The Fourth R:
New Research Shows Which Academic Indicators Are the Best Predictors of High School Graduation — and What Interventions Can Help More Kids Graduate
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It’s an unfortunate — but undeniable — fact: not every young person graduates from high school.

Even in Portland, a city recognized nationally for its array of alternative and supplementary programs to keep students connected, kids fall through the cracks. The good news for educators, parents, community leaders, and policy makers — and most importantly, for kids themselves — is that particular academic indicators can be used to predict which students are most at risk of leaving school. Using these academic indicators to identify individual students’ level of risk is the first step to ensuring these kids get the additional support they need to graduate.

Portland is one of the first cities in the country using a new methodology to understand how individual students fare in school. This methodology involves multivariate, longitudinal cohort analysis: it looks at the progress of every student in a district-wide graduating class, examining multiple academic performance markers to determine each student’s risk of leaving school without graduating. Using this data-driven approach to connect the kids most at risk with the support they need means Portlanders can be more successful than ever before in helping students graduate. The ability to identify individual students based on the academic predictors will allow programs to be more efficiently targeted so fewer kids fall through the cracks.

This process will benefit every student, but the impact on students of color and students living in poverty will be especially profound. Although students of color and students living in poverty are less likely to graduate, students’ performance on the academic indicators is far more accurate than any demographic data in predicting whether or not a student will graduate — which means that we can better identify which individual students of color and poor students are most at risk, eliminating inaccurate and unfair stereotyping of students based on race, ethnicity, immigrant status, or family income.
Methodology: How and Why the Study Was Done

This report summarizes the findings of research looking at data for the Portland Public Schools Class of 2004 as it moved through high school to expected graduation in June 2004. The study was undertaken as the basis for determining how to implement support effectively to increase the number of students who graduate from high school. The research focused on learning what indicators best predict which students are at risk for failing to graduate and determining when, by year and quarter, students are most likely to disengage from school.

The research analyzed data concerning students who were part of the PPS Class of 2004, regardless of whether or not they graduated from PPS in 2004. Membership in the PPS Class of 2004 was defined as follows:

- Students who enrolled in PPS as 9th-graders at the beginning of the 2000-01 school year.

- Students who entered PPS from outside the district in subsequent years at grade levels that would put them on track to graduate in 2004 (i.e., entering as 9th-graders during 2000-01, as 10th-graders during 2001-02, as 11th-graders during 2002-03, or as 12th-graders during 2003-04).

Students who were enrolled in PPS before officially transferring to another district or to a private school were not included in this analysis. Using these criteria, the Class of 2004 totaled 4,853 students.

The study examined the PPS Class of 2004 as a cohort, tracing their longitudinal progress on a student-by-student basis. The analytic technique used to track students was adapted for sociological research from survival analysis as originally developed by medical researchers. This approach permits the researcher to focus on individual students’ level of risk, defined in terms of whether they will graduate, as it varies at each quarter from the beginning of 9th grade through expected time of graduation (in this case, June 2004). Using this methodology to analyze multiple years of longitudinal data on every student in the cohort yields clear evidence of significant patterns of behavior, and thus reveals accurate predictors for determining which students are at risk for not graduating. It also indicates what the best timing is for implementing successful interventions to support these students.
The findings in this report focus on which students are most likely to leave school without graduating. Although it has been common practice to label such students “drop-outs,” that term is misleading, since “no show” students (those who are enrolled one quarter but do not show up in the next quarter and have not officially transferred out of the district) may have entered another district or private school without requesting an official transfer. This report refers to both “no shows” and “withdrawns” (students age 16 or older who legally withdraw from school) as “leaving school without graduating,” with an understanding that these students may later return to school, either in PPS or another district or a private school, or may obtain a GED (the cohort includes 195 students who previously withdrew from school but then returned to PPS during the time period covered by the database). Although it is unfortunate that districts lack the ability to track what happens to all no-show and withdrawn students, this report yields powerful tools for identifying which students are at risk to leave school and when, so that interventions can be implemented to decrease the number of no-show and withdrawn students and ensure that more kids graduate on time.

Findings: What the Data Tell Us about Student Achievement and Educational Outcomes

FINDING 1: Students are more likely to disengage from school at particular times of year, and in particular years.

FIGURE 1 graphs the pattern of disengaging from school for the Class of 2004. Along the bottom of the graph is listed each quarter included in this study, from the first quarter in 9th grade to the last quarter in 12th grade. The left side of the graph shows the conditional risk of leaving school for students enrolled during that quarter (students who were enrolled in the 4th quarter of 9th, 10th, or 11th grade but did not return to school at the beginning of the next school year are included in the last quarter for which they were enrolled). As noted above, students who left the district without a formal transfer may have pursued any number of paths, including disengaging from school entirely.
Conditional risk that a student still enrolled in PPS will leave school in a particular quarter.

What this graph tells us:

The risk of leaving PPS differs significantly by grade and by quarter and is greatest between school years. For students who persevere until grade 12, the risk of leaving school without graduating spikes at the end of the 12th grade.

Implications:

Because a student’s likelihood of disengaging from school peaks during the summer and at the end of 12th grade, support programs can and should be targeted to students at risk well in advance of when the students are likely to leave school. Students are less likely to leave during the school year, presumably because they are more likely to fall through the cracks when school is not in session. Thus, programs that increase engagement with kids during the summer may increase the number of students who return to school each fall.
FINDING 2: Prior academic achievement (pre-high school) is an important indicator for predicting eventual graduation.

Eighth-grade standardized test scores in reading, mathematics, and science are available for about 66% of the students who were a part of the 2004 PPS cohort (because not all students in the cohort were enrolled in PPS at the time of 8th-grade testing, such pre-high school data are not available for some students). Approximately 46% of the students in the 2004 cohort who took the tests met standards in none or only one of the tests they took (see TABLE 1).

TABLE 1: Student Performance on 8th-Grade Standards in Reading, Math, and Science

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did Not Meet Any Standards</td>
<td>987</td>
<td>31.0</td>
</tr>
<tr>
<td>Met 1 Standard</td>
<td>472</td>
<td>14.8</td>
</tr>
<tr>
<td>Met 2 of 3 Standards</td>
<td>489</td>
<td>15.5</td>
</tr>
<tr>
<td>Met All Standards Measured</td>
<td>1,232</td>
<td>38.7</td>
</tr>
<tr>
<td>Total</td>
<td>3,180</td>
<td>100.0</td>
</tr>
</tbody>
</table>
FIGURE 2 graphs the risk of disengaging from school for these students versus the risk for those students who met two or three 8th-grade standards.

**What this graph tells us:**

Whether or not a student meets state standards in the 8th grade is statistically related to the risk of leaving high school without graduating, even when race, age, gender, and free/reduced lunch status are controlled for. Students who, as 8th-graders, failed to meet 2 or more standards (1,459 of the 3,180 students for whom 8th-grade test data were available) were 2.6 times more likely to leave school without graduating than their classmates in the 8th grade who met 2 or 3 standards.

**Implications:**

Although the lack of data on students who transfer into the cohort after 8th grade limits the ability of school personnel to use such test scores for identifying all at-risk students, the relationship is strong enough to indicate that targeting support to individual students who test in the lowest scoring groups will likely increase the number of students who graduate on time. Because these students are more likely to leave school after 10th grade, this early academic indicator provides significant time to support at-risk students before they leave school.
FINDING 3: 9th grade is a pivotal year in which academic failure or success can be a powerful predictor of whether students will graduate.

Failing a core course at any time during the 9th grade significantly affects a student’s chances of eventually graduating from high school, even though students may remain in school for a substantial number of quarters or years after the course failure. Almost three-fourths of the students in the 2004 cohort (3,564 students) were enrolled for at least part of the 9th grade in school year 2000-01 and received at least one semester grade. Of these students, just about 46% failed at least one core course during 9th grade (see TABLE 2). Courses in math, social studies, and language arts had very similar failure rates, while science had the lowest failure rate.

<table>
<thead>
<tr>
<th>Core Course</th>
<th>1st Semester</th>
<th>2nd Semester</th>
<th>One or Both Semesters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Arts</td>
<td>18.9</td>
<td>17.4</td>
<td>26.3</td>
</tr>
<tr>
<td>Mathematics</td>
<td>17.9</td>
<td>20.1</td>
<td>27.7</td>
</tr>
<tr>
<td>Science</td>
<td>11.6</td>
<td>11.3</td>
<td>16.7</td>
</tr>
<tr>
<td>Social Studies</td>
<td>18.7</td>
<td>16.1</td>
<td>25.6</td>
</tr>
<tr>
<td>Any Core Course</td>
<td>34.9</td>
<td>35.0</td>
<td>45.5</td>
</tr>
</tbody>
</table>

FIGURE 3 graphs the risk of disengaging from school for students who failed one or more core courses in 9th grade versus the risk for those students who passed their core courses.
What this graph tells us:

Students who failed one or more core courses during 9th grade were almost 4 times more likely to leave high school before graduation than students who passed all their 9th-grade core courses. Failure in any of the core courses had approximately the same effect, so that failure in any core subject area was an equally strong indicator. The likelihood that a student who fails one or more 9th-grade core courses will leave school increases each summer and each year from 10th through 12th grade, so that most of these students leave long after the initial core course failure.

Implications:

Because 9th-grade core course failure is a strong and early indicator of eventual disengagement from school, intervention timed in immediate response to 9th-grade core course failure will likely increase the number of students who graduate on time.
FINDING 4: Falling behind in course credits does not merely slow a student’s progress to graduation; it significantly increases the student’s risk of leaving PPS without graduating.

In order to graduate from high school in the Portland Public Schools, members of the PPS Class of 2004 were expected to have a minimum of 22 units of credit in specified areas, requiring them to earn an average of 5.5 credits per year of high school. Credit information was available for 84% of all students in the database through the first semester of 11th grade (see TABLE 3).

**TABLE 3: Students Having Sufficient or Insufficient Credits in Each Grade of High School**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Credits Earned</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>9th</td>
<td>Fewer than 5.49</td>
<td>547</td>
<td>15.4</td>
</tr>
<tr>
<td></td>
<td>5.5 or More</td>
<td>3,010</td>
<td>84.6</td>
</tr>
<tr>
<td>10th</td>
<td>Fewer than 10.9</td>
<td>786</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>11 or More</td>
<td>2,887</td>
<td>78.6</td>
</tr>
<tr>
<td>11th</td>
<td>Fewer than 13.75</td>
<td>806</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>13.75 or More</td>
<td>2,765</td>
<td>77.4</td>
</tr>
</tbody>
</table>

As grade level rises, the percentage of students with an insufficient number of credits increases — from 15.4% of students enrolled at the end of 9th grade to 22.6% of students enrolled after the first two quarters of 11th grade. Because the percentages include only enrolled students, they do not reflect the total number of students who had credit deficiencies: students counted as having insufficient credits in 9th grade who left school before 10th grade are not counted in the percentages for 10th or 11th grade; students counted as having insufficient credits in 9th and/or 10th grade who left school before 11th grade are not counted in the percentage for 11th grade.
FIGURE 4 graphs the risk of disengaging from school for students with insufficient credits in any year.

FIGURE 4: Effect of Insufficient Credits on a Student’s Risk of Leaving High School without Graduating

Net of personal factors such as race, age, gender, and free/reduced lunch eligibility, having insufficient credits at any time from grades 9 through 11 contributes significantly to the risk of leaving school before graduation.

What this graph tells us:

Having insufficient credits substantially increases a student’s risk of leaving school without graduating, and this risk increases by year. A student with insufficient credits at the end of the 9th grade has 4.1 times the risk of leaving school without graduating than a student with sufficient credits; a student with insufficient credits at the end of 10th grade has 5.2 times the risk; and a student with insufficient credits at the end of 11th grade has 5.6 times the risk.

Implications:

Students may feel so overwhelmed by the need to make up insufficient credits, particularly by 12th grade, that they disengage entirely from school. Because the risk of leaving school without graduating increases for each year of high school, providing students with early and regular information about their accumulated credits, and targeting students to make up missing credits as soon as possible, will likely increase the number of students who graduate on time.
FINDING 5: Examining multiple academic indicators increases the accuracy with which a student’s likelihood of graduating can be predicted.

While academic indicators such as performance on 8th-grade standards, 9th-grade core course failures, and insufficient credits are each powerful predictors of a student’s risk of leaving school without graduating, reviewing multiple indicators together reveals even more accurately the degrees of risk for individual students. FIGURE 5 demonstrates how reviewing data on multiple academic indicators as compared to single academic indicators affects the ability to predict students’ risk of leaving school without graduating.

FIGURE 5: Effects of Combined 9th-Grade Indicators on a Student’s Risk of Leaving High School without Graduating

Controlling for gender, race, and free/reduced lunch eligibility, the risk of dropping out increases for students who have failed a 9th-grade core course, have fewer than 6 credits at the end of 9th grade, or (especially) both.

What this graph tells us:

Reviewing data on multiple indicators provides an even more powerful way to calculate the degree of risk each individual student faces. As cited above, students identified by the academic indicator of failing one or more 9th-grade core courses were 3.9 times more likely to leave school without graduating; students identified by the academic indicator of insufficient credits were 4.1 times more likely to leave school without graduating. Students who failed one or more core courses in 9th grade and who were deficient in credits were nearly 5 times more likely to leave school without graduating.
Implications:
Dynamic tracking of students’ progress against multiple indicators provides a fuller understanding of each student’s degrees of risk for leaving school, particularly as those degrees change over the course of the high school years. Performing this dynamic tracking regularly will provide the most powerful predictors for identifying at-risk students and targeting timely, effective support to them.

FINDING 6: Many students experience one or more educational disruptions during high school (starting high school at age 15 or older; transferring into, out of, or within the district; or withdrawing from school and then returning), and these disruptions have different effects on a student’s likelihood to graduate.

Although the conventional expectation is that students enter high school at age 14 and progress through grades 9, 10, 11, and 12 of that particular school in each subsequent year, only half of the students in the PPS 2004 cohort fit this pattern (see FIGURE 6).

FIGURE 6: Students Taking Conventional Path through High School Versus Students Experiencing Educational Disruptions
FIGURE 7 graphs the risk of disengaging from school for students on a conventional sequence through high school versus students who deviate from the conventional sequence.

FIGURE 7: Risk of Leaving High School without Graduating for Students Following the Conventional Sequence Versus Those Who are Older, Who Enter Later, or Who Transfer among Schools or Into and Out of the District

The risk of leaving school without graduating is 6 times higher for students who are overage, repeat grades, enter after 10th grade, and transfer inside/outside the district than for those who follow the conventional pattern of high school attendance.

Given the large number of students — 2,432 students, or 50% of the cohort — who do not follow the conventional path, analysis of the impact of particular factors that disrupt students from the conventional path makes the data more useful. As FIGURE 8 and FIGURE 9 indicate, certain disruptions are strong predictors that students will not graduate, while other disruptions are not.
Over one-fifth of the Class of 2004 (1,078 students, 22% of the total cohort) were late arrivals to the PPS Class of 2004, transferring into the district in grades 10, 11, or 12. FIGURE 8 graphs the effect of late arrival on a student’s risk of not graduating.

FIGURE 8: Risk of Leaving High School without Graduating for Students Enrolled in PPS in 8th and 9th Grade Versus Students Entering Portland Public Schools in Later Grades

Even controlling for age, gender, free/reduced lunch eligibility, and race, students who entered the cohort after 9th grade had triple the risk of leaving school without a diploma as students who entered in or before 9th grade.

What this graph tells us:

Students who were late arrivals to PPS were significantly less likely to graduate. These students left school without graduating at three times the rate of students who were already in the district or being classified as a “no show” in 8th grade or who entered the district in 9th grade.

Implications:

Given the greater risk to late arrivals versus the relative success PPS has with students who are in district from 8th and/or 9th grade, as well as the absence of data on academic indicators for students who are late arrivals (i.e., student performance on 8th-grade standards or in 9th-grade core courses), creating specific orientation and support programs for students arriving in grades 10, 11, and 12 will likely increase the number of students who graduate on time.
In addition to late arrival to the district, significant numbers of students experienced other disruptions to the conventional path through high school, with varying effects on whether they graduated. FIGURE 9 graphs these varying effects.

FIGURE 9: The Risk of Leaving High School without Graduating for Students Whose Educational Path Was Disrupted by Transfers or Previous Withdrawal

Controlling for age, gender, race, and free/reduced lunch eligibility, the risk of leaving school without graduating does not increase significantly for students who have transferred within district but is greatly increased by any withdrawal/return.

What this graph tells us:

Transferring out of PPS and then later returning to the district had little effect on a student’s likelihood of graduating. Transferring from one school to another within the district increased a student’s likelihood of graduating. Formally withdrawing from school (without transferring to another school or district) or being classified as a “no show” and then returning was a significant indicator for not graduating. Students who had previously withdrawn from and then returned to school were 9 times more likely to leave school a final time without graduating (note that the Y axis, set at .30 for all figures, is inadequate to graph this substantially higher level of risk, which reaches .33 by the end of 12th grade).
Implications:

The increased rate of graduation for students who transfer within the district likely reveals that such transfers enable students to find the programs that best suit their individual needs and interests. The substantially increased risk of not graduating for students who have previously withdrawn and then returned to school indicates that intervening early to keep kids from withdrawing at all is far preferable to having them leave the system and then return. Using the academic indicators discussed in previous findings to identify students at risk of withdrawing will make successful early interventions easier to implement.

Academic Indicators Versus Demographics: Determining Effective Approaches for Identifying and Supporting Students at Risk

Data analysis provides an important means for understanding whether the lower graduation rate of a particular category of students is a function of students belonging to that category or whether other factors that happen to overlap with membership in that category are more closely related to, and thus predictive of, graduation rates. This is particularly crucial to understand when addressing concerns about students of color and/or low-income students.

The achievement gap is endemic in the United States. In PPS, as in virtually every school district in the nation, the graduation rate is lower for African American, Native American, and Hispanic students than it is for white or Asian American students. It is also lower for students receiving free or reduced-price meals (i.e., student whose families are low income) than for other students (FIGURE 10). These are not new findings, and many interventions already target students from these groups. What is new — and extremely powerful in terms of getting every student the support she or he needs to graduate — is the ability to determine which factors are truly accurate predictors of an individual student’s likelihood of graduating.
Given the troubling disparities in academic achievement for students of color and students living in poverty, it is crucial to develop a strategy that will increase graduation rates for these students and thus narrow the achievement gap. The findings reported in this study provide a key foundation for such a strategy.
Despite the lower graduation rates for students in particular demographic groups, looking at demographic factors alone proves surprisingly ineffective for predicting which students are most at risk of not graduating. Predicting which students would not graduate based only on race, gender, and age results in identifying only about a third (37.3%) of non-graduates accurately. Using these demographics alone would result in failing to identify 1,307 of the students who left school without graduating — and 556 of the students who did graduate. This would mean that many at-risk students would not be identified in time to get the support they need to graduate, while other students would be wrongly stereotyped when they are not personally at risk of failing to graduate.

The strength of the academic indicators discussed in this report for identifying a student’s level of risk for not graduating further underscores the inadequacy of focusing on demographic factors to predict risk. Figure 11 graphs the comparative usefulness of academic indicators and demographic factors as predictors of a student leaving school without graduating.

**FIGURE 11: The Risk of Leaving School without Graduating by Academic Indicator and by Demographic Factors**

Being overage or being African American, Hispanic, or Native American are far less accurate predictors of academic outcome than performance on 8th-grade standards, performance in 9th-grade core courses, or accumulation of 9th-grade credits.
What this graph tells us:
When two key academic indicators — the number of 8th-grade standards met and the number of core courses passed or failed in 9th grade — are considered together, demographic variables such as race and poverty level cease to be statistically significant.

Implications:
Academic indicators are such accurate predictors of whether a particular student will graduate from high school that demographic factors offer little or no additional insight into which students are at risk. Identifying students based on academic indicators rather than by race or socioeconomic level will ensure that the students most at risk of not graduating get the support they need to succeed — and that students of color and/or low-income students with strong achievements on the academic indicators are not inaccurately and unfairly stereotyped.

The best application of the study findings is to use academic indicators to ensure that at-risk students receive the support they need to graduate. Thus, these data are particularly pertinent for those programs currently operating successfully in Portland that target students of color and/or poor students. Although academic indicators are more accurate predictors than demographic factors, programs targeting kids of color and/or low-income youth remain significant, both because those programs’ current success has likely already had a positive effect on the graduation rate for the students they target and because students of color and/or low-income students identified as at risk based on academic indicators will likely benefit from the culturally appropriate support these programs offer.

What “Graduation Rates” Measure and What They Can’t Tell Us About Drop-Out Rates
Graduation from high school is a key step in ensuring that a young person will connect to higher education and/or work. Because the risk of leaving school without graduating serves as a crucial measure of how connected or disconnected individual students are, these risk levels are cited repeatedly throughout this study. Despite the importance of graduation rates as a measure, however, these rates are extremely hard to ascertain. Moreover, as noted earlier, it is important to understand precisely what graduation rates do and don’t tell us about the students who do not graduate.
Determining the number of students who graduate from a given school district in a given year is relatively easy. Using this number to calculate the graduation rate, however, is substantially more difficult because it requires comparing the number of actual graduates to the number of potential graduates — and approaches for counting potential graduates vary substantially.

Graduating rates are typically calculated using one of two approaches, either of which yields a higher graduation rate than the cohort method used in this study. The first (and most common) approach relies on a “population snapshot,” a count or summary of counts taken at a particular point or set of points in time, such as the number of students starting or finishing 9th grade. These snapshots assume a relatively static class size. The cohort measure is more inclusive than the snapshot method in calculating the size of the class overall — it counts as part of the potential graduating class any student who is enrolled in the district for two or more quarters of grades 9, 10, 11, and/or 12 — and thus the graduation rate it yields is smaller (because the group of potential graduates is larger).

Another common approach uses statistical samples of US Census Bureau data to determine the average rate of high school and/or GED completion in a geographical area that correlates to a particular school district. Because this approach includes GED earners as well as late graduates (those earning degrees between ages 19 and 24), while the cohort measure defines graduation far more narrowly as enrolled students graduating from the district, the cohort measure again yields a smaller graduation rate.

Both the snapshot approach and the census-sample approach draw on less detailed data and thus are far less comprehensive than the longitudinal cohort method: although they yield higher graduation rates, they do not reveal anything about students’ progress over four years. By contrast, the cohort method tracks individual student progress against a range of academic indicators and demographic factors, revealing in greatest detail and accuracy the usefulness of each as a predictor of eventual graduation. It is important to understand that calculating the graduation rate is a by-product rather than a goal of this study. The goal is to identify which students are most at risk of not graduating and to pinpoint when they are most likely to disengage from school so that crucial support is targeted to individual students who need it when it can be most effective. As this goal is met, the graduation rate should rise for the district overall and for every demographic group — regardless of which method is used to calculate it. That is why in using this approach, Portland is raising the bar on analyzing student achievement — and is poised to implement strategic supports to keep more kids connected to school.
About Connected by 25

Connected by 25 is an unprecedented effort that builds on Portland’s extraordinary civic energy and commitment to connect every young Portlander to school, work, and community by the age of 25. Connected by 25 delivers real results for our youth by implementing research-driven initiatives and coordinating a citywide network of highly effective programs and services to ensure that all young people succeed.

Connected by 25 is led by more than 35 local corporations, nonprofit organizations, foundations, and educational and advocacy groups. The effort is funded by the Bill & Melinda Gates Foundation and the Meyer Memorial Trust. For more information about Connected by 25 and how to get involved, please visit www.ConnectedBy25.org.

Success for every young Portlander.
For more information about Connected by 25, please visit www.ConnectedBy25.org

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