Using School and Child Welfare Data to Predict Near-Term Academic Risks

Many districts use early warning systems that identify students who are at risk of academic problems or dropping out of high school so they can better support these students. These systems often track attendance, behavior, and course performance (ABC); indicators that reliably identify students at risk of dropping out in large urban districts. Although districts typically do not incorporate non-academic risk factors into these systems, research has shown that homelessness, teenage pregnancy, child maltreatment, parental substance abuse, and unsafe living conditions are risk factors for negative school outcomes.

REL Mid-Atlantic partnered with Pittsburgh Public Schools, Propel Schools (a charter school network), and the Allegheny County Department of Human Services to assess how well combinations of in- and out-of-school data predict ABCs in the near-term that are reliable precursors of high school dropout. By flagging students who experience precursors to dropout, educators can target resources to those most at risk and intervene before problems become more serious.

This fact sheet describes predictors related to near-term academic problems, meaning academic problems in the next quarter or semester. It draws on a report that details the approach used to develop a predictive model and assesses how well the model identifies at-risk students.

WHAT WE FOUND

1. Predictive models based on machine-learning (ML) algorithms successfully identify at-risk students. The models most accurately predict course failure and state test score performance, though the models for other outcomes also perform well. The model that predicted whether Pittsburgh Public Schools students would have low GPA was the most accurate. Model accuracy is measured using an industry-standard metric called Area Under the Curve (AUC), which can be interpreted as the probability that a randomly selected student with an academic problem is considered at higher risk (by the model) than a randomly selected student without an academic problem.

2. School data are the strongest predictors of near-term academic problems across all outcomes. The strongest predictors include prior absences, low prior grades, and low prior performance on state tests.

3. Predictive performance remains strong when the ML model relies exclusively on school data. Excluding human services data as predictors in the models did not substantially reduce the ability of the models to make predictions for any of the outcomes. When considering all variables simultaneously, outpatient behavioral health services and Medicaid eligibility are the only two human services predictors that appear among the 10 strongest predictors.

4. Accuracy varies by sample size and outcome. The models are more accurate in the larger Pittsburgh Public School than in the smaller Propel charter network. In both districts, they are more accurate at predicting low grade point average, course failure, and
Data sources, sample, and methods

Data sources. The study used data from three sources. Pittsburgh Public Schools and Propel schools provided student demographic, enrollment, course, state test, attendance, and behavior data. Allegheny County Department of Human Services provided student data on receipt of social services, justice system involvement, and public benefits.

Sample. The descriptive analysis included 28,719 unique Pittsburgh Public Schools students and 4,614 unique Propel students in kindergarten to 12th grade.

Descriptive and predictive analysis methods. The descriptive analysis measured how, on average, predictors in one period relate to outcomes in the following period, separately by local education agency and grade levels (elementary, middle, and high). The descriptive relationships describe how one variable relates to another without factoring in other variables. Predictive models use in- and out-of-school data from recent periods to identify the probability that each student will experience each outcome in the upcoming period. The predictive models consider how multiple variables relate to the outcome all at once.

ENDNOTES


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