Education Analytics in K-12: Predicting Student Outcomes and Driving Action

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Uplift Education

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An Introduction to Uplift Education

- Uplift Education is a free public charter school network serving almost 12,000 scholars on 14 campuses in the Dallas-Fort Worth region.
- Uplift's mission is to create and sustain public schools of excellence that empower students to reach their highest potential in college and the global marketplace and that inspire in students a life-long love of learning, achievement, and service in order to positively change their world.
- Uplift is dedicated to providing a college preparatory education to all students in North Texas.

Growth Goals

Key Question

How much is a student projected to academically grow over the course of a year?

Purpose

- Uplift Education uses student performance on standardized assessments to measure student growth
- Student performance is one aspect of a teacher evaluation framework
- Uplift desired to project the academic growth a teacher or school can expect from a student by the end of the school year, as measured by the State of Texas Assessments of Academic Readiness (STAAR) tests
- Based on how a teacher's students performance against these projections would contribute to the performance rating the teacher received
- We created individualized growth goals for each student within our network for each subject specific test they were taking
- Growth Goals are important – they set an expectation of how Uplift expects students to grow and the goals impact pay across the Uplift network

Why Use JMP?

- Rapid reshaping of our data to contain test-grade level information
- Running multiple iterations of OLS regression and logistic regression
- Testing this year’s models against validation sets from previous year data
- Scripting of the process

Methodology

- For each STAAR Test, an Ordinary Least Squares (OLS) Regression and Logistic Regression were run
- The OLS was run using the STAAR Scale Score as the response variable and a Pre-Test Score (either Fall MAP or EPAs) as the explanatory variable
- This information was combined with the minimum passing scale score for each level (as given by the Texas Education Agency) for each test and grade to create a model that sets a growth target. Approximately 70% of students are expected to meet their growth target (for the tests it typically falls between 68% and 72%).
- The Logistic Regression is used to create a set of rules around the Predicted Score so that a student has to either grow to get the scale score required to move up to the next level of passing or grow according to the OLS growth model, whichever required scale score is larger.
- The OLS model is then adjusted by expanding the confidence interval. The confidence interval is expanded until the point that the predicted scores, constrained by the rule set, would be met by approximately 70% of the students. This adjustment is done by rerunning the OLS regression multiple times and changing the confidence interval utilized until 70% of students reach their goal

Questions

Early Warning System

Key Question

Which students will end the year below grade level without intervention?

Purpose

- Uplift Education needs to identify students who are “off track” as early as possible to guide intervention strategy.
- Because up to 1/5 of our students will be new to our network next year, we need to predict end-of-year outcomes using only current year data if possible.

Guiding Principles

An Early Warning System should:

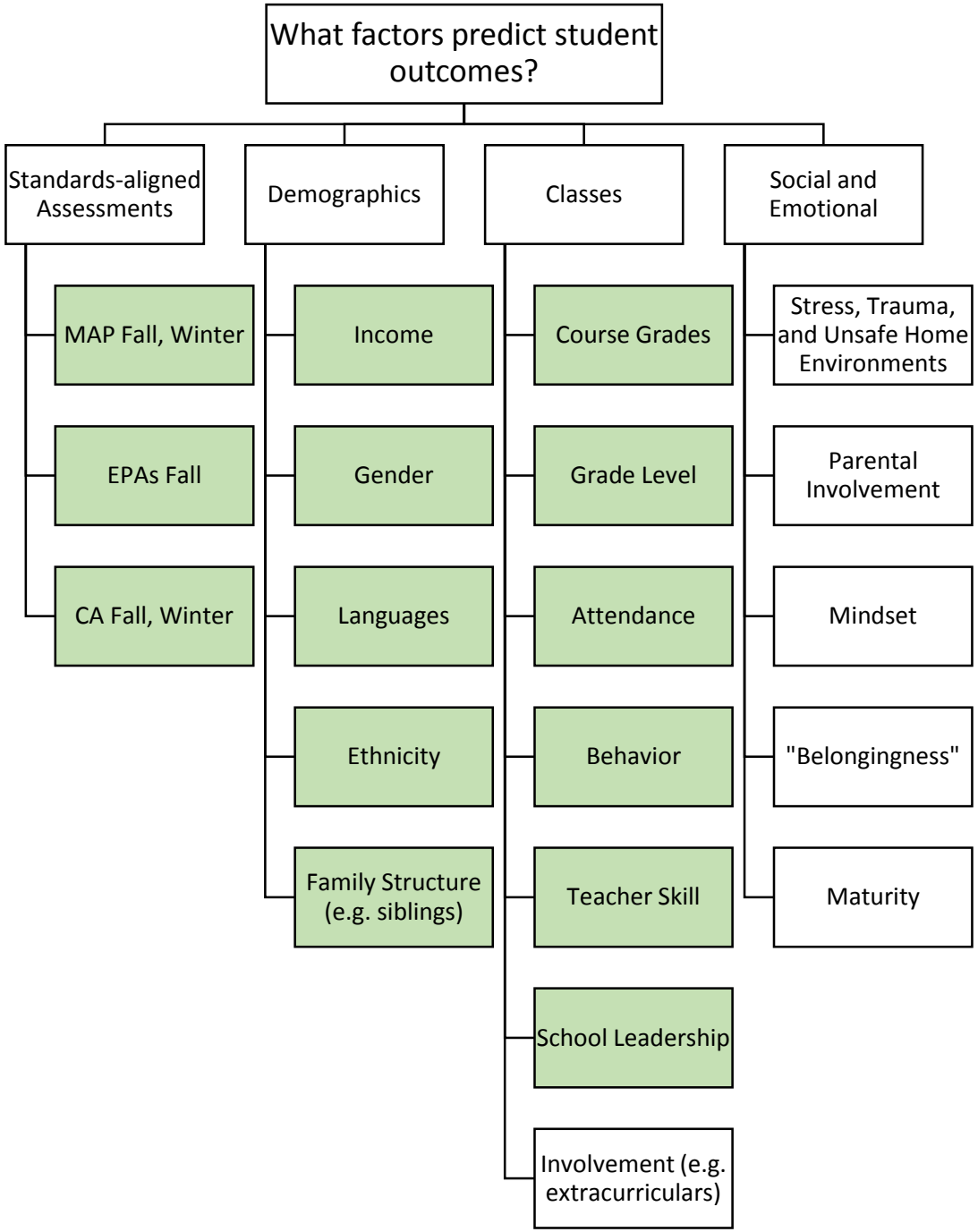
- Prioritize sensitivity over specificity

  False negatives are a missed opportunity to intervene; false positives result in wasted resources. Our preference is for wasting resources rather than opportunities.

- Adapt to changing inputs throughout the course of the year

Why Use JMP?

- Minimal learning curve
- Rapid data restructuring
- Iterative model design and comparison
- Robust model validation (marginal model plots, cross-validation, etc.)
- Easy outlier detection and dummy variable creation
- Low effort for scoring new data


What factors predict student outcomes?
Standards-aligned Assessments
Demographics
Classes
Social and Emotional
MAP Fall, Winter
EPAs Fall
CA Fall, Winter
Income
Gender
Languages
Ethnicity
Family Structure (e.g. siblings)
Course Grades
Grade Level
Attendance
Behavior
Teacher Skill
School Leadership
Involvement (e.g. extracurriculars)
Stress, Trauma, and Unsafe Home Environments
Parental Involvement
Mindset
"Belongingness"
Maturity

Methodology

- Neural network and logistic regression
  - Model comparison

- Dependent variable = “Off-track” = dummy variable where 1 represents a score below grade level on the end-of-year state assessment (STAAR)

Methodology in the Future

- Mixed effects logistic regression
- Random effect: Teacher

Questions

Other Uses for Prediction in Education

What is the predicted end-of-year test score for each student?

- Predict scores, then assign levels based on state standards (e.g. Satisfactory, Advanced)
- Use predicted scores to prioritize academic interventions

Common Assessment 3 Dashboard

TEKS Performance by Student and Reporting Category

The table shows the average percentage of points earned by standard for each student across all CA administrations. Standards are categorized by Reporting Category and Type according to STAAR blueprints (www.lead4ward.com/resources). To select a specific administration or TEKS type, use the filters on the right.

	Process Standard						Computations and Algebraic Relationships									
	None						Computations and Algebraic Relationships									
	111.5.1.C	111.5.1.F	111.5.1.D	111.5.1.A	111.5.1.B	111.5.1.E	111.5.4.J	111.5.4.G	111.5.4.H	111.5.5.E	111.5.4.A	111.5.5.A	111.5.4.K	111.5.4.B	111.5.4.F	111.5.5.C
Student Name	P	P	P	P	P	P	S	S	S	R	R	R	R	S	S	S
[redacted]	0%	10%	0%	25%	20%	0%	0%	17%	0%	25%	4%	17%	25%	50%	50%	0%
	0%	27%	17%	25%	10%	17%	50%	0%	0%	25%	13%	33%	38%	0%	0%	0%
	0%	37%	13%	25%	20%	50%	50%	0%	0%	75%	39%	33%	0%		50%	0%
	50%	10%	13%	0%	25%	33%	0%	0%	0%	0%	29%	0%	25%	0%	0%	50%
	0%	27%	0%	17%	35%	0%	0%	0%	0%	25%	13%	0%	13%	50%	50%	0%
	0%	20%	17%	17%	10%	17%	50%	0%	0%	50%	0%	17%	25%		0%	0%
	50%	27%	13%	0%	25%	33%	0%	0%	0%	0%	29%	0%	0%	0%	0%	50%
	50%	27%	25%	17%	0%	17%	0%	0%	0%	25%	13%	17%	25%	0%	0%	50%
	0%	27%	38%	25%	20%	67%	50%	17%	0%	0%	21%	33%	13%	50%	0%	50%
	0%	47%	13%	17%	10%	17%	0%	0%	50%	50%	8%	0%	13%	50%	100%	50%
	0%	20%	13%	25%	0%	67%	0%	0%	0%	50%	4%	0%	0%	50%	0%	50%
	0%	27%	17%	17%	10%	67%	0%	50%	0%	25%	0%	17%	25%	0%	0%	0%

Filters

Subject
Math

Grade
3

Teacher
(All)

Course
(All)

Section
(All)

CA
(All)

Predicted STAAR Level
(All)

(All)
Unsatisfactory
Level 2 Phase-In 1
Level 2 Recommended
Level 3 Advanced

Other Uses for Prediction in Education

- College retention using National Student Clearinghouse data
- Teacher attrition

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