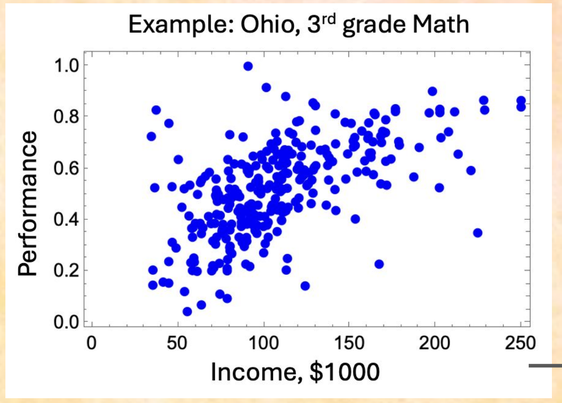
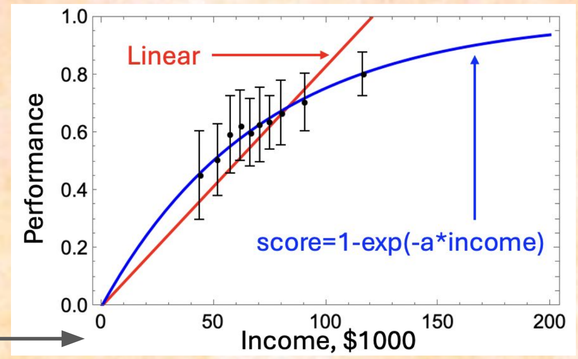
Dependence of K-12 school performance on income in US school districts

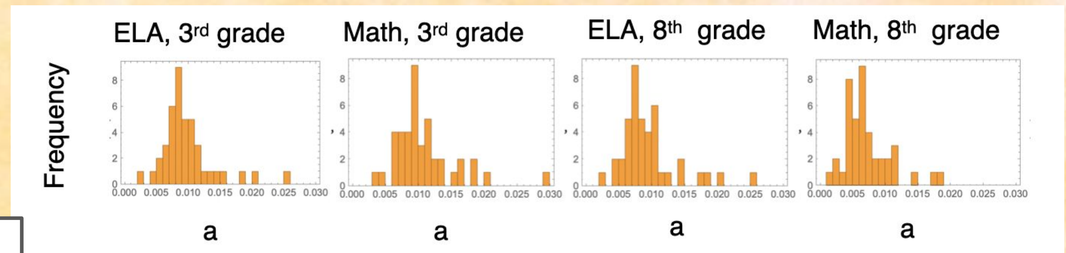
How does income affect K-12 students' performance in different states, different subjects, and different grade levels?

PROCEDURES

- Collected data on income and proficiency for 3rd and 8th grade ELA and math in all 50 states.
- Plotted proficiency vs. income using Google Sheets.
- Discovered that a linear model didn't fit well (scores exceeded 100%), so shifted to a logarithmic model.
- Used logarithms to create a function with an asymptote at 100%.
- Calculated the slope ("a") to represent the rate of score improvement with income.
- Created histograms to show the calculated "a" values for each grade/subject (ELA3, ELA8, Math3, Math8).
- Divided data into ten income quantiles and averaged proficiency scores for each group.
- Compared proficiency between 3rd and 8th grade and visualized the data in a bar chart.

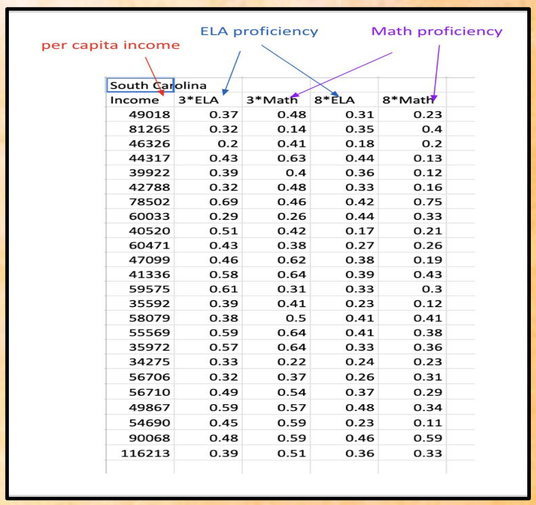




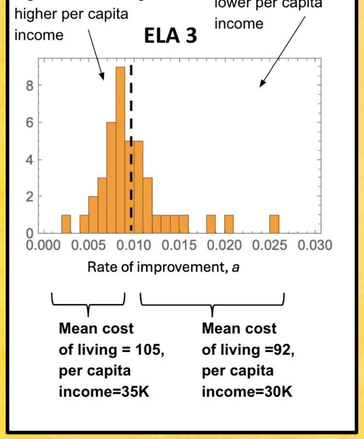


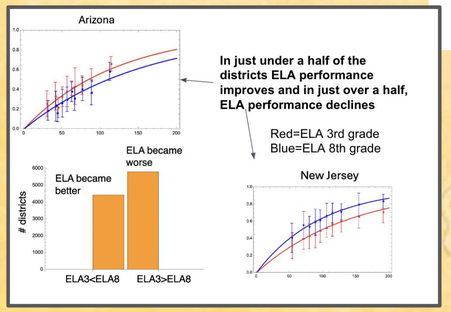
DATA AND MATERIALS

- data set collected form US State Education Departments that contains, for each school district, the percentage of students that perform at or above the grade level
- 4 subject/grade combinations: ELA for 3rd grade, ELA for 8th grade, Math for 3rd grade, Math for 8th grade
- the mean per capita income for each school district for each state obtained from US Census Bureau
- this information was collected for more than 10,000 public school districts
- google sheets to graph, analyze, and organize information and data
- online P-value calculator to determine the significance of the results



Income	3*ELA	3*Math	8*ELA	8*Math
49018	0.37	0.48	0.31	0.23
81265	0.32	0.14	0.35	0.4
46326	0.2	0.41	0.18	0.2
44317	0.43	0.63	0.44	0.13
39922	0.39	0.4	0.36	0.12
42788	0.32	0.48	0.33	0.16
78502	0.69	0.46	0.42	0.75
60033	0.29	0.26	0.44	0.33
40520	0.51	0.42	0.17	0.21
60471	0.43	0.38	0.27	0.26
47099	0.46	0.62	0.38	0.19
41336	0.58	0.64	0.39	0.43
59575	0.61	0.31	0.33	0.3
35592	0.39	0.41	0.23	0.12
58079	0.38	0.5	0.41	0.41
55569	0.59	0.64	0.41	0.38
35972	0.57	0.64	0.33	0.36
34275	0.33	0.22	0.24	0.23
56706	0.32	0.37	0.26	0.31
56710	0.49	0.54	0.37	0.29
49867	0.59	0.57	0.48	0.34
54690	0.45	0.59	0.23	0.11
90068	0.48	0.59	0.46	0.59
116213	0.39	0.51	0.36	0.33

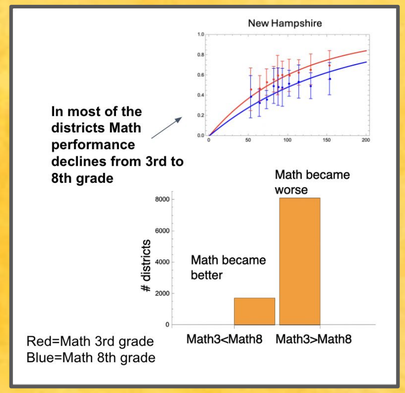




Mean rate of improvement:

3rd-grade ELA: **0.0098** | 3rd-grade Math: **0.0109**

8th-grade ELA: **0.0095** | 8th-grade Math: **0.0072**



RESULTS

- 8th-grade math showed slower improvement with income (a = 0.0072)
- States with lower "a" values (higher rate of improvement) had:
  - Mean cost of living: 105
  - Per capita income: $35k
- States with higher "a" values had:
  - Mean cost of living: 92
  - Per capita income: $30k
- Lower cost of living and per capita income correlated with higher rates of improvement in proficiency.
- ELA scores (3rd vs. 8th grade) were inconsistent:
  - Sometimes 8th grade ELA scores were higher than 3rd grade, and vice versa.
- In math, 3rd grade proficiency scores were consistently higher than 8th grade scores.

CONCLUSION

- Student performance improves with income, but age-related trends vary by subject.
- Math proficiency declines with age, while ELA trends are inconsistent.
- Lower-cost areas see greater improvement with additional resources.
- Findings highlight the need for math interventions in older grades.
- Investiment into lower income areas will have a more positive impact than if one were invest equally in all areas