CAPP 122 Final Project
Tools4Schools

Group Members:
Akila Forde - aforde
Dharini Ramaswamy - dramaswamy
Idalina Sachango - idalina
Nivedita Vatsa - nkvatsa

Brief Overview of Project:
In this project, our team explored factors that affect educational inequity in the Chicago public school system. We accomplished this by developing an index that measures a student's level of opportunity for each school. In calculating our opportunity index, we weighted factors such as internet access, poverty rate, unemployment rate, air pollution, median household earnings and school budget allocation. Our visualizations map the calculated opportunity index, school budget allocation and poverty rate at the census tract level and include distinctions for school size. Additionally, we compared our constructed index with college enrollment rates to validate our results. Our results indicate that the opportunity index is positively correlated with college enrollment rates, meaning that a student's level of opportunity impacts the likelihood that they will enroll in a four-year college. We hope that education institutions can utilize our index and analysis to effectively allocate resources and support students' learning needs. This index is inspired by the Child Opportunity Index 2.0 project. We followed a similar methodology and utilized Chicago-specific data and weights.

Overall Structure of Software:

The first portion of our software loads in the data from our data sources (CDC Data Portal, US Census, Urban Institute Data Portal, Chicago Public Schools) through API queries and one static dataset (raw_budget_data.csv). The scripts for running the API queries are located in tools4schools/data_management/api_code. Each of the files (acs_api_1.py, air_quality_api.py, budget_api.py, earnings_fs_cleaning.py, urban_data_import.R) returns a CSV file containing the cleaned and queried datasets. These datasets are located in categorized folders in tools4schools/data.

The categorized folders in tools4schools/data (acs, environmental, economic, cps, ccd_crdc) serve as inputs into the data processing portion of our software. In tools4schools/data_management, the data_processing.py will consolidate all datasets. The opportunity.py file creates a class that contains all the attributes and methods needed for processing the data. An instance of this class is created in construct_index.py. Running the construct_index.py will return the datasets used to create our visualizations. These datasets are located in tools4schools/data/results.

The third part of the software entails acquiring the visualizations, charts and tables to be used in the application. The five main plots used are found in tools4schools/charts: scatter.py, budget.py, college.py, poverty.py and enroll_scatter.py. The first four charts are maps and take census_tract.json as an input, along with opportunity_index_scaled.csv, indicators_by_school_per_unit.csv, and indicators_by_school_unscaled.csv respectively. Additionally, we create a DataTable displaying the consolidated data from opportunity_index_scaled.csv and indicators_by_school_unscaled.csv in app.py.

The app creation happens in tools4schools/app.py and the deployment happens in tools4schools/__app__.py. The __app__.py file takes the files located in tools4schools/charts as inputs (scatter.py, budget.py, enroll_scatter.py, college.py, poverty_rate.py). Our __app__.py file generates the interactive map and dropdown table.

The details of the statistical analysis and decisions made to calculate the opportunity index are included in a Jupyter Notebook in proj-tools4schools/tools4schools/data_management called Appendix - Methodology.ipynb.

Code Responsibilities by Group Member:

Group Member	Responsibilities	Associated Files/Packages
Nivedita Vatsa	• Processed data • Constructed Opportunity Index	• data_processing.py • urban_data_import.R • opportunity.py • master.py
Akila Forde	• Conducted API queries and cleaned data set • Created Opportunity Index and College Enrollment Scatter plot • Created the Dash infrastructure and Datatable	• acs_api_1.py • app.py • enroll_scatter.py • assets folder • install.sh
Idalina Sachango	• Created visualizations for Opportunity Index, College Enrollment, Poverty Rate • Organized the github file infrastructure	• run_all.py • scatter.py • poverty_rate.py • college.py
Dharini Ramaswamy	• Conducted API queries and cleaned datasets • Created visualization for Budget per Student	• air_quality_api.py • budget_data_api.py • earnings_fs_cleaning.py • budget.py

How to Interact with the Application:

The user can toggle through the maps on our dashboard by clicking through the buttons at the top of the landing page. For example, clicking on “College Enrollment Percent by School” will navigate the user to a map that displays percent college enrollment for schools in Chicago census tracts. By hovering over the data points, the user can view the school name and associated percent college enrollment. Legends that describe the significance of the color gradients are located on the right side of the page. The size of bubbles on the map corresponds to the variable represented on the specific map.

By scrolling down to the dash table, a user can filter data at the school-level. For example, typing in the word “Lane” will allow the user to view the consolidated opportunity index and indicator variable data for Lane Technical High School.

Project Accomplishments and Next Steps:

Our project aimed to create a comprehensive opportunity index by including school-level variables like budget, teacher salaries and law enforcement presence and environmental attributes like economic well-being, internet access and air pollution. We aimed to visualize our analysis geographically, create interactive features such as a hover for school profile information, show regional aggregated indices and view school/census-tract specific information.

We believe our analysis is validated because our calculated opportunity index corresponds highly with college enrollment rates in public schools in Chicago. We utilized the Plotly library and Python Dash to create four visualizations that plotted the opportunity indices, school budget allocation, poverty rate and college enrollment rate on a map of Chicago census tracts.

With more time, we would have created a user interface where a user inputs specific indicator variables and creates an opportunity index based on their input. We would include additional factors in our opportunity index that affect a student’s level of opportunity like crime, level of instructional quality and access to extracurricular activities. We would also develop the ability to filter opportunity indices by demographic information. Lastly, we would enable the user to view a single school’s information both in the dropdown table and map.