam subject.

Table 1. Most students first attempt Keystone-associated courses in 9th or 10th grade.

Grade-level students were in when first attempting the Keystone associated course, by subject area

Enrolled Grade at First Course Attempt	Algebra (N=16,086)	Biology (N=16,709)	Literature (N=15,871)
7th or 8th grade	3.8%	n/a	n/a
9th grade	92.3%	46.7%	9.4%
10th grade	3.1%	47.1%	89.0%
11th grade	0.7%	5.0%	1.4%
12th grade	0.2%	1.2%	0.3%

Data source: Administrative data from the School District of Philadelphia, ninth-grade cohorts expected to graduate in 2017-18 or 2018-19.

Note: The number of students included in the sample for each subject is shown in the column heading.

[3] Student mobility and changing course enrollments means some students started the Keystone associated courses but did not complete them. For this brief, we defined an attempt at the course as an enrollment that had at least two quarters worth of grades, even if the student did not receive a final grade. If no final grade was present, we averaged all quarter grades to estimate a final grade.

Specifically:

- Nearly all students first attempted Algebra I in 9th grade. The share of students who enrolled in Algebra in 7th or 8th grade is very small (<5%).[4]
- Most students (89%) first enrolled in Literature in 10th grade, though nearly 10% did so in 9th grade.
- Students were evenly split between first taking Biology in 9th grade or 10th grade.
- Very few students first attempted Keystone associated courses in 11th or 12th grade.

Also of interest is how students fare in their courses after their first attempts. Table 2 shows that **many students (over 80%) earned a passing grade in the Keystone associated courses on their first attempt**. However, a considerable percentage of students (between 14-17%) did not, translating to between 2,200 and 2,700 students in ninth-grade cohorts expected to graduate in 2017-18 or 2018-19, depending on the subject.

Table 2. Many, but not all, students pass Keystone associated courses on their first attempt.

Percent of students who passed the Keystone associated course upon their first attempt, by subject area

	Algebra (N=16,086)	**Biology** (N=16,709)	**Literature** (N=15,871)
Percent of students that pass the course (with a grade of D or higher) upon their first attempt	83.3%	85.8%	86.1%

Data source: Administrative data from the School District of Philadelphia, ninth-grade cohorts expected to graduate in 2017-18 or 2018-19.

This finding – that a substantial percentage of high school students need additional support to pass core courses – is not new. In previous PERC research, we provided a snapshot of the District's school-year credit recovery utilization—including eligibility, enrollment, and completion—among high school students in traditional high schools.[5] Our study showed that **credit recovery needs in the District are high and many students need significantly more support to succeed in core courses**. Over one-quarter of

[4] Taking Algebra I by the end of 8th grade is a topic of frequent debate in policy and research domains, as discussed in this US Department of Education data story (https://www2.ed.gov/datastory/stem/algebra/index.htmlhttps://www2.ed.gov/datastory/stem/algebra/index.html) and evidenced by California's attempts to make Algebra I universally accessible by 8th grade (Domina, T., McEachin, A., Penner, A., & Penner, E. (2015). Aiming High and Falling Short: California's Eighth-Grade Algebra-for-All Effort. Educational Evaluation and Policy Analysis, 37(3), 275-295. https://doi.org/10.3102/0162373714543685). Access to Algebra is also a local concern as multiple news reports in 2023 discussed the barrier caused by the fact that only 50 of the 195 K-8 and middle schools in the School District of Philadelphia offered Algebra 1 to their students (https://www.chalkbeat.org/philadelphia/2023/11/13/eighth-grade-algebraaccess-equity-masterman). It's important to remember that this study uses historical data for students who were 9th graders in 2014-15 or 2015-16, hence 8-9 years before these recent discussions.

[5] Pileggi, Turner, Liu, & Fontana (2020). Recovering Credits in the School District of Philadelphia: High School Student Credit Recovery Utilization in 2018-19, Philadelphia Education Research Consortium. https://phledresearch.org/recovering-credits-in-the-school-district-of-philadelphia-high-school-student-credit-recovery-utilization-in-2018-19/

students in the study – and one in three students in Grade 10 – had failed a core course at the end of the 2017-18 academic year. Of these students, over half failed more than one core course.[6]

What share of students attempt Keystone exams?

As we have shown in previous studies, in recent years, most SDP high school students took Keystone exams before completing high school—even before the exams were tied to graduation as part of the Keystone pathways outlined in Act 158. In this next analysis, we examine the Keystone exam attempts of students in our study, for students who both passed and did not pass the associated course to answer the question, **what share of students attempt Keystone exams?**[7]

Table 3 shows that **most students took the Keystone exam at some point after taking the associated course, regardless of if they passed or failed the course,** though the relative share of students who attempted the exam differs in important ways by subject area and whether students passed or failed the course.

Table 3. Most students took the Keystone exam at some point after taking the associated course, regardless of if they passed or failed the course.

Percent of students who ever took a Keystone exam after having taken the associated course, by subject area and by whether they passed or failed their first course attempt

Percent of students who ever took the Keystone exam	Algebra	Biology	Literature
Among students who ever took the associated course	92.0% (N=16,086)	84.5% (N=16,709)	83.8% (N=15,871)
Among students who passed their first associated course attempt	95.3% (N=13,401)	88.8% (N=14,333)	88.0% (N=13,668)
Among students who failed their first associated course attempt	75.3% (N=2,685)	58.6% (N=2,376)	57.7% (N=2,203)

Data source: Administrative data from the School District of Philadelphia, ninth-grade cohorts expected to graduate in 2017-18 or 2018-19.

Note: N size is the number of students in the relevant category. For example, in the top right cell, there were 15,871 students in our sample who ever took the Literature associated course. Of those 83.8% attempted the Literature Keystone exam at some point, whether in the same year as taking the associated course or a subsequent one.

[6] The District offers both in-person and online options for recovering failed or missing credits required for graduation. During the 2018–19 school year, our study showed that about half of eligible students attempted to recover at least one credit. While most students (nearly 80%) enrolled in credit recovery completed the recovery courses attempted, only half of the completed course attempts resulted in a passing grade.

[7] It's important to note that students receive their final course grade after the exam is administered. Therefore, some students who failed the course may have been close to or expecting to pass the course when taking the exam.

Specifically:

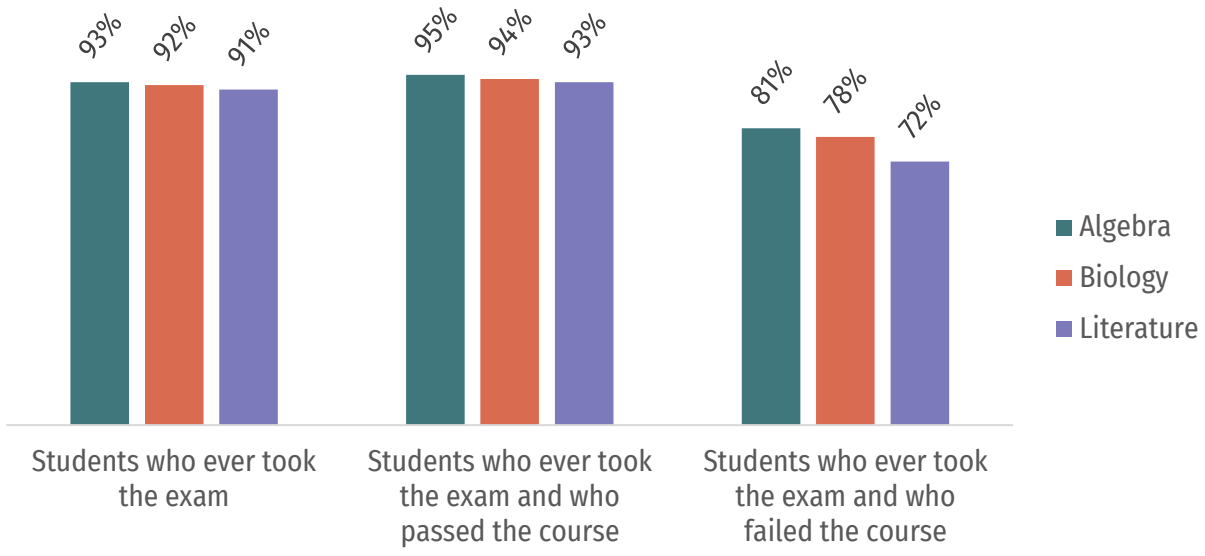
- **Algebra was the most commonly taken Keystone exam**: 92% of students who took the associated course also took the exam at some point after taking the associated course. Most students also took the Biology (85%) and Literature (84%) Keystone exams at some point.
- Even among students who failed their first course attempt, **the majority of students in the study sample went on to take the associated Keystone exam at some point, though the percentages are smaller than among students who passed the course.** For example, compared to 95% of students among those who passed the course, 75% of students who failed their first attempt at the Algebra 1 course went on to take the Algebra Keystone exam.
- However, **it was more common for students who failed their first Algebra course attempt to attempt the Algebra Keystone exam than students who failed either Biology or Literature**. While about three in four students who failed their first Algebra course attempt went on to take the Algebra exam, fewer than 60% of students who failed their first Biology (or Literature) course attempt went on to take the exam at some point.

How common is it for students to attempt a Keystone exam in the same year as their first attempt at taking the course?

The Keystone associated courses are intended to set students up with the content needed to take the Keystone exam at the end of that year, but students are not required to take the exam at that time. As we saw in Table 3, most students do go on to take the exam at some point after taking the associated course, but **when do most students first attempt Keystone exams**? Do they typically take the exam the same year as the associated course? Or do they take the exam later? Figure 1 below shows the share of students who took the exam in the same year as when they first took the associated course, overall and by whether they passed or failed their first course attempt. We find that, historically, **it has been common for students to take their exams in the same year as their first attempt at the associated course, even among those who failed the course.**

Figure 1. It is common for students to take Keystone exams in the same year as they first take the associated course, even if they failed the associated course.

Percent of students who attempted a Keystone exam in the same year as their first associated course attempt, by subject and if they passed or failed the course, among students who ever attempted the exam



Data source: Administrative data from the School District of Philadelphia, SY2012-13 – SY 2018-19. Sample sizes are listed in the first three rows of Appendix Table A1.

Key findings from Figure 1:

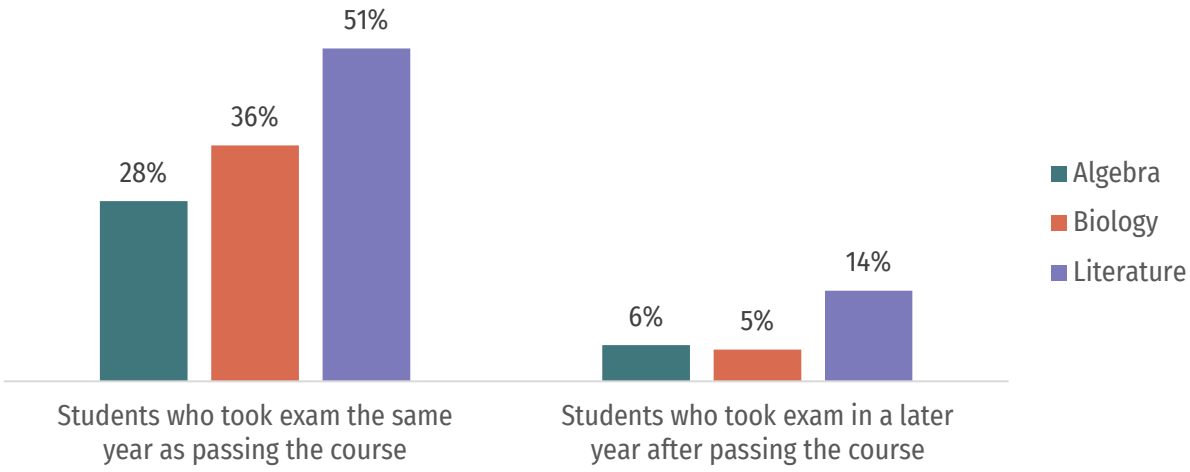
- **Among students who took the exam at some point in high school, it was common for students to do so in same year as the associated course**. Across all subjects, most students (91-93%) took the Keystone exams in the same year as when they first attempted the associated course.
- **Only a relatively small percentage of students take the exam in a later year, even if they failed the course**. Among students who ever wound up taking the exams, most students who failed the course (72%-81%) attempted exam that year.

How common is it for students to pass Keystone exams on their first exam attempt?

We have shown that most students take the Keystone exams and that they most often first attempt exams in the same year as when they take the associated courses (even if they did not pass the course). **But how common is it for students to pass Keystone exams on their first attempt, and do pass rates differ depending on whether students take the exam right away or in a later year?** To answer these questions, Figure 2 and 3 examine exam pass rates, first for those who passed the associated course (Figure 2) and then for students who failed the associated course (Figure 3). While this analysis is not causal (*i.e.*, it does not tell us if it is better for students to take the exam in the same year as the course) it gives us descriptive information about the how students fare on exams based on the timing of those exams in relation to their course taking.

Figure 2. Exam pass rates are low, even among students who pass the associated course at their first attempt and especially among students who take the exam later

Percent of students who passed the Keystone exam on the first attempt among those who passed the course on the first attempt, by subject area and when they took the exam



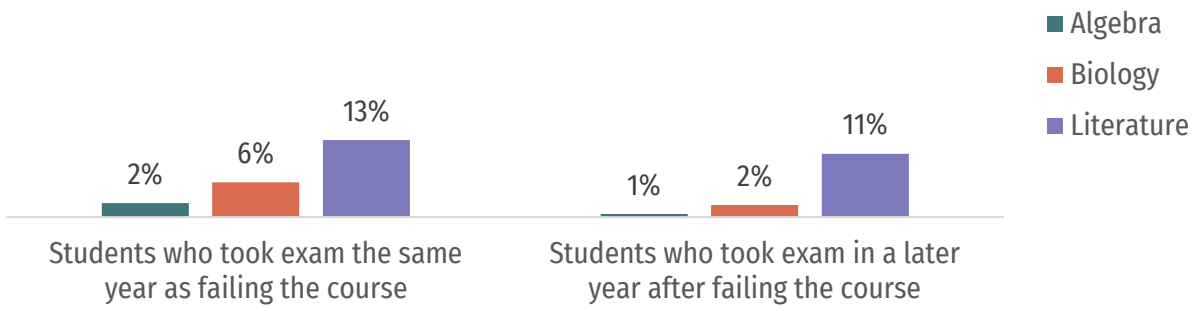
Data source: Administrative data from the School District of Philadelphia, SY2012-13 – SY 2018-19. Sample sizes available in Appendix Table A2.

Figure 2 shows that, even among students who passed the associated course on their first attempt, it is not common for students to pass the Keystone exams. That said, **it is much more common that students pass the exam if they take it in the same year as the associated course**, compared to the very small percentage of students who pass exams when taking them a year or more after first taking the associated course. This pattern is similar across subject areas, though this figure makes clear that the **Algebra and Biology exams present more of a challenge for the District than the Literature exam**:

- Among those who passed Algebra and took the exam the same year, only 28% passed the Keystone exam. A slightly larger share of students who passed Biology went on to take and pass the Biology Keystone that same year, about 36%.
- While better than the Algebra and Biology exams, only about half of students who took and passed the Literature course went on to pass the exam in the same year.
- The pass rate for the Literature exam among those who passed the course but took the exam in a later year was smaller, about 14%, though higher than pass rates for students who took Algebra and Biology exams in a later year (about 5%).

Figure 3. Exam pass rates are very low for students who fail their first course attempt, especially among those who take the exam in a later year.

Percent of students who passed the Keystone exam on the first attempt among those who failed their first attempt at the course, by subject area and when they took the exam



Data source: Administrative data from the School District of Philadelphia, SY2012-13 – SY 2018-19. Sample sizes available in Appendix Table A2.

Figure 3 shows that, **few students who failed the Keystone-associated course passed their exams, regardless of if they took the exam in the same year or a later year**. There were some differences by subject area:

- **A larger percentage of students passed the Literature exam after failing the course, compared to students taking the Algebra and Biology exams.** For example, 13% of students who failed the associated course and took the exam in the same year passed the Literature exam, whereas 2% of students in the same conditions passed the Algebra exam and 6% passed the Biology exam.

Summary and Implications for Policy and Practice

Act 158 creates five pathways to high school graduation, two of which rely exclusively on a student's achievement on the Keystone exams. The latest data posted on the District's Goals & Guardrails dashboard shows that there is significant ground to cover to meet the 2026 target for Keystone proficiency. In 2022-23, 18.5% of students who attempted all three Keystone exams were proficient on all three by 11th grade, substantially below the District's target of 36.1% for that year.[8] The conditions that result in the most successful taking of the exams is a question of clear interest to administrators, teachers, and students in the School District of Philadelphia who seek to graduate through the Keystone pathways. The analyses in this brief unpack descriptive trends in when and how students take and pass Keystone exams, from cohorts not subjected to Act 158.

Key takeaways from this analysis are:

- Most students first took Keystone-associated courses in 9th or 10th grade.
- While most students passed their first attempted Keystone-associated courses in Algebra, Biology, and Literature, a significant share of students did not. While many students who did not pass their first course attempt took the Keystone exam that same year, very few of them passed that first exam attempt.
- Unsurprisingly, exam pass rates are highest among students who took the exam in the same year as having passed the associated course. However, many students needed more support to pass Keystone exams, regardless of if they passed the associated course. In this historical sample, Keystone exam pass rates were low in the District, even among students who passed the associated courses and took the exam in that same year.

We do not know whether these associations are predictive, thus we are unable to draw conclusions about the conditions under which students are likely to pass their Keystone exams. Yet, these descriptive analyses have several implications for policy and practice, and opportunities for further study:

- **Support students in taking the Keystone exam as close to the associated course as possible.** Our findings above show that more students pass the Keystone exams when the exams are taken in the same year as their first attempt at the associated course, regardless of whether the student passed the course or not. This analysis does not illuminate why students might not have taken an exam in the same year as their first course attempt. Those may have been intentional decisions for some whereas others may have happened more as a circumstance of other factors (e.g. a student may have been absent on the examination date). But the findings here suggest that teachers and school staff should support students to take the Keystone exams as close as possible to taking the associated course. This may look like encouraging students to attempt the exam even if their course grades are low. It may also look like following up with students who are absent to provide alternate test dates in the same semester, rather than waiting until the next administration.
- **Review the tools and guidance provided to support decision-making about which graduation pathway is right for individual students.** As the graduation pathways defined by Act 158 went into effect for the Class of 2023, the District's Office of Academic Supports provided schools with guidance on how to use the Student Information System's real-time data to identify which graduation pathway students had met or were close to meeting, when to make decisions on which pathway to pursue, and how to support students in meeting their selected pathway. As we

[8] Goal defined in SDP Goal 4 Dashboard https://dashboards.philasd.org/extensions/goals-and-guardrails/index.html#/goal4. Proficiency rate presented at the October 12, 2023 Goals and Guardrails Meeting of the School Board. See Slide 16 of the meeting agenda posted here: https://www.philasd.org/schoolboard/meetings.

publish this report, one cohort of students has already navigated the graduation pathways and another is less than two months away from graduation. District offices will be taking time to examine how graduation rates may have changed since Act 158 came into effect, as well as understanding which pathway graduates used to satisfy the requirements. Additional work could be done to understand what systems and guidance helped students and schools navigate the policy, looking both at resources and supports provided by the District and those developed within individual schools. All of this work will help inform how future cohorts of students are supported.

- **Gain a better understanding of what conditions help students pass a Keystone exam.** The analysis in this report showed descriptively what percentage of students passed the Keystone exams and broke those percentages down based on how the student fared in the associated course and when they took the exam. However, further study is needed to understand if there are connections between passing the Keystone exam and the conditions studied here as well as other conditions. For example, are students more likely to pass the Keystone exam if they take it in 9th grade vs. 10th grade? And beyond just passing or failing, is there an association between the grade a student receives in the associated course and their likelihood of passing the Keystone exam? Since students are permitted to retake the Keystone exams, additional analyses focused on retaking the exam could examine if there are conditions that are more supportive of passing an exam on retaking (e.g. within particular schools, retaking the Algebra exam while enrolled in Algebra II course, etc.) or if there are patterns in scaled scores earned at the first attempt above which students are more likely to pass.

Appendix A – Data Tables

Table A1. Percent of students (and number of students in the category) who attempted the exam in the same year as their first attempt at the associated course

Percent of students who attempted the exam in the same year as their first attempt at the associated course	Algebra	Biology	Literature
Among students who ever took the exam	93.0% (N=14,795)	92.3% (N=14,125)	91.0% (N=13,296)
Among students who ever took the exam and who passed the course on their first attempt	95.0% (N=12,772)	93.9% (N=12,733)	93.0% (N=12,026)
Among students who ever took the exam and who failed the course on their first attempt	80.5% (N=2,023)	78.2% (N=1,392)	71.5% (N=1,270)
Among students who ever took the associated course	85.5% (N=16,086)	78.0% (N=16,709)	76.2% (N=15,871)
Among students who passed the course on their first attempt	90.5% (N=13,401)	83.4% (N=14,333)	81.9% (N=13,668)
Among students who failed the course on their first attempt	60.7% (N=2,685)	45.8% (N=2,376)	41.2% (N=2,203)

Data source: Administrative data from the School District of Philadelphia, ninth-grade cohorts expected to graduate in 2017-18 or 2018-19.

Note: N size is the number of students in the relevant category. For example, in the top right cell, there were 13,296 students in our sample who ever took the Literature Keystone exam. Of those 91.0% attempted the Literature Keystone exam in the same year as their first attempt at the associated course.

Table A2. Percent of students who passed the exam on their first attempt

Percent of students who passed the Keystone exam on their first attempt	Algebra	Biology	Literature
Among students who passed their first attempt at course and took the exam the same year	27.8% (N=12,129)	36.4% (N=11,951)	51.4% (N=11,187)
Among students who passed their first attempt at the course and took the exam in a later year	5.6% (N=643)	4.9% (N=782)	14.0% (N=839)
Among students who failed their first attempt at course and took the exam in the same year	2.3% (N=1,629)	5.8% (N=1,089)	12.8% (N=908)
Among students who failed their first attempt at the course and took the exam in a later year	0.5% (N=394)	2.0% (N=303)	10.2% (N=362)

Data source: Administrative data from the School District of Philadelphia, ninth-grade cohorts expected to graduate in 2017-18 or 2018-19.

Note: N size is the number of students in the relevant category. For example, in the top right cell, there were 11,187 students in our sample who passed their first attempt at the Literature associated course and took the Keystone exam in the same year. Of those, 51.4% passed the Literature Keystone exam.