

## Identifying Misleading Data-Driven Arguments

Imagine that you are a gubernatorial candidate who is making education and college preparedness a key facet of your campaign. Consider these two state average SAT scores. (Data is from back when the test had a 1600 point scale.)

	<b>Quantitative</b>	<b>Verbal</b>	<b>Total</b>
<b>Connecticut</b>	450	480	930
<b>Mississippi</b>	530	550	1080

Your campaign statistician assures you that this difference is highly statistically significant—that is, it is very unlikely to be the product of random chance. You know that SAT scores are highly correlated with freshman year performance and overall college outcomes. Those who score higher on the test tend to receive higher grades, are less likely to drop out in their freshman year, are more likely to complete their degrees in four or six years, and are more likely to gain full-time employment when they're done.

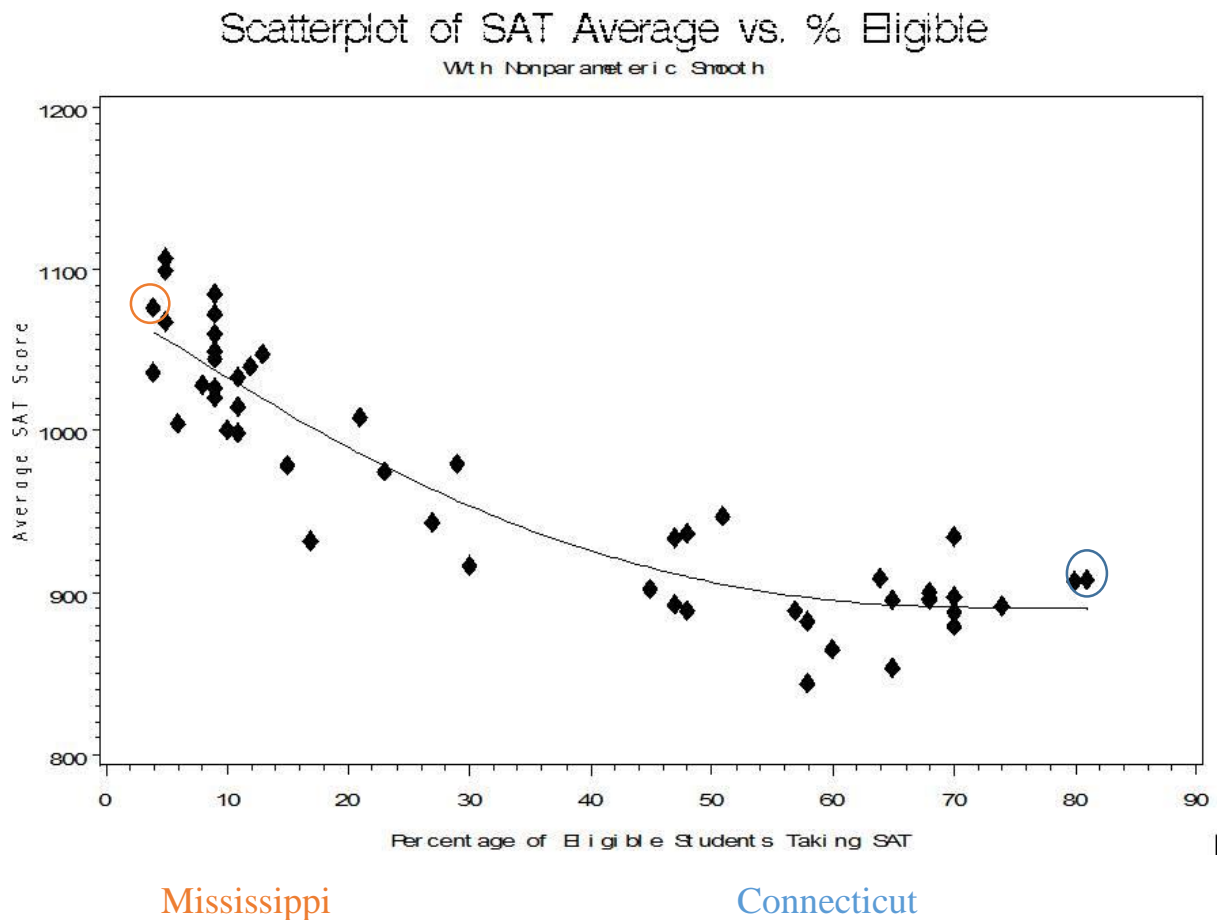
You note that Connecticut has powerful teacher unions which represent almost all of the public teachers in the state, while Mississippi's public schools are largely free of public teacher unions. You resolve to make opposing teacher unions in your state a key aspect of your educational platform.

Is this a reasonable course of action?

## Problem: Restricted Range

Anyone who follows major educational trends would likely be surprised at these SAT results. After all, Connecticut consistently places among the highest-achieving states in educational outcomes, Mississippi among the worst. In fact, on the National Assessment of Educational Progress (NAEP), widely considered the gold standard of American educational testing, Connecticut ranks as the second-best state for 4<sup>th</sup> graders and the best for 8<sup>th</sup> graders. Mississippi ranks second-to-worst for both 4<sup>th</sup> graders and 8<sup>th</sup> graders. So what's going?

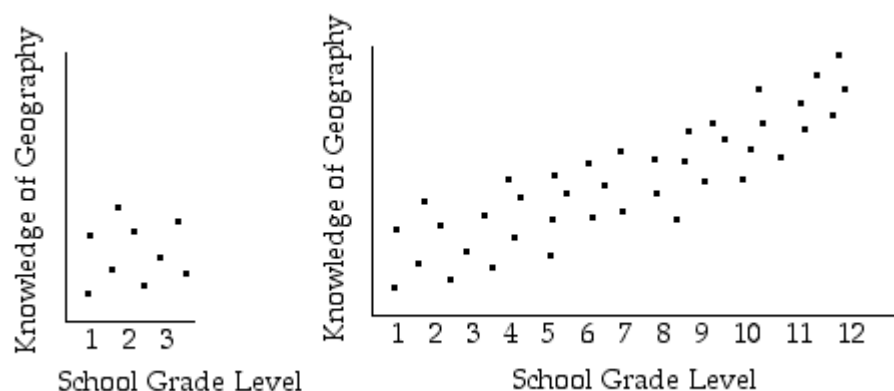
The key is participation rate, or the percentage of eligible juniors and seniors taking the SAT, as this scatter plot shows.



As can be seen, there is a strong negative relationship between participation rate and average SAT score. Generally, the higher percentage of students take the test in a given state, the lower the average score. Why? Think about what it means for students in Mississippi, where the participation rate is 3%, to take the SAT. Those students are the ones who are most motivated to attend college and the ones who are most college-ready. In contrast, in Connecticut 88% of eligible juniors and seniors take the test. This means that almost everyone of appropriate age takes the SAT in Connecticut, including many students who are not prepared for college or are only marginally prepared. Most Mississippi students self-select themselves out of the sample. The top performing quintile (20%) of Connecticut students handily outperform the top performing quintile of Mississippi students. Today, on the 2400 point scale, the highest state average in the country is that of North Dakota—where only 2% of those eligible take the SAT at all.

This is the phenomenon of *restricted range*.

**Restricted Range** in plain English: When your data contains less information than you need to make an informed, responsible analysis.



*In the left hand figure, restricted range hides the strength of the overall relationship*