



Education Budgets and Outcomes

DATASCI 209

Fall 2023

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Why

Transparency about spending on education is important for the general public

Seeing if there are trends in this data due to enrollment, instructional spending, or student outcomes can help inform decision making



Users

Primary User: Teachers,
educators, policy makers



Data



Dataset	NCES
Data Source	U.S. Census Bureau and the National Center for Education Statistics (NCES). Additional Datasets: <ol style="list-style-type: none">1. Region Data: Kaggle2. Latitude/Longitude Data: Kaggle
Number of Instances	Primary Data: 1715 Secondary Data: 374,161
Key Features	Enrollment Size, Average Math and Reading Scores, Total Revenue, Instruction Expenditure, States, Regions
Additional Data	Regions, Latitude, Longitude, Districts

Use Cases

1. Analyzing Instruction Expenditure Trends

2. Linking Educational Spending to Academic Achievement

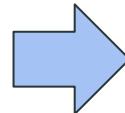
3. Assessing Regional Performance Differences

4. Impact of Enrollment on Academic Scores

5. School Districts counts Comparison (state wise)

6. Spending Analysis in Top School Districts

Usability Testing Results I - Major Feedback



1. Effectiveness of charts/graphs in data comprehension.

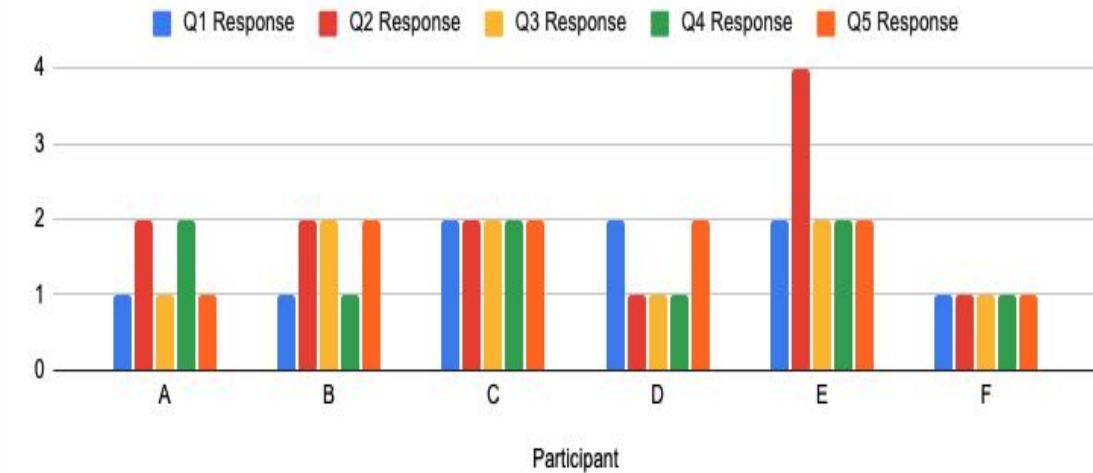
2. User-rated website navigability.

3. Success in locating specific data.

4. Understandability of presented data/statistics.

5. Overall user satisfaction with the website.

Users Feedback Post Usability Testing



Usability Testing Results - II

- Slope graph, **change colors** of region, explore **aggregation or faceted views** to minimize occlusion
- Need more **clarity on why states are spending more on instruction, users conflating spending more with “valuing” more or putting more importance behind instruction**
- Add **explanatory text** to guide the user through the tableau interface
- Mention when visualizations are interactive
- Size visuals so they fit fully on computer screen
- Vary colors to make it more enjoyable for user experience

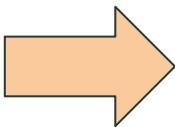
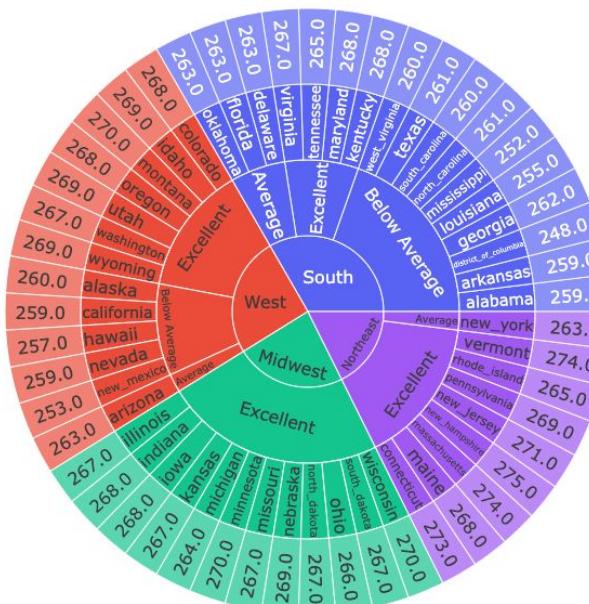
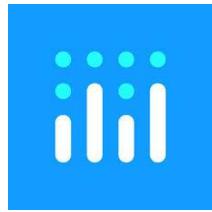
Usability Testing Results - III: Questions

NAEP Data Portal Usability Feedback Survey

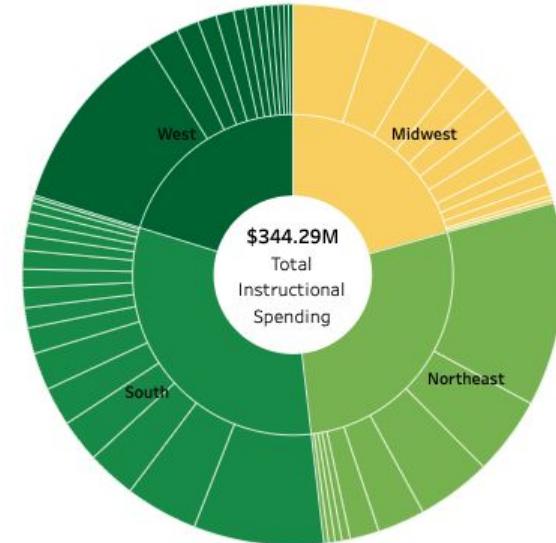
Thank you for taking time to view our visuals. Please fill out this survey

1. Were the visual representations (charts, graphs, etc.) effective in helping you understand the NAEP data?
2. On a scale from "Very Easy" to "Very Difficult," how would you rate the ease of navigating our NAEP data analysis website?
3. Were you able to find the specific NAEP data you were looking for without any issues?
4. How clear and understandable did you find the data and statistics presented on the site?
5. How satisfied are you with the overall usability of our NAEP data analysis website?

Instruction Spending By Region And States



Instructional Spending by Regions and States (2015)



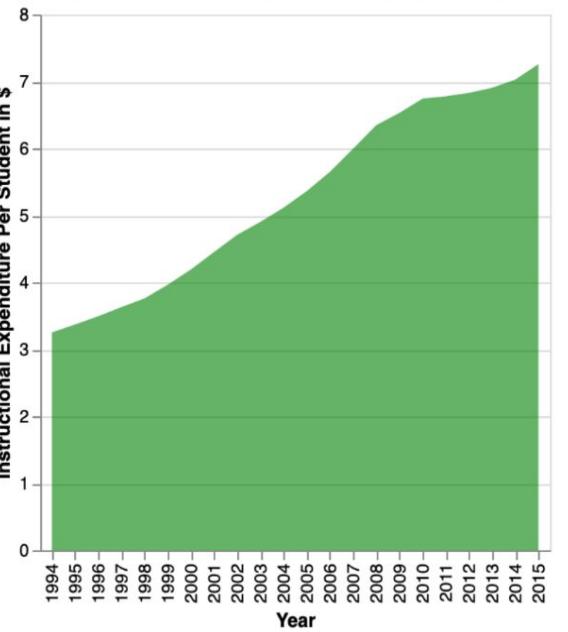
Why sunburst?
Structural
breakdown of
our data
hierarchy

Compare Expenditure, Inflation and Population

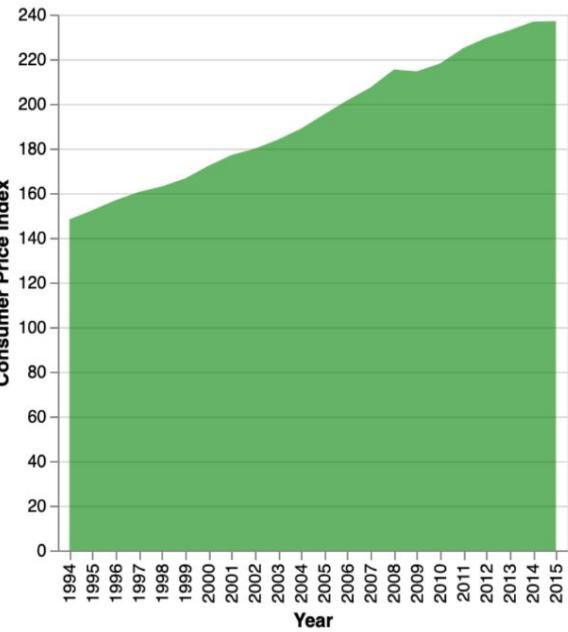
Additional
datasets:

- US Population
- US Consumer Price Index
- US Census

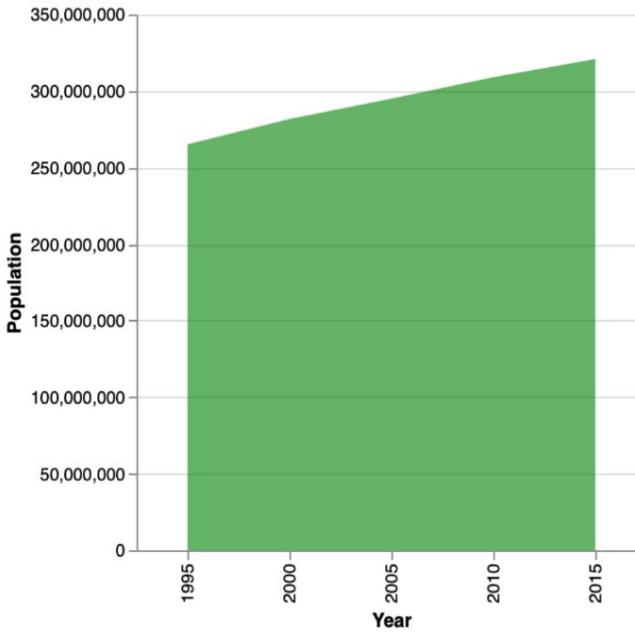
Average Instructional Expenditure Per Student Increase



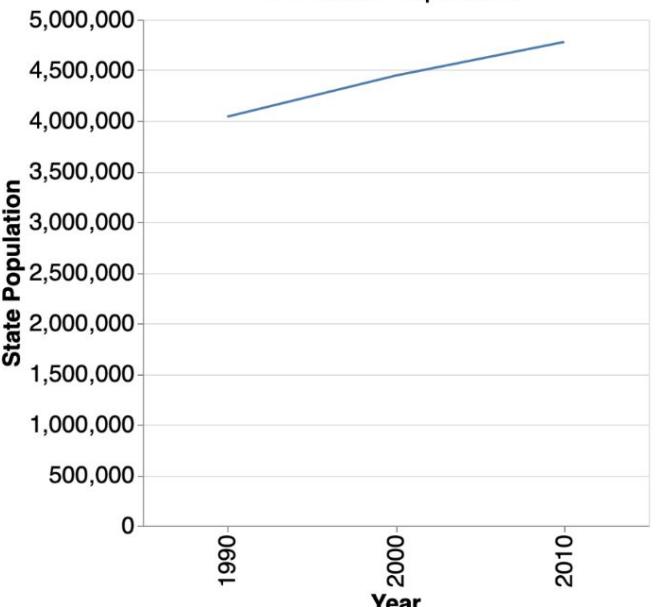
US Inflation Increase



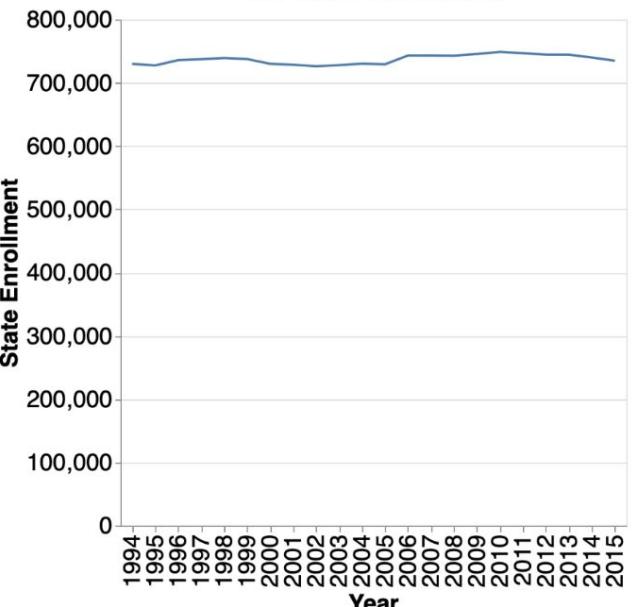
US Population Increase



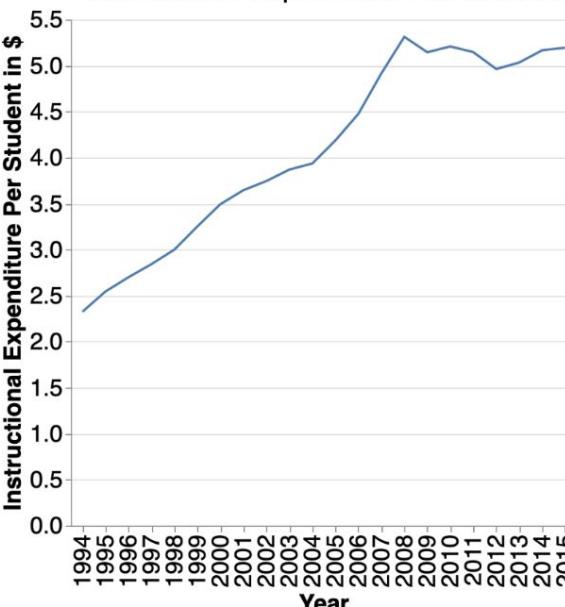
US State Population



US State Enrollment



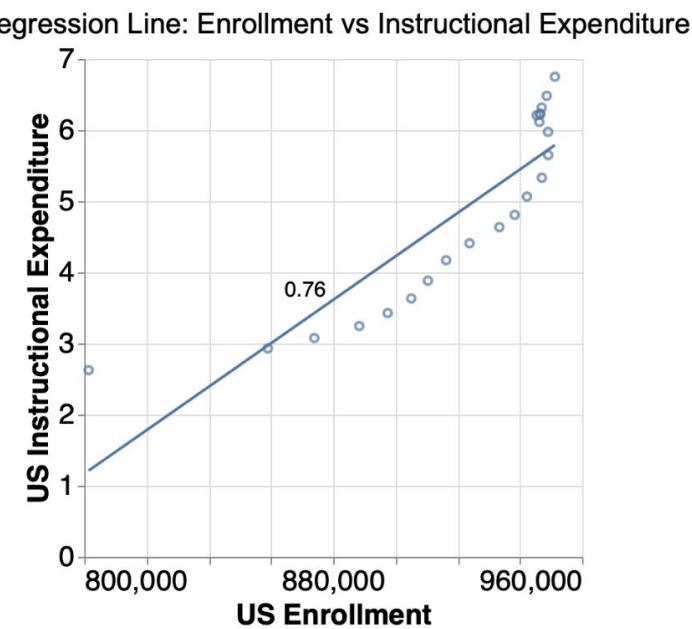
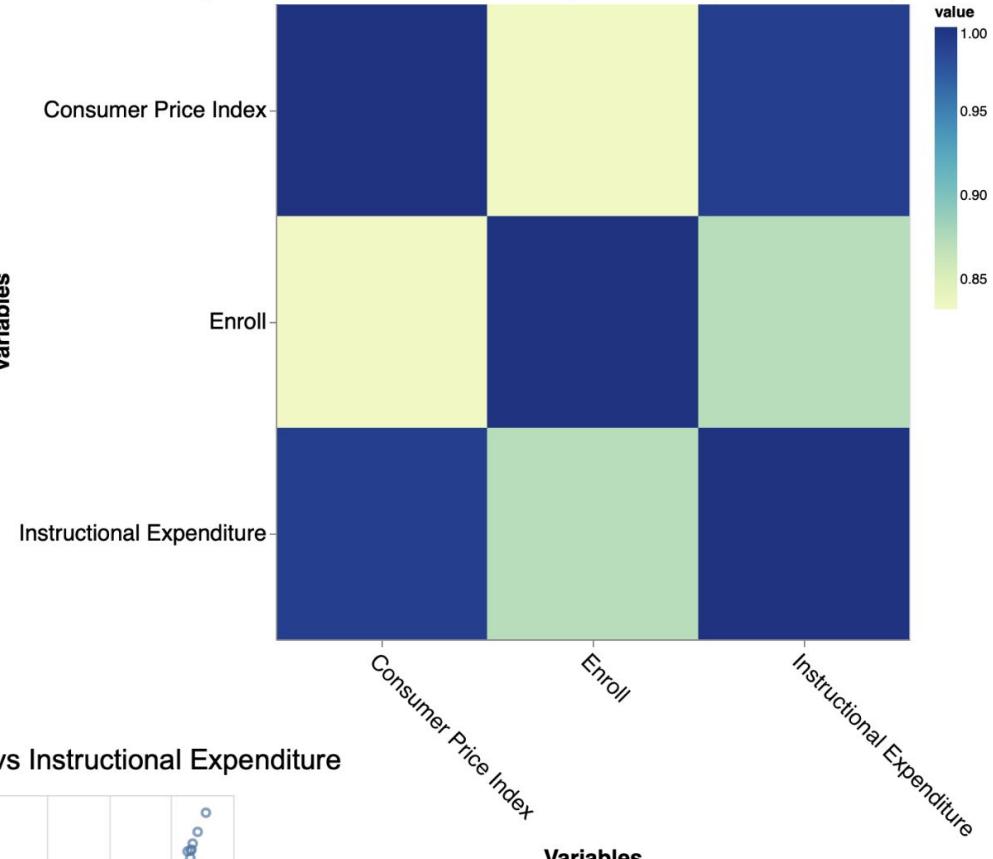
Instructional Expenditure Per Student



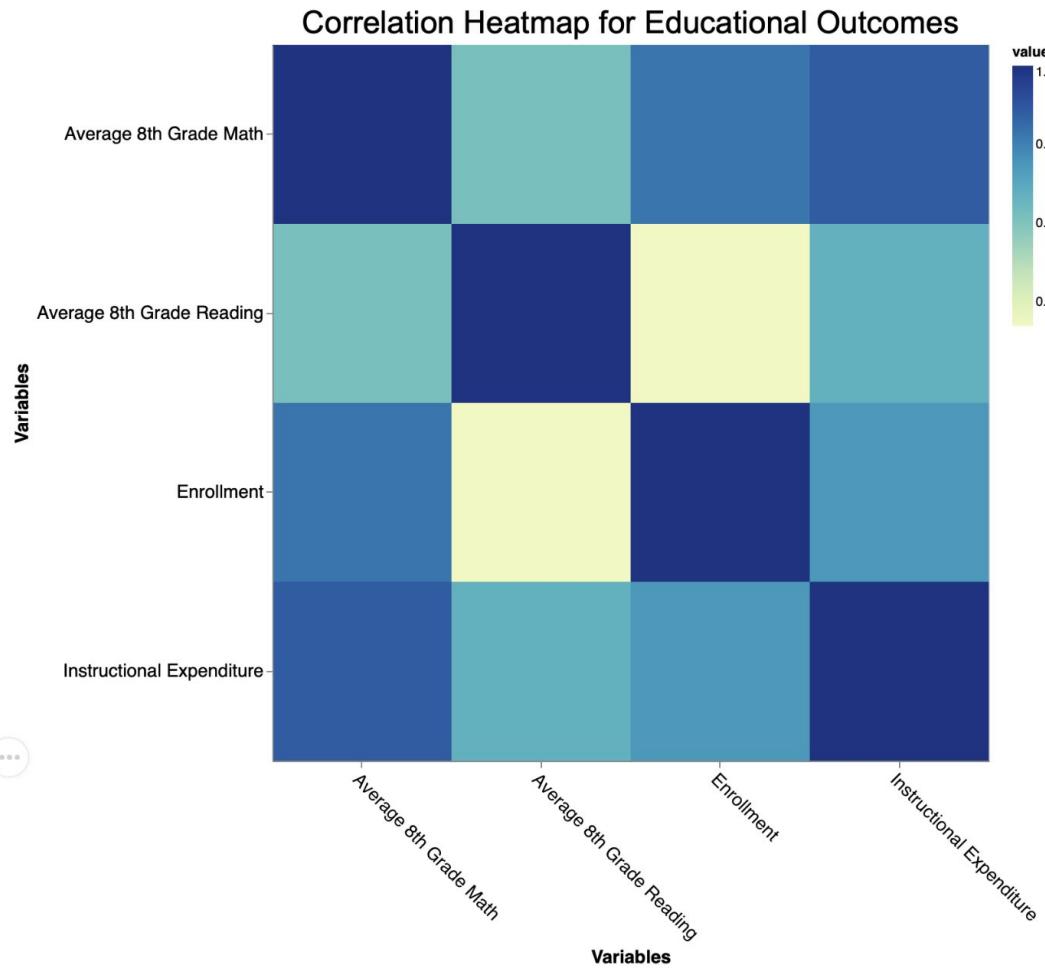
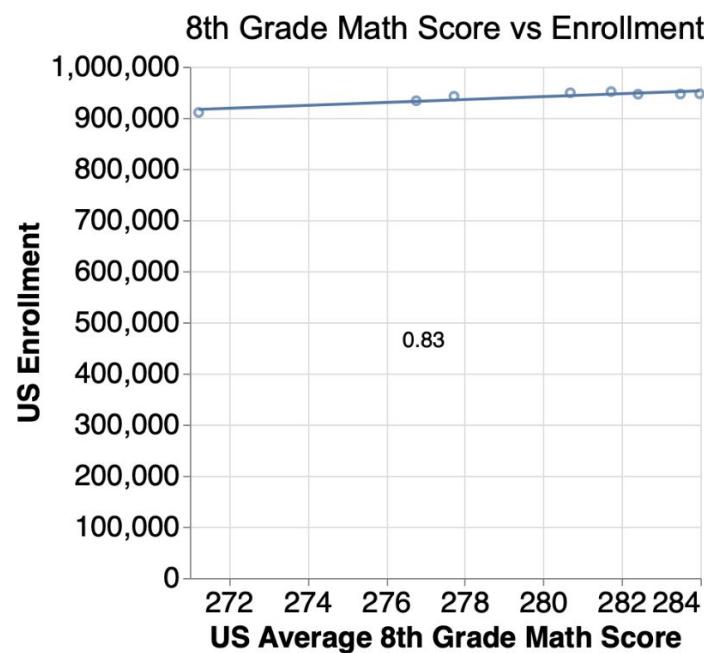
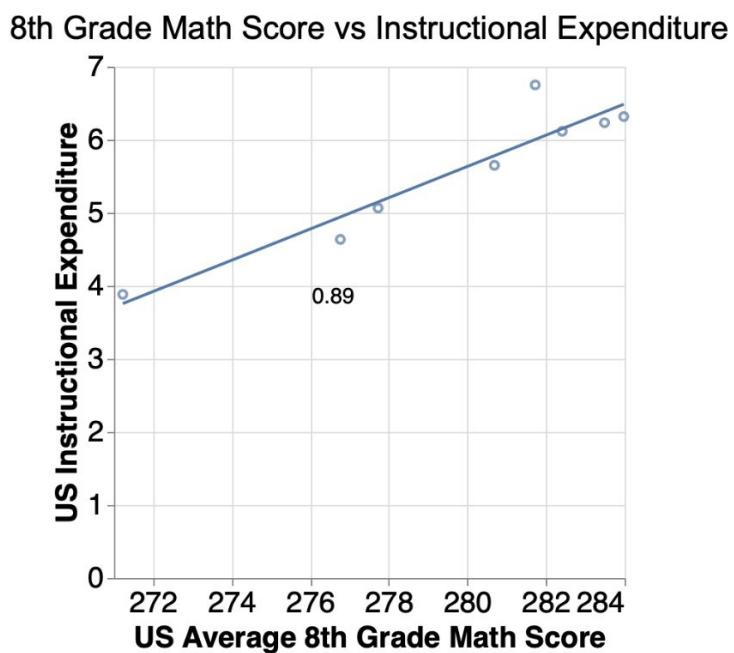
Select_state Alabama

Analyze Correlation Map and Regression Lines for Instructional Spending, Enrollment, and CPI

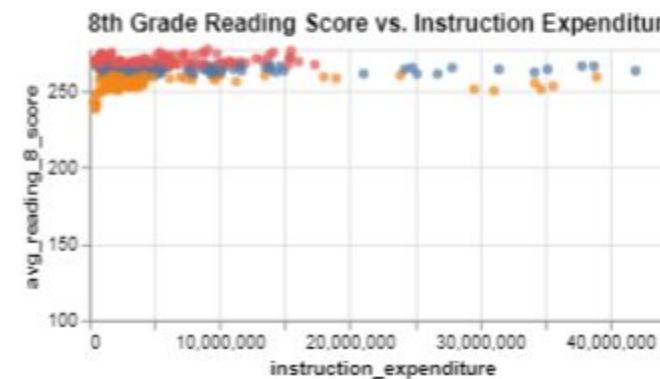
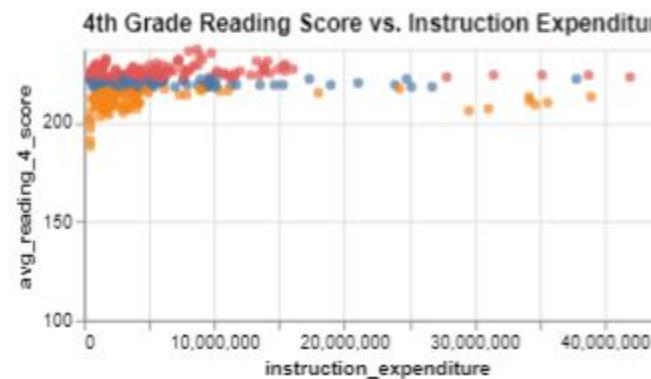
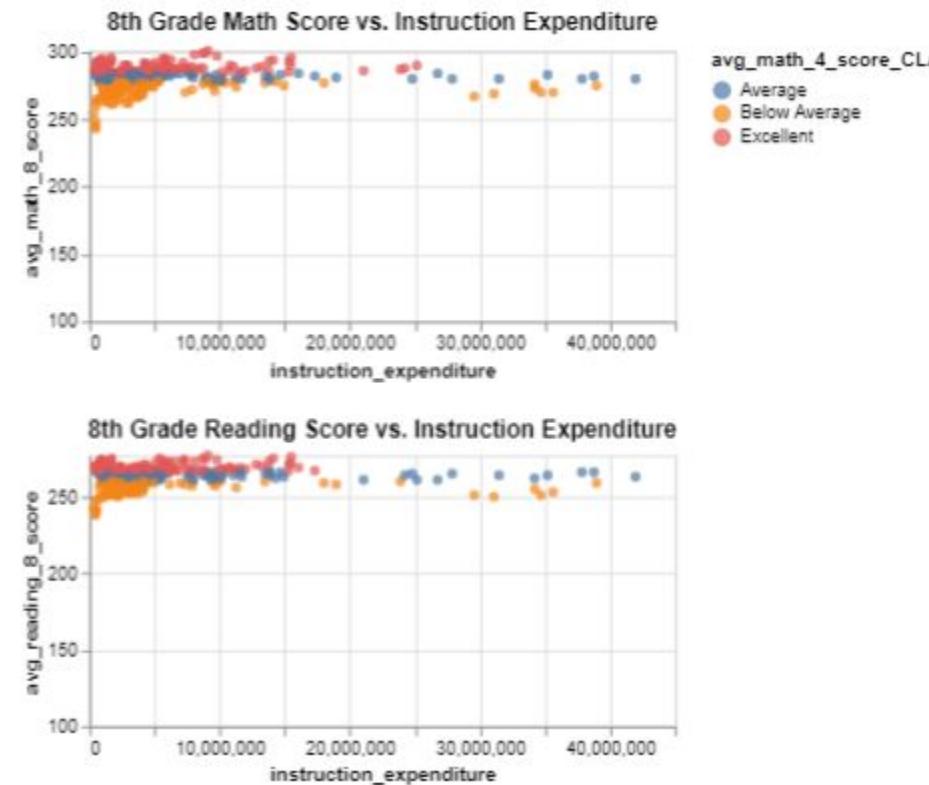
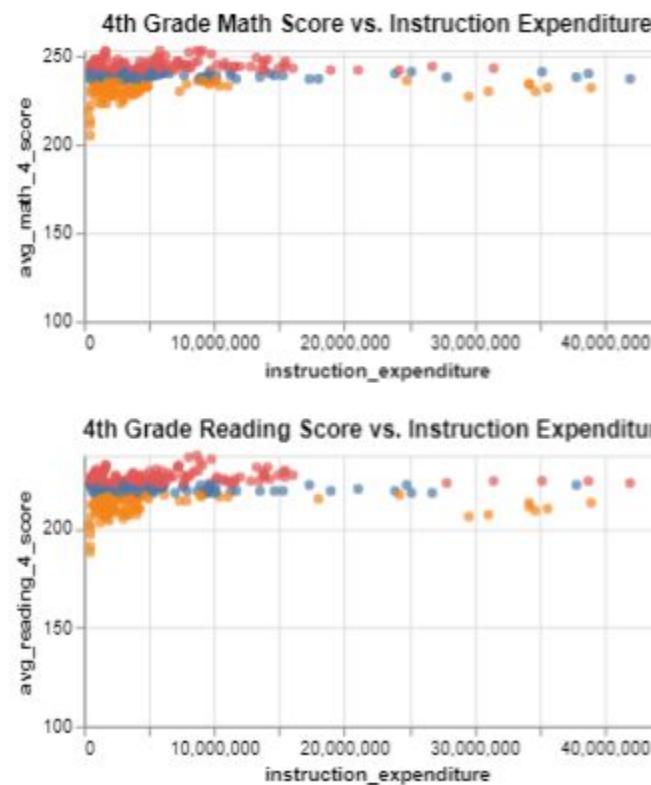
Correlation Heatmap for US Instructional Expenditure, Enrollment, & Consumer Price Index



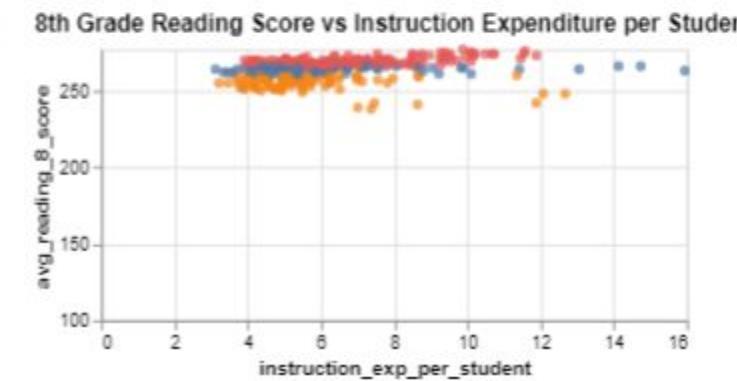
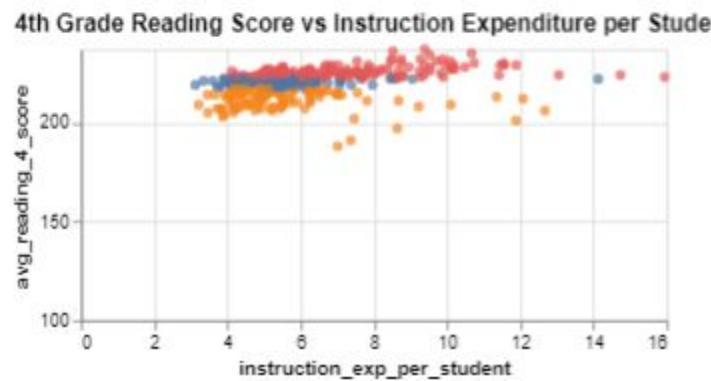
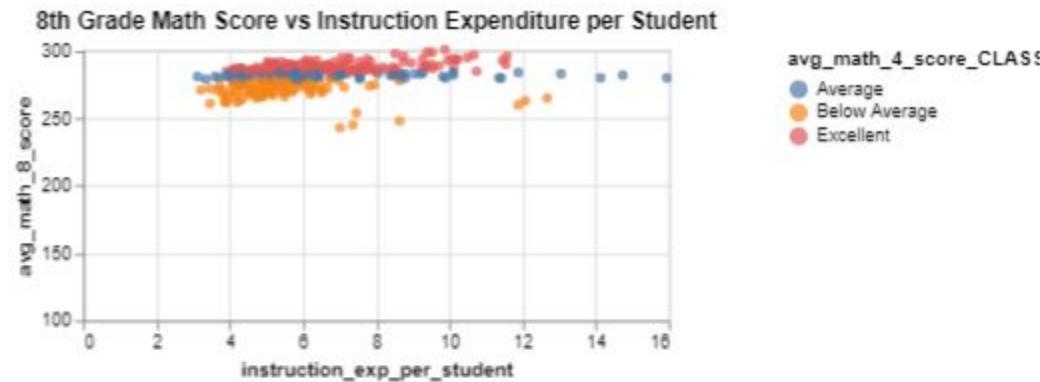
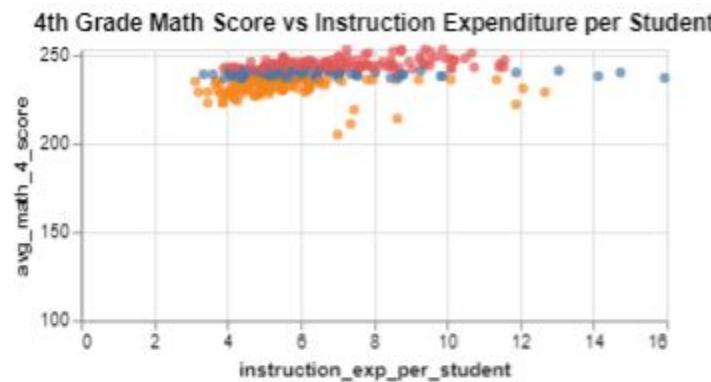
Analyze Correlation Map and Regression Lines for Student Outcomes, Enrollment, and Instructional Spending



Unraveling Math and Reading Scores Across Instruction Expenditure - Grade 4 and Grade 8

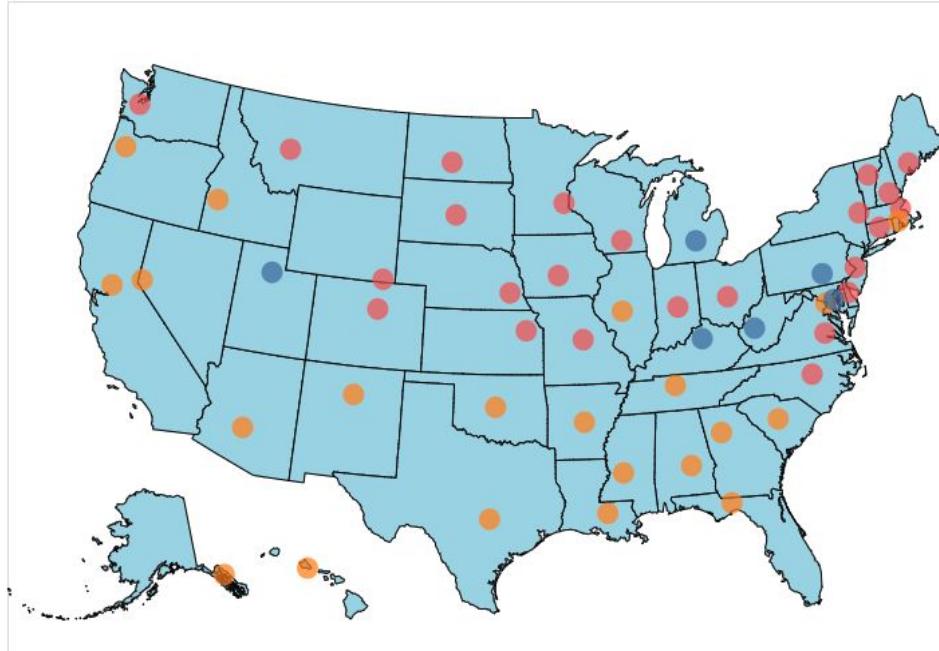


Unraveling Math and Reading Scores Across Instruction Expenditure per Student - Grade 4 and Grade 8



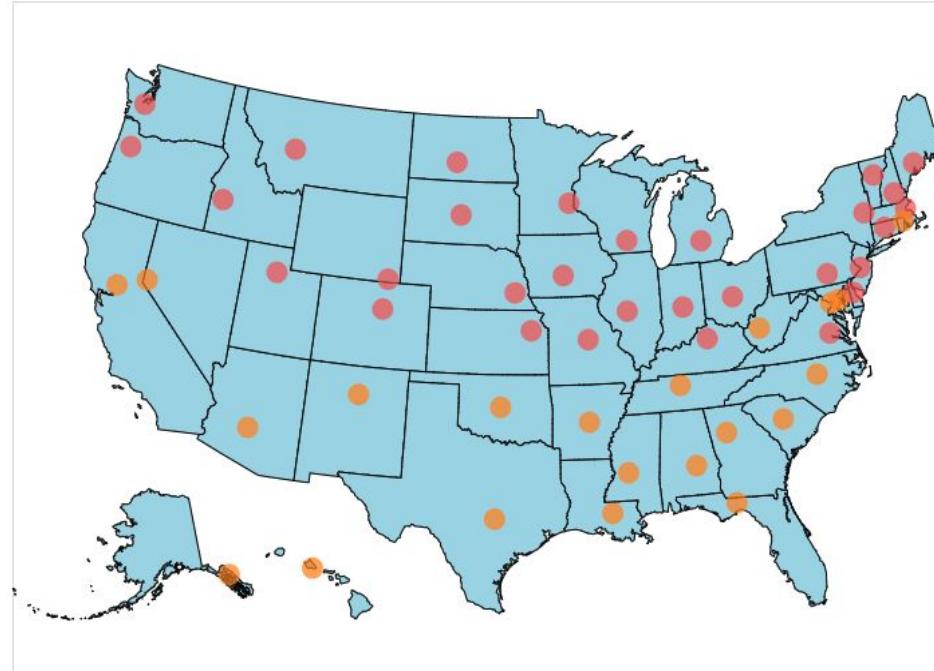
Identify low and high scores for states- Grade 8

US Reading Categories by State for Grade 4



Select_Year_for_Grade_8_year 2003
Select_Year_for_Grade_4_year 2003

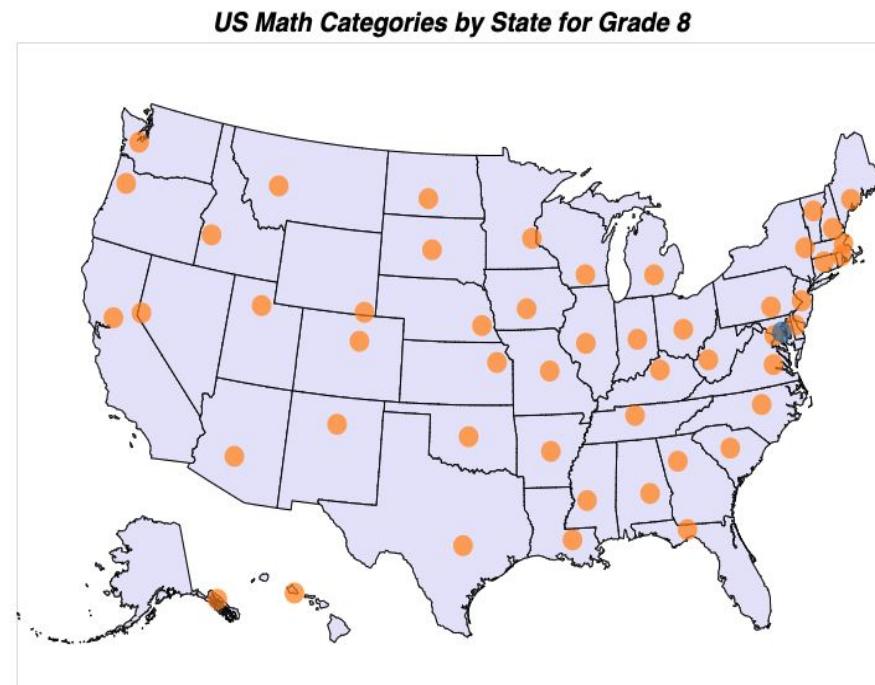
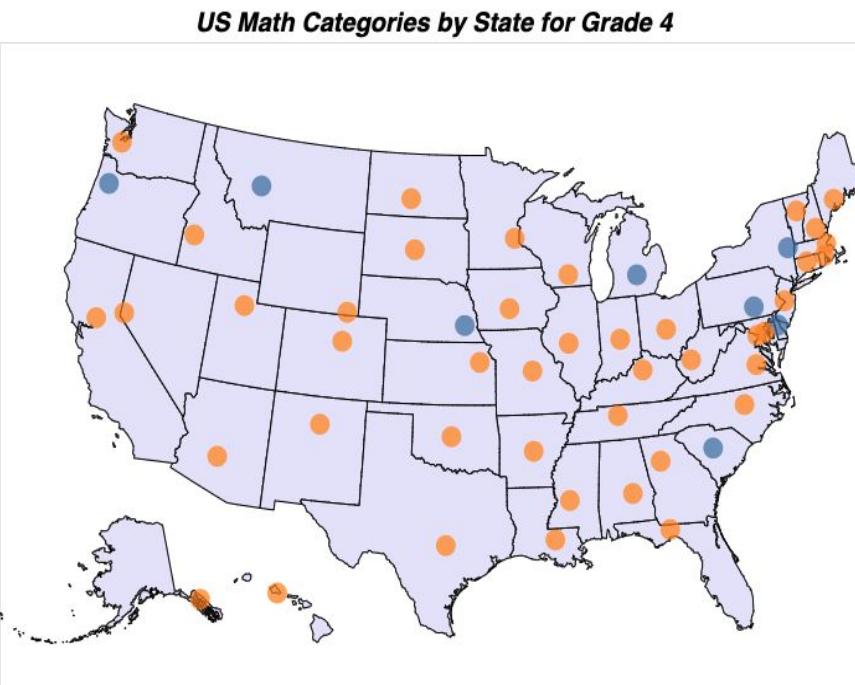
US Reading Categories by State for Grade 8



reading_category_grade4, reading_category_grade8

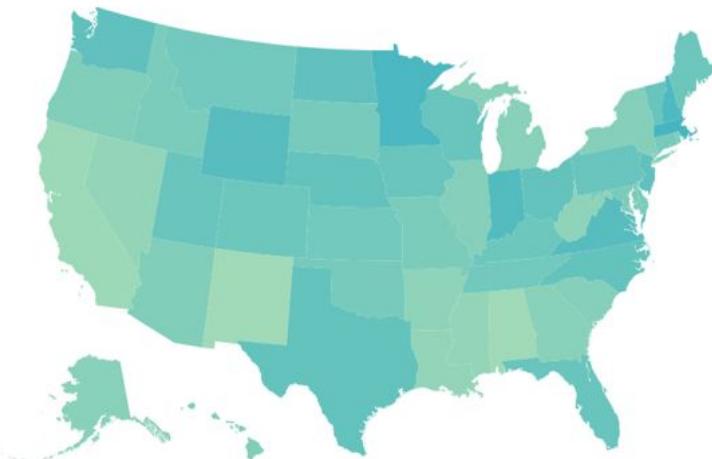
- Average
- Below Average
- Excellent

Identify low and high scores for states- Grade 4

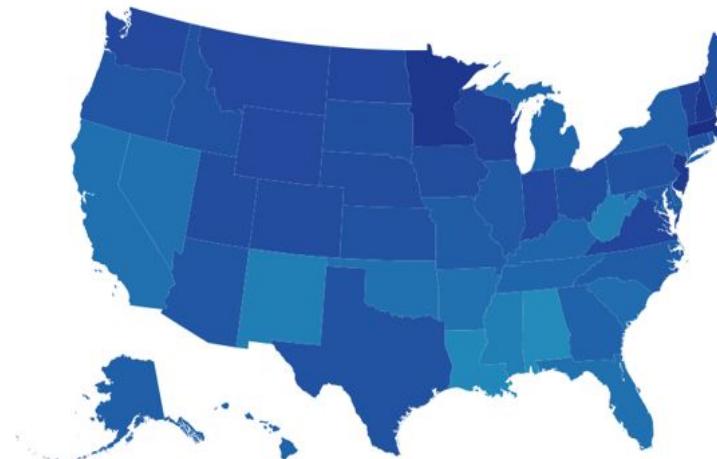


Select_Year_for_Grade_8_math_year 2003
Select_Year_for_Grade_4_math_year 2003

Math Grade 4

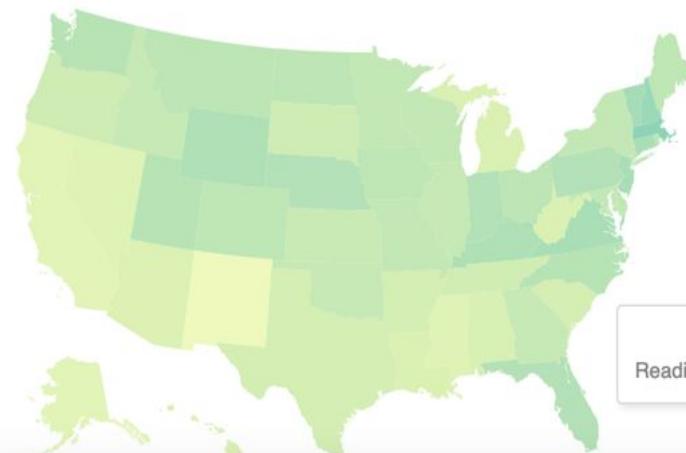


Math Grade 8



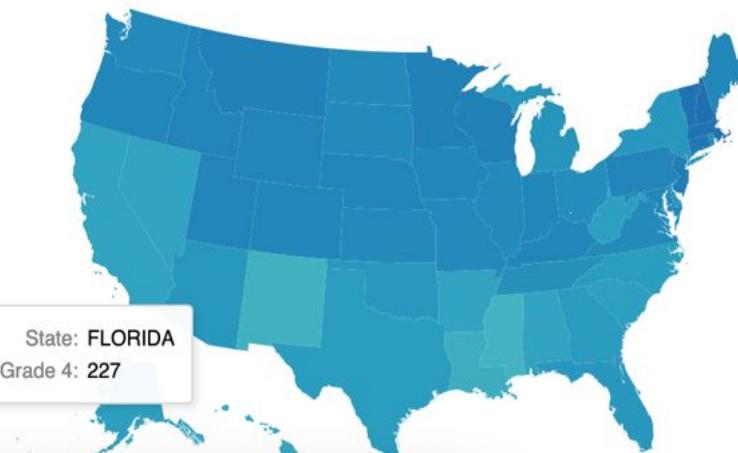
Score Assessment
280
260
240
220

Reading Grade 4



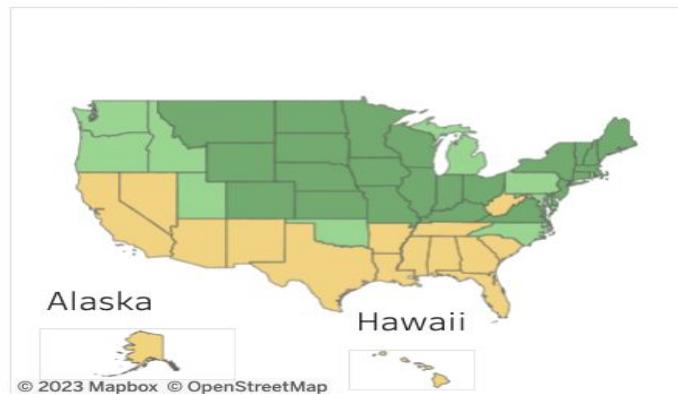
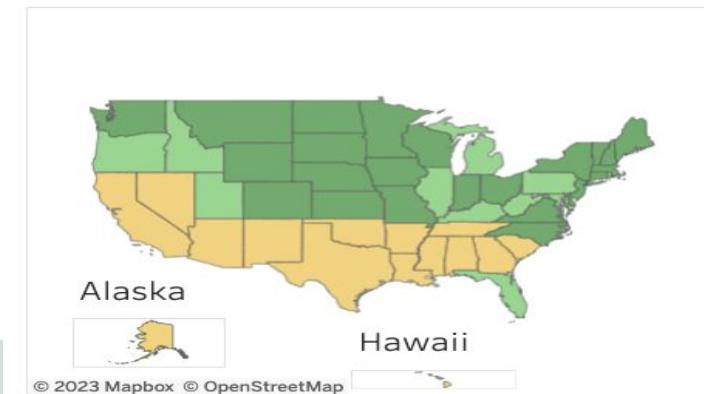
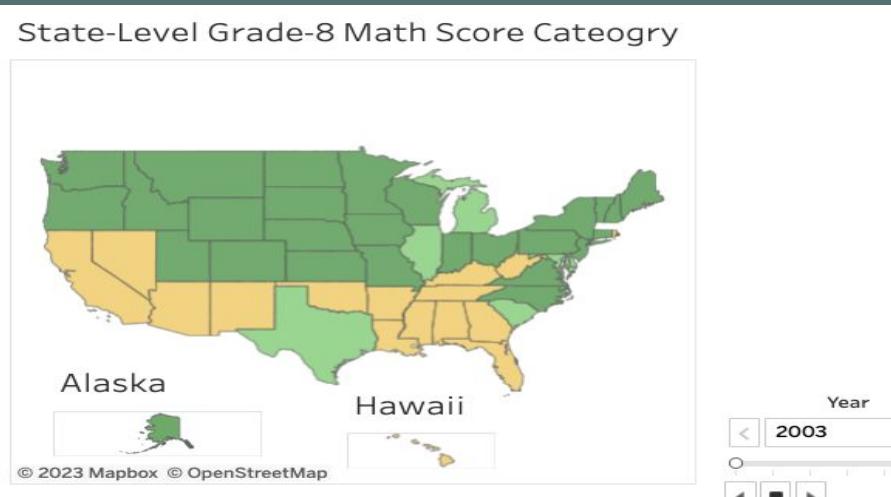
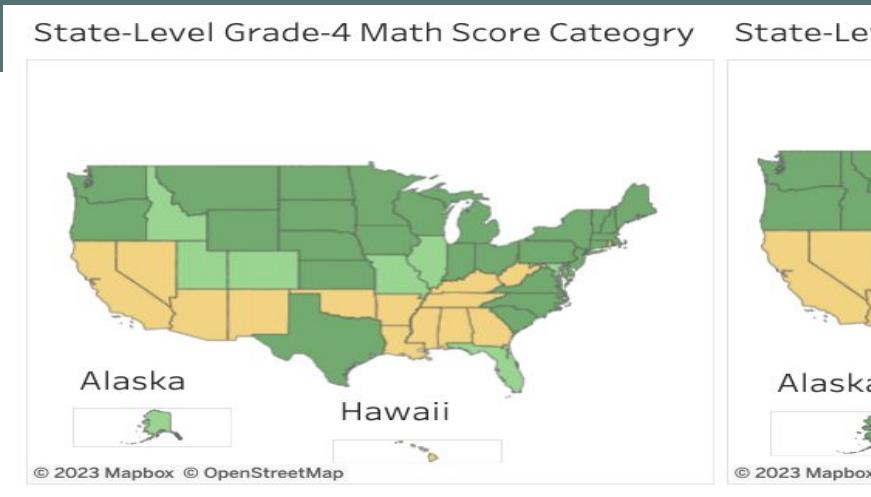
State: FLORIDA
Reading Grade 4: 227

Reading Grade 8



This visual shows maps of US states and average score by individual state. Most students from both 4th and 8th grades seem to perform better on reading score than on math score. 8th graders scores are a little better than those of 4th graders in both subjects of math and reading.

State Academic Performance in Math and Reading: Grade 4 vs Grade 8

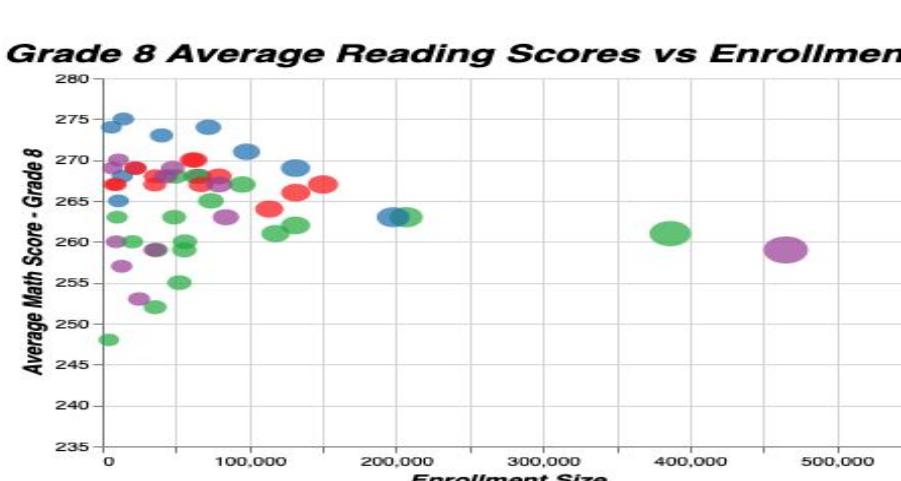
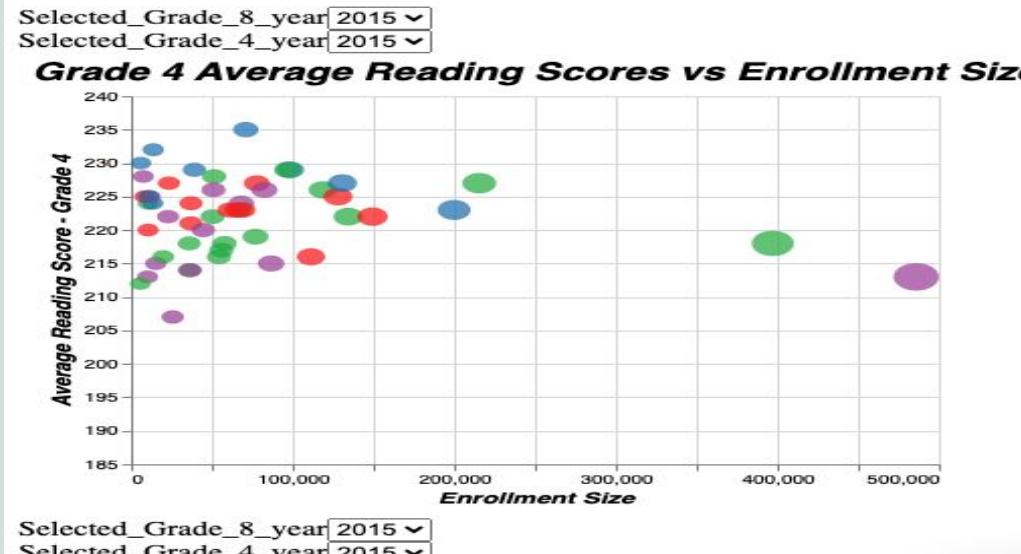
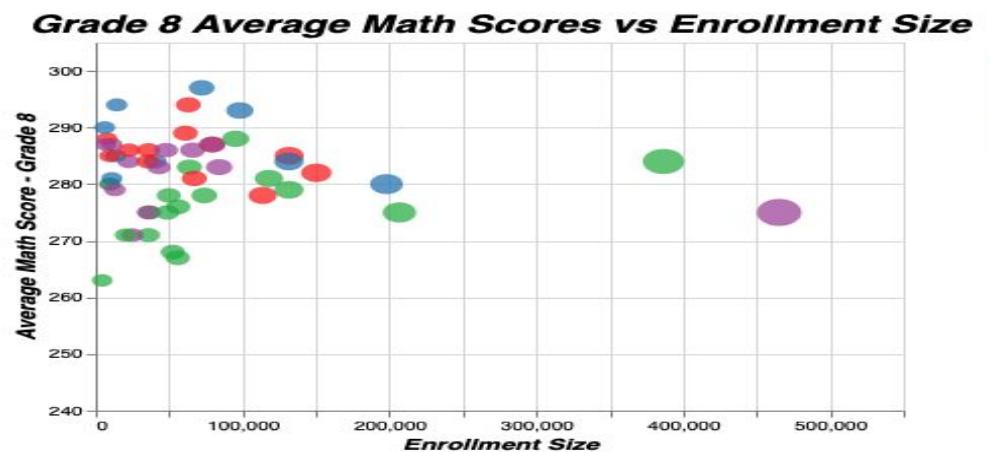
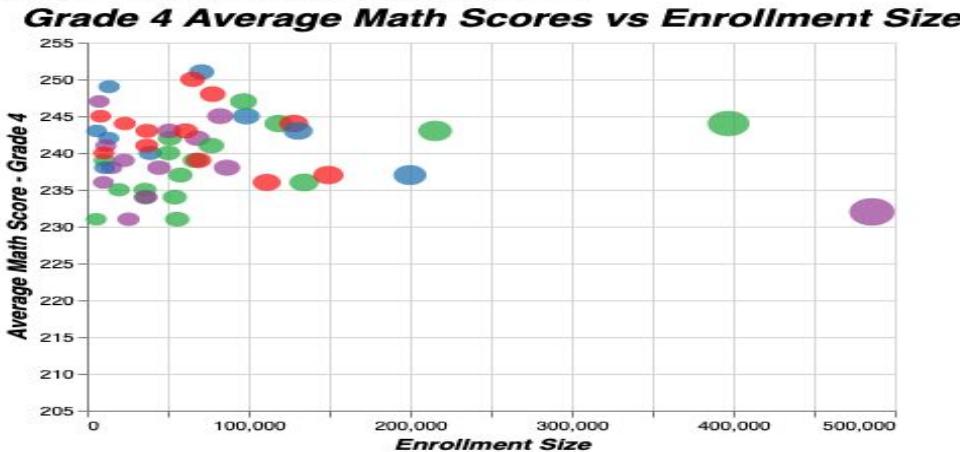


Why useful?

1. Temporal trends
 2. Spatial Context
 3. Historical Change Tracking through animation

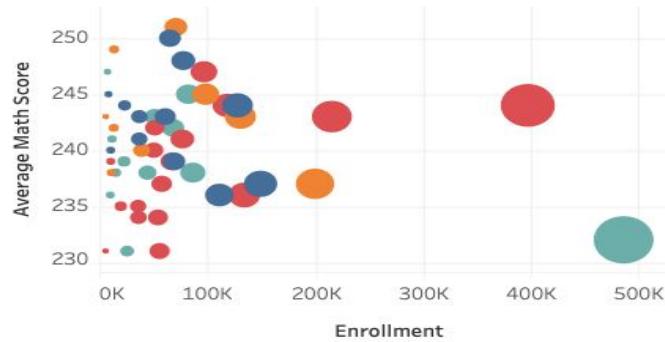
Average Scores Vs Enrollment - Grade 4 and Grade 8

Select_Year_for_Grade_8_math_year 2003
 Select_Year_for_Grade_4_math_year 2003

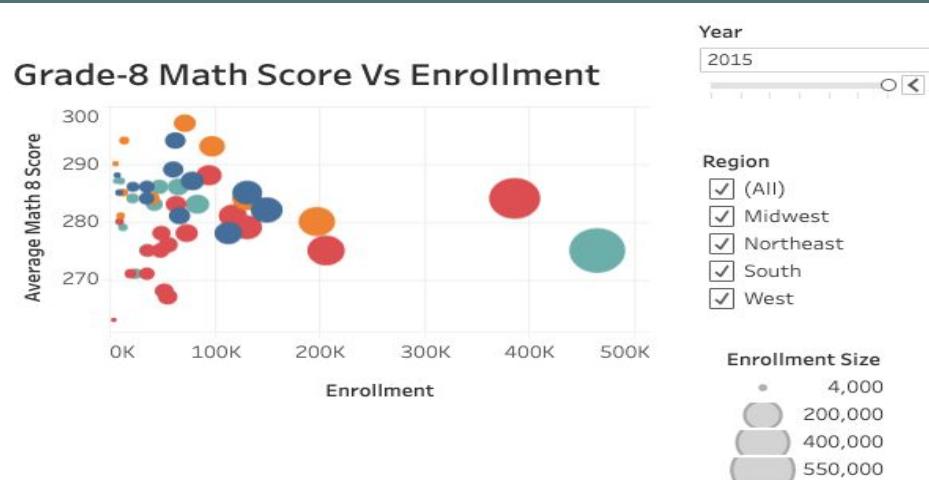


Average Scores Vs Enrollment - Grade 4 and Grade 8

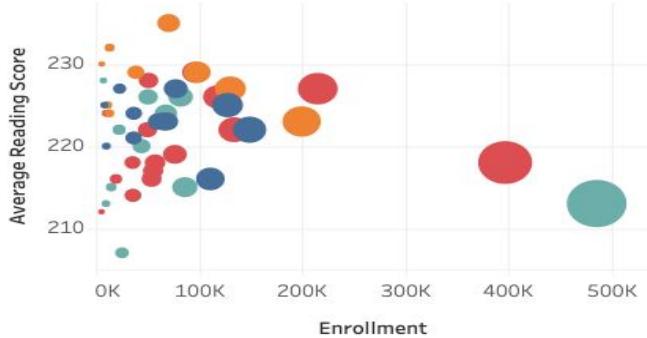
Grade-4 Math Score Vs Enrollment



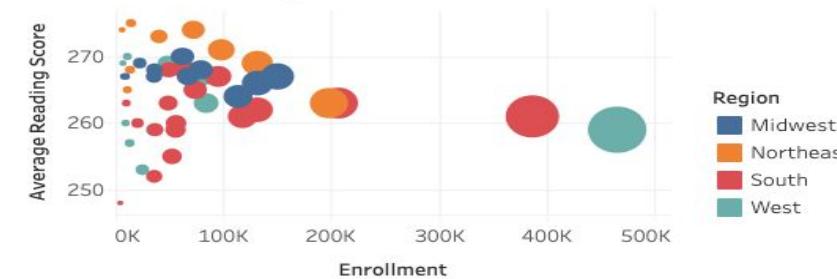
Grade-8 Math Score Vs Enrollment



Grade-4 Reading Score Vs Enrollment



Grade-8 Reading Score Vs Enrollment



Why useful?

1. Direct Correlation Visibility
2. Outlier Identification
3. Regional Comparison through color encoding and checkboxes

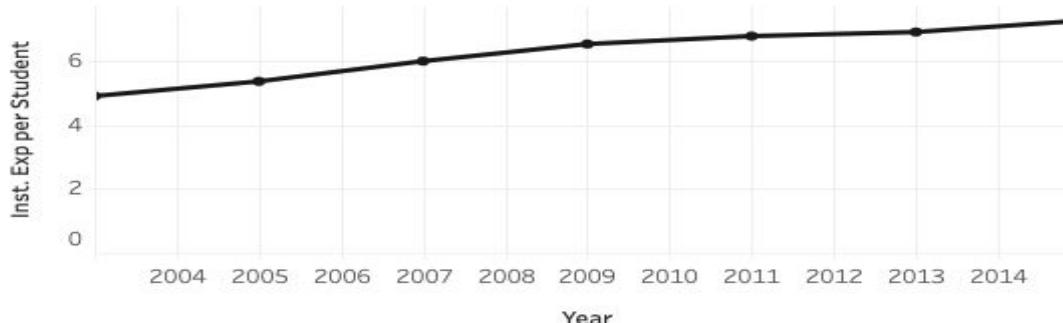
Trends in Instruction Expenditure and Average Scores for all States

Trends in Instruction Expenditure and Average Scores for all States

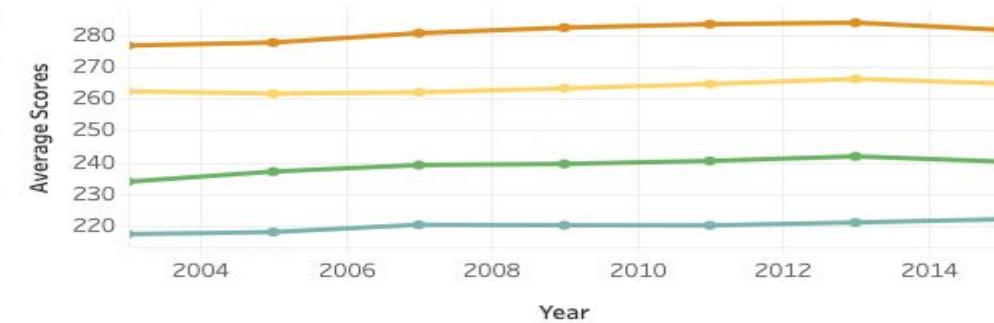
Click on the states in the map to view trend lines for instructional expenditure per student and observe the score trends for Grades 4 and 8. Use the home, zoom, pan in and pan out buttons in the map to adjust the map view.



Trends in Instruction Expenditure per Student



Grade-4 & Grade-8 Score Trends



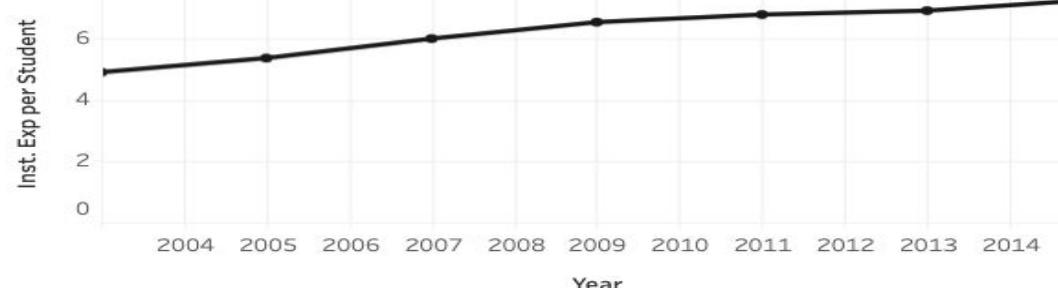
Trends in Instruction Expenditure and Average Scores for all States

Trends in Instruction Expenditure and Average Scores for all States

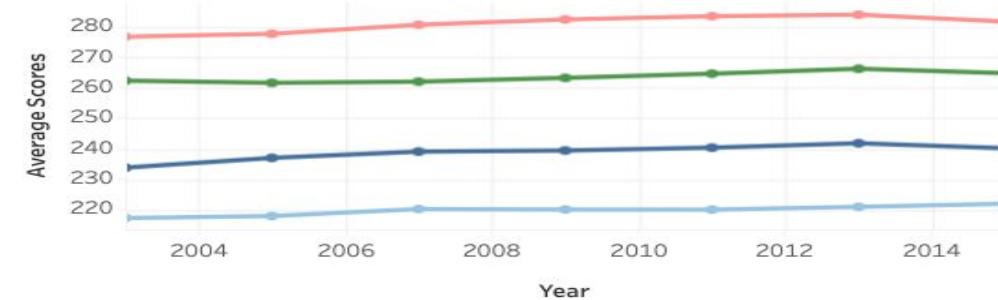
Click on the states in the map to view trend lines for instructional expenditure per student and observe the score trends for Grades 4 and 8. Use the home, zoom, pan in and pan out buttons in the map to adjust the map view.



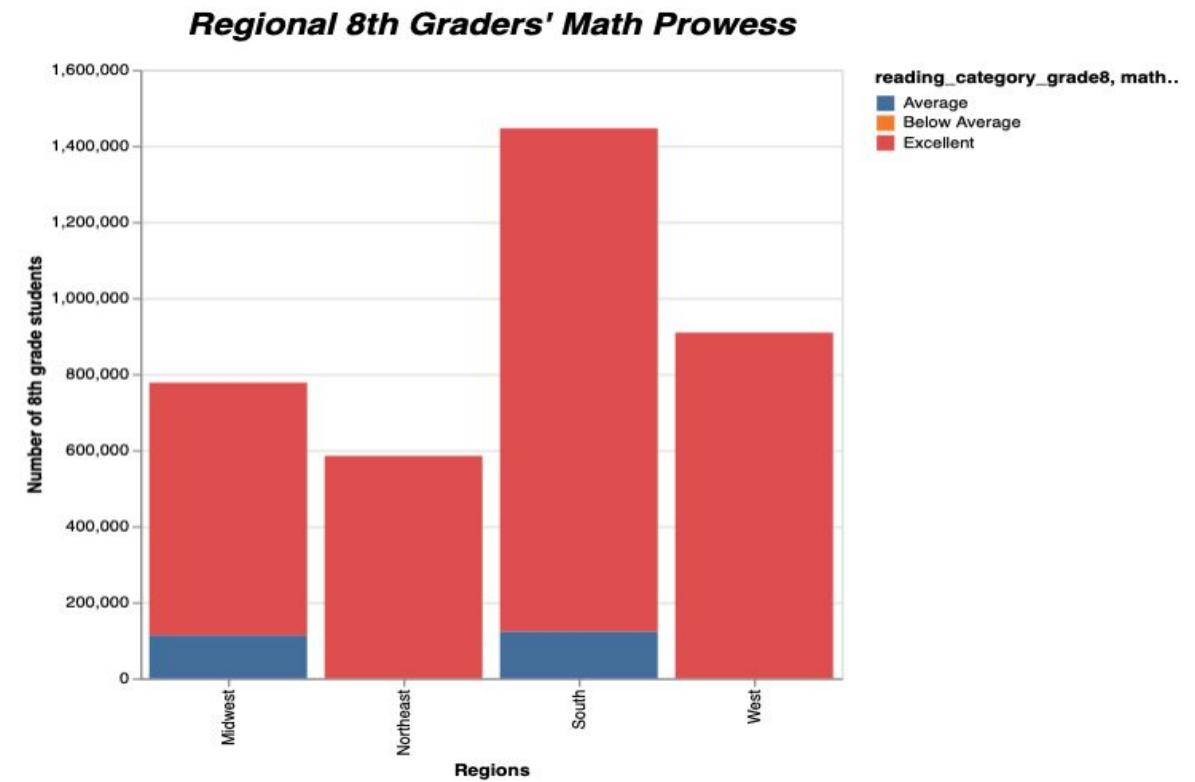
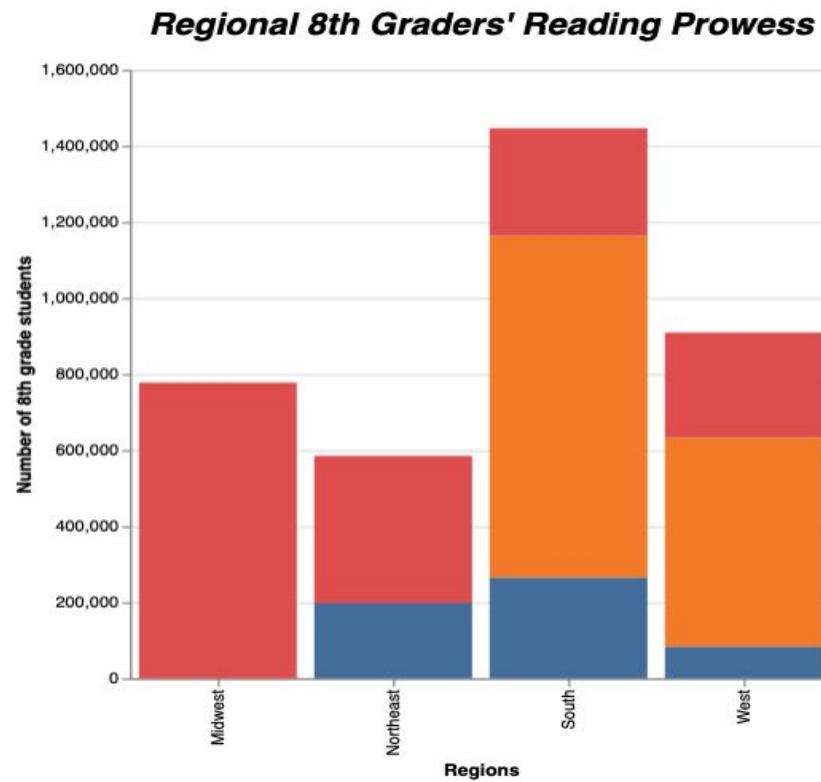
Trends in Instruction Expenditure per Student



Grade-4 & Grade-8 Score Trends



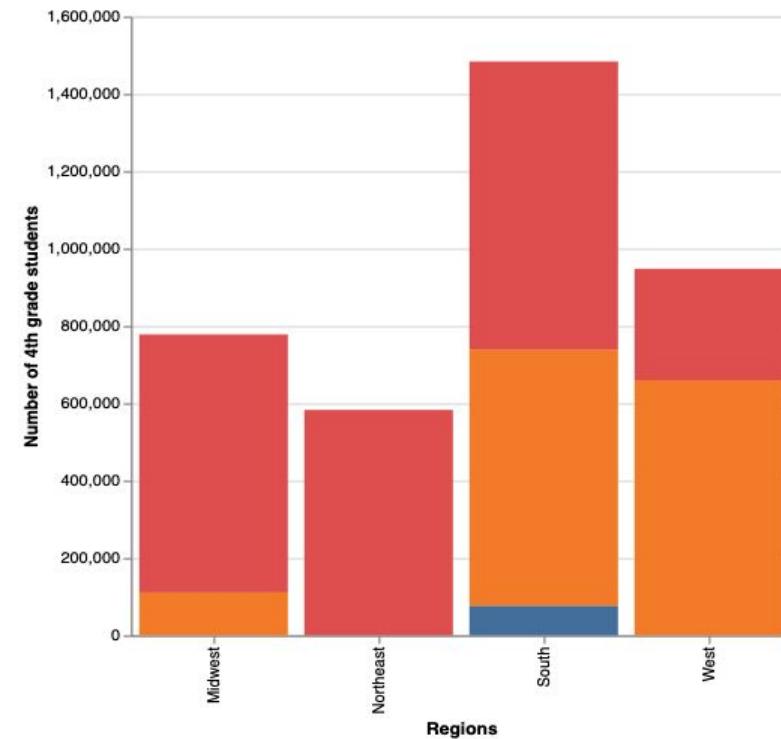
Compare regional trends for US - Grade 8 (Reading & Math)



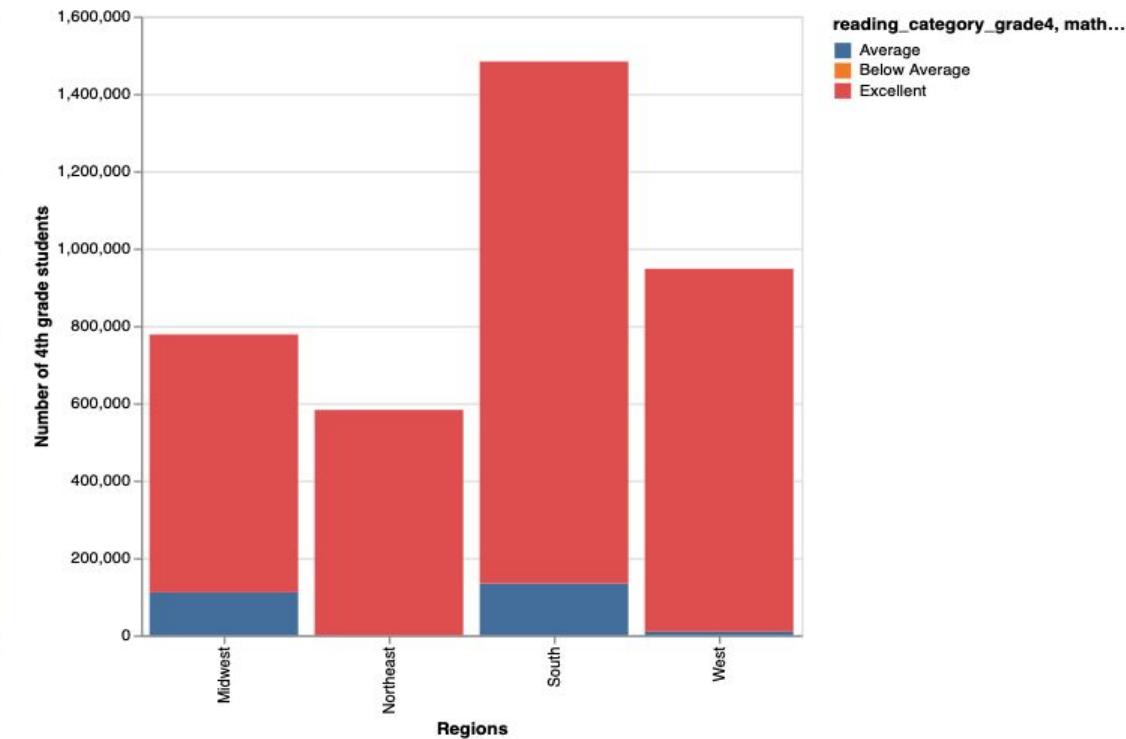
Selected_Grade_8_year

Compare regional trends for US - Grade 4 (Reading & Math)

Regional 4th Graders' Reading Prowess



Regional 4th Graders' Math Prowess



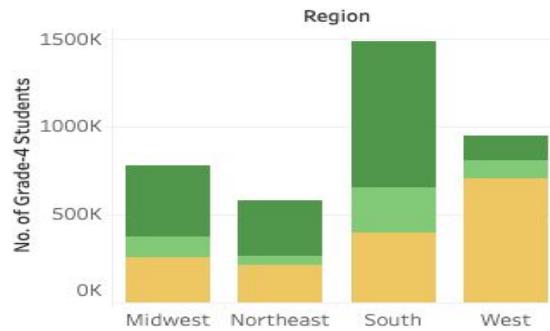
reading_category_grade4, math...

- Average
- Below Average
- Excellent

Selected_Grade_4_year

Regional Academic Performances Categories

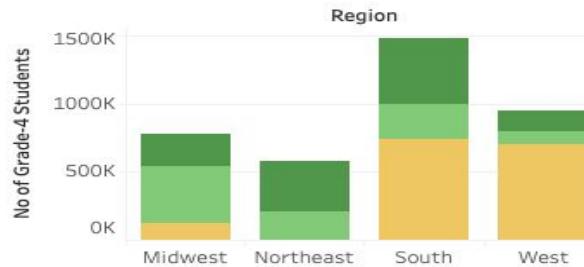
Regional Grade-4 Math Prowess



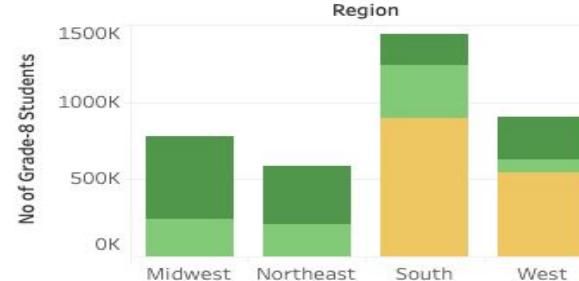
Regional Grade-8 Math Prowess



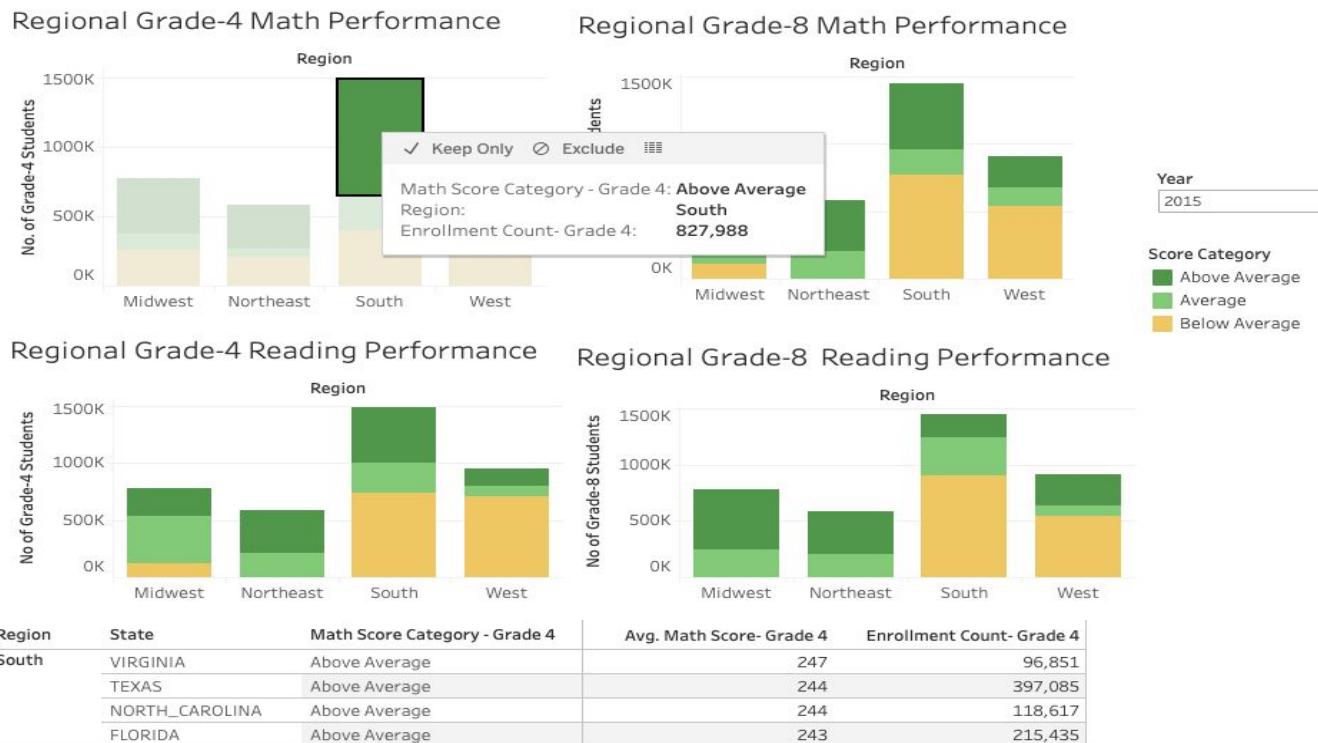
Regional Grade-4 Reading Prowess



Regional Grade-8 Reading Prowess



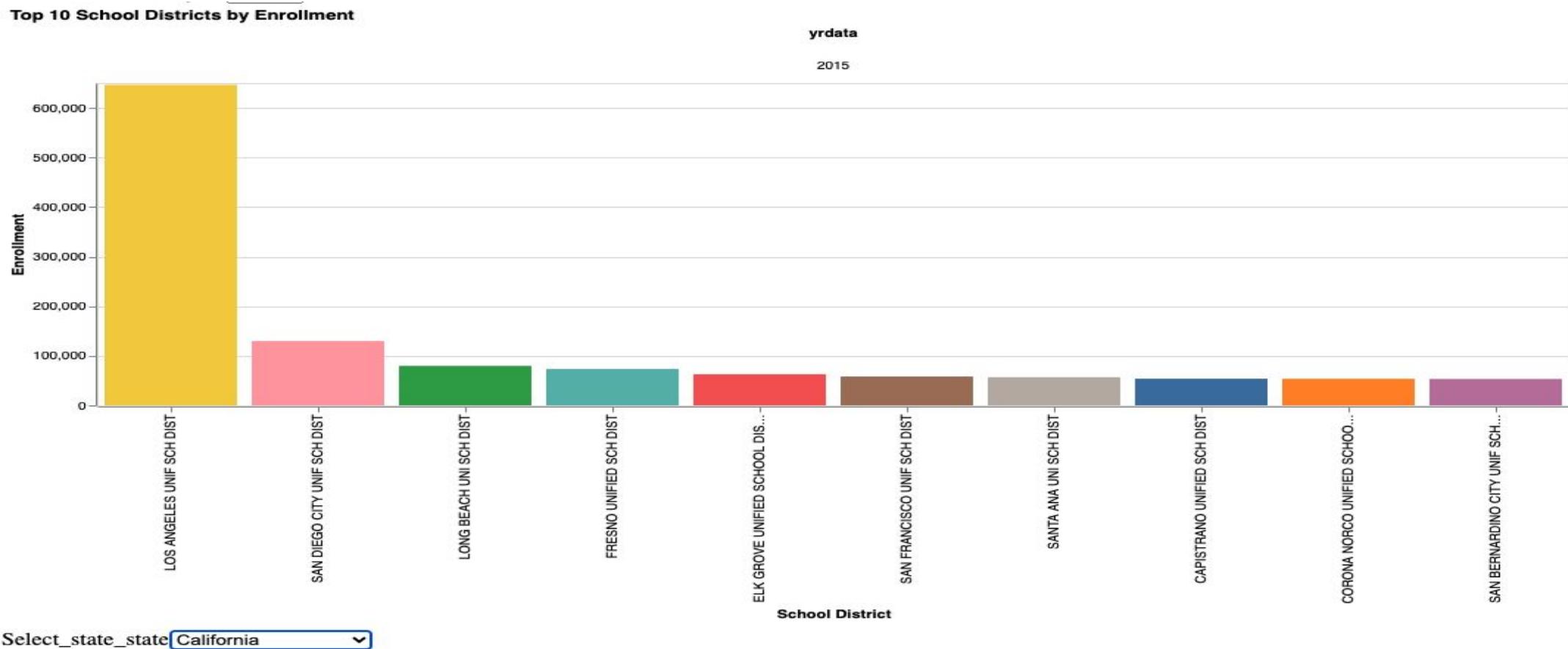
Regional Academic Performances Categories



Why useful?

1. Easy for Comparative Analysis
2. Best for layered information in our data

State-by-State Showcase: The top 10 School Districts in Enrollment

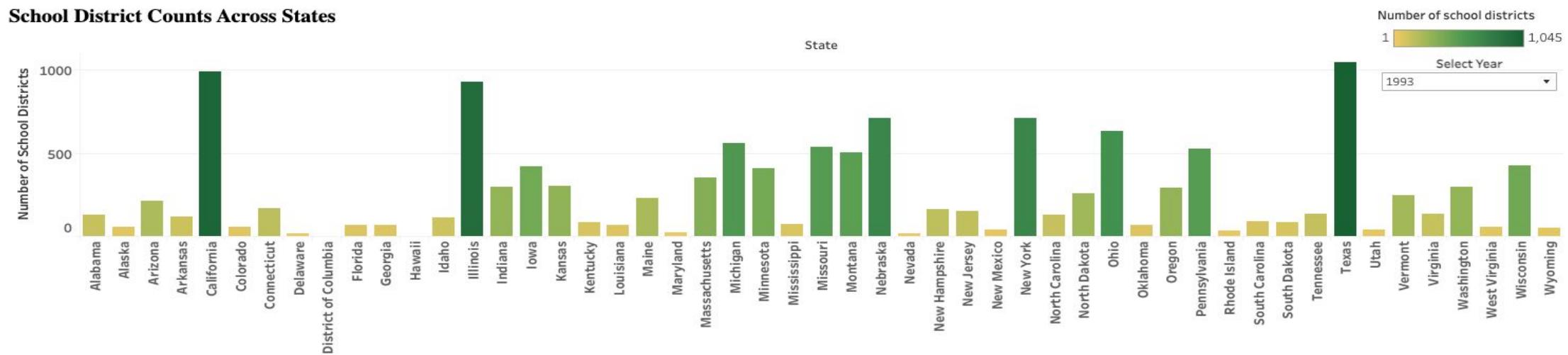


School District Counts Per State

Understanding the Landscape of Education Spending and Enrollment

The chart shows a comparison among states, with bars representing the number of school districts each state has. The varying heights of the bars suggest differences in the number of districts between states. Some states, like Texas and California, have a very high number of districts.

School District Counts Across States



Top Twenty School Districts By Instruction Expenditure

State	Name	Instruction Expenditure	Enroll	Expenditure Per Student	Total Expenditure
Alabama	MOBILE COUNTY SCHOOL DISTRICT	874,574	180,581	15	1,827,998
	JEFFERSON COUNTY BOARD OF EDUCATION	693,218	148,330	19	1,386,674
	MOBILE CO SCH DIST	549,592	196,171	8	1,047,037
	BALDWIN COUNTY SCHOOL DISTRICT	461,676	86,862	16	934,247
	MONTGOMERY COUNTY SCHOOL DISTRICT	458,199	93,644	15	902,109
	BIRMINGHAM CITY SCHOOL DISTRICT	414,661	78,063	16	895,325
	HUNTSVILLE CITY SCHOOL DISTRICT	411,216	70,063	18	939,672
	SHELBY COUNTY SCHOOL DISTRICT	386,757	75,018	16	788,512
	BIRMINGHAM CITY SCH DIST	352,612	118,488	9	670,182
	MONTGOMERY CO SCH DIST	291,472	102,871	9	517,865
	MADISON COUNTY SCHOOL DISTRICT	286,552	58,362	15	550,533
	HOOVER CITY SCHOOL DISTRICT	268,415	40,153	20	499,421
	HUNTSVILLE CITY SCH DIST	251,274	71,654	11	461,166

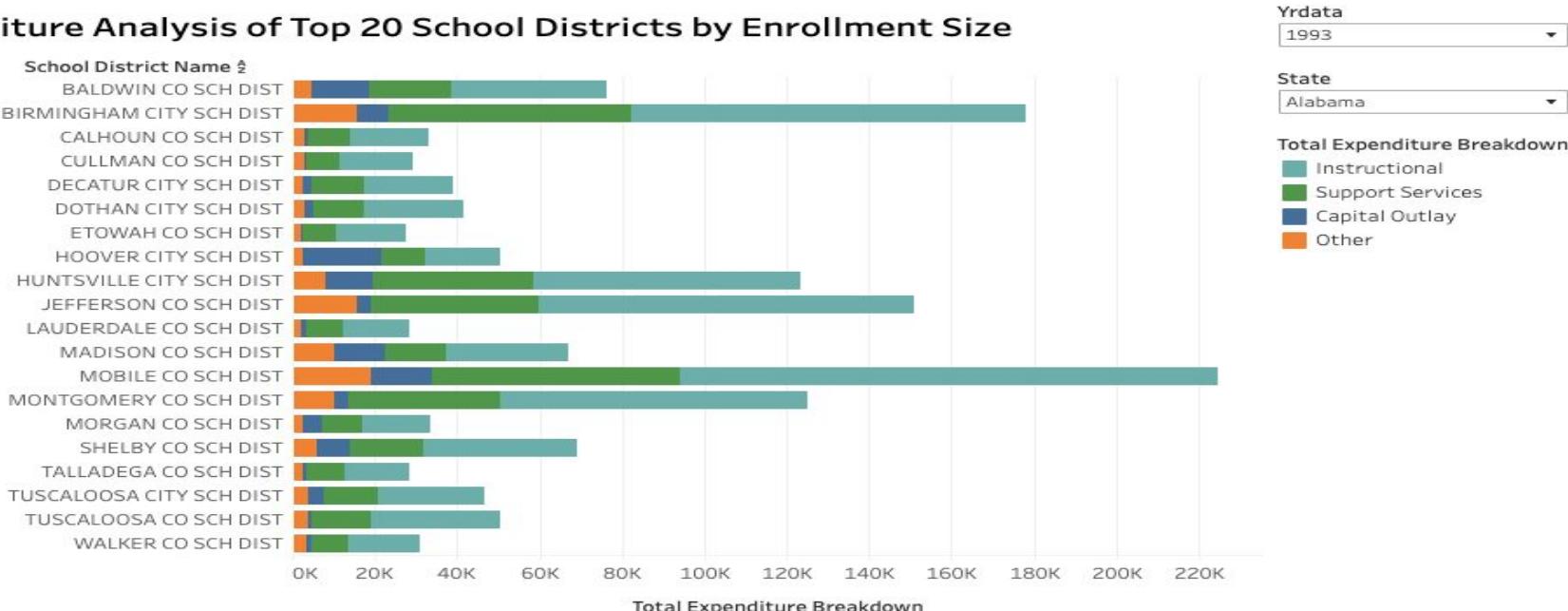
Top Twenty Large School Districts Expenditure Analysis

Expenditure Breakdown of the Top-Twenty School Districts by Enrollment Size

The stacked bar charts showcase the distribution of spending across different categories within various school districts. The expenditure categories are as follows:

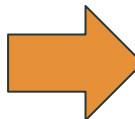
- **Instructional:** Funds dedicated to the teaching process, including teacher salaries and classroom resources.
- **Support Services:** Expenditures for essential non-instructional services that support the educational environment, such as administration, transportation, and maintenance.
- **Capital Outlay:** Investments in long-term assets like building construction, facility upgrades, and equipment acquisition.
- **Other:** Miscellaneous or indirect costs that are not classified under the other categories.

Expenditure Analysis of Top 20 School Districts by Enrollment Size



Website Changes Post Usability Study

The screenshot shows the original SCORESCAPE website layout. At the top, there's a navigation bar with links like Home, Fiscal Trends, Score Analytics, District Financial Analytics, Contact, and Get Started. Below the navigation is a section titled "Why Transparency Matters?" with two bullet points: "For insightful analysis" and "For informed decision making". Another section, "Our Audience", includes two bullet points: "Primary users: Teachers and educators are at the forefront of this platform. They can use the insights gained to advocate for necessary resources and tailor their teaching strategies in line with budgetary constraints and opportunities." and "Secondary Users: Parents and policymakers also play a crucial role. With access to budgetary and outcomes data, they are better equipped to understand the challenges and successes within the education system and contribute to meaningful discussions on policy and resource allocation." Below these sections is a large image of several people working together around a table with laptops. At the bottom, there's a summary of education statistics for 2015: Total Students (2015) 48.5M, Average Instruction Expenditure per Student \$7, Avg. Grade 4 Math Score (2015) 240, Avg. Grade 4 Reading Score (2015) 222, Avg. Grade 8 Math Score (2015) 282, and Avg. Grade 8 Reading Score (2015) 265.



The screenshot shows the updated SCORESCAPE website. The layout is more minimalist. At the top, there's a navigation bar with Home, Fiscal Trends, Score Analytics, School District Analytics, and Contact. Below the navigation is a large image of a diverse group of people (teachers, students, parents) sitting around a table, smiling and working together. To the left of the image is a brief purpose statement: "Education is the bedrock of personal and societal growth. We delve into the intricate world of education budgets, enrollments and how they correlate with student outcomes. Using U.S. Census Bureau data and National Assessment of Educational Progress (NAEP) data from 1994-2015 we analyze trends, patterns, and outcomes to encourage access to and transparency around educational data." Below the image is a section titled "Purpose and Users" with a similar image of people working together. At the bottom, there's a summary of education statistics for 2015: Total Students 48.5M, Average Instruction Expenditure per Student \$7, Avg. Grade 4 Math Score 240, Avg. Grade 4 Reading Score 222, Avg. Grade 8 Math Score 282, and Avg. Grade 8 Reading Score 265.

More Text To Less Text

apps-fall.ishool.berkeley.edu/~hamsini.sankaran/w209/

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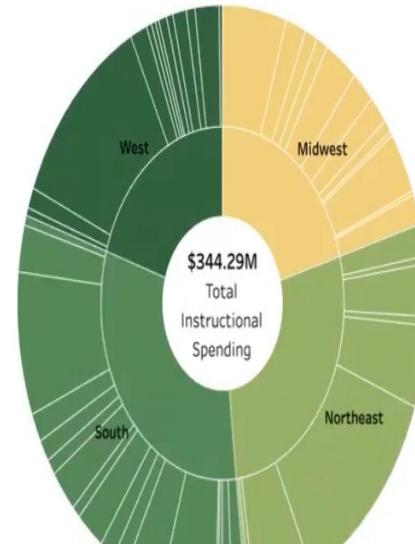
Data Sources

- ① School Finance Data: Sourced from the U.S. Census Bureau, detailing expenditures and revenues.
- ② Academic Metrics: Performance metrics in key subjects provided by the National Center for Education Statistics (NCES).
- ③ Regional and Geographic Data: Available via Kaggle, including specific states and precise locations.
- ④ NAEP Test Scores: National Assessment of Educational Progress (NAEP) test score data for every alternate year from 2003 to 2015.

Data Links

- ① Primary Dataset: US Education Datasets Unification Project
- ② Secondary Dataset: US Educational Finances
- ③ Latitude and Longitude Data: Latitude and Longitude for Every Country and State
- ④ USA States to Region Mapping: USA States to Region
- ⑤ Primary Dataset: US Education Datasets Unification Project
- ⑥ Secondary Dataset: US Educational Finances
- ⑦ Latitude and Longitude Data:
- ⑧ USA States to Region Mapping: USA States to Region

Instructional Spending by Regions and States (2015)



Data Sources

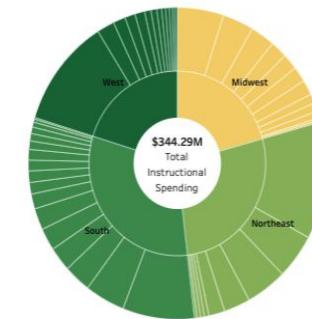
We use the U.S. Census Bureau data and the National Assessment of Educational Progress (NAEP) data from two separate datasets. The NAEP data provides a representative measure of student achievement and is administered to U.S. elementary and secondary students.

- Primary Dataset: US Education Datasets Unification Project
- Secondary Dataset: US Educational Finances
- Additional Datasets: Latitude and Longitude for Every Country and State, USA States to Region

Total Instruction Expenditure Distribution

The visual below displays a sunburst chart detailing instructional spending across four U.S. regions, the West, Midwest, Northeast, and South, and states on the outer ring. Hovering over a slice will display instructional spending figures for specific regions or states.

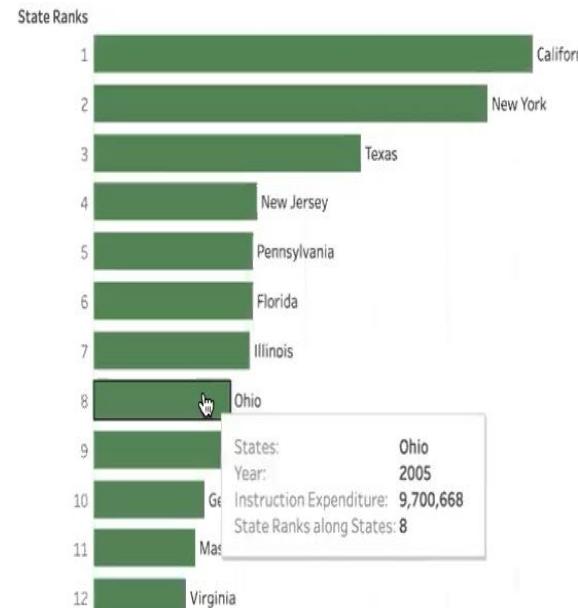
Instructional Spending by Regions and States (2015)



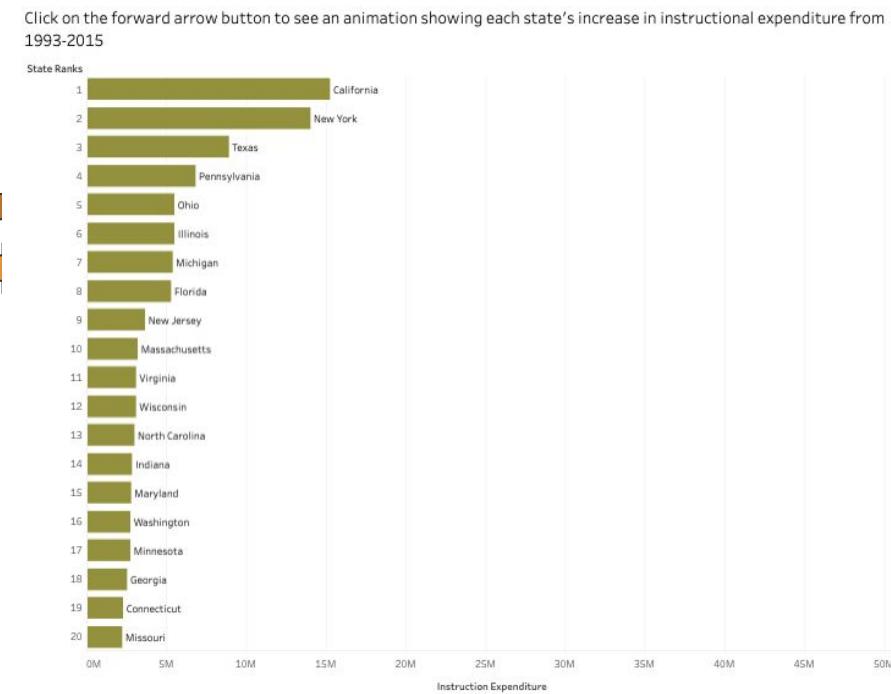
Visual color Changes

their large educational budgets.

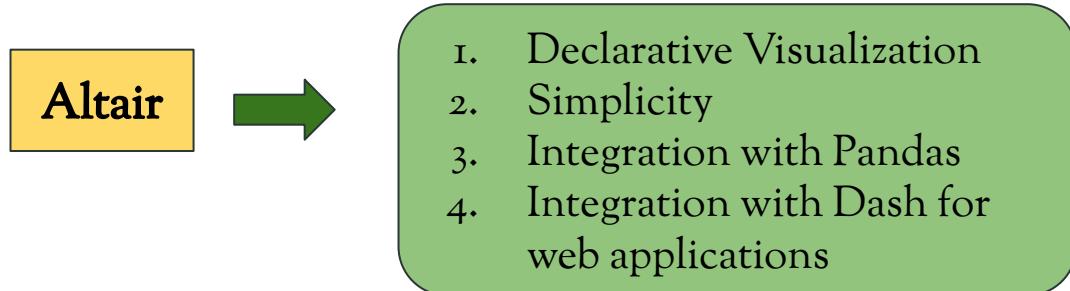
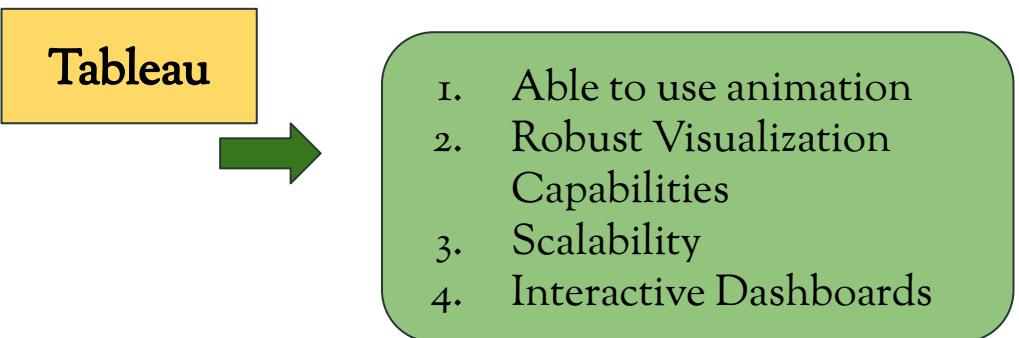
Top 20 States: A Snapshot of State Instruction Expenditure Over Time



Top 20 States: A Snapshot of State Instruction Expenditure Over Time



Visualization and Web Framework



Web Development



DEMO



[Scorescape](#)

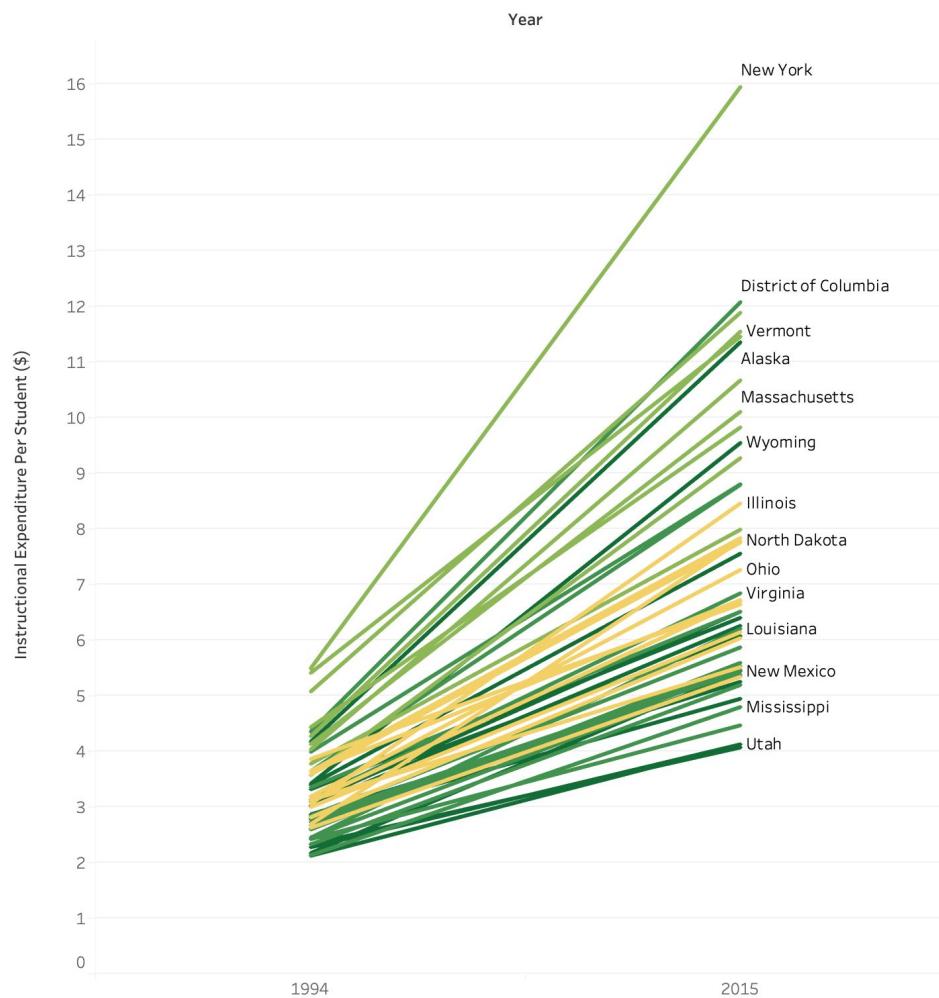


THANK
YOU

lilycsm@berkeley.edu

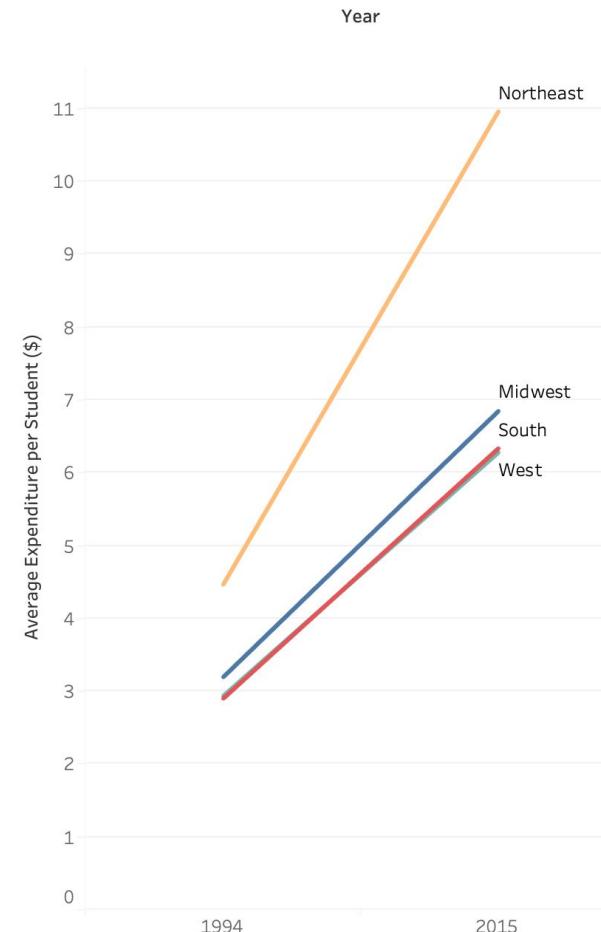
Compare instructional expenditure per student for states and regions

Slope Graph of Instruction Spending



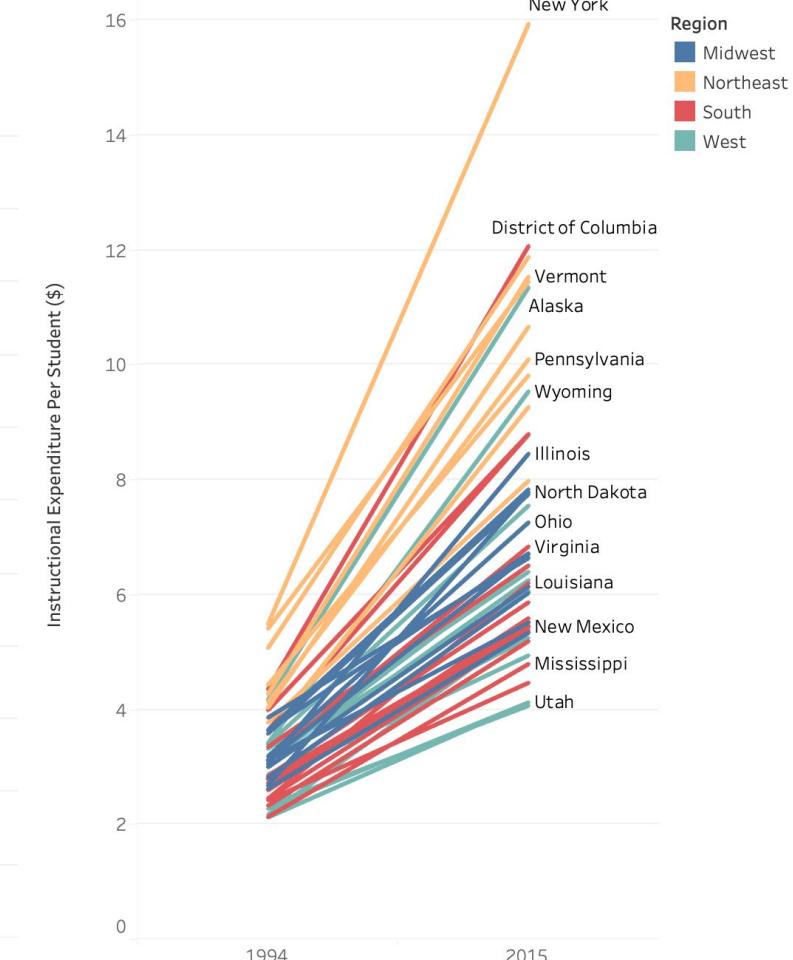
Regional Increases in Instructional Expenditure per Student

Select a region to see the states highlighted in the graph to the right



State Increases in Instructional Expenditure Per Student

Year

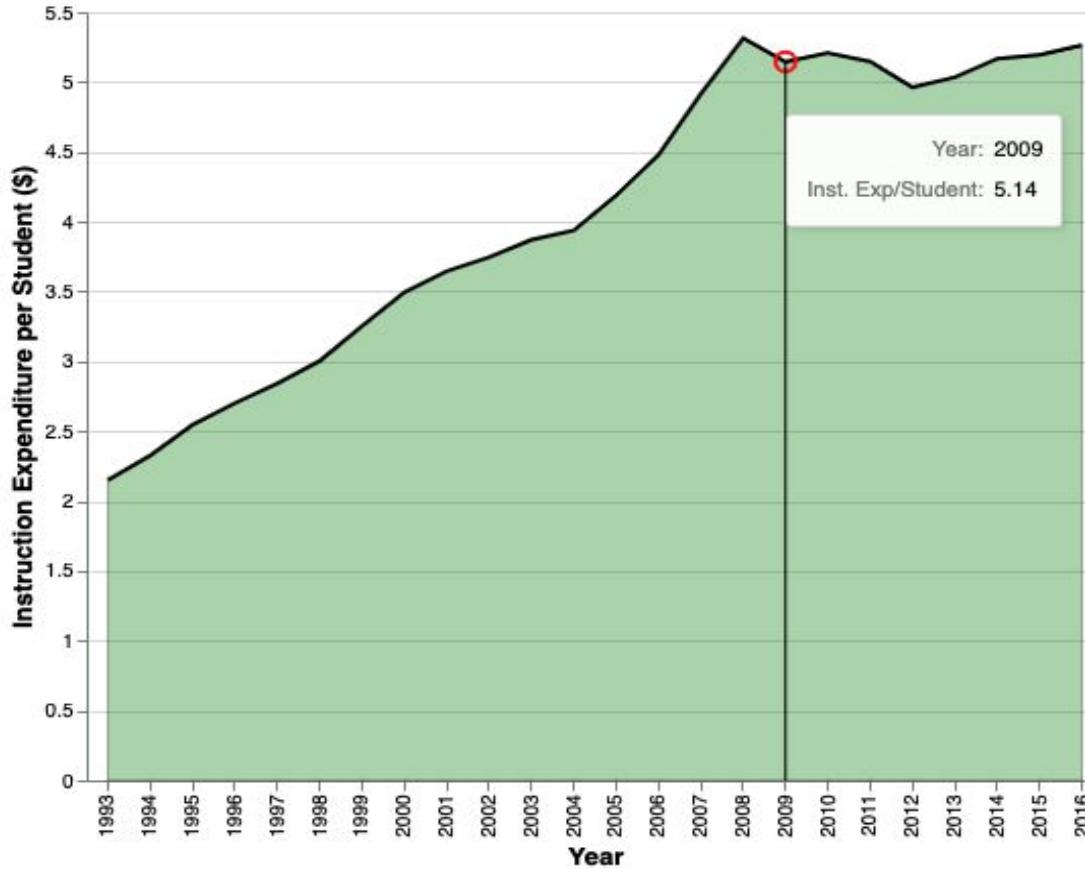


- Region
- (All)
 - Midwest
 - Northeast
 - South
 - West

- Region
- Midwest
 - Northeast
 - South
 - West

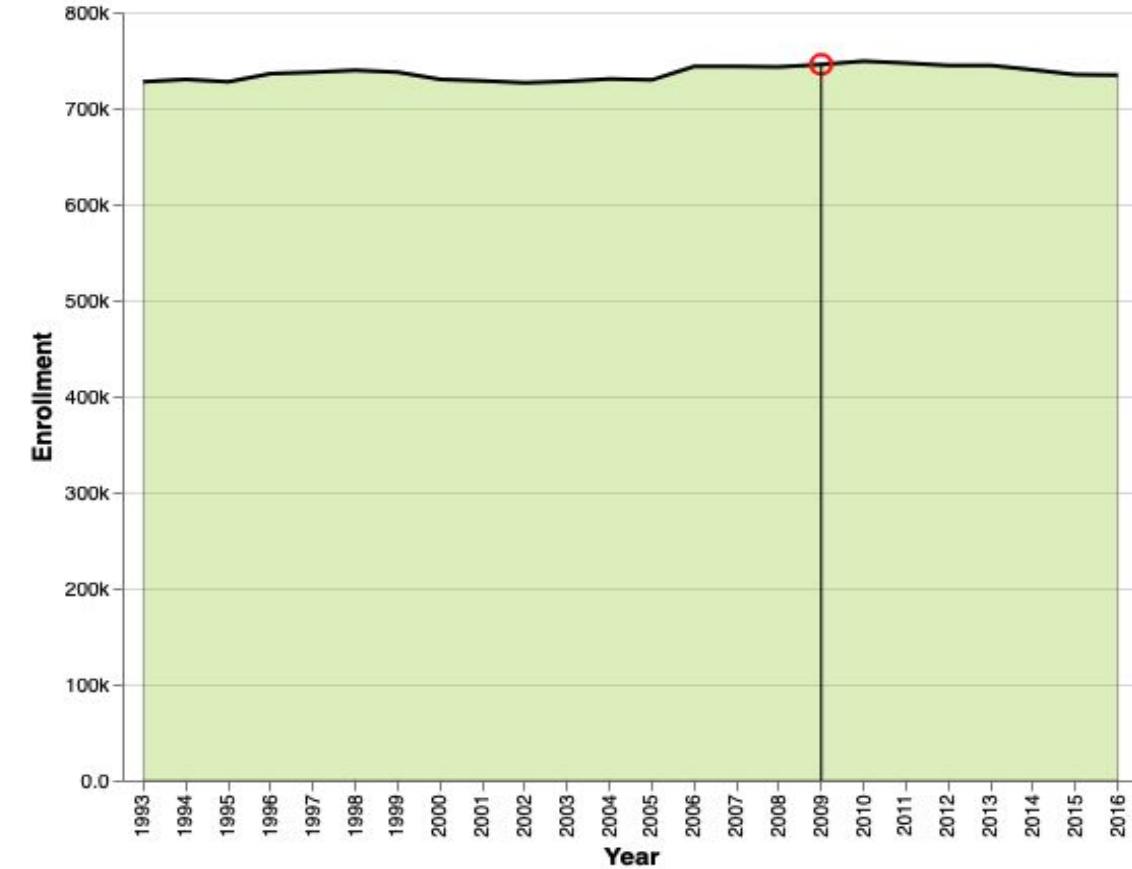
Instruction Expenditure and Enrollment Trends

Instructional Expenditure Per Student Over Years

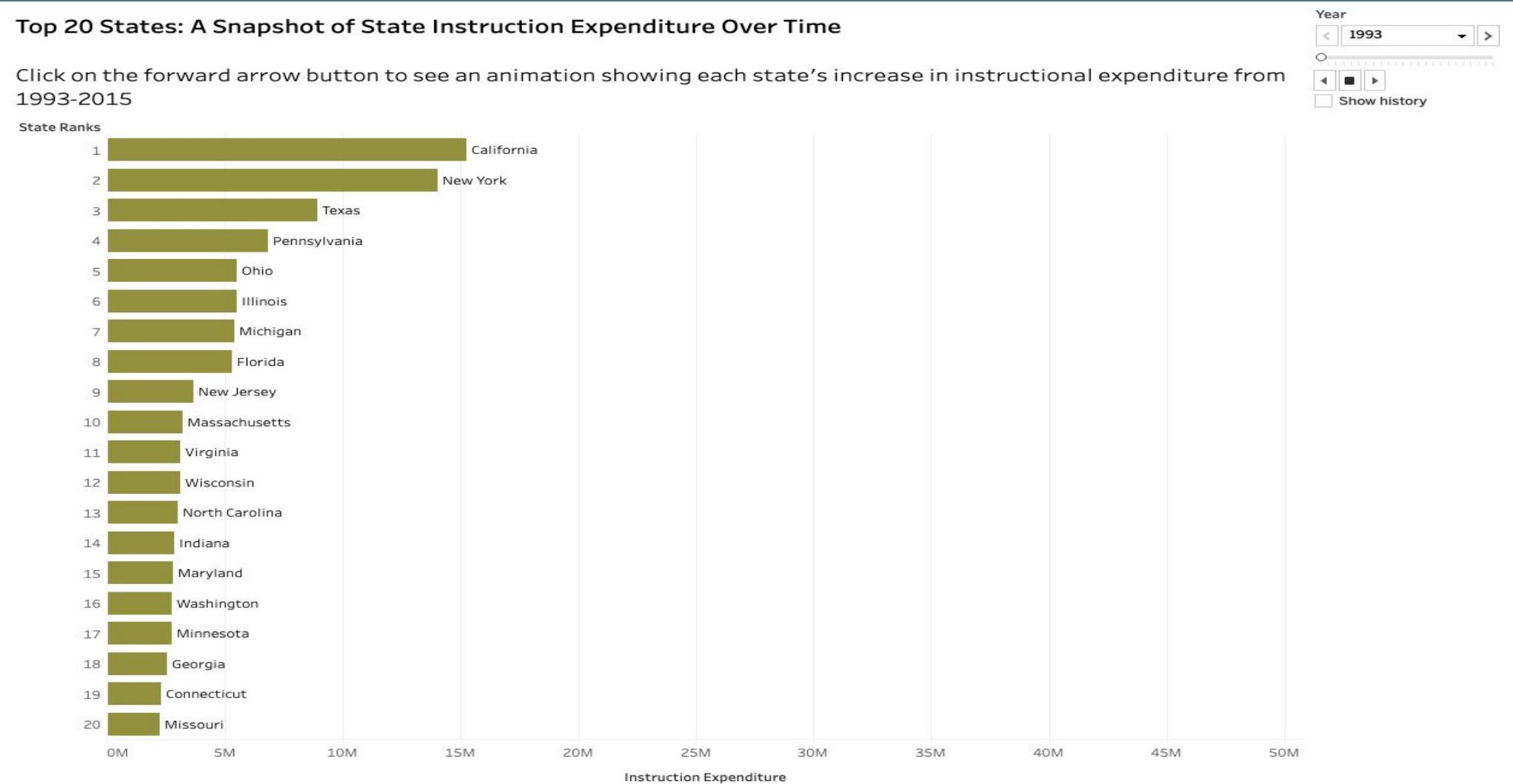


Select state

Enrollment Over Years

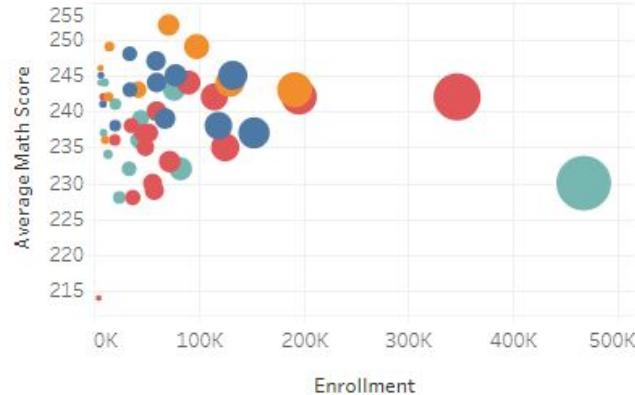


Top Twenty States based on Total Instruction Expenditure

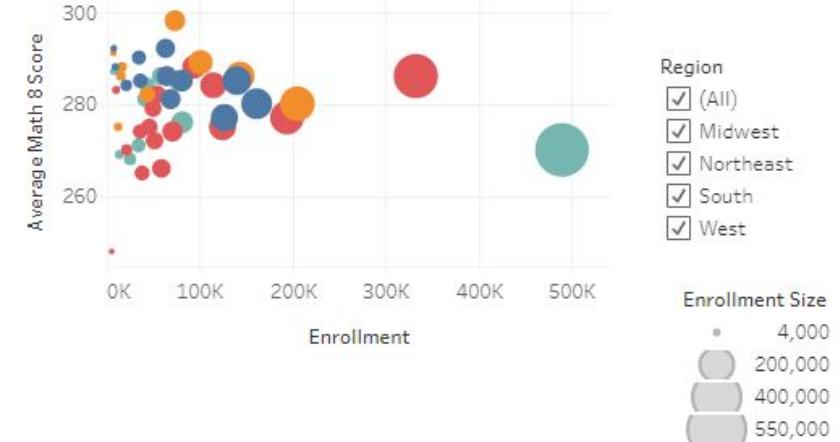


Unraveling Math and Reading Scores Across Enrollment - Grade 4 and Grade 8

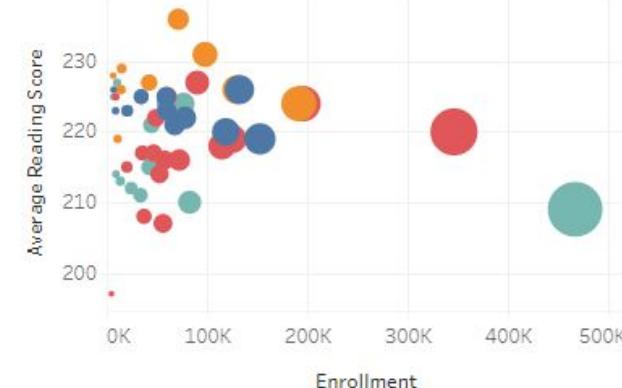
Grade-4 Math Score Vs Enrollment



Grade-8 Math Score Vs Enrollment



Grade-4 Reading Score Vs Enrollment



Grade-8 Reading Score Vs Enrollment



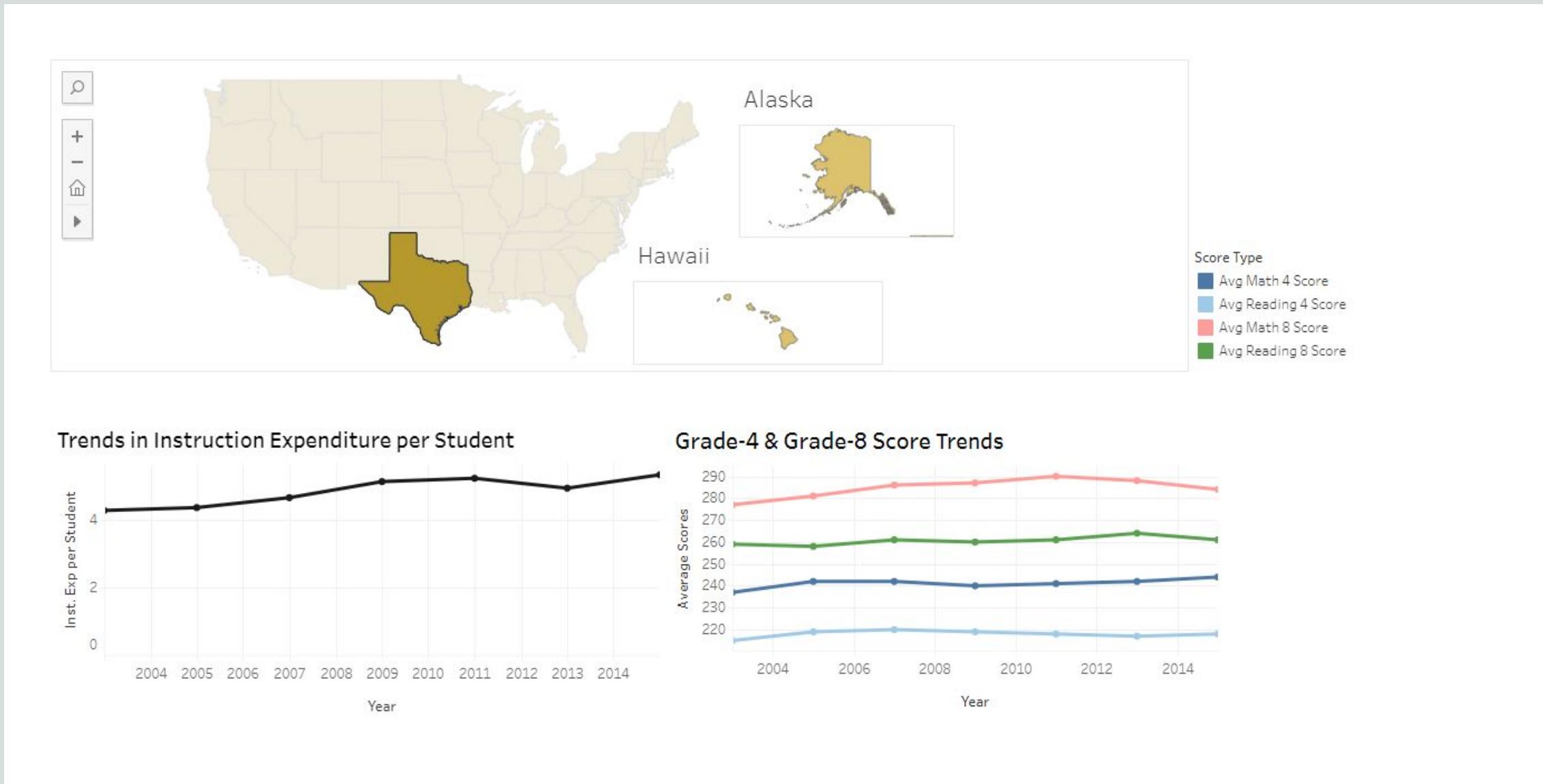
Year
2007
○ □ ▶ ▶

Region
 (All)
 Midwest
 Northeast
 South
 West

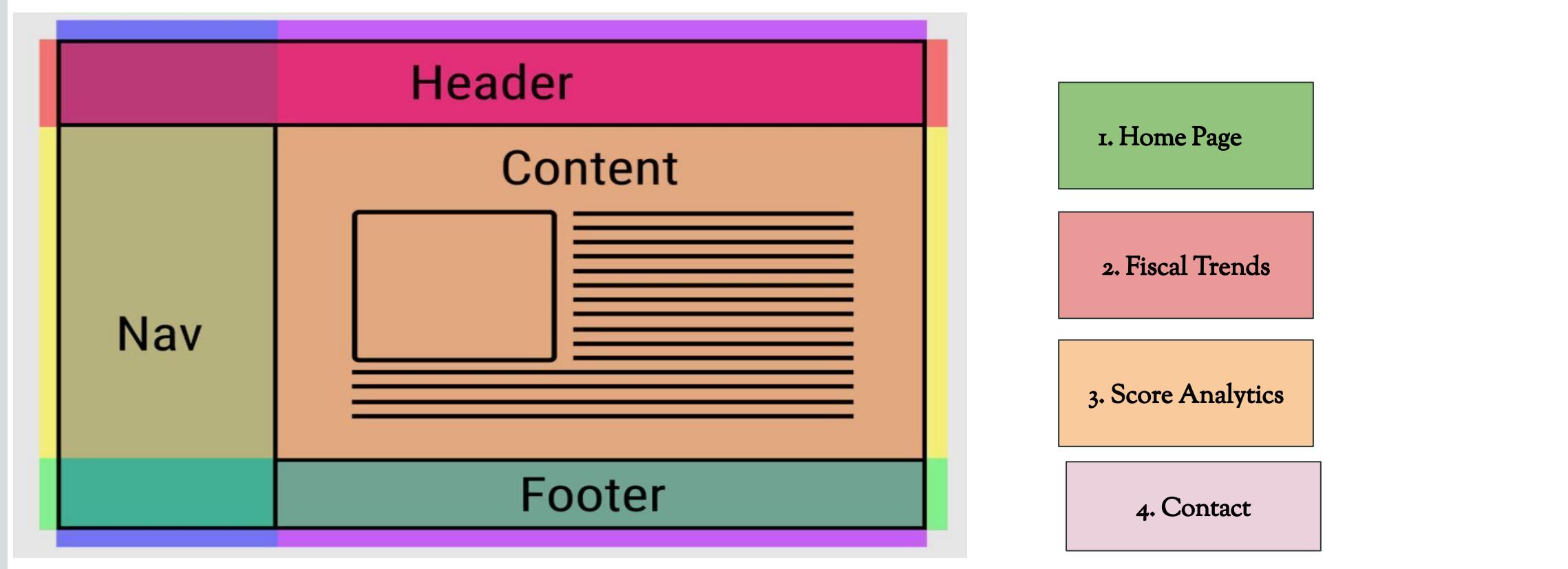
Enrollment Size
• 4,000
○ 200,000
□ 400,000
■ 550,000

Region
Midwest
Northeast
South
West

Unraveling Math and Reading Scores Across Instruction Expenditure per Student - Grade 4 and Grade 8

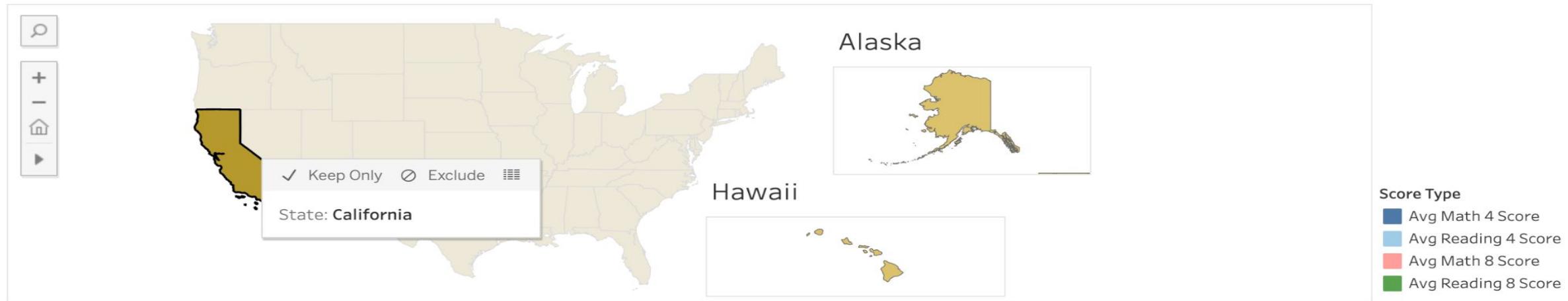


Website Layout

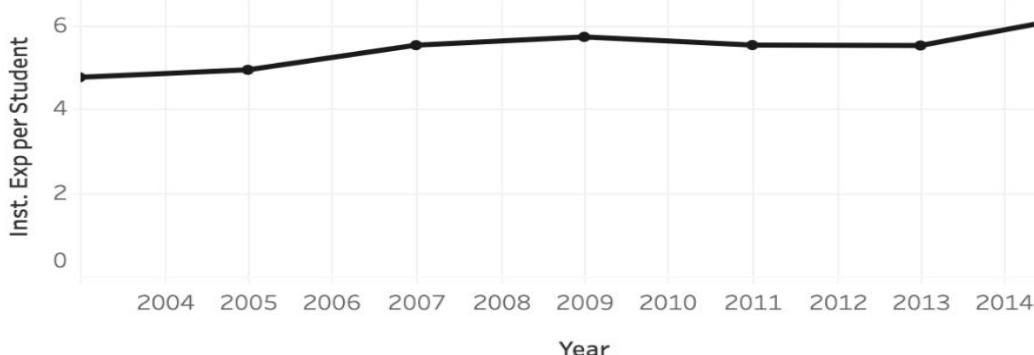


Trends in Instruction Expenditure and Average Scores for all States

Click on the states in the map to view trend lines for instructional expenditure per student and observe the score trends for Grades 4 and 8. Use the home, zoom, pan in and pan out buttons in the map to adjust the map view.



Trends in Instruction Expenditure per Student



Grade-4 & Grade-8 Score Trends

