

MATH AND READING SCORES

RELEVANT JMP PLATFORMS AND STATISTICAL TECHNIQUES

Graph Builder : Map, Line Graph, Bar Chart

Other : Bubble Plot, Creating new variables via Formula Editor

PROBLEM STATEMENT

Getting visibility into what students know and can do across a variety of subjects is extremely helpful in assessing the performance of the country's educational system. The National Center for Education Statistics (NCES) periodically conducts a national testing study known as the National Assessment of Educational Progress (NAEP) also referred to as "The Nation's Report Card" [1]. This nation-wide study provides the means to quantitatively assess student competency. These data are analyzed by researchers and others to identify trends and areas of concern, compare performance between states, subjects, ages, gender, among other attributes. These insights help federal, state, and local school systems and policy makers develop paths to improve the country's schools.



The data that will be analyzed is from the mathematics and reading scores of 4th and 8th graders from 2003 to 2022. The focus of the analyses will be to create a variety of visualizations and use those to summarize test results, discover trends, make comparisons, and communicate features gleaned from the data.

DATA SET

Math_and_Reading_Scores.jmp

Year	Year of assessment (2003, ..., 2022)
Region	Group of states defining 9 regions of the country
State	State name (including Washington D.C.)
Math 4 th Grade	Average score of the mathematical assessment test of all 4 th graders tested within a given state in a given year
Reading 4 th Grade	Average score of the reading assessment test of all 4 th graders tested within a given state in a given year
Math 8 th Grade	Average score of the mathematical assessment test of all 8 th graders tested within a given state in a given year
Reading 8 th Grade	Average score of the reading assessment test of all 8 th graders tested within a given state in a given year

EXERCISES

1. Create a map of the United States coloring each state based upon the score variables.

Instructions: Use Graph Builder. Place the variable 'State' into the center of the graph. Place the variable 'Math 4th Grade' into the Color Role. Select the Column Switcher under the red triangle. Choose to switch the 'Math 4th Grade' variable with that and the other three score variables. Now any of the score variables can be used as the color for the states. This graph is using the average score across all 10 years. To display the scores for a single year, create a Local Data Filter. Choose 'Local Data Filter' under the red triangle, and select to use the variable 'Year'. Now the scores for individual Years (or the average of groups of Years) can be used for the color variable.

2. Create a Bar Chart displaying the difference in the score for each state from the average score across all the states for each year.

Instructions: To do so, you'll first need to create a set of new variables that are the difference in the score for each state from each year's average. Choose Cols > New Columns. Select Column Properties > Formula. Generate the formula:

`Math 4th Grade - Col Mean (Math 4th Grade, Year)`

Name the variable 'Math_4th Grade_Diff from Yearly Avg'. Repeat for the other 3 score variables.

Launch Graph Builder. Place the variable 'Math_4th Grade_Diff from Yearly Avg' on the Y axis. Place 'State' in the X axis. Currently the graph is displaying the data across all years. To choose individual years, create a Local Data Filter. Choose 'Local Data Filter' under the red triangle, and select to use the variable 'Year'. To display the other variables, select the Column Switcher under the red triangle. Choose to switch the

'Math_4th Grade_Diff from Yearly Avg' with the other new variables created. Now any of these new difference score variables and year can be selected.

3. Create a Time Series Graph showing the national average score for all the score variables across years.

Instructions: Use Graph Builder. Place the variable 'Year' on the X axis. Place all 4 score variables on the Y axis. Choose the Line Graph from the Graph Palette. 

4. Create a Time Series Graph that displays the scores for each state across years.

Instructions: Launch Graph Builder. Place the variable 'Math 4th Grade' on the Y axis. Place 'Year' on the X axis. Place 'State' in the Overlay role. Choose the Line Graph from the Graph Palette. 

As a means to display select Regions and/or States, choose 'Local Data Filter' under the red triangle, and select to use the variables 'Region' and 'State'. To display the other score variables, select the Column Switcher under the red triangle. Choose to switch the the 'Math 4th Grade' variable with that and the other 3 score variables. Now a particular grade and subject can be chosen and a line graph for select regions and/or states displayed.

5. Create Bubble Plots showing the Math and Reading Scores for each Grade and how it changes over time.

Instructions: Launch Graph > Bubble Plot. Place 'Math 4th Grade' in the Y role and 'Reading 4th Grade' in the X role. Place both 'Region' and 'State' in the ID role. Place 'Year' in the Time Role. Place 'Region' in the Coloring role. Click OK. From the graph choose Trail Lines > All and Label > All under the red triangle. As a means to display select Regions and/or States, choose 'Local Data Filter' under the red triangle, and select to use the variables 'Region' and 'State'. Click the play button  to observe the change in scores over time. Selecting the bubble for a particular region and selecting Split will expand that region showing all the individual states. Selecting Combine returns the bubble to the Region. Repeat for the 8th Grade scores.

6. Using the various visualizations created, write up a brief report describing some key findings. Note: Not necessary to write about every feature revealed in these data. Select a few themes to focus on that you would consider important and that can be communicated through these visualizations. Perhaps focus on select regions, states, and/or years (e.g., Are there regions/states that consistently perform better or worse than others? Are there regions/states that are showing a positive/negative trend? Is there a noticeable change in scores from 2019 to 2022? Why might this be?

COMPLIMENTARY MATERIALS

1. The National Assessment of Educational Progress (NAEP) “The Nation’s Report Card” by National Center for Education Statistics (NCES).
<https://www.nationsreportcard.gov>

Note: Please adhere to any citation requirements for distribution and use of this report and data.