Identifying Areas for Change: North Carolina Public School Performance

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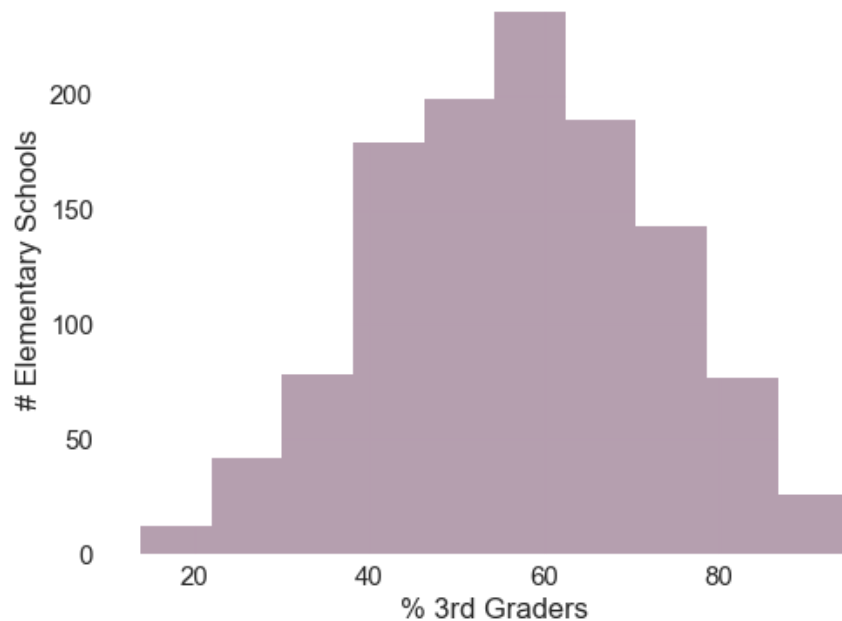
Advisor: **Jacob Drew PhD**.

Made Possible by

John M. Belk Endowment, "Operating Principles" [Online]. Available: http://jmbendowment.org/who-we-are/operating-principles/ [Accessed 5 July 2018].
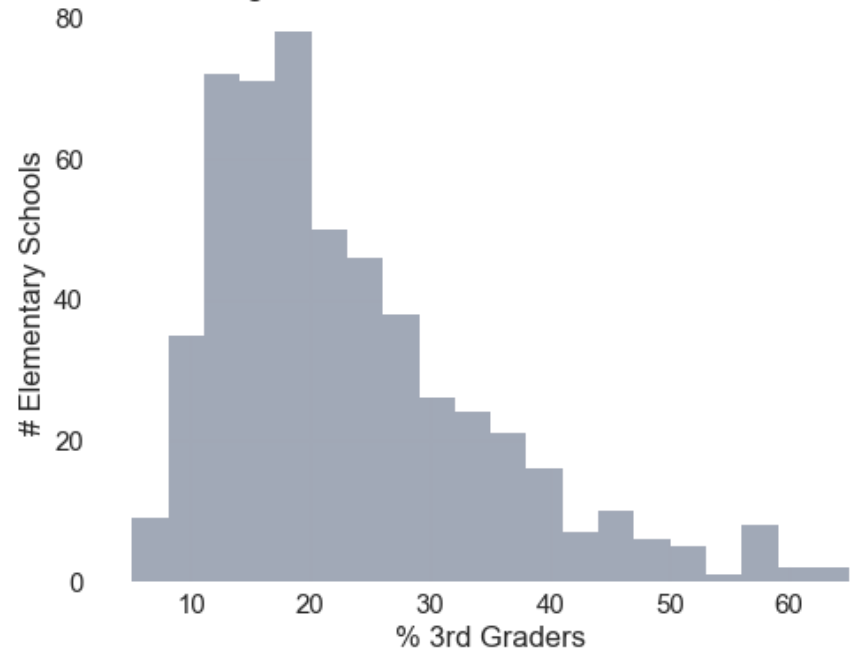
In North Carolina

Percentage of Students Passing 3rd Grade Reading, 2017

* Data Represents 1180 out of 1268 Elementary Schools

Percentage of Students Retained in 3rd Grade, 2017

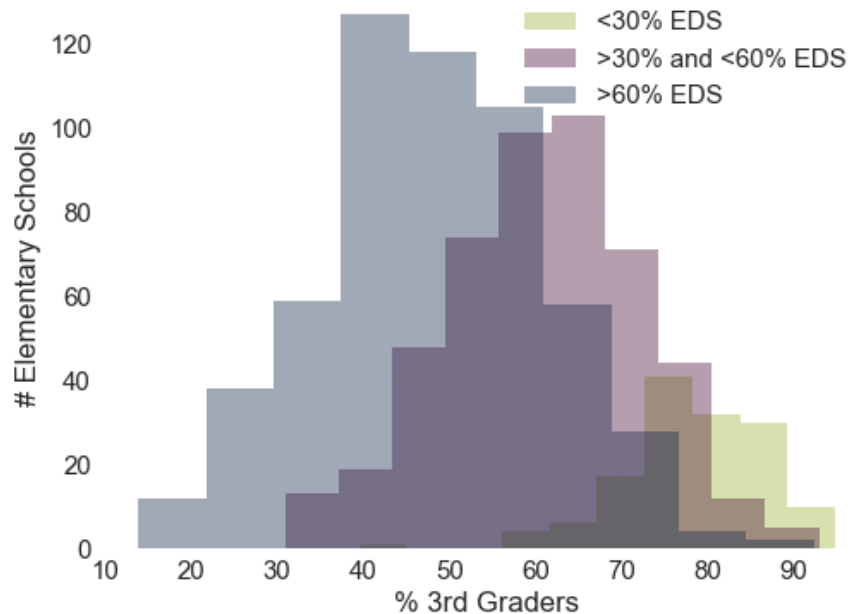** Data Represents 527 out of 1268 Elementary Schools*
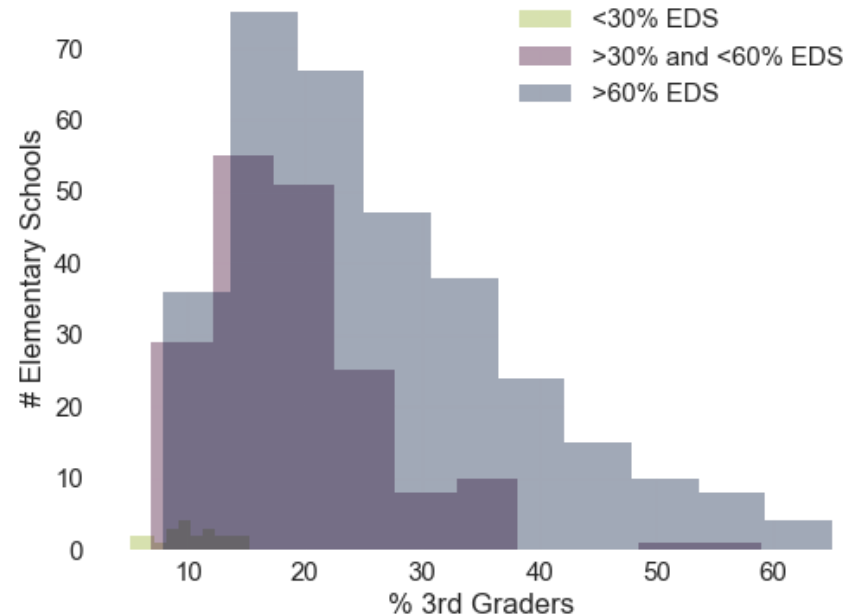
Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

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Student Body

EDS: Economically Disadvantaged Students

% of Students Passing 3rd Grade Reading by EDS, 2017

Legend:
- <30% EDS
- >30% and <60% EDS
- >60% EDS

Y-axis: # Elementary Schools
X-axis: % 3rd Graders

* Data Represents 1180 out of 1268 Elementary Schools

% of Students Retained in the 3rd Grade by EDS, 2017

Legend:
- <30% EDS
- >30% and <60% EDS
- >60% EDS

Y-axis: # Elementary Schools
X-axis: % 3rd Graders

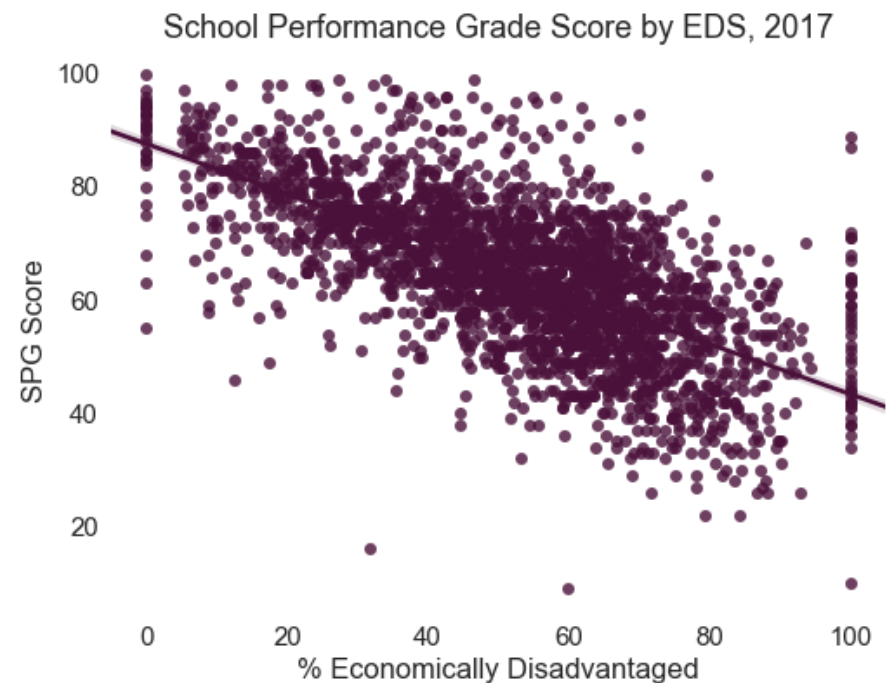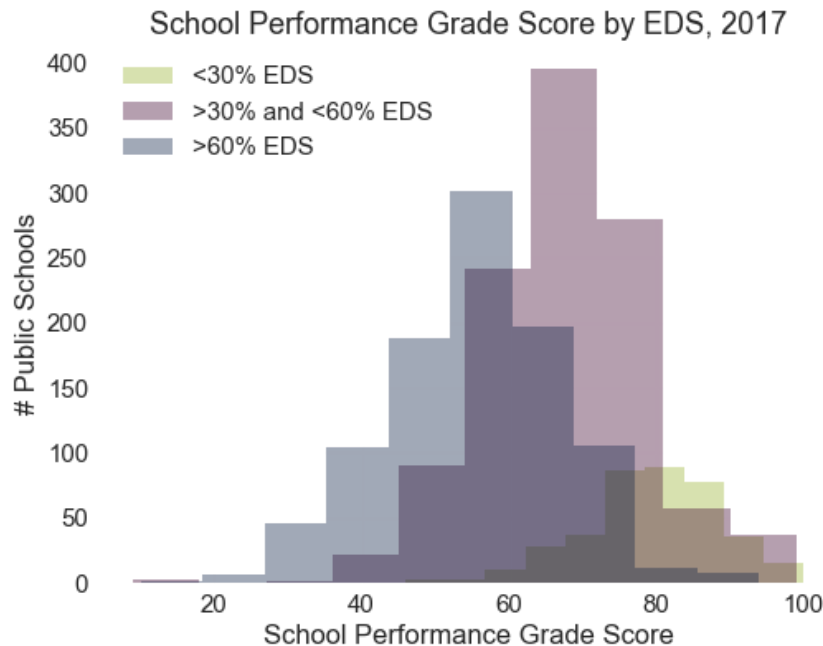** Data Represents 527 out of 1268 Elementary Schools*

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Larger than the 3rd Grade

School Performance Grade Score by EDS, 2017

School Performance Grade Score by EDS, 2017

** Data Represents 2340 out of 2480
Public Schools*

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Between 2013 and 2017

462,086 students studied in a low performing school between 2013 and 2017

2013-2017 Low Performing Schools Count
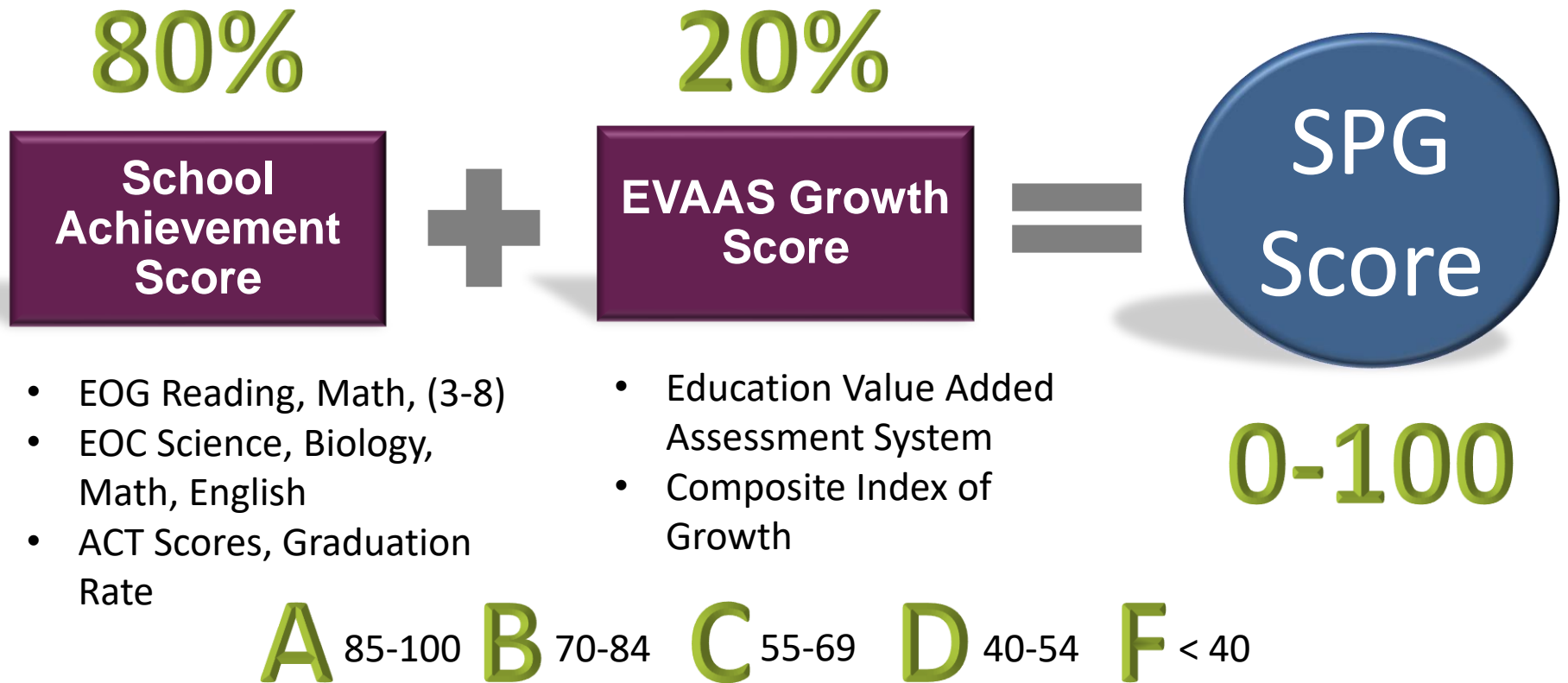

2013-2017 Low Performing Schools Count
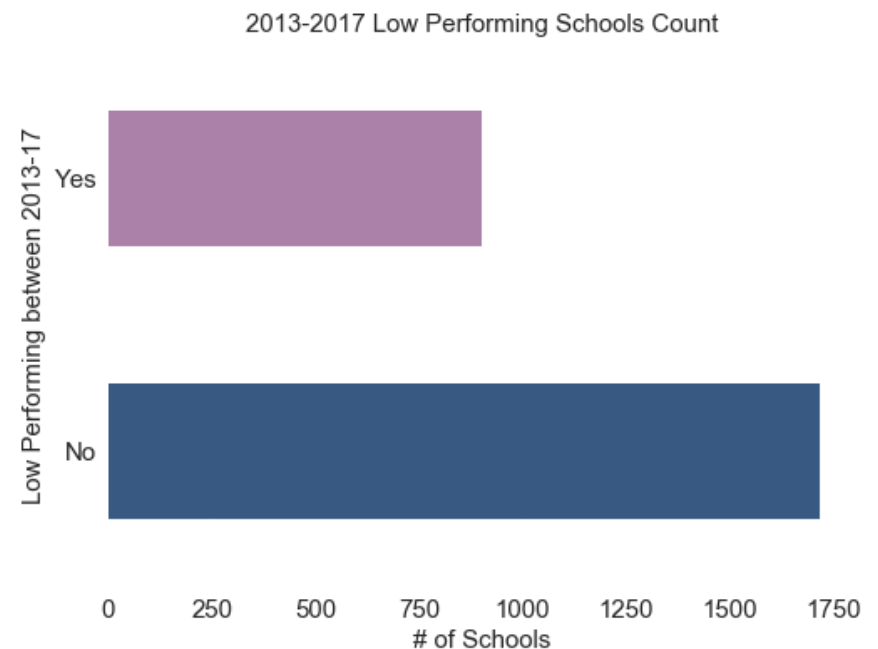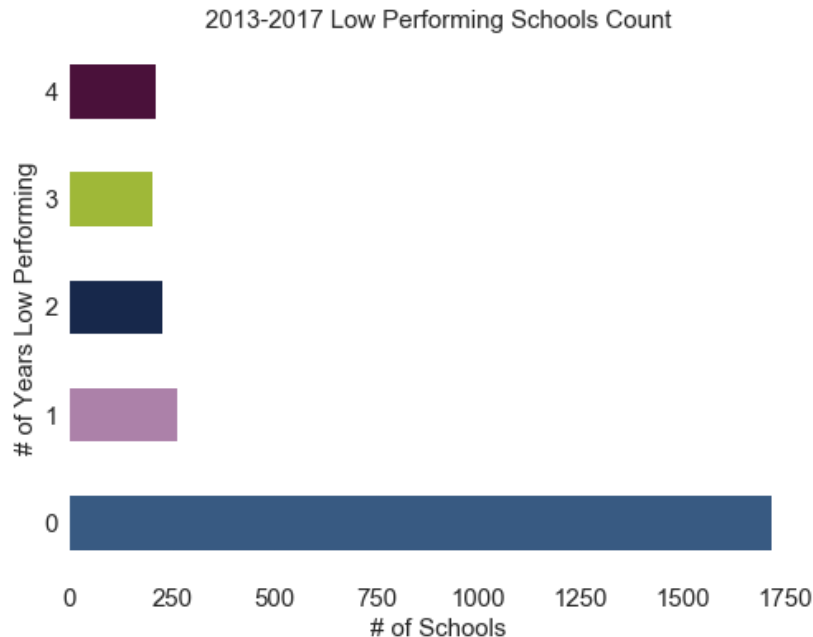
103,128 students have been studying in a school that has been low performing for all 4 years

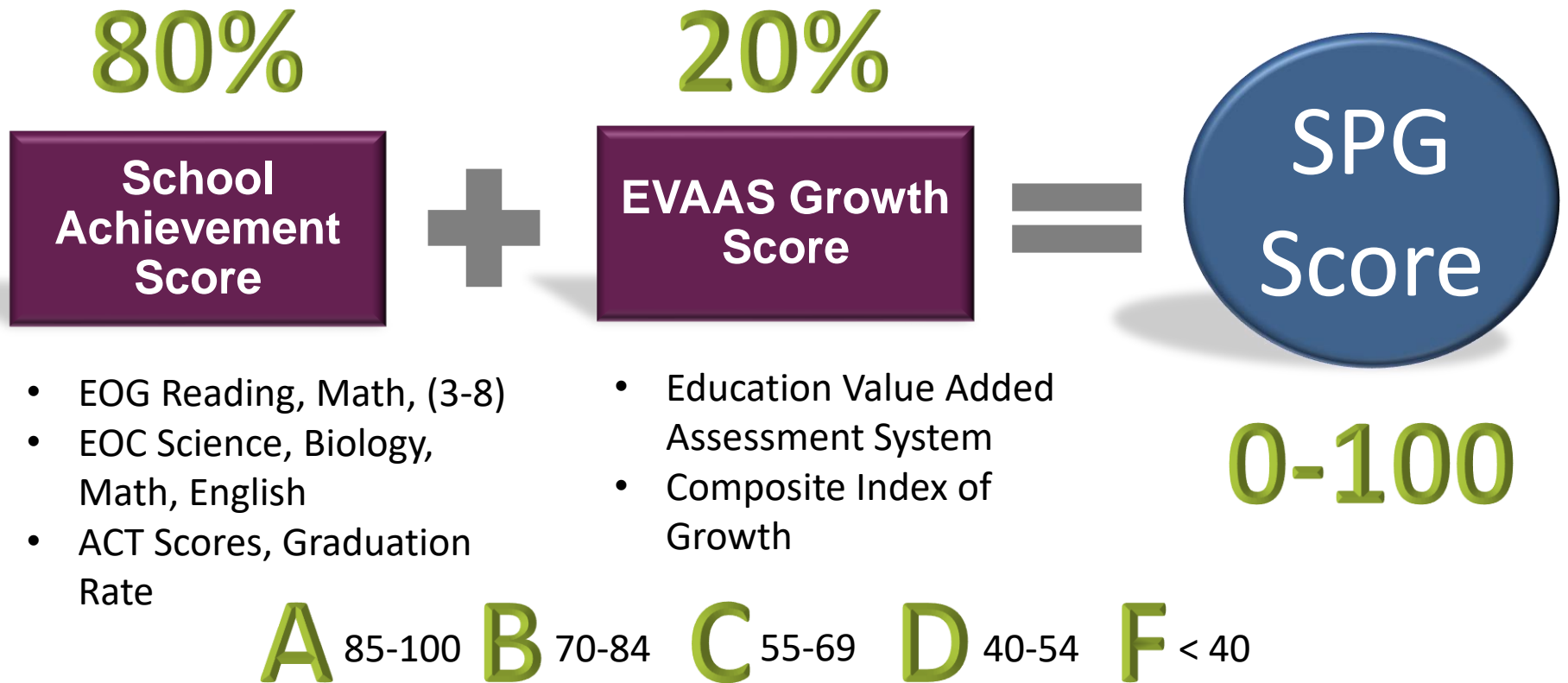Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

School Performance Grade Score

80%

School Achievement Score

$+$

20%

EVAAS Growth Score

$=$

SPG Score

0-100

- EOG Reading, Math, (3-8)
- EOC Science, Biology, Math, English
- ACT Scores, Graduation Rate

- Education Value Added Assessment System
- Composite Index of Growth

**A** 85-100 **B** 70-84 **C** 55-69 **D** 40-54 **F** < 40

North Carolina Department of Public Instruction, Accountability Services Division, "2014-15 Performance and Growth of North Carolina Public Schools: Executive Summary", 2 September 2015. [Online]. Available: http://www.dpi.state.nc.us/docs/accountability/reporting/2017/documentation/exsumm17.pdf [Accessed 1 March 2018].

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School Performance Grade Score

80%

School Achievement Score

+

20%

EVAAS Growth Score

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SPG Score

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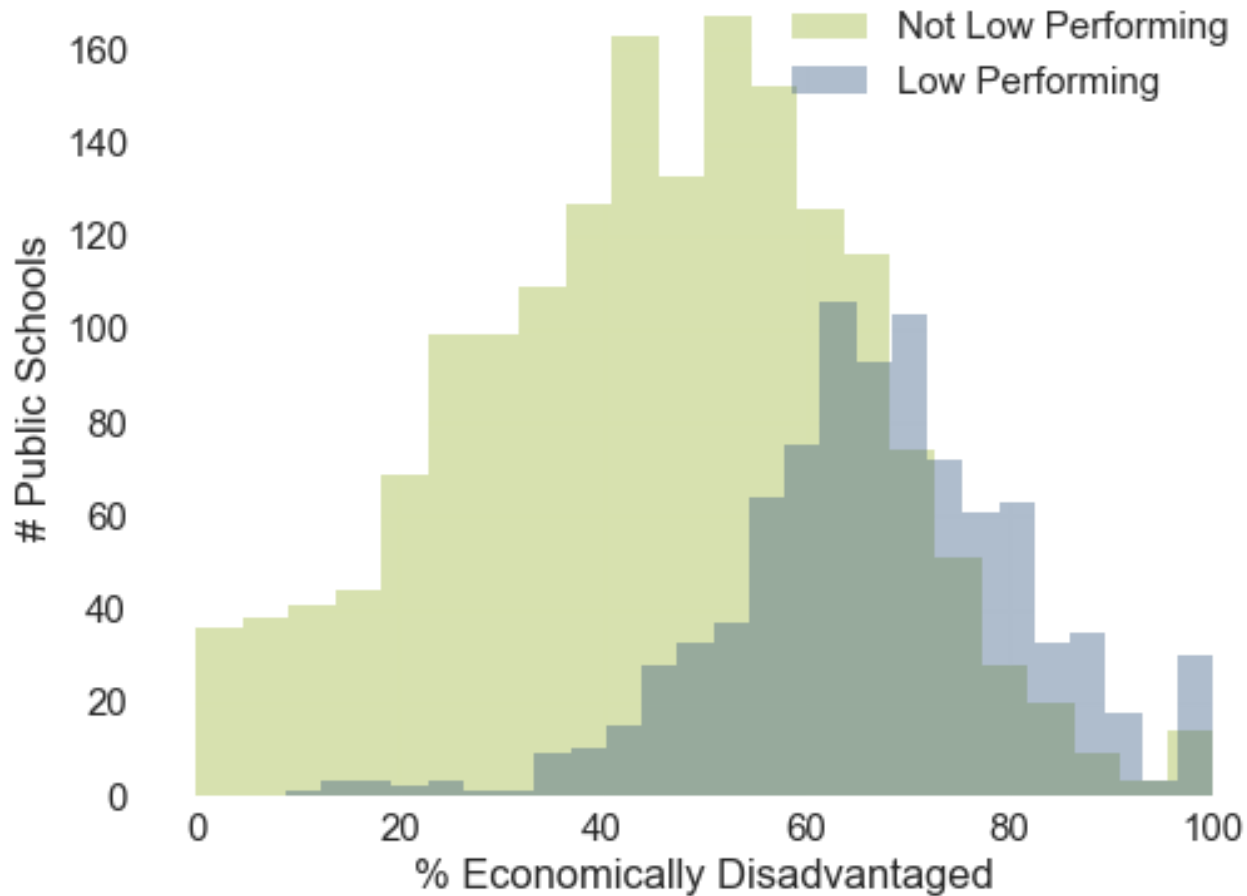DataScience@SMU

Start Behind, Stay Behind

- Low-performing schools tend to have higher concentrations of students economically disadvantaged[1]
- Students arrive at schools needing support that some schools are not equipped to provide[1]
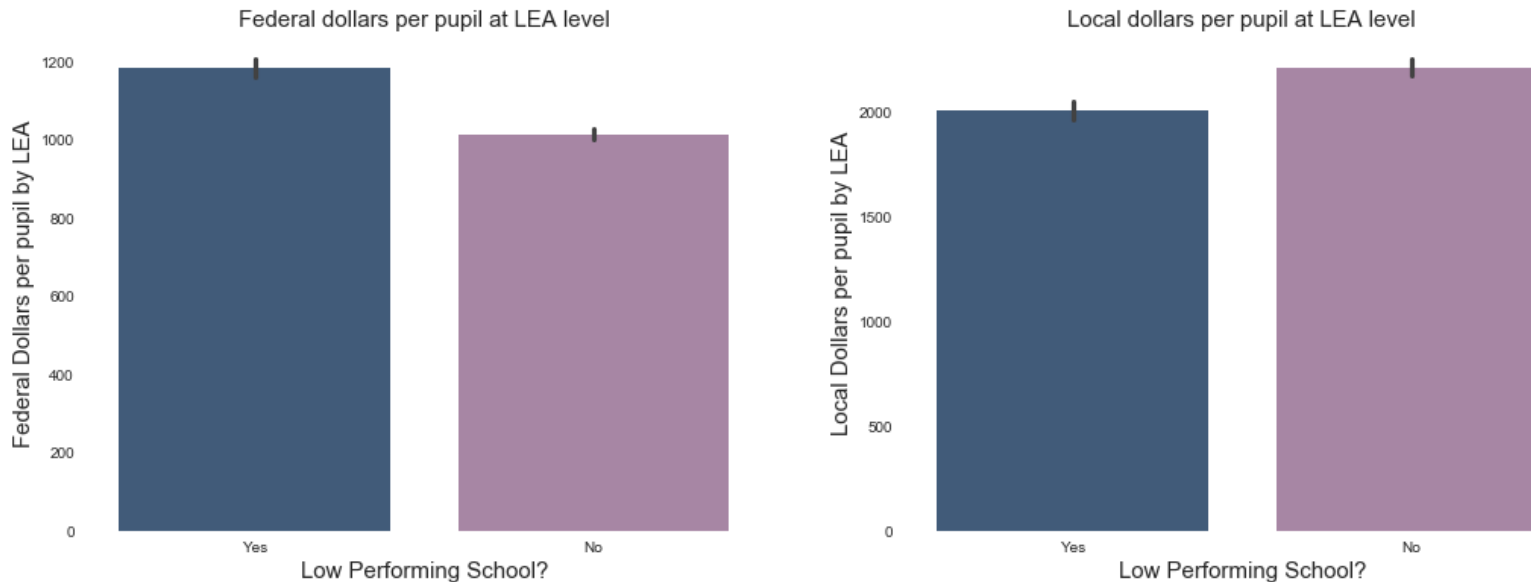
[1] McIlwain, Virginia. Director of Strategic Initiatives, John M. Belk Endowment. Primary Source. June 5 2018.
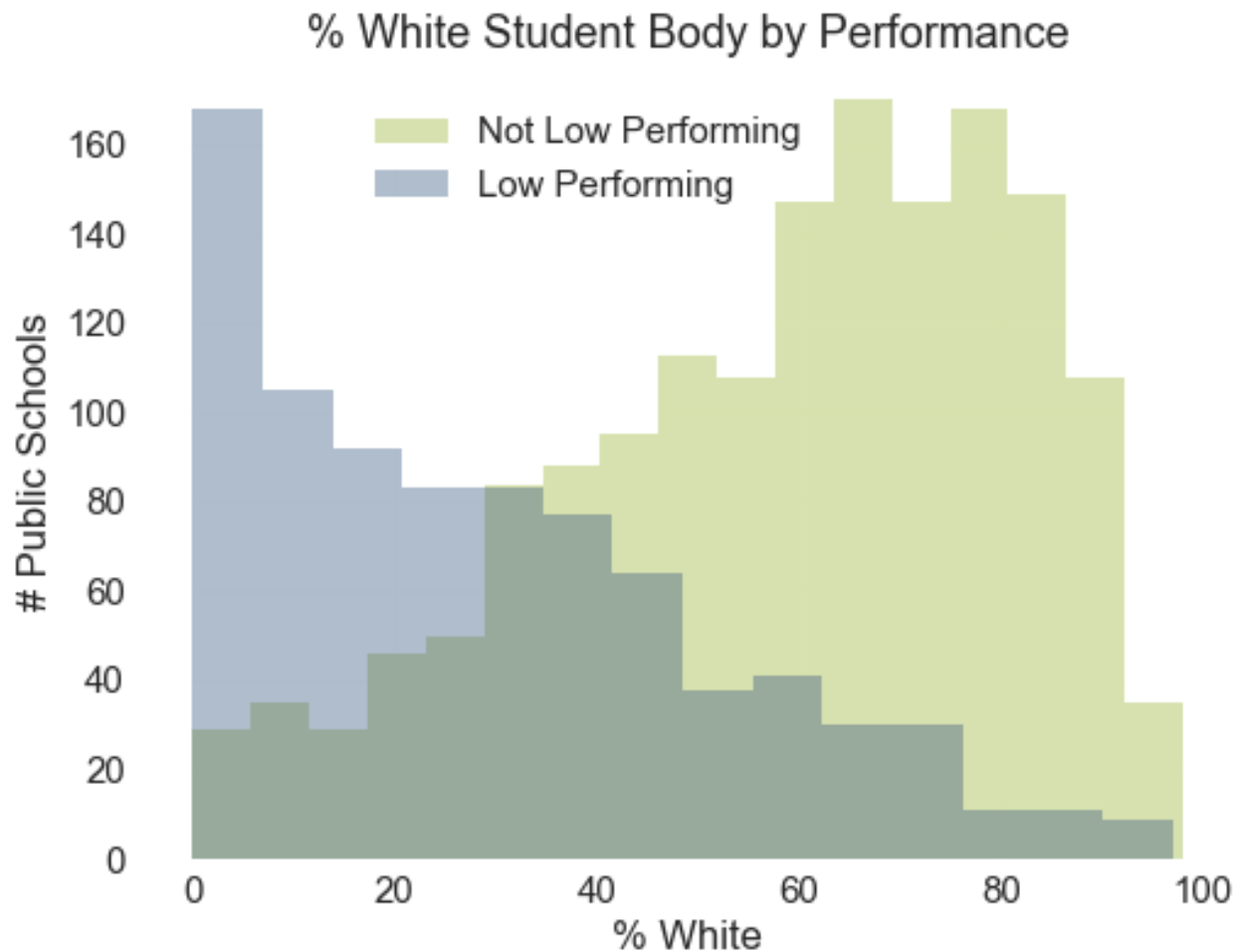Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

% Economically Disadvantaged by Performance

The Big Problem

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.
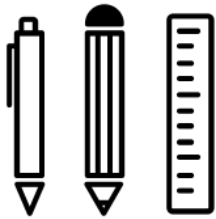
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% White Student Body by Performance

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

The Big Problem

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Our Solution

What Can School Administrators Actually Do?

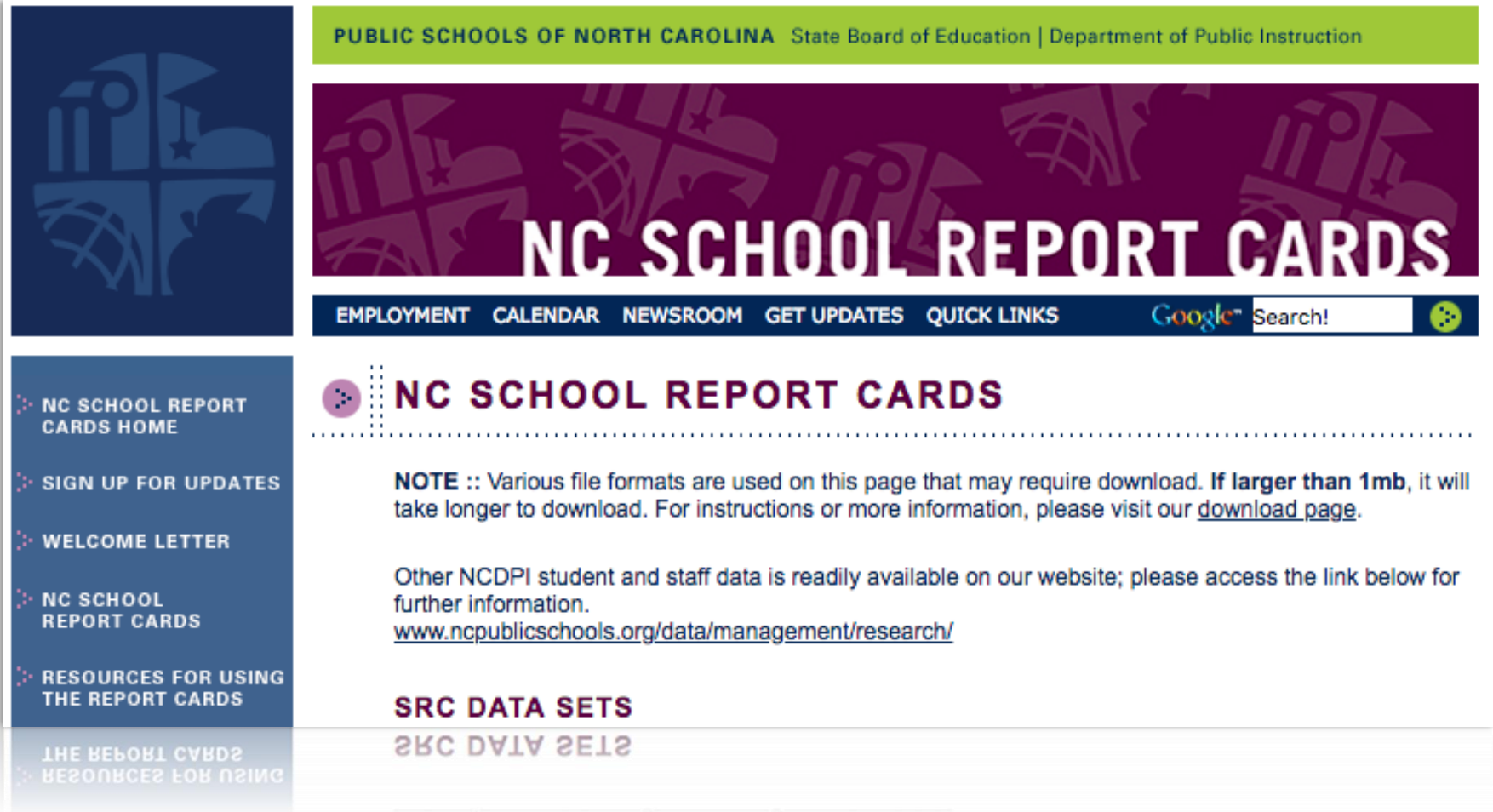Identify and Assess School-Level Factors within Administration's Control
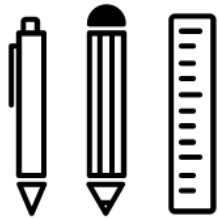
Our Solution

Model School Performance

Predict Expected Change in SPG Score

Data

North Carolina Department of Public Instruction, NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/. [Accessed 1 March 2018]

Tables

Funding

Environment

Student Body

Classroom

Personnel

Courses

Educators

School Performance

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Data

	Schools	Features
2014	2298	141
2015	2302	184
2016	2302	171
2017	2313	165

Features

- **Environment**
  - Suspensions
  - Technology
- **Educator**
  - Years of Experience
  - Effectiveness
- **Personnel**
  - Years of Experience
  - Licensure
- **School Profile**
  - Size

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

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Data

class_teach_num   Average Number of Classroom Teachers

avg_daily_attend_pct   Average Daily Attendance Percentage

tchyrs_4thru10_pct   % of Teachers with 4-10 Yrs of Experience

student_num   # of Students Registered at the School

nbpts_num   # of Nationally Board Certified Staff

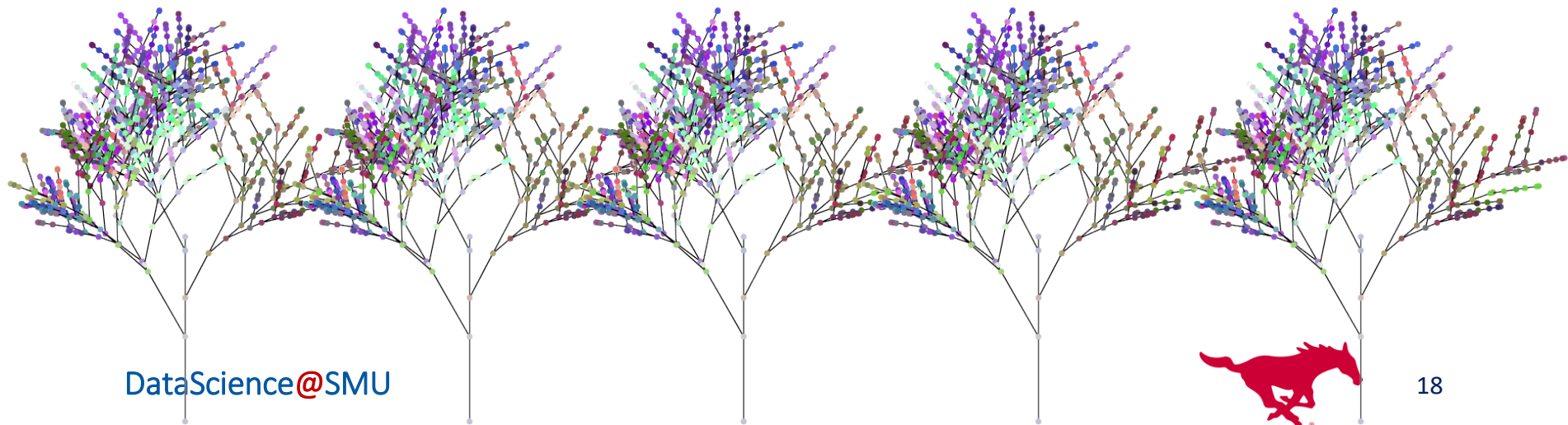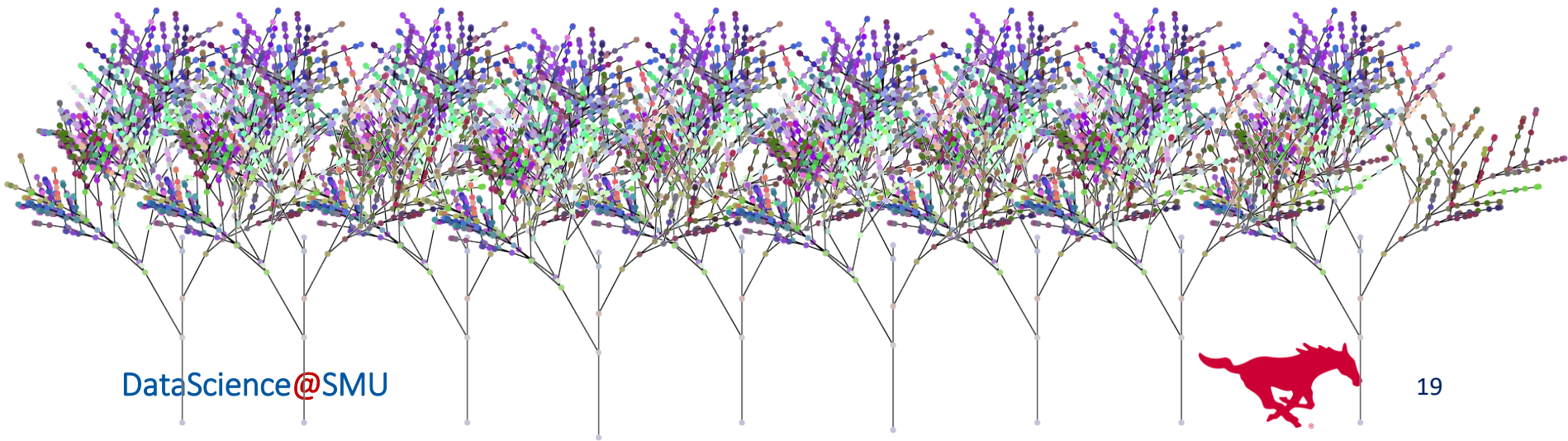short_susp_per_c_num   Short Term Suspensions per 100 Students

Feature Importance

Question 1: Can we build a model that accurately predicts school performance using school-level factors unrelated to student body demographics?

eXtreme Gradient Boosting
XGBoost

A Very Fancy Decision Tree

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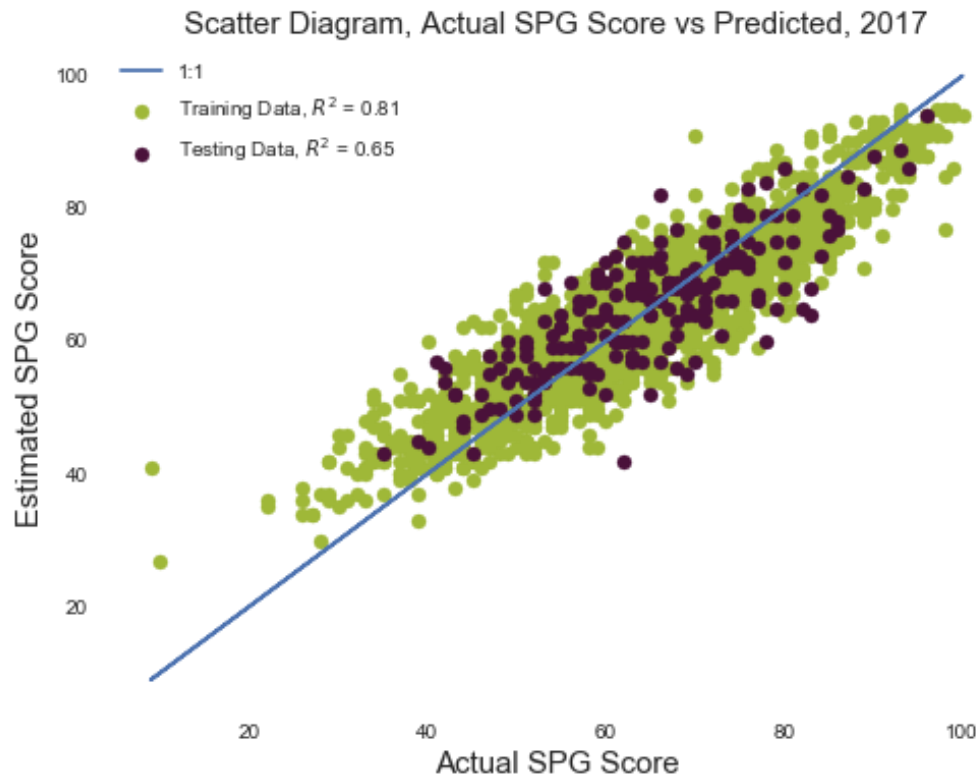
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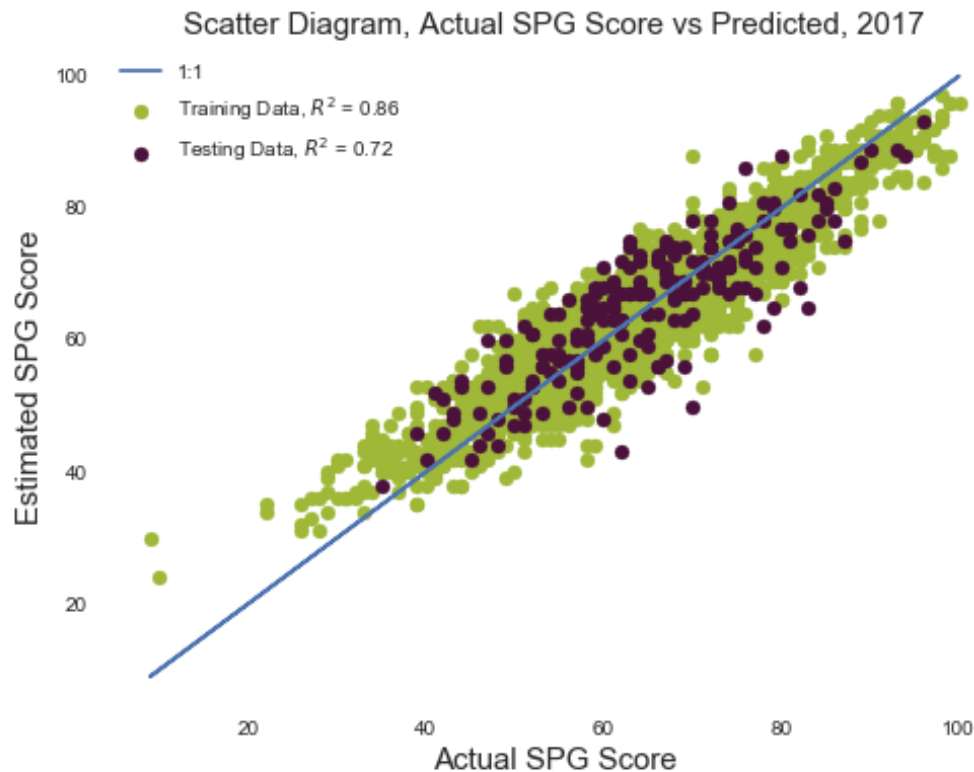

Scatter Diagram, Actual SPG Score vs Predicted, 2017

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

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Modeling SPG Score

Question 1: Can we build a model that accurately predicts school performance using school-level factors unrelated to student body demographics?

Scatter Diagram, Actual SPG Score vs Predicted, 2017

— 1:1
● Training Data, $R^2 = 0.86$
● Testing Data, $R^2 = 0.72$

Estimated SPG Score

Actual SPG Score

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

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Feature Importance

Question 2: Are there factors within administration's control related to School Performance Grade?

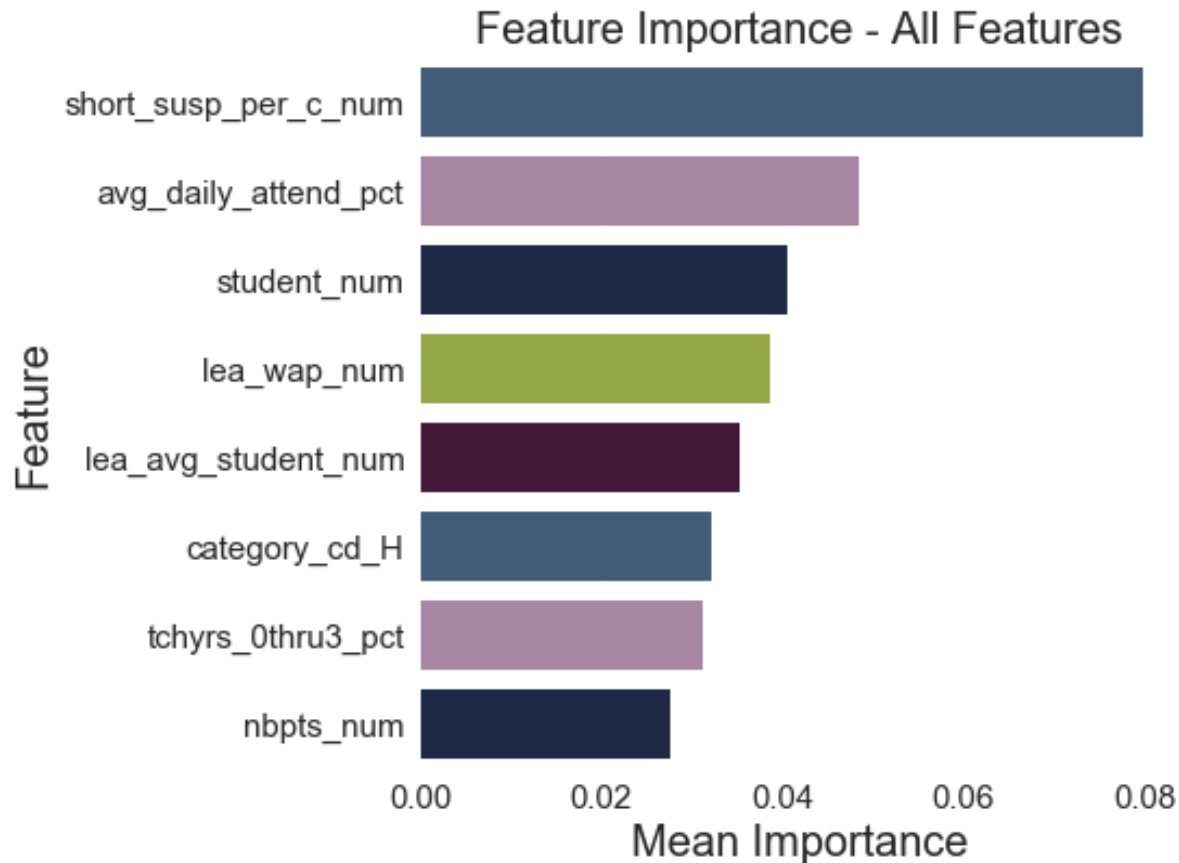Feature Importance - All Features

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Feature Importance
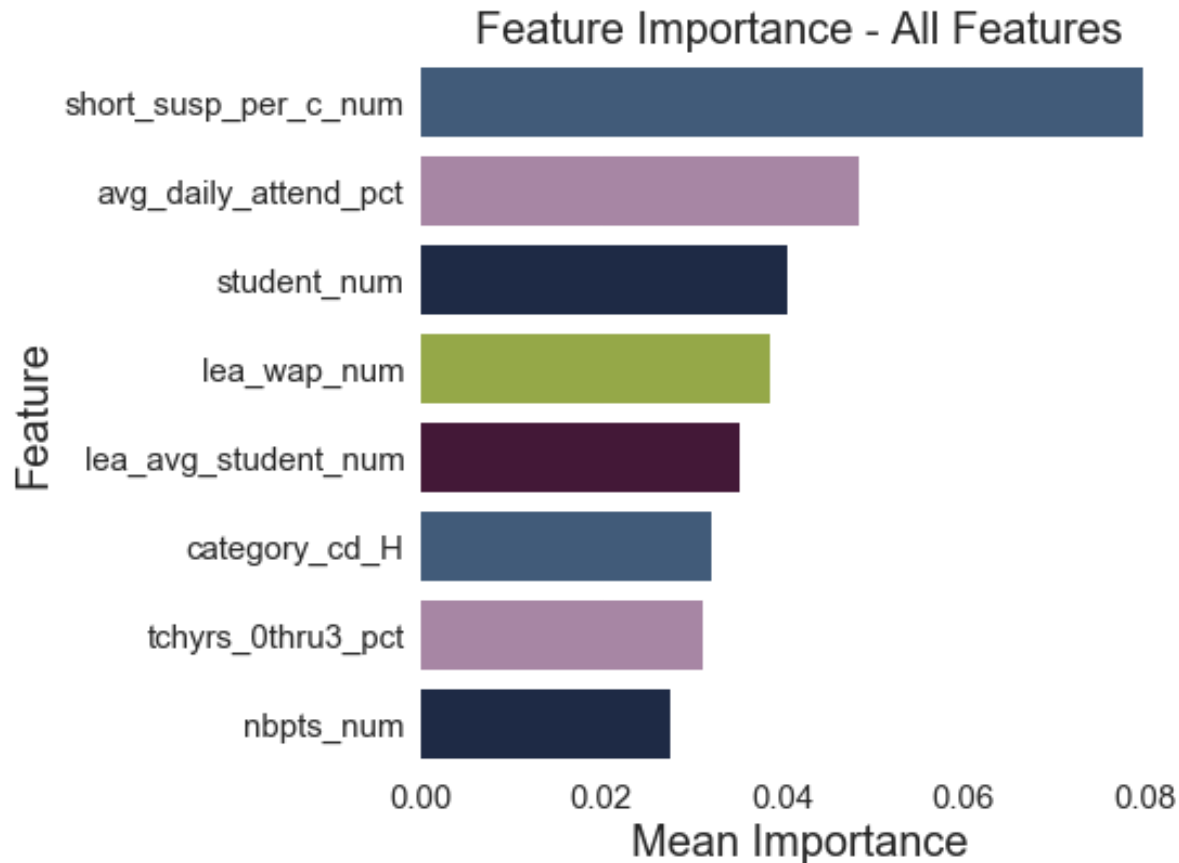
Question 2: Are there factors within administration's control related to School Performance Grade?

Feature Importance - All Features

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Estimating the Future

Question 3: Can we estimate how school performance would increase if we change one of these factors?

Given a 5% increase in Daily Attendance we expect to see...

Estimating the Future

Question 3: Can we estimate how school performance would increase if we change one of these factors?

Input

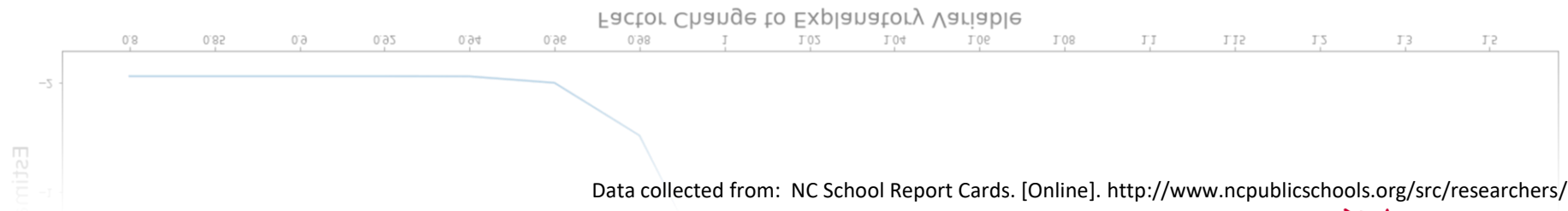All Variables including Student Demographics
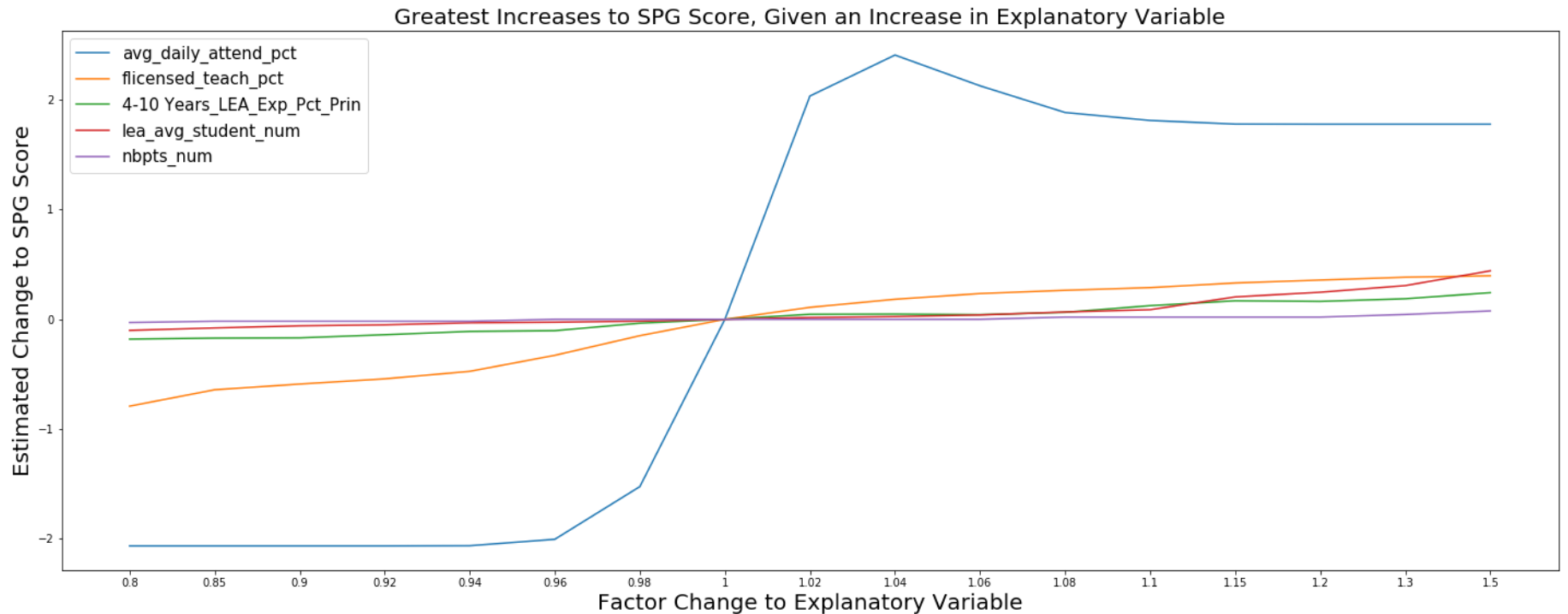
+

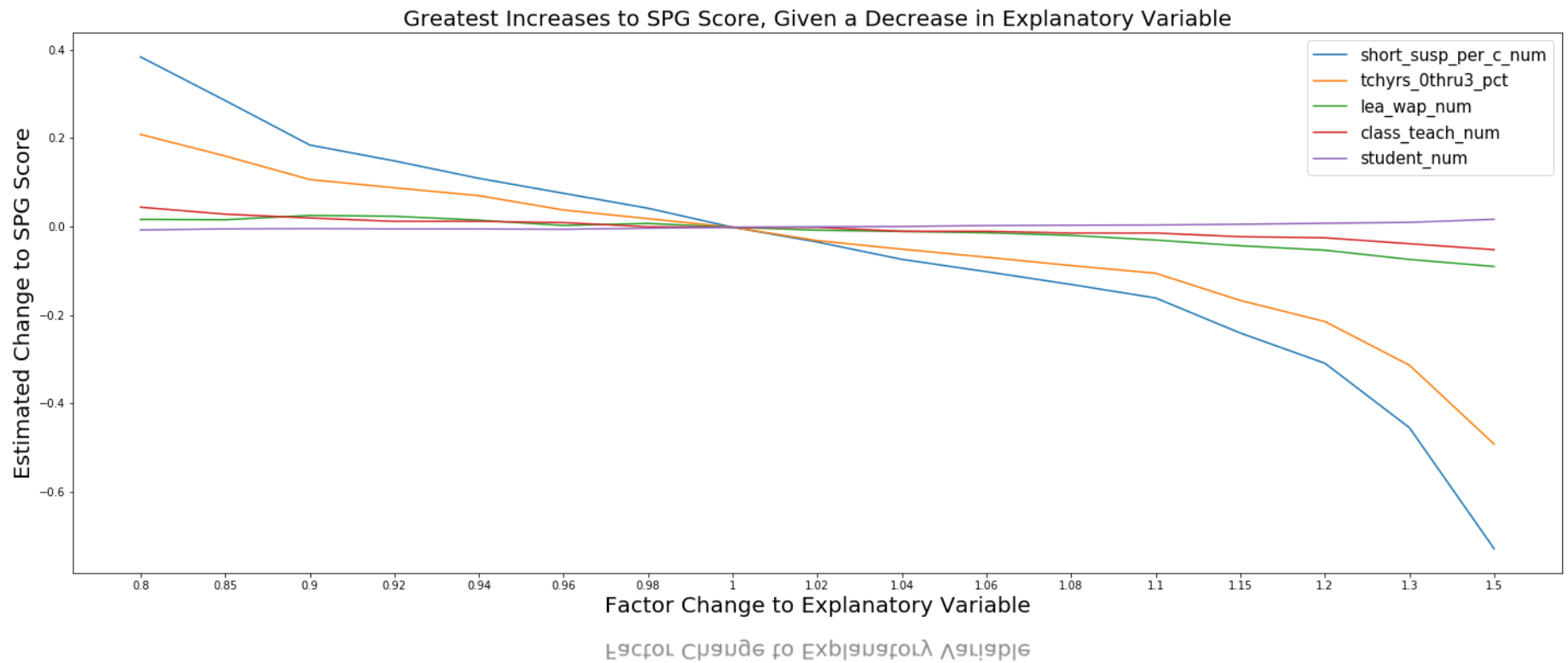x % change in variable

XGBoost

Output

New Estimations of SPG Score

Synthetic Prediction Results

Greatest Increases to SPG Score, Given an Increase in Explanatory Variable

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Synthetic Prediction Results

Greatest Increases to SPG Score, Given a Decrease in Explanatory Variable

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Synthetic Prediction Results

Joint Factor Changes to SPG Score: Short Term Suspensions and Average Daily Attendance

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.
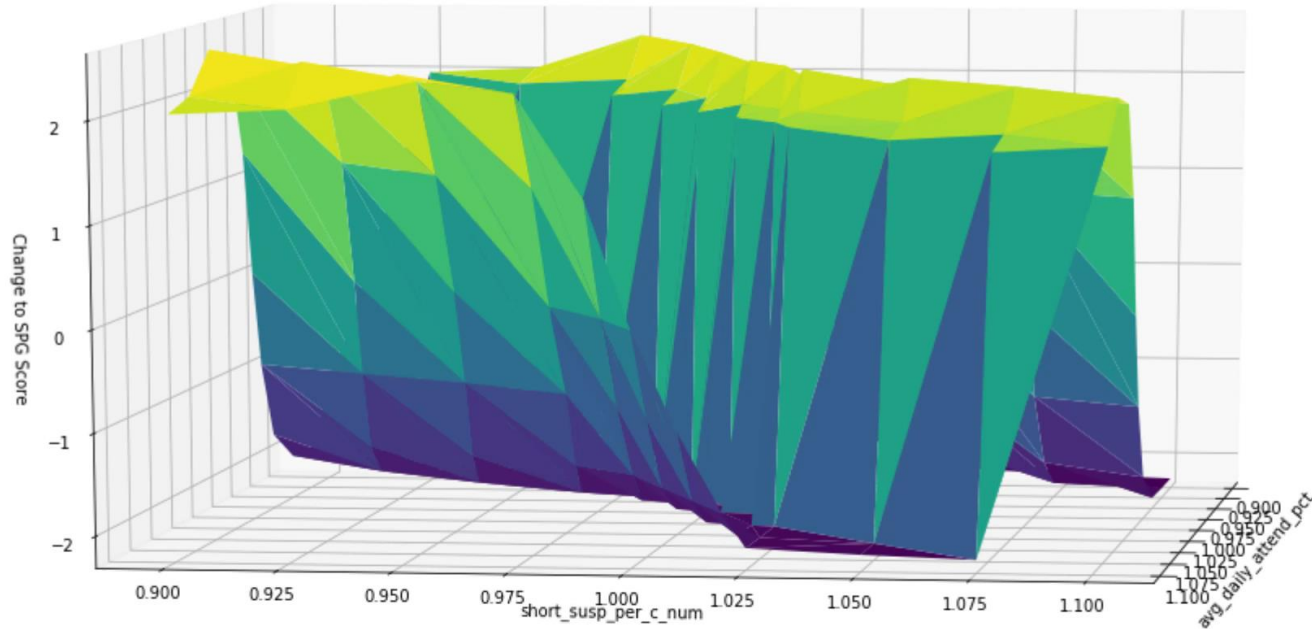
Synthetic Prediction Results

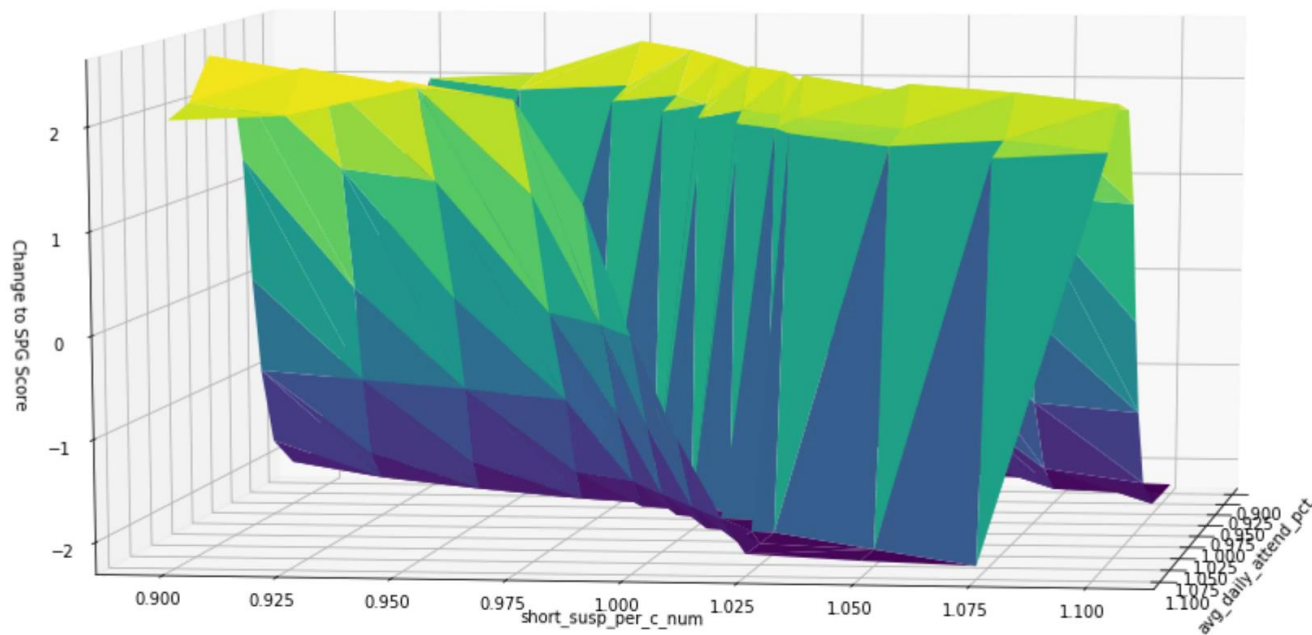Joint Factor Changes to SPG Score: Short Term Suspensions and Average Daily Attendance

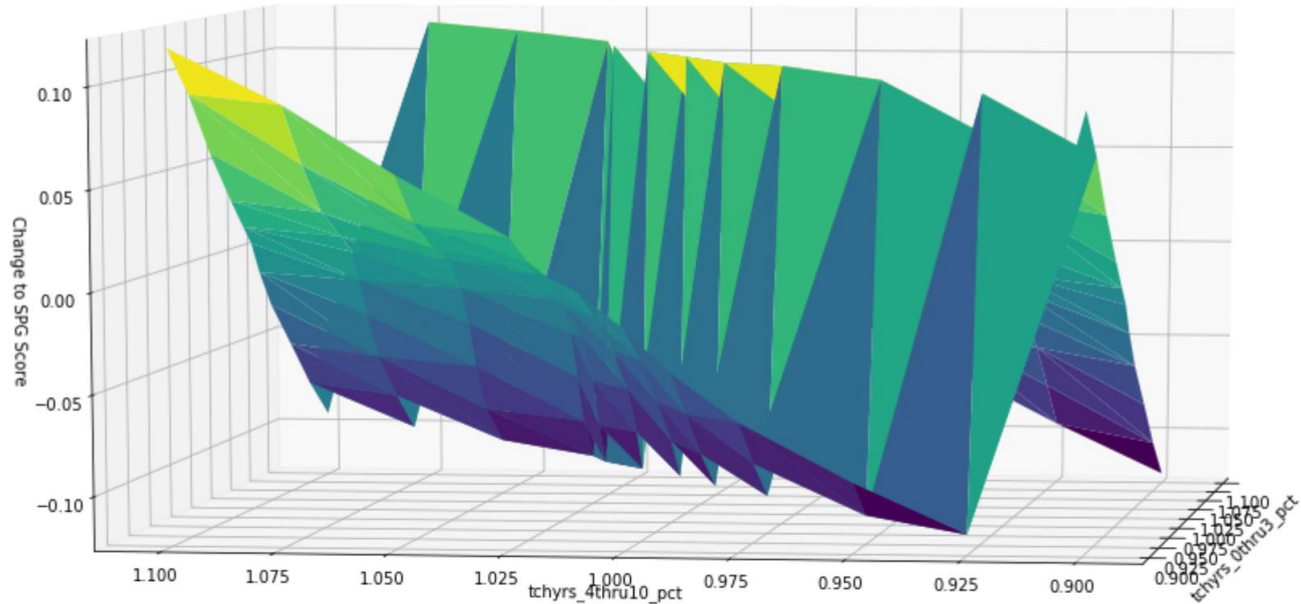Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Synthetic Prediction Results

Joint Factor Changes to SPG Score: % of Teachers 0-3 Years and % of Teachers 4-10 Years of Experience

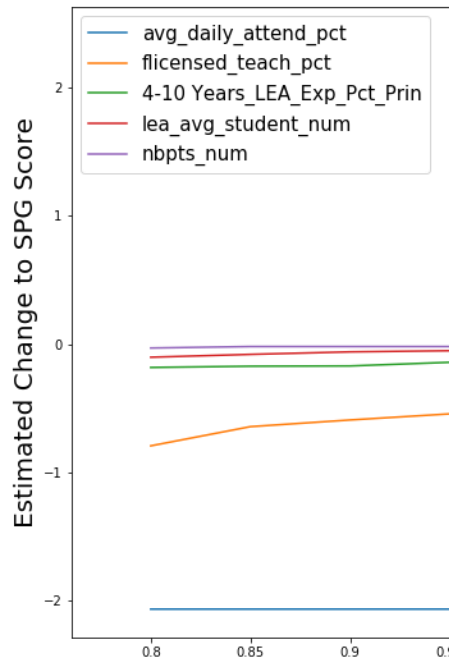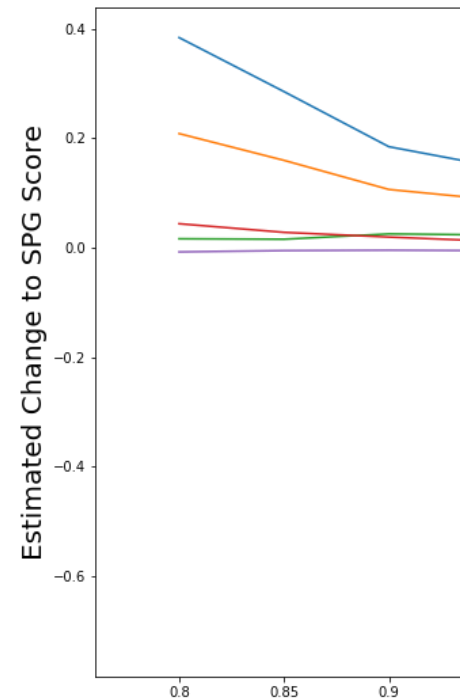Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Conclusion

Consider the Magnitude

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.

Conclusion

What's Most Important

Change in SPG Score by Change in Explanatory Variable

Data collected from: NC School Report Cards. [Online]. http://www.ncpublicschools.org/src/researchers/.
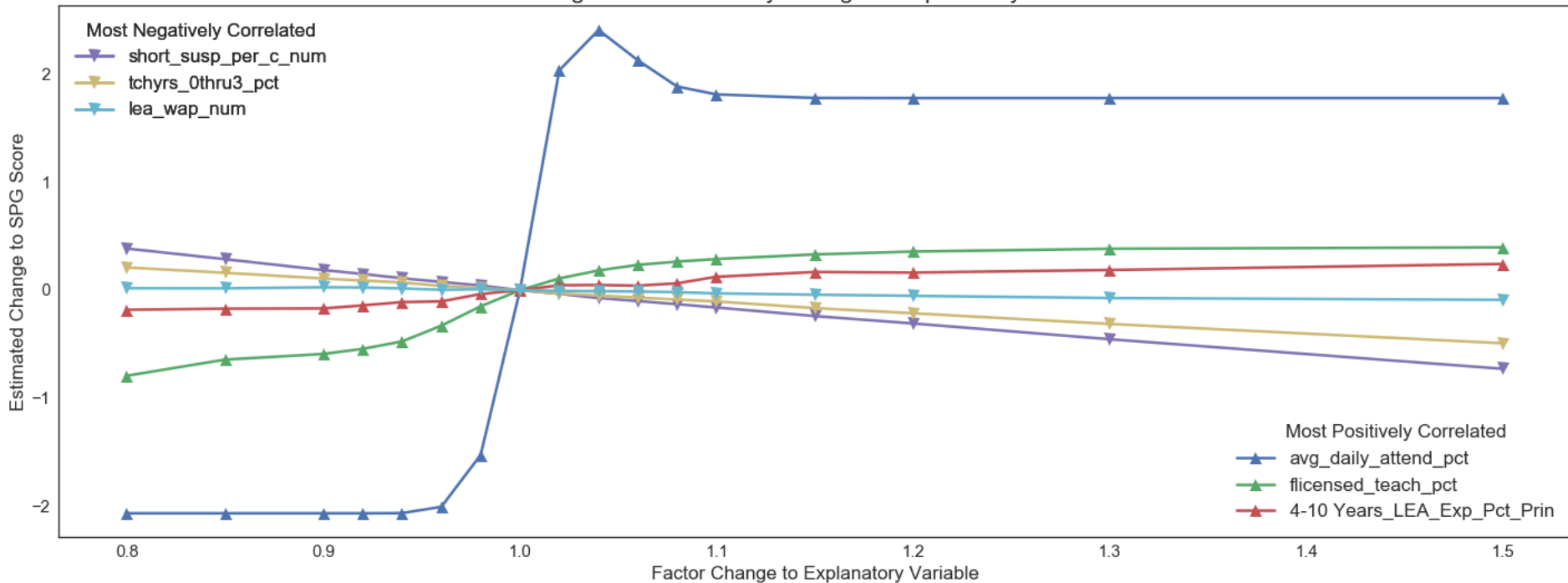
Conclusion

- We find the following to have a positive influence on SPG Score:

  - Decreasing the number of short term suspensions
  - Increasing average daily attendance
  - Employing teachers with more than 3 years of experience