Data Science Project

Best Start Central Long Beach Research

Analyzing the Impact of Student Language Skills and Financial Status on Academic Achievement

Motivation

Language and cultural barriers often make social interactions difficult, leading to a lack of information and other challenges that negatively impact my academic pursuits.

COVID-19 has had a significant and adverse impact on the overall education system, particularly affecting students from disadvantaged backgrounds. (https://www2.ed.gov/about/offices/list/ocr/docs/20210608-impacts-of-covid19.pdf)

Aimed to investigate the academic achievement of low-income students and contribute to finding solutions.

Background / Introduction

Dataset: Integrating the following three datasets based on CDS codes.
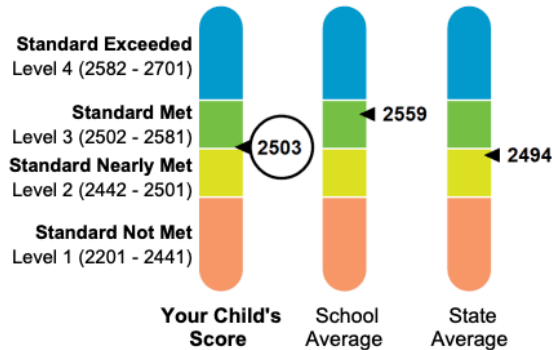
- CDS code (county/district/school): a 14-digit code that is used as the official identification for a district or school within California

- Raw Datasets
  - ELA/Math assessment in CA(CAASPP) of 2022 **https://caaspp-elpac.ets.org/elpac/**
  - Free and reduced lunch 2021-2022 **https://www.cde.ca.gov/ds/ad/frpmtop.asp**
  - ELS (English learner program) 2021-2022 **https://www.cde.ca.gov/ds/ad/top.asp**

Population: California enrolled students K-12
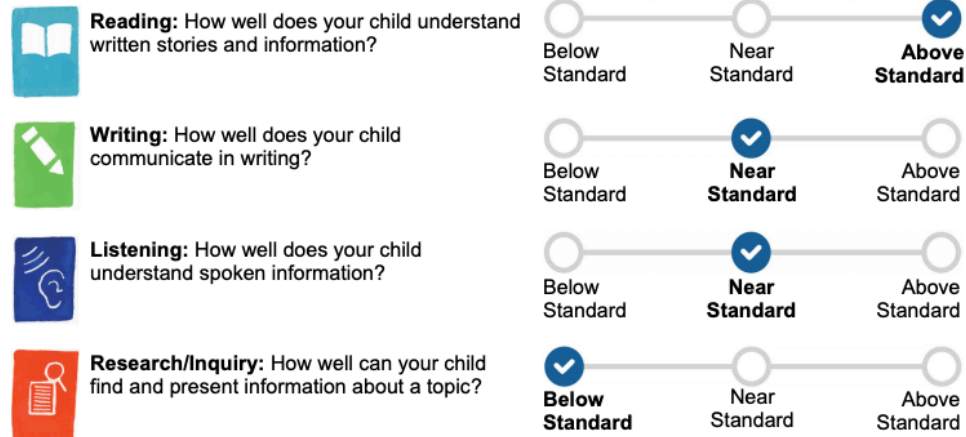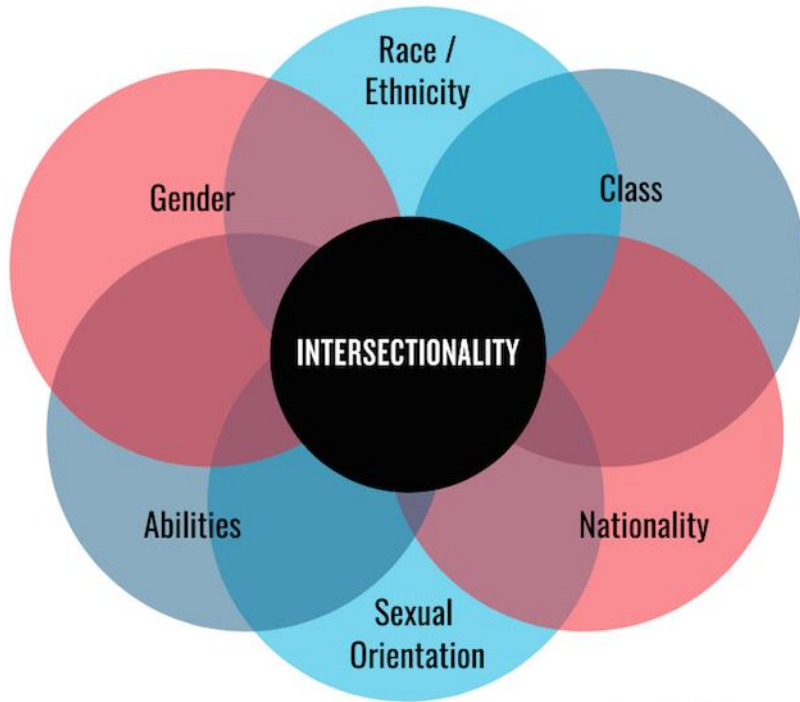
Background / Introduction

o **Measure of Variables:**
- Socioeconomic Status: Free/Reduce Meal
- English Literacy: ELS

o **Academic level:**
- The total sum of CAASPP test scores of enrolled students determines the school's level.
- 1 = Very Low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High
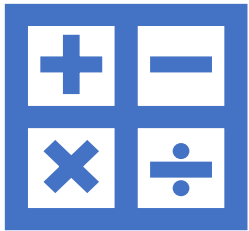
Hypothesis & Questions

AS THE SOCIOECONOMIC STATUS AND ENGLISH LITERACY DECREASE, WE ALSO EXPECT THE STUDENT'S ACADEMIC PERFORMANCE TO LINEARLY DECREASE

HOW DOES THE INTERSECTIONALITY BETWEEN POVERTY AND ELS AFFECT A STUDENT'S ACADEMIC PERFORMANCE?

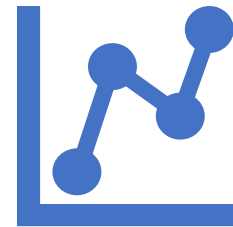# Methods & Procedure: Classical Statistics

Method 1: Linear Regression

Response variable: Academic level of 1-5(type: integer, numerical variable)

Features : ELS_proportion, FreeReduced_meal

Starting point: Simplest and fundamental approach in statistical analysis

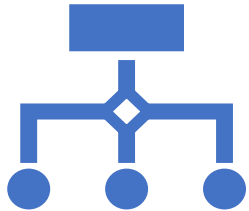**Method 2: Ordinal Logistic Regression**

Response variable was converted to factors 1 – 5

Suitable for ordered response variable

Methods & Procedure: Machine Learning

Method 1: SVR

SVR: Support Vector Machine is a supervised machine learning algorithm

Method 2: Random Forest Regression

Random Forest Regression: a supervised learning algorithm that uses tree-like learning method for regression.

Results / Data: Classical Statistics

1. Linear Regression

$$Academic\ Level = 4.664 + 0.36(ELS\ Proportion) - 3.61(Free/Reduced\ Meal)$$

P-value	<0.003
R-squared (R^2)	0.511

2. Ordinal Logistic Regression

$$Academic\ Level = 4.664 + 0.88(ELS\ Proportion) - 7.80(Free/Reduced\ Meal)$$

Result / Data: Machine Learning

1. Support Vector Machine Regression

$$Academic\ Level = 4.95 + 0.71(ELS\ Proportion) - 3.99(Free/Reduced\ Meal)$$

Mean Squared Error (MSE)	0.82
R-squared (R^2)	0.502

2. Random Forest Regressor

Mean Squared Error (MSE)	0.746
R-squared (R^2)	0.55

Results/Data: Correlation Factor

Correlation(X & Y)	Value
Free/Reduced Meal Prop. & Academic Level	- 0.714
ELS Prop. & Academic Level	-0.361
Free/Reduced Meal Prop. & ELS Prop.	0.55
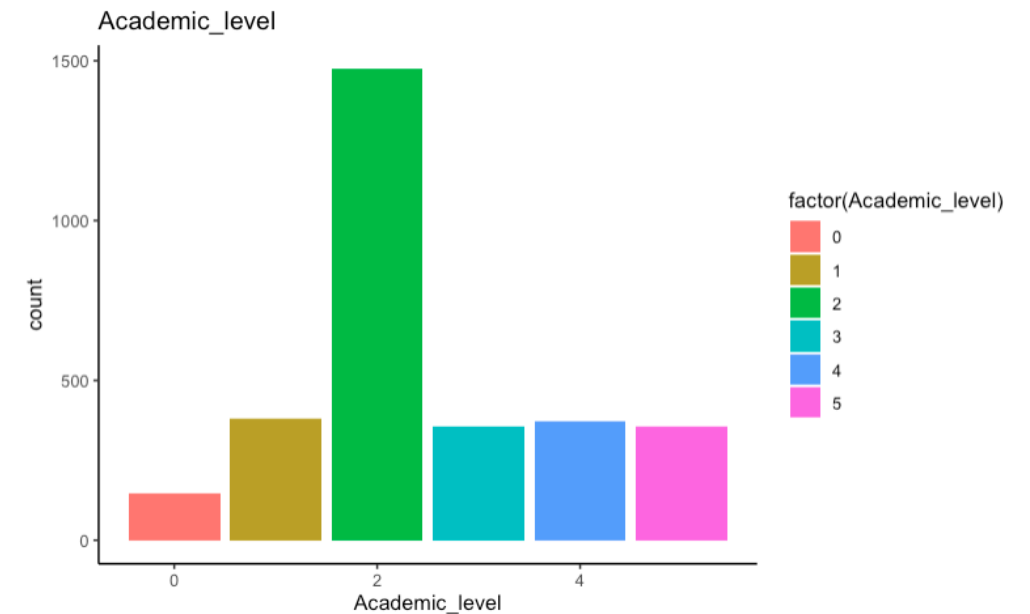
Discussion / Interpretation: English Literacy

ELS (English Language Learner) students' proportion has barely any impact on academic achievement yet still exhibits a relatively **weak negative** correlation with academic outcomes

Conjecture:

- The difficulties in building social relationships due to language and cultural barriers which, in turn, may lead to psychological distress and reduce productivity and performance

- Cultural barriers in immigrant households hinder parental involvement and voice within school committee

Discussion / Interpretation: Socioeconomic Status

The **strong negative** correlation observed between the proportion of students eligible for free/reduced meals and academic achievement levels clearly indicates lower academic performance among students from low-income households

- Free / Reduced Meal Proportion weighed much more significantly towards Academic Level of the school based on all the regression models.

Conjecture:

- o Low income family struggle to find good, affordable resources to help their students overcome academic barriers
- o The lack of financial stability may cause the student's priorities to shift from academics to employment.

Discussion / Interpretation: Intersectionality

Question: How does the intersectionality between poverty and ELS affect academic performance?

- A **moderate positive** correlation(=0.55) between socioeconomic status and English literary.
- There seems to be a relationship between student's family socioeconomic status and the student's English literacy.
- There may be a compounding effect on school's overall academic performance if a significant proportion of their students are both low income and ESL.

Conclusion

Further study

- Analysis of the relationship between non-English speakers and immigrants regarding their socioeconomic status.
- Is this only within Long Beach or are there other counties/cities that have high ESL proportions that also struggle with academic level? If not, why is LB especially impacted from a low academic level regarding ESL proportion?

Solution

- Provide a program with better transition for our non-English speaking students and allocate more resources towards poverty families.
- Suggest: Implement community programs for immigrants. Language education, parental university, Community Mentorship Program, and Community Liaison
- Suggest: Implement practical community programs for low-income households. Transportation Assistance, Marketing and Outreach, and Incentives and Recognition

Reference

Parental Involvement Research: Moving to the Next Level,*William H. Jeynes (2011)*

Family Engagement in Schools: Parent, Educator, and Community Perspectives , Noel E. Kelty1 and Tomoko Wakabayashi1

What triggers economic insecurity and who is most at risk?, Maren Jiménez (March 2021 United Nations Department of Economic and Social Affairs)

Thank you!