The background of the slide is a close-up, slightly blurred image of a multiple-choice test sheet. It shows rows of questions with numbers and circular bubbles containing letters A, B, C, and D. A yellow pencil is visible on the right side, pointing towards the bubbles. The overall tone is educational and focused on standardized testing.

General Assembly

Data Science Immersive – 10

Project 1 – SAT and ACT analysis

27th September 2019

Problem Statement:

The mission of this assignment is:

- *To assess trends in ACT and SAT participation rates and performance; and*
- *To understand factors that affect participation rates and performance; and*
- *To provide recommendations to improve participation rates and performance in States where they are both low*

Disclaimer:

The data that has been used in this assignment has **some limitations:**

- *The ACT and SAT tests are not directly comparable given that they are not synonymous in the method of grading (ACT composite scores are averages of scales whereas SAT scores are a sum of a scaled raw score)*
- *The ACT has more components than the SAT – where the ACT assesses the candidate over 4 different key areas, and the SAT has only 2 subjects of assessment*
- *The population partaking in the test varies from year to year, and is not a controlled population, and hence is not directly comparable*
- *We have utilized State averages in our analysis – which is still a fairly generalized data given the size of the population in each state. For a more detailed analysis, more granular data (eg by district) would have to be used.*

Executive Summary

1	SAT participation rates have grown strongly over the 2017-18 period whilst ACT participation has slightly declined	<ul style="list-style-type: none">• Average SAT participation rates have grown by ~5% over the 2017-18 period, and minimum participation rates have improved from a 2% participation rate to 8%• Average ACT participation rates have experienced a slight decline, which has mainly been due to Colorado students [favoring the SAT], which has resulted in a drop in participation from 100% in 2017 to 30% in 2018 (SAT participation rates for Colorado had increased from 11% to 100% in the same time period)
2	Average total SAT scores and ACT composite had shown a year-on-year decline, although at a lower magnitude for the ACT	<ul style="list-style-type: none">• Average total SAT scores decreased to 1120 in 2018 from 1126 in the previous year, however min-max for total scores had improved. This suggests that whilst there are better candidates in this cohort compared to the previous year, there is a larger population of the cohort at the lower end of the spectrum (which is shown by a lower 50% percentile result)• There was a small decline in average composite scores for the ACT (from 21.51 to 21.49) however is negligible given its low magnitude. Candidates at the lower end of the spectrum showed some improvement, with 25% quartile scores showing a ~0.2 score improvement.
3	Median household income and overall ethnicity of the state has little influence on overall participation rates and performance...	<ul style="list-style-type: none">• Median household income showed little correlation to test participation rates and performance – which is a surprise as the initial hypothesis was that states that are more affluent would be able to afford additional tuition and test fees which would boost test performances and participation rates• Overall ethnicity also had little influence however this may be because the lower class ethnicity groups are not enrolled in school to begin with and is not considered within the population
4	...However, the ethnicity distribution of the candidate group seemed to influence test scores	<ul style="list-style-type: none">• Although data was limited, using the SAT 2018 candidate data, there was a strong correlation between student ethnicity and test scores – where states with a higher white population scored higher than states with a low to middle ratio of white population
5	In the past, state policy has been fairly successful in influencing participation rates and could be exercised to further encourage students to participate in standardized testing	<ul style="list-style-type: none">• In 2018, Colorado and Illinois switched over from ACT to SAT which has resulted in participation rates for the SAT to drastically increase from 2017-18• To encourage higher participation rates, the College Board could encourage colleges to ensure potential applicants take a mandatory testing, or increase state funding to encourage students to participate or use state funding to provide additional tuition for the students who would otherwise not participate due to the lack of self-confidence.• Given that most colleges are moving away from standardized test scores, the best option may be to use funding and policies to influence participation rates

Factor Tree

We have investigated a range of potential factors that may have an impact on test participation rates and performance

Factors	Initial Hypothesis	Findings
1 Median income for households	<ul style="list-style-type: none">States with higher household income would have higher participation rates given they have a better ability to afford exam and tuition fees – they are also more likely to go to college and hence would be required to take the examTest performance are also expected to be better for households with a larger income given they would be able to afford tutors	<ul style="list-style-type: none">There was no strong correlation between median income for households and both tests' participation rates and test scores.This may be due to the presence of government funds for tests in the poorer states
Household ethnicity	<ul style="list-style-type: none">States with a higher white (and potentially Asian) population would have higher participation rates and better performance given they are deemed to be the more affluent and educated population	<ul style="list-style-type: none">There was no strong relationship between overall ethnicity of households in the state with participation rates or test scores.
Ethnicity of candidates	<ul style="list-style-type: none">States with a higher ratio of white candidates would have a higher participation rate and overall test scores given a better overall quality of life	<ul style="list-style-type: none">Data was limited to test the validity of this statement – however using the data in 2018 for SAT students, there was a strong correlation between ethnicity and test performance, however weak correlation for participation rates.
2 Private to public school ratio	<ul style="list-style-type: none">Better participation rates and performance is expected given private schools are able to offer a better quality of education, and students who attend are likely to be of a more affluent population	<ul style="list-style-type: none">States with a higher ratio of private to public schools had a lower ACT participation rate however these states were able to achieve higher ACT composite scoresThere was no strong correlation with SAT scores.
ACT/SAT Compulsory	<ul style="list-style-type: none">In states where SAT/ACT tests are compulsory, there would be a higher participation rate but not necessarily higher test score	<ul style="list-style-type: none">Even in states where ACT and SAT is made compulsory, there has not been a high participation rate – which may indicate a high rate of drop-outs
ACT/SAT funding by state	<ul style="list-style-type: none">In states where SAT/ACT tests are paid for, there would be a higher participation rate but not necessarily higher test score	<ul style="list-style-type: none">Similar to above, there isn't a consistent trend whereby state funding has resulted in a clear improvement in participation rate

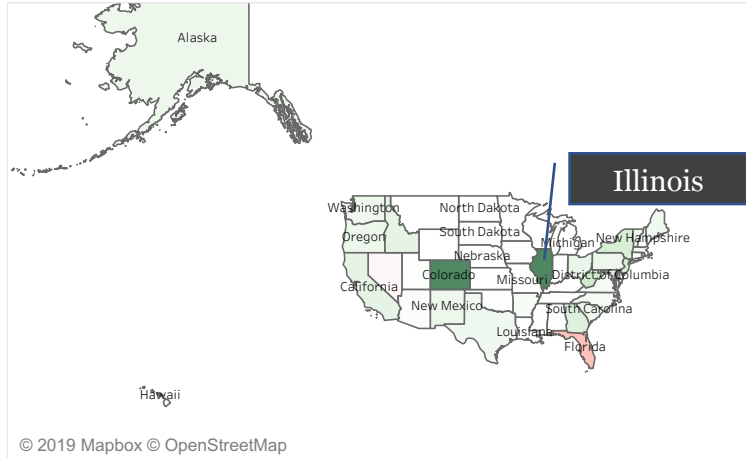
Other factors that have not been investigated that could be of particular interest are..

- Gender of candidates
- First language of candidates
- Highest level of parental education
- Average student/teacher ratio
- Choice of university / degree

Changes in Participation Rates and Performance

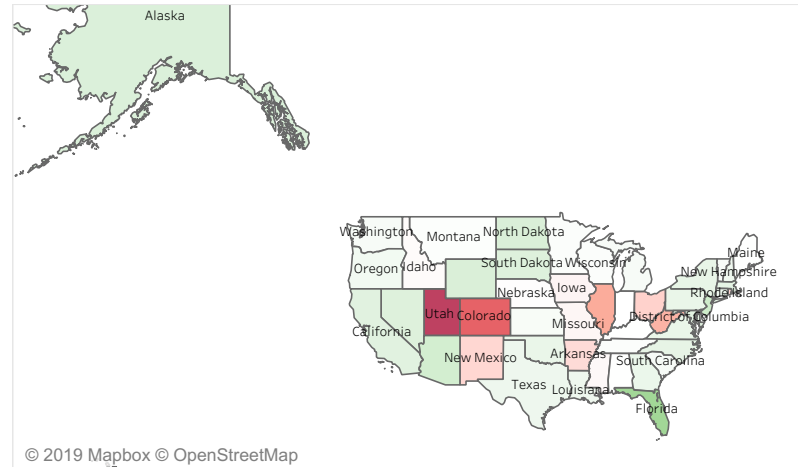
Colorado, Illinois and Alaska had a shift in participation towards SAT; Utah experienced a sharp decline in SAT scores in 2018.

SAT Change in Participation



The 3 states that has had shifts in participation rates in the time period observed in opposite directions are *Colorado, Illinois and Alaska*, with a decrease in ACT participation rates and an increase in SAT participation rates.

SAT Change in Scores

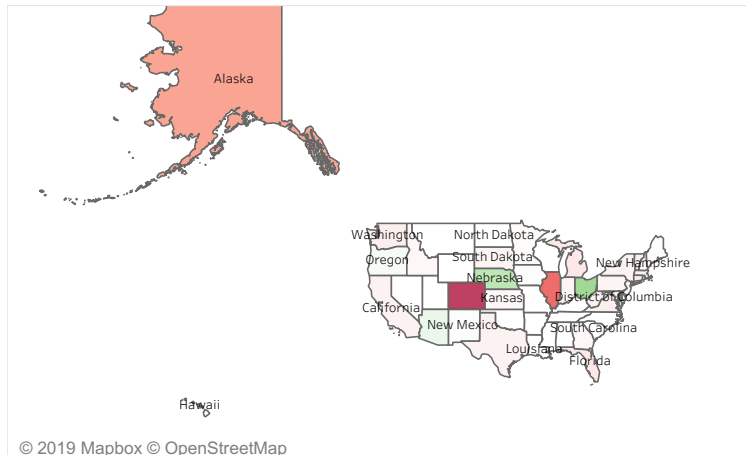


Interestingly, the 3 states that had movements towards the SAT also experienced better ACT scores in 2018.

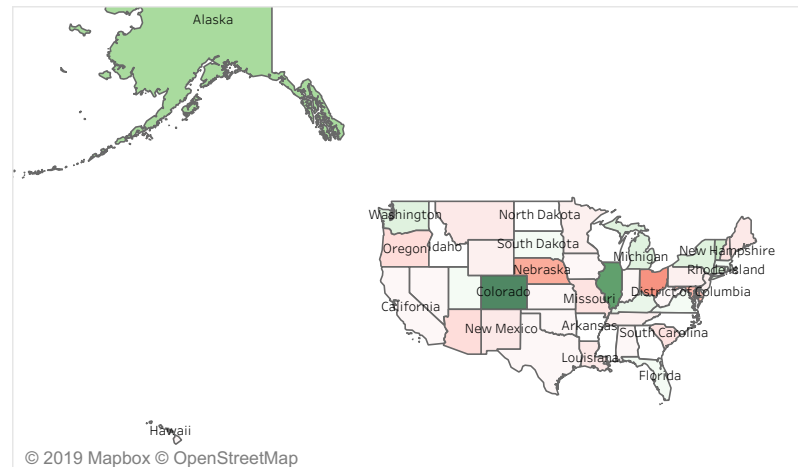
It can also be observed that there are many states that had a slight decline in average ACT composite scores, with a lower occurrence of decline in total scores in SAT.

However Utah's SAT score is quite unusual and will be explored further.

ACT Change in Participation



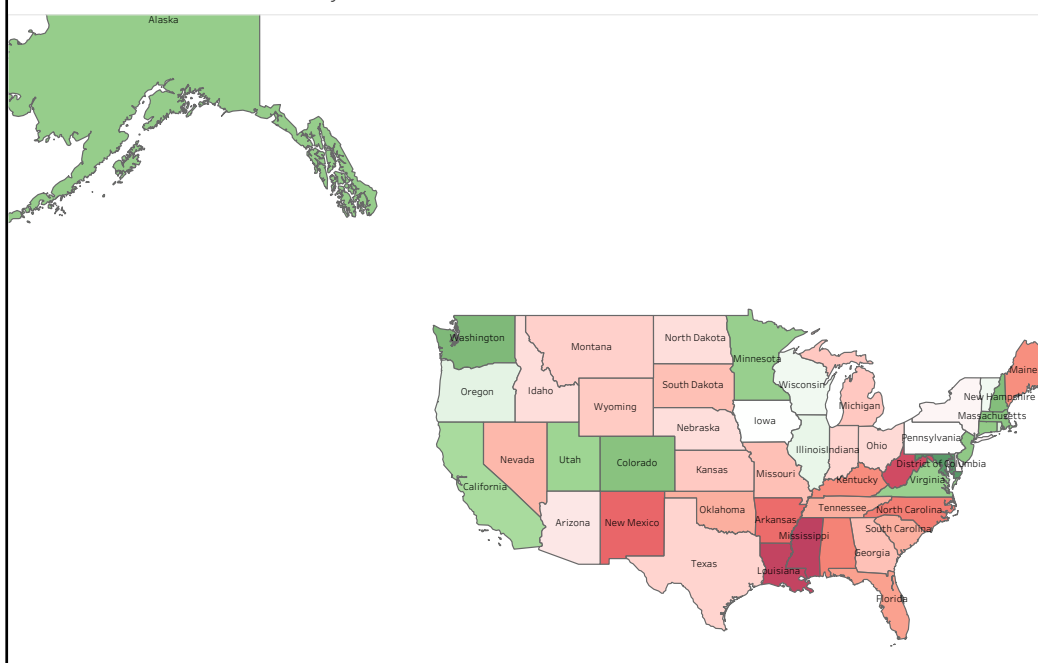
ACT Change in Scores



Median Household Income by State

No strong correlation to participation rates and performance – may be influenced by state funding and policies

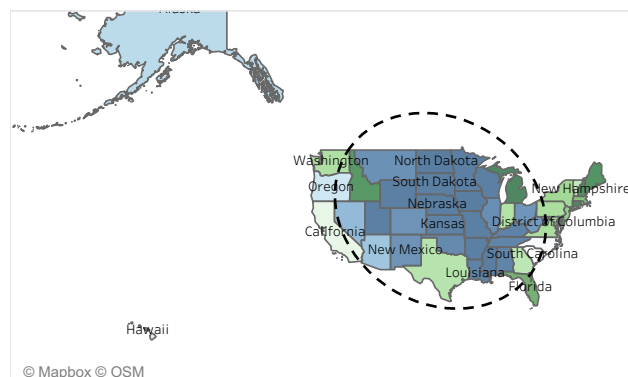
Median Household Income by State 2017



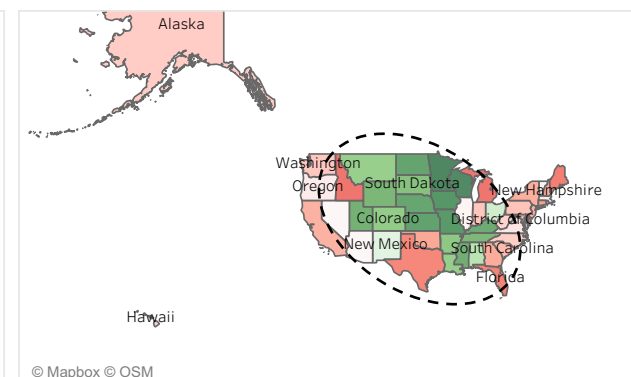
When observing the relationship between median household income and participation rates, as well as test scores - we can make the following notes:

- *Poorer states tend to have higher participation rates in the ACT than in the SAT*
- *However in the poorer states where there is participation in the SAT, candidates tend to do very well*
- *There is a low correlation between HH income and ACT scores – rich states (e.g. Alaska and Utah) still have below average scores*

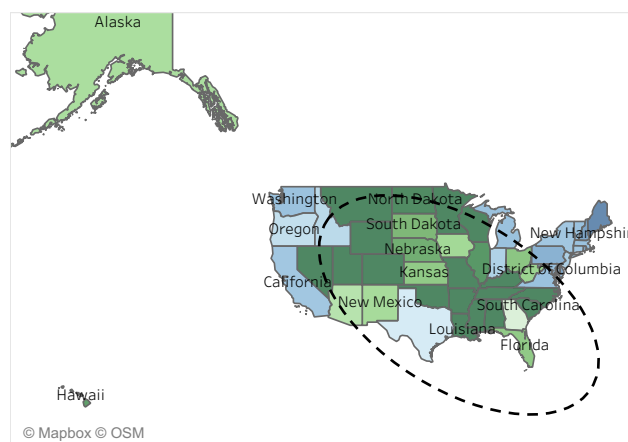
SAT 2017 Participation Rate



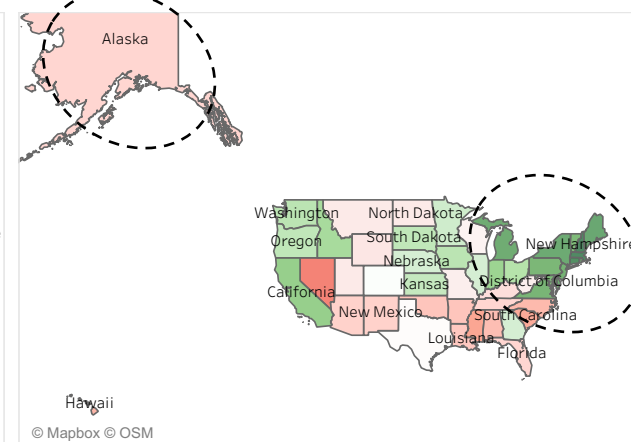
SAT 2017 Total Scores



ACT 2017 Participation Rate



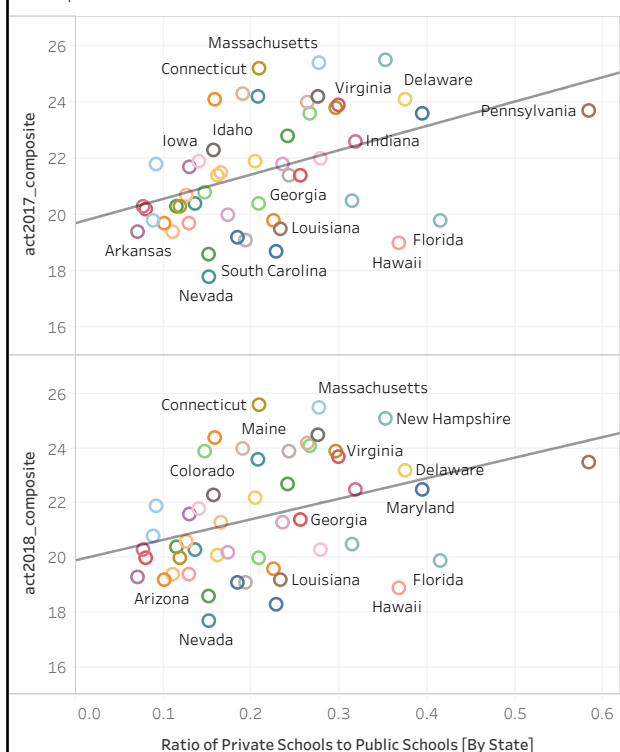
ACT 2017 Composite Scores



Ratio of Private School to Public Schools

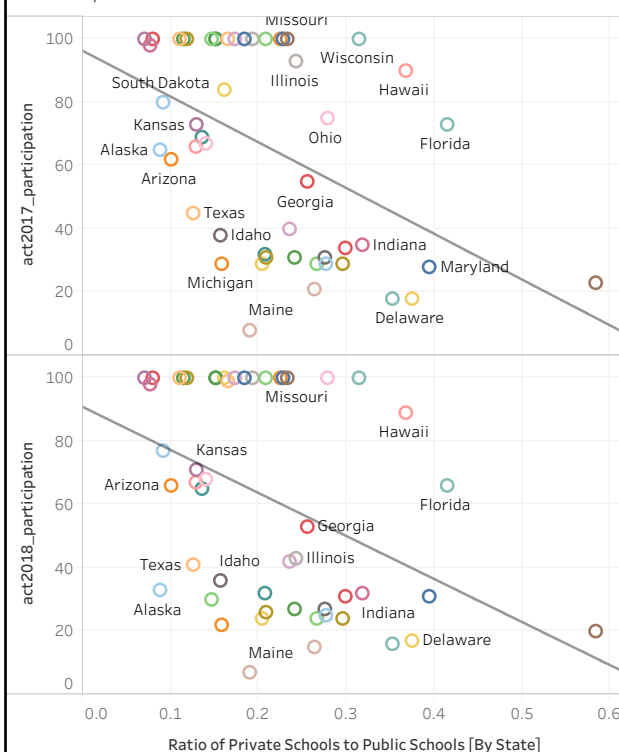
There seems to be an arguable relationship for ACT, where states with higher ratios have a lower participation rate but higher average composite score – however this relationship is not observed for SATs

Ratio of Private to Public Schools vs ACT Composite Scores



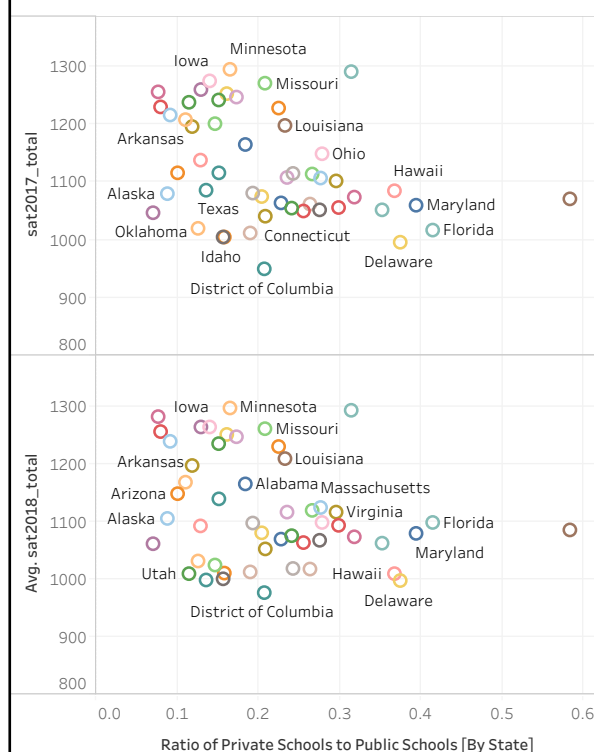
Sum of [Private Schools]/[Public Schools] vs. sum of act2017_composite and sum of act2018_composite. Color shows details about state. The marks are labeled by state.

Ratio of Private to Public Schools vs ACT Participation Rates



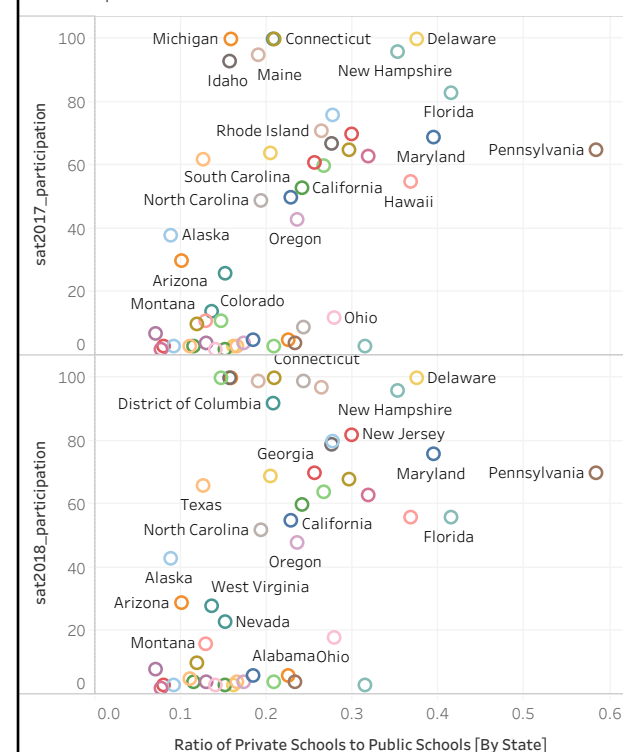
Sum of [Private Schools]/[Public Schools] vs. sum of act2017_participation and sum of act2018_participation. Color shows details about state. The marks are labeled by state.

Ratio of Private to Public Schools vs SAT Total Scores



Sum of [Private Schools]/[Public Schools] vs. sum of sat2017_total and average of sat2018_total. Color shows details about state. The marks are labeled by state.

Ratio of Private to Public Schools vs SAT Participation Rates



Sum of [Private Schools]/[Public Schools] vs. sum of sat2017_participation and sum of sat2018_participation. Color shows details about state. The marks are labeled by state.

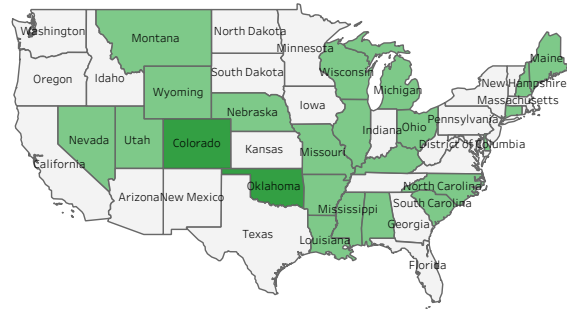
Recommendations

In order to increase participation rates and test performance, providing government funding to encourage more people to participate or to provide tuition fees for candidates with lower scores to improve may be the most effective

States where ACT/SAT is paid

Legend:

- Dark green indicates both ACT & SAT are funded
- Light green indicates *either* ACT or SAT is funded
- White indicates no funding is provided for ACT & SAT



© 2019 Mapbox © OpenStreetMap

Map based on Longitude (generated) and Latitude (generated). Color shows SUM([SAT_pays]+[ACT_Pays]). The marks are labeled by state.

To increase participation rates and test scores, there are a few initiatives that the College Board could potentially explore:

- **Encouraging colleges to make standardized tests mandatory** – however most US colleges are *moving away* from standardized tests as a form of assessment and hence may not be viable
- **Increasing state funding across USA for students to take ACT/SAT tests for free** – this would help to relieve students of a fee burden and in the case where retake is necessary this may come in handy (however there should be a limit on how many retakes a candidate is allowed to take for free)
- **Providing lower income households / lower class ethnicity students tuition fee subsidy or providing funding for additional classes taken outside school hours** to increase confidence level to partake in standardized testing – however this may be an expensive investment for the government

Thank you!

Please explore more data at my Github link:
www.github.com/lynnng91/GA_Project1