STRATEGIC DATA PROJECT

SDP FELLOWSHIP CAPSTONE REPORT

Student Success and College Readiness: Translating Predictive Analytics Into Action

Jason Becker, Providence Public Schools

L. Shane Hall, Dallas Independent School District

Benjamin Levinger, Prince George's County Public Schools

Anthony Sims, Prince George's County Public Schools

Anthony Whittington, Prince George's County Public Schools

SDP Cohort 4 Fellows

SDP Fellowship Capstone Reports

SDP Fellows compose capstone reports to reflect the work that they led in their education agencies during the two-year program. The reports demonstrate both the impact fellows make and the role of SDP in supporting their growth as data strategists. Additionally, they provide recommendations to their host agency and will serve as guides to other agencies, future fellows, and researchers seeking to do similar work. *The views or opinions expressed in this report are those of the authors and do not necessarily reflect the views or position of SDP or the Center for Education Policy Research at Harvard University.*

Introduction

Preparing students for college has become a national educational priority, as a growing number of school systems make college readiness part of their goals. Despite this growing emphasis on college readiness, little consensus exists on the best supports and interventions at the secondary level to help keep students on track toward graduation and better prepare them for college and career success. Knowing how and when to intervene are essential steps in fostering high school success and college readiness—steps requiring the collection and analysis of reliable data that will signal to educators when students need additional support and intervention, be it academic, social-emotional, or otherwise.

Predictive analytic techniques commonly used in the business field have more recently been applied to the field of education and have the potential to yield valuable information to teachers and administrators. This report will focus on how predictive analytics can help school systems best measure and support high school success, on-time high school graduation, and college readiness by examining the experiences of three urban school systems: the Prince George's County Public Schools, the Providence Public Schools, and the Dallas Independent School District.

Background

Predictive analytics uncovers patterns in existing data to better predict future events (Siegel, 2013). In education, predictive analytics methods can help schools predict student outcomes such as ninth grade success, on-time high school graduation, and postsecondary readiness by analyzing available data to identify indicators associated with these outcomes.

A rich body of research (ACT, 2008; ACT, 2012; Balfanz, 2009; Roderick, et al., 2009; Lee, 2012; Lee, 2013; Kemple, et al., 2013) has identified variables associated with high school success and college readiness, and this work informs much of the predictive analytic work under way in school systems, including the agencies involved in this report. ACT (2008) and Balfanz (2009) highlighted the importance of middle school success and identified predictors of success, including high rates of attendance, low rates of course failure and grade retention, and proficiency on state assessments.
Allensworth and Easton (2005) identified the first year of high school as critical and found the ninth grade on-track indicator as a stronger predictor of high school graduation than previous test scores or student background characteristics. Subsequent research by Allensworth and Easton (2007) highlighted ninth grade as a make-or-break year in which course performance and attendance are the most significant predictors of high school graduation. Research by ACT (2012) found maintaining a high school

GPA of at least 3.0, passing high school exit exams, and meeting college readiness benchmarks on college entrance exams to be correlated with success in entry-level college courses.
This work shaped the development of early warning indicator systems, designed to identify students at risk of failing or going off track so that educators can intervene to keep them on track toward graduation. Early adopters of early warning indicator systems include Montgomery County Public Schools in Maryland, Chicago Public Schools, and the School District of Philadelphia. More recently, the idea of early warning indicators has been extended to incorporate indicators of college readiness, defined by Conley (2010) as the knowledge and skills necessary to enroll and succeed in college without remediation. College readiness indicators go beyond the measures used in early warning systems to include not only academic performance measures, but other skills, attitudes, and behaviors needed to succeed in college.

Montgomery County Public Schools in Maryland is an early example of the application of predictive analytics to student success and college readiness. Montgomery County's "7 Keys of College Readiness" model outlines seven benchmarks of K–12 success that researchers there found predictive of college readiness, including advanced reading skills in grades K–2, successful completion of Algebra I in grade 8, and scoring a 3 or higher on at least one Advanced Placement (AP) exam in high school (Zhao and Liu, 2011; Childress, Doyle, and Thomas, 2009). This work influenced some of the predictive and college readiness work in other districts, including Dallas, one of the districts discussed in this report.

Prince George's County Public Schools: Early Warning Indicator System and 9th Grade Promotion

Agency Profile

Prince George's County Public Schools (PGCPS) is a large, diverse school system, which borders Washington, DC. There are about 125,000 students and 205 schools in PGCPS. Approximately 91% of the student population is African-American or Hispanic with 62% of students receiving Free and Reduced Meals (FARMS), compared to 44% of students statewide. PGCPS began a partnership with the Strategic Data Project (SDP) in August 2012. Anthony Sims and Anthony Whittington applied to SDP and were selected Agency Fellows. Anthony Sims was a Performance Management Associate in the Division of Performance Management. He primarily worked to develop the data literacy of elementary and middle school leaders with a focus on enhancing their use of data to improve organizational effectiveness and student achievement. Anthony Whittington was the High School Performance Specialist. He provided direct assistance to the Associate Superintendent of Schools for those responsibilities that affect the implementation of high schools' instructional programs. Ben Levinger was an SDP Data Fellow selected by Duane Arbogast, Chief Academic Officer for the district. In August 2012, Levinger was appointed as a Strategic Data Analyst, working directly for the Chief Academic Officer.

Policy Context

In 2010 the board of education specifically identified College and Career Readiness as a Key Performance Indicator for the district. While college and career readiness was a goal for the district, a significant number of PGCPS students were failing to graduate from high school. In SY 2011–12, the Four-Year Adjusted Cohort Graduation Rate was 72.9%. In fact, further analysis revealed that about 20% of first-time 9th graders were being retained each year. Past district data showed that the majority of 9th grade repeaters failed to graduate from high school. District leadership decided to focus on 9th grade promotion as a priority for the district. Specifically, they decided that a new Early Warning Indicator (EWI) system would be designed to predict which students were most at risk of being retained in 9th grade.

PGCPS had previously developed an early warning "Watch List" classification system. However, an analysis of this system conducted by the PGCPS Department of Research & Evaluation (Adams and

Taylor 2011) found that the implementation of this system was "severely flawed." Use of this early warning system had fallen over time.

District leadership and the SDP Fellows decided to create a new and improved Early Warning Indicator system. This new system was based on the same general concept as the earlier model: eighth grade performance data can help predict ninth grade performance. However, the technical components of the new Early Warning Indicator system were not based on the Watch List model. In addition to the new model, there would be a deliberate systemic emphasis on the importance of 9th grade success and how the early warning data could help schools focus these efforts.

The general concept of this EWI system was based on the national literature on early warning systems: a student's performance in school is often a good predictor of their future school performance. Allensworth and Easton (2007) shows that 9th grade performance is a strong predictor of high school graduation in Chicago Public Schools. Von Secker (2009) shows how Montgomery County Public Schools (MCPS) expanded this concept by creating "college readiness" benchmarks along the K–12 continuum. MCPS used predictive analytics to create these "Seven Keys", providing a trajectory for students to be college-ready by the end of high school. Many early warning systems used similar variables in these models: course grades, attendance, and sometimes standardized test scores and discipline data.[1] The SDP Fellows decided to examine past PGCPS data to customize the EWI model for PCGPS.

Project Scope and Timeline

During the discussions at the SDP Convening in May 2013, the PGCPS team comprised of SDP Fellows, the Chief Academic Officer/Acting Deputy Superintendent and the Director of Testing decided to implement a new early warning system for school year 2013–14. Since there were only three months remaining before the start of the new academic year, the team members decided that the best strategy would be to score a "quick win" to establish the new early warning system. Their goal was to initiate a simple, yet improved, early warning system that focused on middle school and 9th grade students. This system would use 9th grade promotion as its desired outcome. Early Warning Indicator Reports (EWIR) would be created for incoming 9th graders, as well as incoming 7th and 8th graders. The team believed that middle schools were crucial in preparing students to succeed in 9th grade.

Examining past PGCPS data to customize the EWI model for the district, Levinger ran logistic regressions with 9th grade promotion as the dependent variable, the outcome they were trying to predict. The key

[1] Allensworth and Easton (2005) shows the importance of course grades, course failures, and attendance in 9th grade. MCPS mainly used test scores and course grades in their "Seven Keys" (Von Secker 2009).

set of regressions used 8th grade academic performance as independent variables, the indicators that were being used to predict 9th grade promotion. The results of this analytic research were similar to those found in the literature (Allensworth and Easton 2005). Course grades from 8th grade were the best predictor of 9th grade promotion. Attendance and standardized test scores were less predictive than course grades but were still statistically significant factors in the regressions. Discipline, measured by number of suspensions since School Year 2008–09, was also statistically significant in most regressions.[2] Table 1 below displays the results from the primary regression, a logit regression with 9th grade promotion as the dependent variable.

Table 1. Odds Ratios for Predictive Model, PGCPS

Independent Variable	Odds Ratio
8th Grade GPA	4.04***
Average GPA of 8th Grade Class at Student's Middle School	0.44***
Attendance Rate * 10	1.78***
MSA Math Score	1.01***
MSA Reading Score	1.01***
Total # of Suspensions since SY 2008-09	0.94**
Constant	0.00***

* Sig. at the 5% level; ** Sig. at the 1% level; *** Sig. at the 0.1% level
Note: 9th grade promotion is the dependent variable. It equals 1 if the 9th grade student is promoted to the 10th grade, and it equals zero if the student is retained or dropped out. (Retention was a much more common outcome than dropping out for first-time 9th graders.)

The regression from Table 1 examines the relationship between 8th grade data and 9th grade promotion for the cohort of students who were first-time 9th graders in SY 2012–13. Other regressions, one with 7th grade data and one with 6th grade data, also predicted the promotion rate of this same cohort of first-time 9th graders. Using the fitted values from these regressions, Levinger derived coefficients that could be applied to the incoming 7th, 8th, and 9th graders to give them a "promotion probability," the probability that they will pass 9th grade their first time given their most recent data. For example, each of the SY 2013-14 incoming 9th grade students now had a promotion probability that was between 0% and 100%. (See Appendix A for the calculations used to create promotion probabilities using the logit regression coefficients.)

In order to show these data in a way that was familiar and accessible for principals and other school staff, the Fellows created color-coded risk categories: red, yellow, and green. The red category indicated "high-risk" students, those with less than a 70% chance of passing 9th grade. The yellow

[2] Multiple years of suspension data were included to increase the variation between students. However, some students had been attending PGCPS schools since School Year 2008–09 or earlier, while others had transferred into the system after that school year, making direct comparisons misleading. For this reason, the EWI model for SY 2014–15 will include number of suspensions during the previous school year (SY 2013–14) only.

category represented “moderate-risk” students, those with a 70-95% chance of passing 9th grade. The green category represented the “low-risk” students, those with a 95% chance of passing 9th grade or higher. See Appendix B and Appendix C for examples of the Early Warning Indicator Reports with the color-coded risk categories.

In early August 2013, school-level reports were created, listing each incoming 9th grader, their risk category, and their feeder school. The production of the raw reports was automated, but Whittington manually added some formatting and aesthetic elements to make the reports easier to read and understand. He then disseminated the reports to each high school principal in mid-August 2013 prior to the first week of the new school year. The Fellows soon decided to further enhance the reports with additional information by including the promotion probability and the relevant 8th grade data contained in the model: GPA, attendance, test scores, and number of suspensions. They distributed the expanded set of reports during the first week of the school year (See Appendix B for an example of one of these “improved” EWI Reports sent to high schools). The reports for the 7th and 8th graders, with a full set of data, were sent to middle school principals in mid-September.

District leadership charged each high school with the goal of reducing its 9th grade retention rate from the previous school year by five percentage points. The Associate Superintendents and the Instructional Directors, who are the principals’ direct supervisors, monitored the principals throughout the year to observe what strategies were used to support students identified as at-risk of repeating the 9th grade. While the Instructional Directors were tasked with checking to ensure that the principals were implementing interventions to help these students, the principals were given discretion and flexibility to determine how they wanted to intervene. In February and March, Whittington began surveying the principals via face-to-face interviews to learn what interventions they put in place. He also conducted focus groups with school staff and 9th grade students to collect information on the interventions implemented and perceptions of their effectiveness.

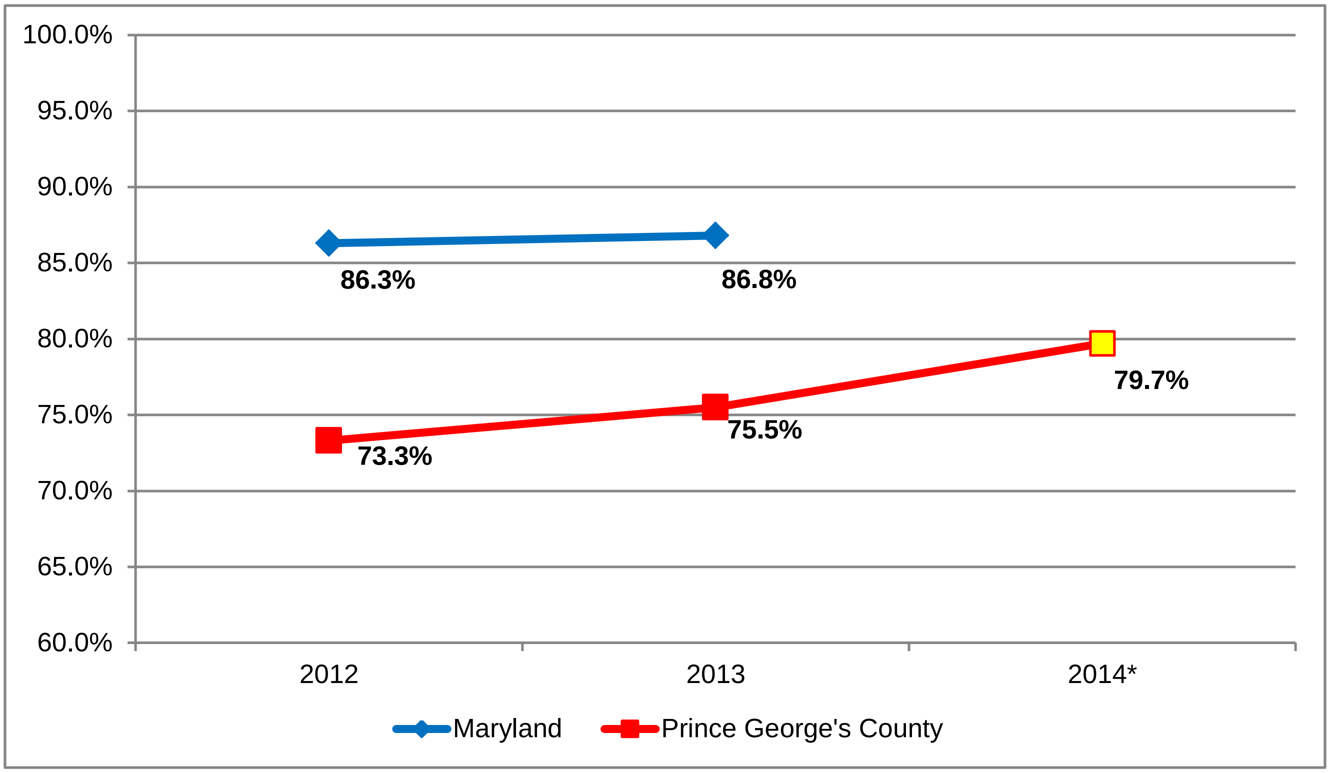
At the end of each quarter of the 2013–14 school year, updated EWI reports were sent to all middle and high school principals. These reports were based on updated regressions, which factored in the most recent GPA and attendance data. The updated regressions for Q1 examined how 9th grade promotion (in SY 2012–13) related to Q1 data from that school year, as well as some data from the previous year. The new reports displayed the initial promotion probability and risk category from the beginning of the year, the academic data from the previous school year, as well as the new promotion probability and risk category, and new academic data. Using these reports, school staff could observe whether students were improving their likelihood of passing 9th grade each quarter. One clear sign of improvement was the number of students who exited the red, high-risk category. The updated EWI reports were provided to principals four times over the course of the year: after the progress report distribution halfway through the first quarter and after every report card distribution at the end of quarters 1, 2, and 3. (See Appendix C for an example of a 9th grade EWI report from Q1).

The support of key stakeholders was essential throughout the rollout of the new EWI system. Dr. Duane Arbogast was the Chief Academic Officer and supervisor of the SDP Fellows when the project began. His advocacy was crucial to getting the EWI system off the ground, and his support helped district leaders maintain a focus on this initiative. There were several major changes in district leadership that occurred just before and during SY 2013–14. Dr. Kevin Maxwell was announced as the new CEO on June 28, 2013, and Dr. Monique Davis was named Deputy Superintendent in August 2013. Davis provided critical support for the EWI system during a period of significant transition. Whittington had strong collaborative relationships with the high school principals, who were also key stakeholders. Through working with district leaders and elementary school faculty, Sims helped promote the conceptual bridge between students' academic and social-emotional experiences in elementary school and their readiness for middle and high school.

Results/Impact

At the time of this report, SY 2013–14 has ended, but the final 9th grade promotion rate is not yet available because there are students who will be promoted due to their progress in summer school. However, the preliminary 9th grade promotion rate is 79.7%. This is a 4.2 percentage point increase from SY 2012–13, and the summer school promotions may increase the rate by several percentage points. It is possible that the promotion rate will surpass the SY 2007–08 promotion rate of 82.7%, the highest 9th grade promotion rate on record.[3] Figure 1 shows a three-year time trend in the 9th grade promotion rate for PGCPS and for the state of Maryland. The district's promotion rate has been increasing steadily, narrowing the gap between PGCPS and the state.

[3] There are currently 494 9th graders in summer school or credit recovery. If all of them are promoted, it would increase the promotion rate to 84.3%. In past years, the vast majority of 9th graders in summer school were promoted to the 10th grade. If only 80% of the 9th graders are promoted, the promotion rate would be 83.4%.



*2014 is a preliminary result before summer school promotions have been counted. Statewide promotion rate for 2014 is not yet available.

Figure 1. 9th Grade Promotion Rate Three-Year Trend, PGCPS vs. State

The feedback received from principals and other school administrators has been quite favorable. Many principals expressed their feelings of excitement each time they received the updated EWI Report. Principals provided the following statements regarding the importance of the EWI Reports:

"The EWIR has assisted in providing us with the ability to have a laser-like focus on identifying and providing intervention to our at-risk population. It has been an invaluable tool in helping to reduce our 9th grade retention rate."

"The report was extremely useful for guiding the courageous conversations necessary to move student improvement. Parents were impressed and supportive with the information we had about their child and the interventions that we recommended. The report helped teachers and administrators have a focus on the specific needs of these students."

"The EWIR data was utilized for identification of students that were in need of additional support in the areas of organization, writing, self-esteem, English 9 requirements and other content areas. A support team was formed of administrators, counselors, the PPW [Pupil Personnel Worker] and English 9 teachers. The quarterly disaggregated data provided was used primarily to actively monitor the progress of yellow and red students to ensure that they [were] successfully moving towards completion of ninth grade. EWIR was invaluable to the success of our school."

"The EWIR assisted our ninth grade academy with analyzing the progress of our ninth grade students over the course of the school year using one resource document. The EWIR allowed us to measure multiple metrics of student success in one place. As a result, successes were celebrated and positive behaviors reinforced, and interventions were applied to students who continued to struggle."

In addition to the EWI Reports, there were complementary supports that also focused on 9th grade success. Ninth graders must pass English 9, or an ESOL (English for Speakers of Other Languages) English course, in order to be promoted to 10th grade. Each grading period, the Fellows produced additional reports showing the English 9 grade distribution by high school, which included the number of students failing. The district also sent English instructional specialists to two high schools that had struggled with 9th graders the previous year. This multi-tiered focus on 9th grade helped promote the use of the EWI system among school staff.

Next Steps

The EWI model was **updated for school year 2014–15**, with the updated regressions using the data from the SY 2013-14 9th graders. One major change to the model itself was the removal of the state standardized test scores. Maryland is switching to the Common Core, and the Maryland School Assessment (MSA) was phased out in preparation for the PARCC assessment. The new model will include Lexile scores from the Scholastic Reading Inventory (SRI) test. The SRI data is a reasonable substitute for the MSA scores because the SRI had become a districtwide focus in SY 2013–14.
In addition, further thought was required about how to address students with missing data. The initial EWI Reports omitted any first-time 9th graders that were missing data required for the model. So these reports excluded all 9th grade students who were newly enrolled in the district. In addition, the reports excluded continuously enrolled students who were missing at least one data element, such as their MSA scores. On the first EWIR distributed at the beginning of School Year 2013–14, approximately 13% of first-time 9th graders were either newly enrolled or were missing data and were therefore excluded from the reports. The Q2 and Q3 reports included these "missing data" students, but they usually did not have promotion probabilities and risk categories, and they were placed on a separate tab with all of their existing data. The new model for SY 2014–15 captures some of these students by running an alternate model for some students with missing data. The alternate model excluded the SRI Lexile variable, so students with missing SRI scores could still be included in this model as long as they had complete GPA, attendance, and discipline data.

The district would also benefit from **automating the process further**. In the first year, the Fellows spent a significant amount of time formatting Excel files manually. Displaying the EWI data online as part of the district's Data Warehouse would improve the efficiency and convenience of the EWI process.

In the first year implementing the EWI system, principals were given considerable flexibility to identify interventions for at-risk students and implement these interventions. District leadership had to decide whether the second year of this program would operate in this same way. **The district leadership has decided to add some structure to the process that schools must use when analyzing the EWIR data, but they will not specify which interventions schools should use to help their at-risk students.** School-based teams will conduct root-cause analyses by digging deeper into the cumulative files of each at-risk student, and they will identify the appropriate intervention(s) for each student. This additional structure is meant to ensure that school teams are using the EWIR data to implement strategies with fidelity.

The district will also have the opportunity to expand and improve the system in other ways. In the first year, the system focused on grades 7–9. The **system could be expanded to include other grade levels**. New outcome variables could be chosen to best match the grade levels used. For grades 10–12, high school graduation or college enrollment would be logical outcomes. For elementary grade levels, benchmarks based on test scores or course grades could be used.

The EWI system provides a framework for a deeper analysis of the data and aligned work relative to student learning and instructional effectiveness. For example, future predictive analytic work could **focus on specific academic skills or content standards**. In addition, socio-emotional skills are crucial during the 9th grade transition and throughout the entire school trajectory.[4] Sims has begun to map out the theoretical framework around how these foundational academic skills and socio-emotional skills relate to future academic success. Future predictive analytic work could incorporate student perception and engagement data currently being collected as part of the teacher evaluation system. These socio-emotional data could be integrated in the existing predictive model, or more schools could implement interventions designed to address the socio-emotional needs of their students.

[4] Farrington et al. (2012) provides a comprehensive overview of the role of "noncognitive" factors in education. Tough (2014) focuses on examples of how socio-emotional factors affect the transition to college.

Getting Back on Track: Predicting High School Success in the Providence Public School District

Agency Profiles

The Annenberg Institute for School Reform (AISR) is a national policy-research and reform-support organization, affiliated with Brown University, that focuses on improving conditions and outcomes for all students in urban public schools, especially those attended by traditionally underserved children. AISR conducts research, works with a variety of partners committed to educational improvement to build capacity in school districts and communities, and shares its work through print and Web publications. AISR's vision is the transformation of traditional school systems into "smart education systems" that develop and integrate high-quality learning opportunities in all areas of students' lives—at school, at home, and in the community.

Providence is the largest city in Rhode Island and the third largest in New England. Of its 170,000 residents, 26% live below the poverty line. The Providence Public School District (PPSD) is the largest school district in the state, operating 38 schools that serve a diverse student body of 24,000 students: 64% Hispanic, 18% African American, 9% Caucasian, and 3% multi- racial. PPSD faces many challenges associated with large urban centers: the highest percentage of English Language Learners (18%) in Rhode Island; 83% of students receiving free and reduced price lunch, compared with 43% statewide; and a chronic absentee rate of 32%. High levels of student and family poverty dramatically affect educational attainment in Providence Schools. Only 65% of PPSD students graduate in 4 years. On NECAP (New England Common Assessment Program), only 50% meet state standards for reading and 34% for math.

AISR has long had an interest in the use of leading indicators in districts (Supovitz, Foley & Mishook, 2012). This work led to their involvement in the College Readiness Indicator Systems project (CRIS). It was a natural extension of their existing research and has been an opportunity to engage with urban districts implementing leading indicators to drive their college and career readiness agendas. AISR has worked with the five CRIS sites to better understand the system level and identify its college and career readiness indicators, addressing the question: What are the components and infrastructure districts need to work with a diverse set of external partners to deliver quality programming that enhance student supports for achieving college readiness? As part of CRIS, AISR studies collaborations specifically focused on college readiness.

AISR and PPSD have had a long history of collaboration, and a growing interest in college and career readiness at PPSD led directly to pursuing a joint fellow from the Strategic Data Project. This case study summarizes the work of the SDP Fellow.

Policy Context

Since 2003, the Rhode Island Board of Regents has developed, refined, and implemented regulations for Proficiency-Based Graduation Requirements (PBGRs) to ensure that each diploma recipient has attained an acceptable level of achievement in each of six core academic areas in order to be successful in college and careers (R.I. Admin. Code 21-2-46).

In 2011, the state Board of Regents for Elementary and Secondary Education adopted revised regulations including the state assessment component (R.I. Admin. Code 21-2-46), that would go into effect with the graduating class of 2014. The PBGRs require students to:

- meet partial proficiency or above on the state assessment or assessments in reading and in math (a 2 or greater on a 4 point scale for the New England Common Assessment Program);
- successfully complete state and local course requirements; and
- successfully complete two performance-based diploma assessments.

The PBGRs also require that local education agencies (LEAs) provide individualized supports for their students to meet these requirements. The most prominent mechanisms adopted by LEAs in Rhode Island for these supports are individual learning plans for students in grades 6–12 that monitor their progress against the requirements and an early warning system to identify students in need of supports.

Project Scope

PPSD developed the Personal Graduation Plan (PGP) process in 2010 with a sophisticated concept of student success. Rather than understanding graduation as meeting compliance-driven requirements, the PGP views graduation as a demonstration that PPSD successfully met that student's needs to attain success. In practice this is articulated through a belief that the district has to build a comprehensive system of supports for students so that intervention is individualized to meet each student's academic and non-academic needs. This is in contrast, for example, with a system that universally responds to under-credited students with credit recovery and retesting opportunities without any further understanding of why each of those students was unsuccessful in their initial attempts.

The PGP process is designed so that PPSD staff identify individual student needs through a data-informed decision making process and select only evidence-based programmatic interventions as part of the PGP. Students are not identified and matched to programs entirely through a fixed set of business rules or a decision tree. Instead, PPSD is enabling its staff to review several forms of complex data on individual students to facilitate matching them to a vast array of interventions. PPSD also has detailed information for each intervention regarding target groups, purpose, and evidence on program efficacy. Of the decisions PPSD staff need to make during the PGP process, identification of at risk students seems like the least complex. Teachers, guidance counselors, and other staff with close relationships to their students often know those who are most at risk. However, there are several key advantages to using predictive models rather than depend on individual, personal relationships for every student alone. Predictive models:

- set expectations objectively based on past performance that leads to results, quickly, for all students
- distinguish more precisely between levels of risk, reducing the likelihood that a student who is falling behind is not identified
- achieve greater sensitivity to signs that students are falling behind to allow for earlier identification

Providing clear information about which students are at risk of not graduating permits PPSD staff engaged in the PGP process to focus on uncovering why students are off track and how to address those needs.

Bowers, Sprott, and Taff (2013) have a thorough meta-analysis of 36 studies and 110 drop out indicators cataloging this research as far back as the early 1980s. They have helpfully documented the features used in each of these studies, grade span of included students, and key measures of the predictive properties of each indicator.

PPSD has generated new models for identifying which students are at risk of failing to graduate based on this rich body of research using Providence Public Schools Data, summarized in Table 1. Utilizing readily available administrative and student performance data, we can have multiple modeling techniques and a combination of drop out indicators suggested by previous work on predicting high school graduation. Like Bower, Sprott, and Taff (2013), we use the Relative-Operator Characteristic (ROC) and confusion matrices as the primary tool for comparing the predictive properties of these models. Building from their work, we are also able to include the ROC properties of other models and indicator systems to compare against our locally developed models. As a result, we can assess the predictive qualities of these models compared to the leading research in predicting high school success nationwide.

Results and Impact

PPSD was able to compare the predictive capacity of each of our models to other indicators using the dataset collected by Bowers et al. (2013). In particular, we compared each of our models to indicators that used data with the same starting grade span as our models, each of which use only one year of data to maximize their applicability to the most number of students. We found that few indicators outperformed our models, and most of those indicators used substantially more demographic data, multiple years of data on the same students, and more complex modeling techniques. Our models, therefore, show that applying predictive analytics technique to district-specific data can provide more accurate data for local use. A summary of the model features and odds-ratios are in Table 2.

Table 2: Odds Ratio for Predictive Models

	8th Grade Model	9th Grade, Quarter 1 Model	9th Grade Model	10th Grade Model
Attendance * 10	2.34	1.83 (8th Grade)	1.68	1.72
Average Course Performance	2.25	3.12 (9th Qtr 1) 1.46 (8th Grade)	2.10	1.97
Course Failures		1.13		0.86
Average Course Performance * Course Failures		0.89		1.05
Overage	0.46 (8th Grade)	0.47 (9th Grade)	0.40	0.42
NECAP Math	1.07			
NECAP Reading	1.17			
Days Suspended			0.94	
School changes (mobility)			0.78	0.56
Core Course Credits			1.31	
Science Course Credits			1.34	
AUC	0.821	0.808	0.90	0.87

Similar to extensive existing qualitative and quantitative research, we find that the transition to 9th grade is a critical juncture. Although we are able to accurately predict graduation using only 8th grade data, models adding course performance data from the first quarter of 9th grade improved the predictions. As shown in Figure 2, students with the same risk level when they enter high school who perform better than their peers are more likely to graduate. In fact, students who enter “On-track” who eventually fail to graduate have higher quarter 1 average course performance than their peers who entered at higher risk. This is a strong demonstration that low *absolute* performance alone may identify the wrong students. Instead, performance compared to incoming preparation is key.

We also observe the devastating impact of poor performance in 9th grade. Students who start PPSD in 9th grade who do not transfer out before graduation have a 65.8% graduation rate. Those who reach 10th grade, whether or not they had been held back at any time, have a 73.3% graduation rate. Students who are promoted to 10th grade on time have an 81% graduation rate. Students who are retained at the end of 9th grade have a graduation rate around 15%. We suspect that the 9th grade model is the most complex because of the importance of that year for student success.

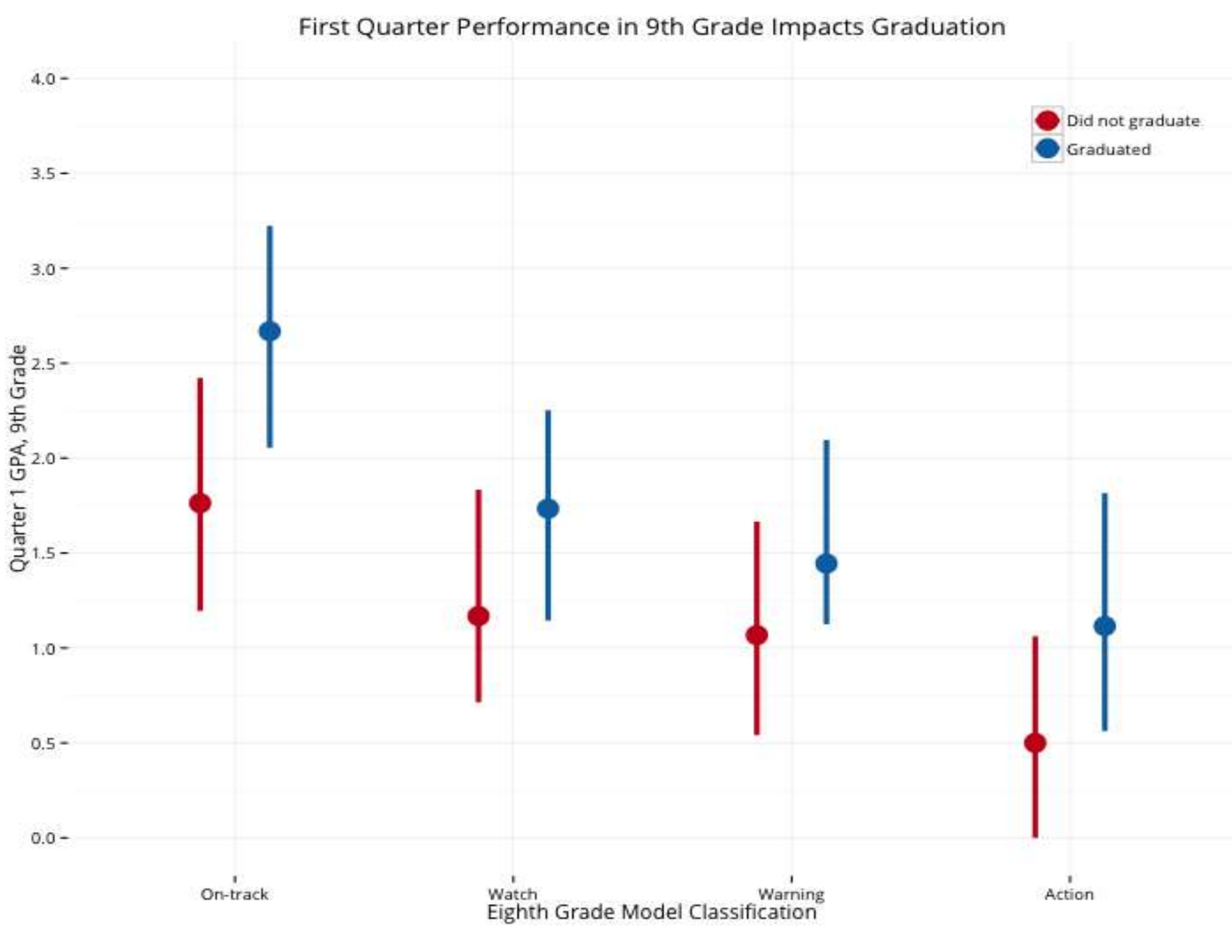


Figure 2. First Quarter Performance in 9th Grade, Graduates vs. Non-Graduates

In Providence, students who are retained at the end of 9th grade are far less likely to graduate (Appendix D). Despite the importance of retention, we were able to avoid using this measure in our models so that student classifications can be updated during the year. We found that models that include whether or not a student is overage (based on age in months at the start of the school year compared to the PPSD age-cutoff for kindergarten enrollment) and the total accumulated credits in math, English, social studies, and science sufficiently captured the differences between retained students and those who were promoted on time.

In Providence Public Schools, attendance, course performance, and on-time progression through schooling are consistently the key elements that predict graduation. This is also consistent with the literature on high school readiness and success (Bowers et al, 2013; Balfanz et al 2007). The Johns Hopkins Everyone Graduates Center has popularized the “ABCs”—Attendance Behavior, and Course Performance—as key indicators of high school success. While these models do not all include suspensions, we find that students who were suspended even one day are far less likely to be on-track (Appendix E and F). By developing models using only local data, we were able to outperform, as determined by the sensitivity and specificity of our models (Appendix G) the vast majority of indicators available in the research literature in spite of using simpler techniques.

There are key gaps in on-track status by student demographics, middle school, and receiving high school. The Personal Graduation Plan must grow from an individualized plan to a process that interrogates these broader patterns, builds understanding around why and how some middle schools produce more prepared students, and contextualizing the challenges faced by high schools receiving student bodies with dramatically different levels of preparation. There is also some evidence that some high schools are more successful at bringing students who entered off-track to on-track status after freshman year. Understanding where policy or practice plays a role in these successes will be key to spreading strong practices throughout the district.

The On-Track to Graduation measure can now be used as one way to measure the success of the programmatic interventions students are referred in their PGP. Rather than wait until graduation to review the success of these programs, we can use updated on-track status as a summary measure to understand whether students are improving with greater immediacy. Although we expect this data is not as reliable as a long-term outcome such as graduation, it can serve as an excellent ongoing monitoring tool and provide opportunities for intervention earlier on.

PPSD is now exploring using On-track Status as a key indicator for internal school accountability. Guidance counselors in high schools will be able to identify students who are at-risk of failing to graduate and take action from the first day of high school. The predictive models also allow for updating student status throughout the 9th and 10th grade, which will serve as a form of continuous formative impact on the success of programmatic interventions. We are working to drive the highest activity toward ensuring high school graduation far earlier in the secondary school experience, efficiently and effectively improving outcomes while freeing up resources to guide students in the 11th and 12th grade toward postsecondary opportunities.

This project has also strengthened the partnership between AISR and PPSD. The SDP Fellow was a formal part of the AISR Research and Policy team. There, he maintained a new database of student-level data from PPSD that went through extensive reshaping and validation so as to be more conducive to longitudinal research. This partnership will allow for continued data sharing and research in a key area of interest for PPSD. In 2014, AISR and PPSD applied to a Researcher-Practitioner Grant with the Institute for Education Sciences. Based on the supportive, positive feedback from that submission, we are confidently resubmitting in 2015. This proposal directly addresses aspects of the Personal Graduation Plan Process that require research and data analytic capacity and support to work well. It will enable qualitative and quantitative research on the PGP process, working in partnership to:

1. **Analyze trends and changes in on-track status over time to better understand the impact of the Personal Graduation Plan:** This includes both analysis with existing administrative data and new research through Youth Participatory Action Research to more fully understand how and how well the Personal Graduation Plan works for students.
2. **Document the available programs at each school that support college and career readiness, particularly the external partners that operate throughout the district**: In particular, partner readiness for working with PPSD will be assessed across multiple criteria and the type of services they provide and the intended outcomes of those supports. This will allow for thorough analysis of the availability of supports and how well that meets the broadly demonstrated need of students in each school. Additionally, the grant activities include working to build a common language of college and career readiness that will facilitate aligning goals with external partners and assist in the development of Common Service Agreements and future evaluation.
3. **Facilitate data-based inquiry with guidance counselors and freshman advisors** in several high schools to improve their facility with using data as the PGP process expects, to document the current data capacity in schools, and to determine what additional supports are needed to

improve data use. Focus groups in the high schools will help to better understand how guidance counselors and advisors are using the PGP and Richer Picture to learn about the necessary supports and inform changes to the process, forms, and/or software to make them easier to use.

Providing research and analysis support for the PGP while it is relatively new should help to ensure its continued success as a lynch pin in PPSD long-term strategy for college and career readiness success for its students.

From High School to College: Predicting Postsecondary Readiness in the Dallas Independent School District

Agency Profile

Dallas Independent School District (ISD) is the 14th largest school district in the United States and the second largest in the state of Texas. It has 159,000 students in 223 elementary and secondary campuses. The district's diverse student body is 70% Hispanic, 24% African-American, and 5% white, with Asians, American Indians, and other ethnicities comprising the remaining 1%. Nearly 90% of Dallas ISD students are economically disadvantaged, and 31% are English language learners. Dallas ISD's commitment to graduating its students ready for college and careers continues under its current Superintendent, Mike Miles. This commitment is reflected in the Destination 2020 improvement plan, which states that by the Fall of 2020, 80% of Dallas ISD students will graduate on time ready to enter college, the military, or a "career-ready" job. Although Dallas ISD has made progress toward this goal, much work remains to be done. A longitudinal study of college enrollment and completion patterns found that an average of 60% of Dallas ISD graduates from 1998–2009 cohorts enroll in college sometime after high school (Hall and Johnson, 2011). However, further analysis of the classes of 2006 and 2007 revealed only 18% completed any kind of postsecondary credential (National Student Clearinghouse, 2013).

Policy Context

Dallas ISD's efforts to develop a system of college readiness indicators began in 2008, when the district received the first of three Bill and Melinda Gates Foundation grants. The second of those grants, provided under the Gates Foundation's College Readiness Indicator Systems (CRIS) initiative, made Dallas one of five sites across the country to collaborate with the Annenberg Institute for School Reform at Brown University and the John Gardner Center at Stanford University to develop a menu of measurable indicators of college readiness. The CRIS initiative focused on a developing a national model that would generate data for districts to determine which students were on track toward college readiness, as well as to tie those data to appropriate interventions. Under the CRIS framework, college readiness is a function of three dimensions: academic preparedness, college knowledge, and academic tenacity.

To ensure the continuation of the CRIS work beyond the grant period, the initiative further funded a Strategic Data Project Agency Fellowship for one fellow from each of the five agencies taking part in CRIS: Dallas Independent School District, San Jose Unified School District, Pittsburgh Public Schools, the School District of Philadelphia, and New Visions For Public Schools in New York City. Dr. Shane Hall was selected as Dallas' SDP Agency Fellow. Hall, who served as the district's liaison under the CRIS grant, was a senior-level specialist and manager in the Dallas ISD's Department of Evaluation and Assessment.

Because Dallas ISD emphasizes the proper use of appropriately analyzed data to drive decisions at the campus and district level, it is important to have valid indicators of college readiness to inform supports designed to ensure more students graduate with sufficient preparation for postsecondary work. In his position as a manager in Evaluation and Assessment, Hall is responsible for overseeing research in this area, responding to requests for reports and analyses on college readiness by district leadership, and managing a team whose duties include conducting formative and summative evaluations of programs related to college and career readiness.

Project Scope and Timeline

During the course of the SDP Fellowship, Hall and the Dallas ISD CRIS team conducted extensive analyses to identify the indicators that were predictive not only of college readiness, but of college success, defined as successful completion of a postsecondary credential, ranging from a certificate to a baccalaureate degree. The district's CRIS team was housed in the Dallas ISD Department of Evaluation and Assessment, led by Dr. Cecilia A. Oakeley, Assistant Superintendent for Evaluation and Assessment. The CRIS team also included representatives of the district's College and Career Readiness and Counseling departments. The team analyzed data on past Dallas ISD cohorts that went on to complete college, as well as more recent graduating classes. The models employed logistic regression, a popular modeling technique in predictive analytics. Dr. Linda K. Johnson, Dallas ISD's Executive Director for College and Career Readiness, was a member of the Dallas ISD CRIS team and was a consultant under the grant before becoming Executive Director in 2012.

In addition to using data to predict college readiness and success, Hall and his team in Evaluation and Assessment produce a variety of reports to inform schools' efforts to prepare their students for college. They also conduct formative and summative evaluations on college readiness programs and supports. The district receives National Student Clearinghouse reports, as well as student-level data, twice a year: once in the fall and again in the spring. Every month, Hall produces reports for high school counselors on college applications and FAFSA completions. The monthly FAFSA report enables counselors to download a spreadsheet of senior students, which allows counselors to identify students with whom they should work on filling out the FAFSA. Dr. Sylvia Lopez, Dallas ISD's Director of Counseling Services, was an active member of the district's CRIS team. Her participation helped forge closer ties and greater collaboration between the Evaluation and Assessment and Counseling departments.

The logistic regression analyses presented in this case study of Dallas ISD employed three different dependent variables: enrolling in any type of college (two- or four-year), enrolling in a two-year institution, and enrolling in a four-year institution—all in the fall immediately following high school. Data presented in this study are for the Dallas ISD class of 2013, meaning data on delayed enrollment or transfers from two-year to four-year college were not available. Previous research has shown that more than 60% of Dallas ISD graduates who go on to any type of postsecondary institution after high school begin their postsecondary careers in two-year institutions (Hall and Johnson, 2011). The higher education landscape is diverse, and what it means to be "college-ready" may differ by institutional level. For this reason, the study operationalized the outcome of interest in three different ways.

Results and Impact

Dallas ISD's predictive study, tracking the district's graduating senior class of 2013 from high school graduation into college, merged data from the district and the National Student Clearinghouse. Variables chosen for the analysis are based on the past work of the Dallas ISD CRIS team, as well as the CRIS Menu of Indicators published by the John Gardner Center at Stanford (2014). Table 1 displays the results of the three analyses and reports the odds ratios of the variables found to be significant (α=.05) predictors of the three outcomes (college enrollment overall, enrollment in four-year colleges, and enrollment in two-year colleges). Because the data are for the class of 2013, this report captures only seamless enrollment (enrollment in college the fall after high school graduation). As shown in Table 3, the model is strongest for predicting enrollment in four-year colleges and universities, with the ROC curve showing a score of 0.802. For the model that included both two- and four-year colleges in the outcome variable, the area under the curve was 0.701, a statistically significant improvement over random guessing, but lower than the predictive model for four-year enrollment. The reason for this appears to be the difficulty in predicting two-year college enrollment, as indicated by the results in model 3, with an area under the curve of only 0.62. As shown in the odds ratios, meeting the Destination 2020 benchmark for SAT/ACT was among the highest odds ratios (1.90 in Model 2, 1.32 in Model 1), along with enrollment in AP/IB/DC (1.20, Model 1; 1.29, Model 2). High school GPA and attendance were significant across all three models.

Table 3. Results of Dallas ISD College Prediction Models

Predictor	Model 1: all Postsecondary	Model 2: 4-year Colleges	Model 3: 2-year Colleges
HS GPA	1.08**	1.16**	0.94**
HS Attendance Rate	1.06**	1.02**	1.07**
Destination 2020 benchmark for SAT/ACT	1.32**	1.90**	0.60*
CTE course enrollment			1.10**
AP/IB/DC course enrollment	1.20**	1.29**	
9th Grade GPA			
9th Grade On Track			
PSAT College Readiness Benchmark	0.789*		
ROC Curve (Area/Sig.)	**0.701****	**0.802****	**0.621****

* Sig. at the .05 level ;** Sig. at the .001 level

Across all three analyses, high school grades and attendance were consistently significant predictors of postsecondary enrollment. In addition, meeting or exceeding the Destination 2020 benchmarks for the SAT or ACT (21 composite for the ACT or a combined reading and math score of at least 990 on the SAT) was a consistent predictor. These findings are consistent with previous work by the Dallas CRIS team in its analyses of college success by 2006 Dallas ISD graduates (Dryden, Hall, and Johnson, 2012). Enrollment in at least one Advanced Placement (AP), International Baccalaureate (IB), or Dual Credit (DC) course was found to be significant for overall and four-year enrollment, but not for two-year.

Overall, two-year college enrollment was much harder to predict. One reason for this may be the enrollment policies of Dallas County Community College District (DCCCD), where many Dallas ISD high school graduates enroll. DCCCD maintains an open-door enrollment policy to extend postsecondary opportunities to the greatest number of students. This means students with varying levels of academic performance in high school enroll in two-year colleges.

Further analysis has focused on remedial course enrollment by Dallas ISD graduates who attend DCCCD campuses. Data for the Dallas ISD senior classes of 2010, 2011, and 2012 found that, among the students who enrolled in DCCCD, more than 60 percent had to enroll in at least one remedial/developmental course (see Appendix H). This raises concerns about college success, as research by Brock (2010) found that less than one-third of community college students who enroll in remedial courses in community college complete a degree within eight years of enrollment, compared to a 43% completion rate by students who do not require remediation. Dallas ISD analysis has focused on the PSAT as an early indicator of future success. Higher PSAT scores have been associated with lower rates of remedial course enrollment (see Appendix H), and early regression work with 2010–2012 cohorts has indicated that students with PSAT scores of 135 or higher are 5 times less likely to require remedial courses.

Interestingly, the Dallas ISD on-track variable was not statistically significant in these analyses. This may be a consequence of the data themselves, which included only those students who successfully completed high school in four years. The data showed that 85 percent of the students analyzed were on track at the end of 9th grade. Nevertheless, the importance of being on track at this critical point cannot be dismissed. Figure 3 shows the differing levels of high school GPA by on-track status and college enrollment level. Students who were on track by the end of Grade 9 graduated high school with higher overall GPAs across all three college enrollment levels.

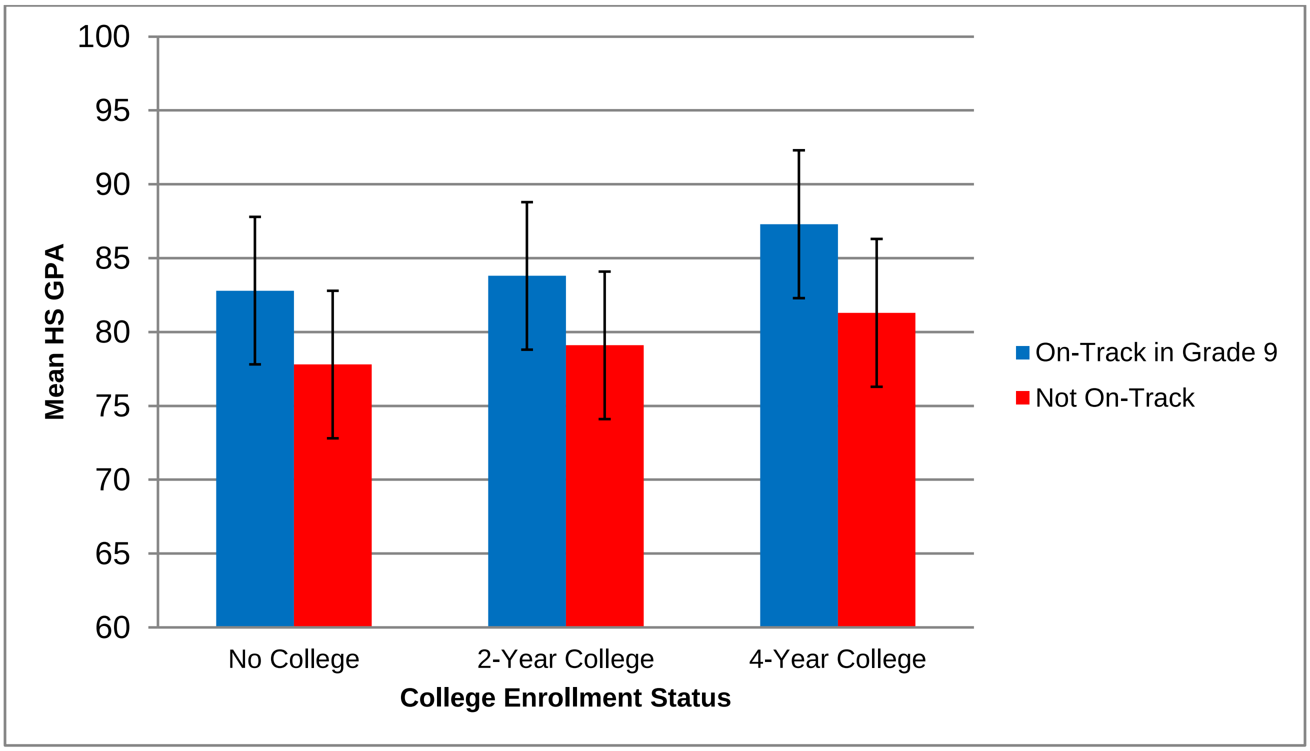


Figure 3. High School GPA by College Enrollment and 9th Grade On-Track Status, Dallas ISD Class of 2013

In the context of the CRIS framework for college readiness, the models used here and the variables found to be significant are consistent with the framework's dimensions of college readiness, especially academic preparedness and academic tenacity. Variables on college admissions tests, Advanced Placement, and high school GPA all help measure student preparedness for college-level work. School systems across the country have extensive data related to academic preparedness, and Dallas ISD is no exception. The academic tenacity dimension is more difficult to measure, as it involves attitudes and behaviors that drive academic success. Attendance and discipline are popular proxy measures for this dimension. Attendance emerged as a significant predictor in the models presented here. Survey instruments are another popular tool for measuring academic tenacity. Dallas ISD has previously used surveys, but low response rates and the failure of some schools to even administer the survey compromised the quality of the data. In the future, Dallas ISD may use surveys that target certain schools or student populations, rather than large-scale surveying efforts.

Further discussion of high school GPA as an indicator is in order here. High school GPA is traditionally considered an academic preparedness indicator (John Gardner Center, 2014). However, this variable can arguably fit into both the academic preparedness and academic tenacity dimensions. High school grades not only measure student mastery of academic subjects, but may also reflect effort, study habits, and other behaviors conducive to academic success. To succeed in their classes, students must have good time management and study skills, meet multiple deadlines, and manage assignments in a range of subjects, some of which they will like less than others. Through this lens, high school GPA can serve as a measure of student effort as well as mastery of academic content.

As for college knowledge, the third dimension of college readiness in the CRIS framework, Dallas ISD has made extensive strides in this area. High school counselors are significant sources of college knowledge, as they are the usual point of contact for students seeking assistance with completing college admission and financial aid applications. The monthly reports on college applications and FAFSA completion enable high school counselors to monitor whether senior students have completed these steps in accessing higher education.

The work conducted here and in the past as part of the CRIS project has heightened schools' interest in the college readiness and postsecondary success of their students. Increasingly, campuses have requested data and reports on student progress toward college readiness. The work also has forged closer, more collaborative ties among the Counseling, College and Career Readiness, and Evaluation and Assessment departments in the district. As a consequence of the CRIS work, Hall and his team in Evaluation and Assessment produce the monthly reports on college applications and FAFSA completion for Counseling Services, which evaluates high school counselors in part on these measures. Dr. Cecilia Oakeley, Assistant Superintendent for Evaluation and Assessment, and Dr. Linda Johnson, Executive Director for College and Career Readiness, were active members of the Dallas ISD CRIS team and have been strong supporters of the work conducted in this area throughout the CRIS initiative and the SDP Fellowship.

Since the CRIS initiative, the district has also introduced new activities that are designed to heighten student interest in college. The district's Destination 2020 plan calls for increasing the proportion of high school seniors who meet or exceed district college readiness benchmarks on the SAT and ACT, and analyses by both the district CRIS team and Hall's Evaluation and Assessment team illustrated how students who met these benchmarks were more likely to enroll and succeed in college. In February 2014, Dallas ISD paid for every 11th grade student to take the SAT on a school day. The district plans to fund ACT testing for all 12th grade students in 2014–15. Hall and his team in Evaluation and Assessment will continue to support college readiness efforts in Dallas ISD through formative and summative evaluations designed to gauge the effectiveness of various programs and interventions. Dallas ISD plans to use the findings reported here and in other analyses by the district's CRIS team to refine its efforts at college matching and counseling students' postsecondary interests. The district also has developed stronger relationships with outside entities interested in college readiness and success, including DCCCD, the Dallas Regional Chamber, and Commit!, a partnership of education, business, and nonprofit leaders interested in improving student success across Dallas County.

Next steps include further work to predict two-year college readiness and success, including examination of remedial course taking by Dallas ISD graduates who enroll in DCCCD. Dallas ISD completed a data sharing agreement with DCCCD during the early months of the CRIS grant in 2011, and preliminary analyses of data from DCCCD indicate that 60% of Dallas ISD graduates who entered DCCCD enrolled in at least one remedial course (see Appendix H). Additional steps include efforts to examine not only postsecondary, but workforce outcomes. Dallas ISD is in talks with representatives of the Texas Workforce Commission to collect and analyze workforce data on its graduates.

The most recent data on six-year college completion rates (graduation within six years after high school graduation) from National Student Clearinghouse indicate an increase in college completion rates for Dallas ISD graduates (see Appendix I).

Lessons Learned

This report has presented three case studies describing the experiences of three public school systems—the Prince George's County Public Schools in Maryland, the Providence Public Schools in Rhode Island, and the Dallas Independent School District in Texas—applied predictive analytic methods to issues related to secondary school success and college readiness. This section summarizes lessons learned by the three school systems and considerations for other education agencies using such models to predict student success in secondary grades, high school graduation, or college readiness.

- **Predictive models can drive interventions**. At their best, predictive analytic models can identify students who are at risk of failing ninth grade or dropping out of high school, and enable educators to intervene before these students fall off track. Prince George's County and Providence used their early warning systems to enable schools to intervene in middle and high school before students fall behind in 9th grade and to keep them on track for on-time graduation. Dallas, meanwhile, used indicators of high school success to predict student college readiness and has since developed supports such as funding school-day SAT and ACT testing to support more students preparing for college.
- **Models should be embedded in the broader policy context of the school system or educational agency**. Dallas' improvement plan calls for increasing the number of college-ready students, based in part on the proportion of students who meet district college readiness benchmarks for these tests. Dallas included these SAT and ACT benchmarks in its predictive models. Prince George's County noted the problem of 9th grade retention and its implications for high school graduation and subsequently identified 9th grade promotion as a priority. Its predictive models then focused on identifying students most at-risk of being retained in this critical grade level. Providence found that the models have the potential to inform the Personal Graduation Plans, allowing them to function not only as individualized student plans but as tools for understanding middle school achievement patterns and the challenges faced by high schools in working with students with varying levels of preparedness.
- **Ninth grade success matters**. Consistent with prior research by Allensworth and Easton (2005, 2007), the predictive work by the three agencies presented in this report underscore the importance of being on track in ninth grade. The first year of a high school is a "make or break" year with important implications for high school graduation and postsecondary success.

- **“Quick wins” can build support for broader use of predictive models**. Prince George’s County found this by implementing a simple early warning system that improved on the previous system that was found to be flawed. Initial response to this system was favorable, especially among campus principals, who found the early warning indicator reports valuable. Predictive work in Providence has helped support the district’s use of the PGPs. In Dallas, early analytic work under the CRIS grant put additional tools into the hands of high school counselors, enabling them to better help students navigate the college preparation and admissions process. The work also has heightened schools’ interest in the postsecondary success of their graduates.

Appendices

Appendix A: Prince George's County Public Schools

First of all, coefficients were taken from the primary logit regression for the students who were first-time 9th graders in SY 2012-13. These coefficients were combined with the new data values for the incoming 9th graders (students who would be first-time 9th graders in SY 2013-14) to create a "linear combination" for each of these new, incoming 9th grade students:

Linear_Combination = -12.193318 + 1.3979112*_GPA_SY13_ + (-0.81539375)*_GPA_mean_g8_ + 5.7830349*_Attendance_Rate_SY13_ + 0.01035061*_MSA_Math_Score_g8_ + 0.00779406*_MSA_Read_Score_g8_ + (-0.0566524)*_Disc_Total_Before14_

GPA_SY13 is the GPA when the student was in 8th grade in SY 2012-13; *GPA_mean_g8* is the average 8th grade GPA in that student's school in SY 2012-13; *Attendance_Rate_SY13* is the student's attendance rate (as a decimal) when the student was in 8th grade in SY 2012-13; *MSA_Math_Score_g8* is the student's scaled score on their MSA Math standardized test from the spring of their 8th grade year; *MSA_Read_Score_g8* is the student's scaled score on their MSA Reading standardized test from the spring of their 8th grade year; and *Disc_Total_Before14* is the total number of suspensions and expulsion requests for the student from SY 2008-09 through SY 2012-13.

Once you calculate the "linear combination" for each student, you use the following formula to calculate the promotion probability:

Promotion_Probability = 1/(1+(e^(-(*Linear_Combination*))))

Linear_Combination is taken from the calculation above; *Promotion_Probability* now represents the probability (between zero and one) that this incoming 9th grader will pass 9th grade, according to the EWI model.

Appendix B: Prince George's County Public Schools

This is an example of a EWI Report which was sent to a high school before the 2013 school year began. This section is taken from the "yellow" tab, displaying data of the moderate-risk students. These students had a promotion probability between 70% and 95% according to the model.

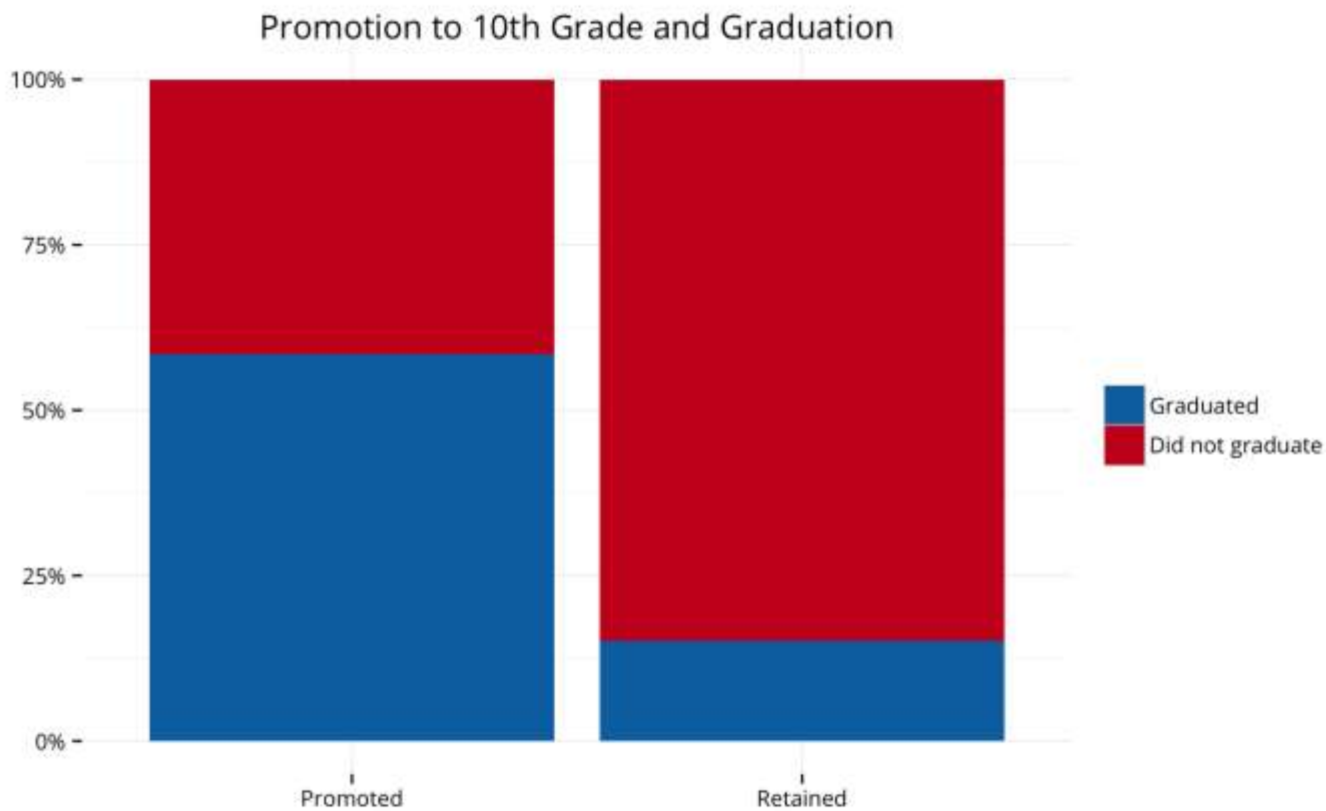
Last Name	First Name	Risk_Level	Promotion_ Probability	g8_GPA	Attend Rate	MSA Math Score	Math Proficiency	MSA Read Score	Read Proficiency	Num Suspensions
Last	First	Yellow	95%	3.11	88%	411	Proficient	419	Proficient	0
Last	First	Yellow	95%	2.71	99%	414	Proficient	448	Advanced	1
Last	First	Yellow	95%	3.38	98%	380	Basic	411	Proficient	0
Last	First	Yellow	94%	2.70	95%	411	Proficient	435	Advanced	0
Last	First	Yellow	94%	2.59	98%	470	Advanced	433	Advanced	0
Last	First	Yellow	94%	2.92	97%	410	Proficient	407	Proficient	0
Last	First	Yellow	94%	2.88	99%	422	Proficient	435	Advanced	0
Last	First	Yellow	94%	2.64	96%	402	Basic	441	Advanced	0
Last	First	Yellow	94%	2.79	97%	388	Basic	419	Proficient	0
Last	First	Yellow	94%	2.25	98%	440	Proficient	452	Advanced	2
Last	First	Yellow	94%	2.64	93%	422	Proficient	441	Advanced	0
Last	First	Yellow	94%	2.86	96%	429	Proficient	399	Proficient	1
Last	First	Yellow	94%	2.86	96%	402	Basic	399	Proficient	0
Last	First	Yellow	94%	2.78	100%	414	Proficient	448	Advanced	0
Last	First	Yellow	94%	3.00	98%	374	Basic	410	Proficient	0
Last	First	Yellow	93%	2.57	100%	412	Proficient	423	Proficient	0
Last	First	Yellow	93%	2.14	99%	429	Proficient	435	Advanced	0
Last	First	Yellow	93%	2.61	93%	420	Proficient	435	Advanced	1
Last	First	Yellow	93%	3.27	93%	377	Basic	361	Basic	0
Last	First	Yellow	93%	2.61	99%	407	Proficient	391	Proficient	0
Last	First	Yellow	93%	2.61	92%	430	Proficient	423	Proficient	1
Last	First	Yellow	93%	2.93	98%	380	Basic	402	Proficient	0

Appendix C: Prince George's County Public Schools

This is an example of a EWI Report update which was sent to a high school after Q1 ended. This section is taken from the "red" tab, displaying data of the students who were considered high-risk at the beginning of the year, those with initial promotion probabilities below 70%. Some of these students had moved into the yellow and green risk categories over the course of Q1.

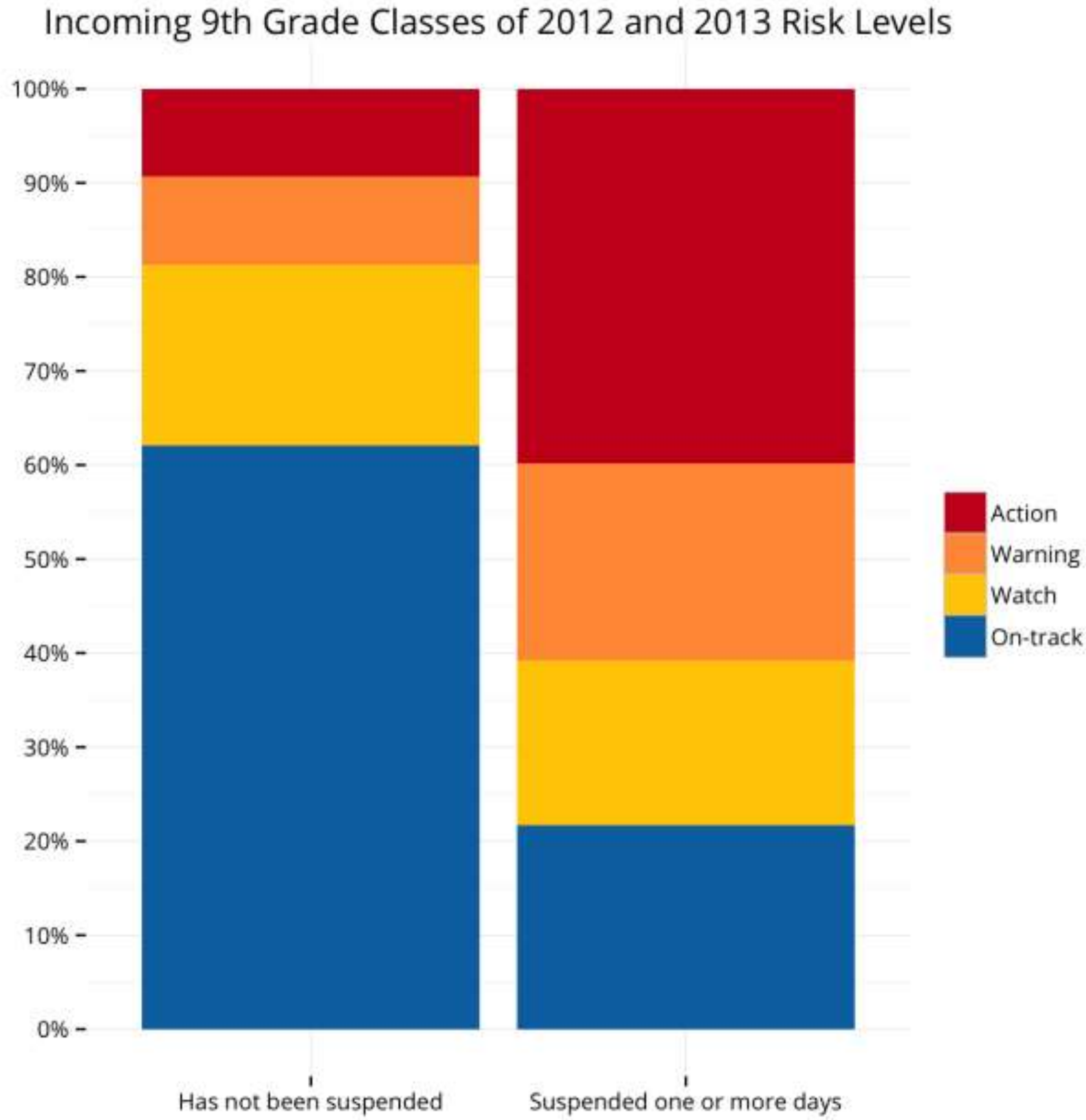
Last Name	First Name	Current Risk Level	Promotion Probability	Current GPA	Attend Rate	–	Initial Risk Level	Initial Promotion Prob	g8_GPA	g8 Attend Rate	Math Prof	Read Prof
Last	First	Yellow	85%	1.88	96%		Red	69%	2.00	95%	Basic	Basic
Last	First	Green	98%	3.00	96%		Red	69%	2.08	90%	Basic	Basic
Last	First	Yellow	77%	1.50	99%		Red	69%	1.67	92%	Proficient	Proficient
Last	First	Yellow	80%	1.75	100%		Red	69%	1.79	97%	Basic	Basic
Last	First	Yellow	80%	1.50	95%		Red	69%	1.93	90%	Proficient	Proficient
Last	First	Red	53%	1.13	98%		Red	68%	1.54	98%	Basic	Basic
Last	First	Green	97%	3.00	100%		Red	68%	1.50	94%	Basic	Advanced
Last	First	Green	96%	2.50	100%		Red	68%	2.17	94%	Basic	Proficient
Last	First	Green	97%	2.63	99%		Red	67%	2.00	87%	Basic	Proficient
Last	First	Red	42%	0.88	98%		Red	67%	1.17	93%	Proficient	Advanced
Last	First	Yellow	93%	2.38	89%		Red	66%	1.75	87%	Basic	Proficient
Last	First	Green	96%	2.63	95%		Red	66%	2.00	76%	Proficient	Advanced
Last	First	Yellow	93%	2.50	100%		Red	66%	0.96	95%	Proficient	Advanced
Last	First	Red	13%	0.13	83%		Red	65%	1.58	91%	Basic	Proficient
Last	First	Yellow	76%	1.50	100%		Red	65%	2.17	94%	Basic	Basic
Last	First	Green	97%	2.75	99%		Red	64%	1.50	92%	Basic	Proficient
Last	First	Green	96%	2.63	100%		Red	64%	1.71	93%	Basic	Basic
Last	First	Red	63%	1.38	100%		Red	64%	1.25	96%	Basic	Proficient
Last	First	Yellow	90%	2.13	98%		Red	63%	1.67	86%	Basic	Proficient
Last	First	Yellow	81%	1.63	92%		Red	63%	1.96	87%	Basic	Proficient
Last	First	Yellow	88%	2.25	100%		Red	57%	1.08	97%	Basic	Proficient
Last	First	Yellow	85%	1.88	99%		Red	57%	2.00	93%	Basic	Basic

Appendix D: Providence Public School District



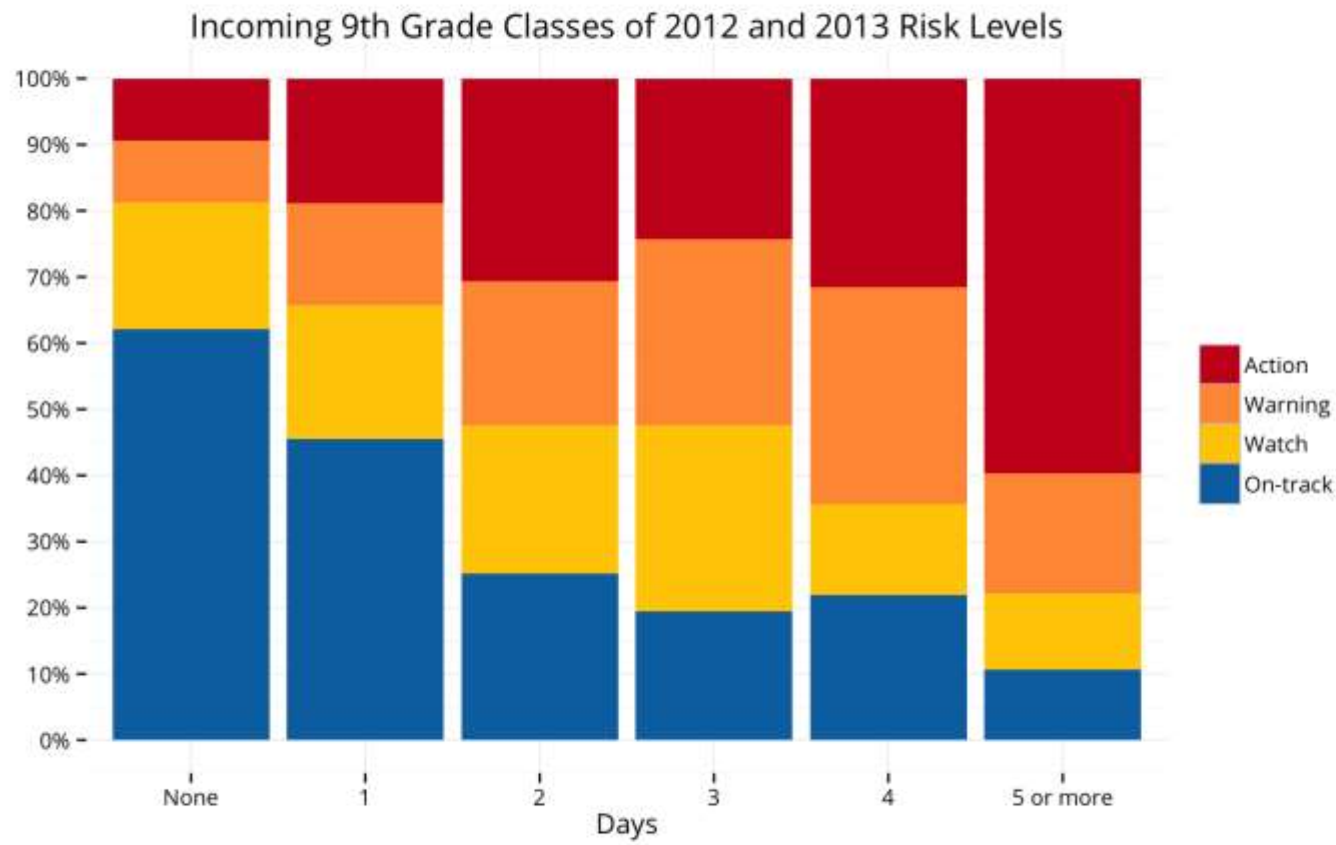
Retention at the end of 9th grade has devastating consequences for graduation likelihood in Providence Public Schools. Nearly 20% of all first time 9th graders are retained.

Appendix E: Providence Public School District



The difference in “on-track” classification between students suspended for one or more days and those who have never been suspended.

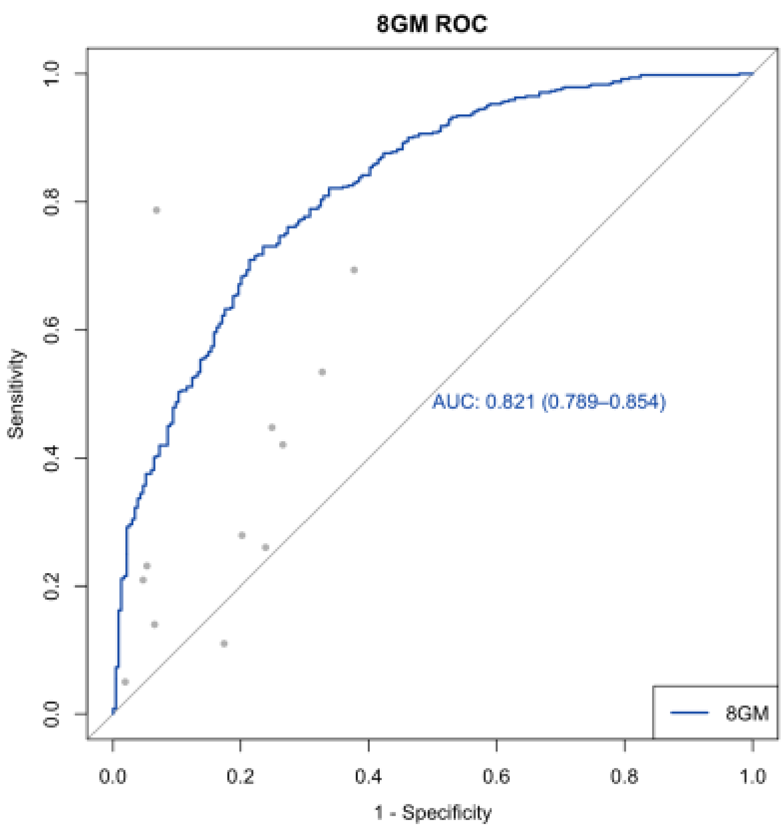
Appendix F: Providence Public School District



Each additional day a student is suspended sees a dramatic decrease in on-track status.

Appendix G: Providence Public School District

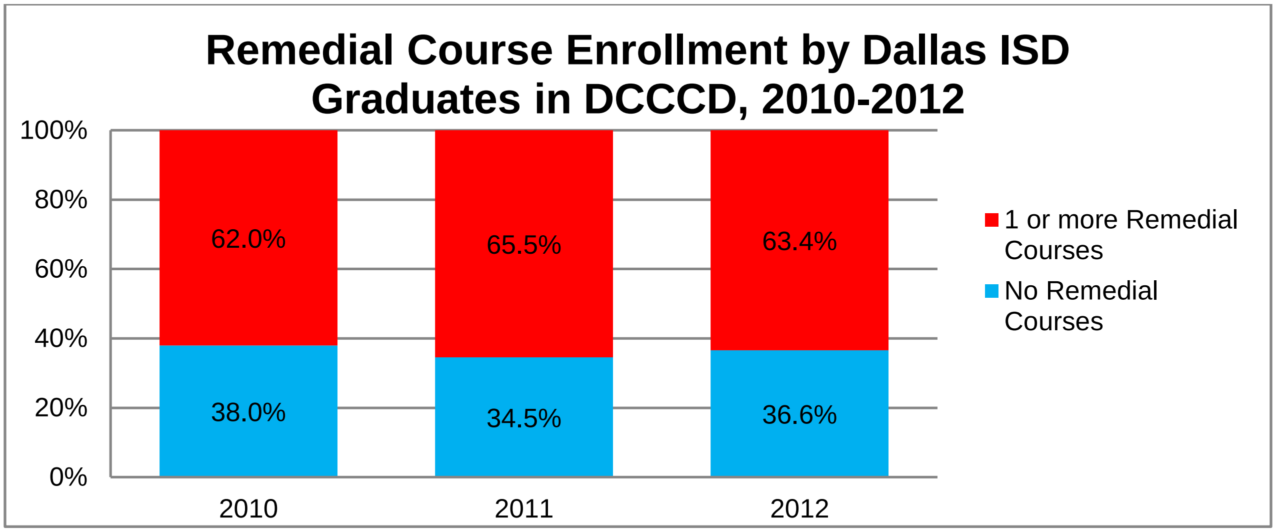
The following images display the Relative-Operator Characteristic of each of the PPSD predictive models. The more the curve reaches the top left corner of the graphic, the higher the predictive value. Each gray dot represents an indicator based on other researchers' graduation indicators from the Bowers et al (2013) meta-analysis. Only indicators that used the same starting grade as the PPSD model are included. Indicators that fall to the left and above the curves can be generally interpreted as having favorable characteristics to the PPSD models. Indicators that fall below the curves are not as successful at discriminating between on- and off-track students.

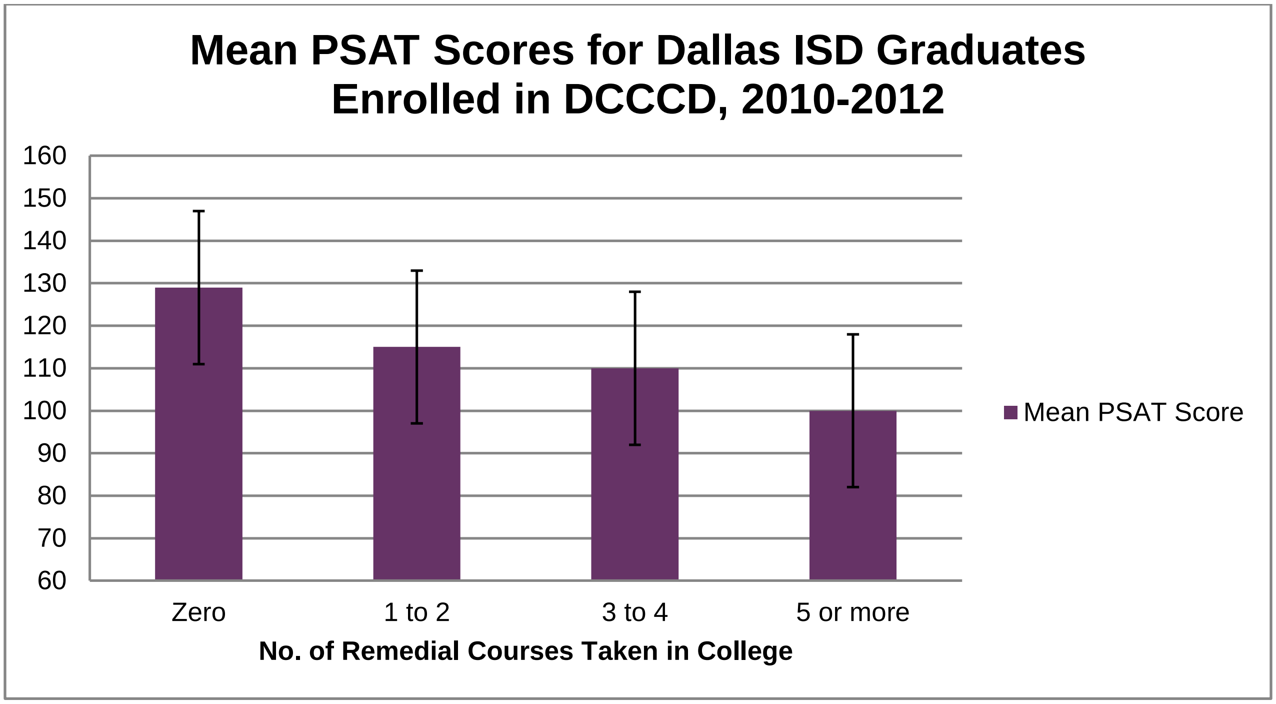


8th grade model

Appendix H: Dallas Independent School District

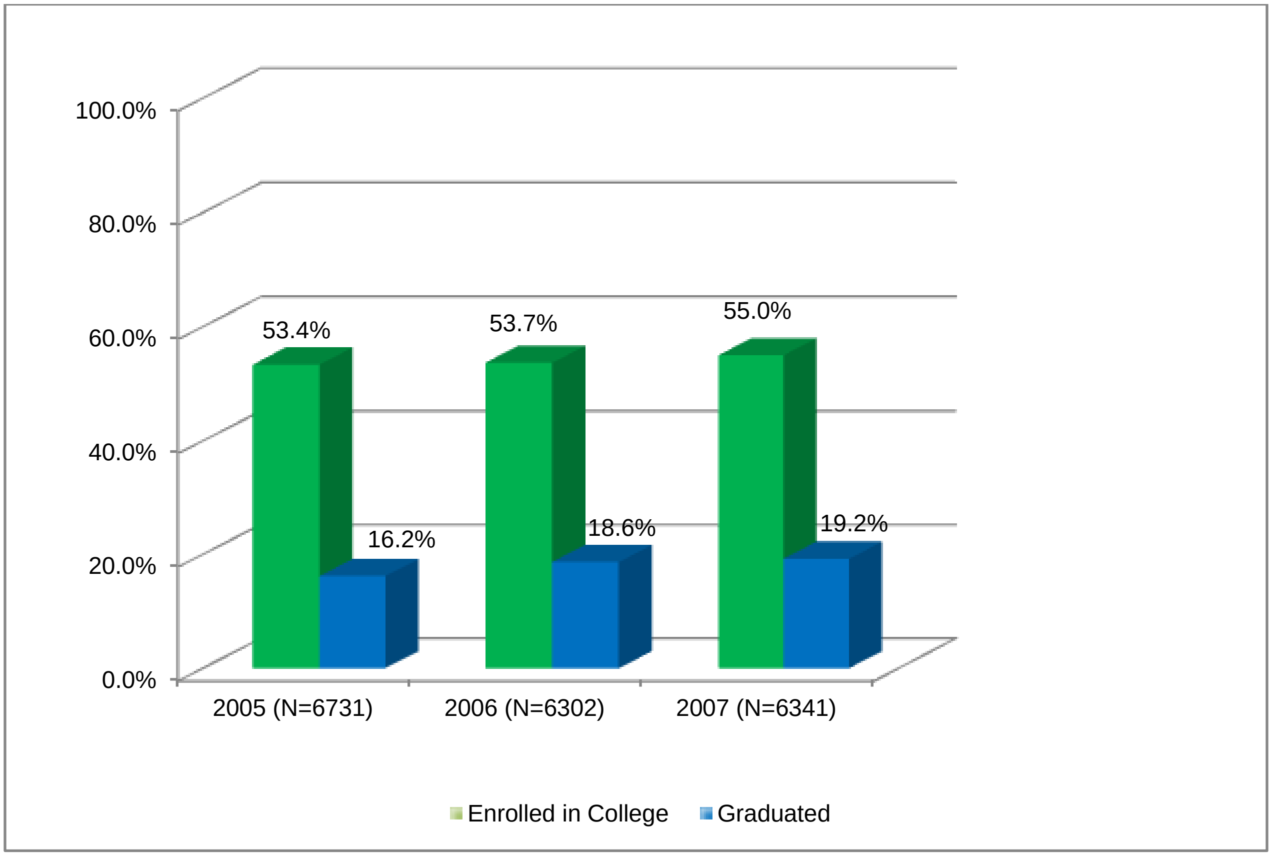
These charts show the level of enrollment in remedial courses by Dallas ISD graduates for the years 2010 to 2012 who enrolled in the Dallas County Community College District (DCCCD), and mean PSAT scores for students who enrolled in DCCCD. More than half of the students who had to enroll in remedial courses had to take remedial math. Subsequent work has focused on the PSAT as an indicator of future postsecondary success.





Appendix I: Dallas Independent School District

This chart illustrates college enrollment and completion rates for Dallas ISD high school graduates for the classes of 2005 through 2007, the most recent cohorts for which 6-year college graduation rates are available.



References

ACT. (2008). The forgotten middle: Ensuring that all students are on track for college and career readiness before high school. Iowa City, IA: Author.

ACT. (2012). *The condition of college & career readiness.* Iowa City, IA: Author.

Adams, C.D. & Taylor, E.D. (2011). Evaluation of Prince George's County Public Schools' Early Warning System. *Evaluation Report produced by the PGCPS Department of Research and Evaluation.*

Allensworth, E. M. & Easton, J. Q. (2005). The on-track indicator as a predictor of high school graduation. Consortium on Chicago School Research.

Allensworth, E. & Easton, J. (2007). What Matters for Staying On-Track and Graduating in Chicago Public Schools: A Look at Course Grades, Failures, and Attendance in the Freshman Year. Chicago: Consortium on Chicago School Research at the University of Chicago

Balfanz, R. (2009). Putting Middle Grade Students on the Graduation Path. National Middle School Association.

Bowers, A.J., Sprott, R., and Taff, S.A. (2013). Do We Know Who Will Drop Out? A Review of the Predictors of Dropping Out of High School: Precision, Sensitivity and Specificity. *The High School Journal 96(2),* 77-100.

Childress, S.M., Doyle, D.P., and Thomas, D.A. (2009). Leading For Equity: The Pursuit of Excellence in Montgomery County Public Schools.

Conley, D.T. (2010). College and Career Ready. San Francisco: Jossey-Bass

Dryden, M., Hall, L.S., and Johnson, L.K. (2012). How to Measure Academic Self-Discipline. Presentation given at College Readiness Indicator Systems Meeting, Dallas, TX, Nov. 9, 2012.

Farrington, C.A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T.S., Johnson, D.W., and Beechum, N.O. (2012). Teaching Adolescents to Become Learners: The Role of Noncognitive Factors in Shaping School Performance: A Critical Literature Review. Consortium on Chicago School Research.

Hall, L.S., and Johnson, L.K. (2011). Early Indicators of Future College Success for Dallas Independent School District Graduates, 1998-2009. Dallas Independent School District

Kemple, J., Segeritz, M., & Stevenson, N. (2013). Building on-track indicators for high school graduation and college readiness: evidence from New York City. *Journal of Education for Students Placed at Risk, 18,* 17–28.

Lee, J. (2012). College for all: Gaps between desirable and actual P–12 math achievement trajectories for college readiness. *Educational Researcher, 41*(2), 43–55.

Lee, J. (2013). College for all: Gaps between desirable and actual P–12 math achievement trajectories for college readiness. *Educational Researcher, 42*(2), 78–88.

Roderick, M., Nagaoka, J., & Coca, V. (2009). College readiness for all: The challenge for urban high schools. *The Future of Children, 19*(1), 185–210.

Siegel, E. (2013). Predictive Analytics : The Power to Predict Who Will Click, Buy, Lie, or Die. Hoboken, N.J. : Wiley & Sons, Inc.

Tough, P. (2014). Who Gets to Graduate? *New York Times Magazine, May 18, 2014.*

Von Secker, C. (2009). Closing the Gap : Seven keys to college readiness for students of all races/ethnicities. Rockville, MD : Montgomery County Public Schools.

Zhao, H., and Liu, S. (2011). College Readiness and Postsecondary Educational Outcomes for 2003 Graduates in Montgomery County Public Schools. Office of Shared Acountability.