1. The Brief

The brief for this assignment was as follows.

“Well done! Having spent years analyzing financial records for big banks, you've finally scratched your idealistic itch and joined the education sector. In your latest role, you've become the Chief Data Scientist for your city's school district. In this capacity, you'll be helping the school board and mayor make strategic decisions regarding future school budgets and priorities.

As a first task, you've been asked to analyze the district-wide standardized test results. You'll be given access to every student's math and reading scores, as well as various information on the schools they attend. Your responsibility is to aggregate the data to and showcase obvious trends in school performance.”

The full details of the brief can be found at: - <https://monash.bootcampcontent.com/monash-coding-bootcamp/monu-virt-data-11-2021-u-c/-/blob/master/02-Homework/04-Pandas/Instructions/README.md>

Each element of the brief has been documented in the comments in the Python / Pandas solution.

I would have liked to take the analysis further as the observable trends highlighted below show some differences to the national trends, however, data limitations and time limitations preclude this further analysis.

1. Background / Limitations of the Dataset

Charter schools were introduced in the USA in the eighties to be more accountable for student outcomes and, among other things, to address the disparity between white and non-white students in terms of outcomes.

It would have been interesting to be able to determine whether this disparity was evident for the datasets studied for this assignment, however, data limitations prevent this analysis.

It would also be interesting to study the ratio of students per teacher to determine if large class sizes impacted achieved outcomes in the areas studied for this assignment. Again, data limitations prevent this analysis.

A 2019 study by the US Department of Education found that there was no meaningful difference between the eighth graders in charter schools and public schools when it came to math or English proficiency, as measured by the [National Assessment of Educational Progress](https://nces.ed.gov/nationsreportcard/), often called "the nation’s report card."[No.2]

The 2020 Credo study by Stanford University showed: - “The average charter school student in Washington state demonstrated academic growth in reading and math equivalent to his or her counterparts in nearby, similar district schools.” [No. 3]

This is in contrast to the observable trends in the datasets studied for this assignment (discussed below).

The limitations of the datasets are: -

* they only include a relatively small number of schools (15),
* there is no data for the number of students per teacher,
* there is no data for ethnicity,
* the qualitative data for students is limited to name and gender.

There are some 13,800 district schools and more than 7,400 charter schools in the USA [No. 1], catering for 55 million and 3.3 million students respectively.

1. Observable Trends
2. **The results for charter schools show improved outcomes compared to district schools for all of the measures studied.**

This is in contrast to the trends highlighted in the 2019 study by the US Department of Education and the 2020 Credo study by Stanford University which showed no “meaningful” difference in outcomes for charter and district schools.

District schools, being State or District based have larger numbers of students of diverse backgrounds and are more likely to reflect disadvantaged students than select Charter schools. [No. 4]

Further analysis needs to be done to determine other underlying factors contributing to improved outcomes for students. For example, ethnicity seems to be a factor contributing to improved outcomes in both maths and reading in the 2020 CREDO report. [No. 3]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type of School | Avg Maths Score | Avg Reading Score | % Pass Maths | % Pass Reading | % Pass Maths & Reading |
|  |  |  |  |  |  |
| Charter | 83.42 | 83.90 | 93.70 | 96.65 | 90.56 |
| District | 76.99 | 80.96 | 66.52 | 80.91 | 53.70 |
|  |  |  |  |  |  |

1. **The outcomes are inversely proportional to the average budget spend per student. The lowest range of budget spend per student has the highest outcomes across the board and the highest range of budget spend per student has the lowest outcomes across the board.**

Spending more money per student does not translate to improved student outcomes. Further analysis needs to be done to determine how well or otherwise the budget spend per student is spent.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Spend per Student | Avg Maths Score | Avg Reading Score | % Pass Maths | % Pass Reading | % Pass Maths & Reading |
|  |  |  |  |  |  |
| <$585 | 83.36 | 83.96 | 93.70 | 96.69 | 90.64 |
| $585-$615 | 83.53 | 83.84 | 94.12 | 95.89 | 90.12 |
| $615-$645 | 78.06 | 81.43 | 71.40 | 83.61 | 60.29 |
| $645-$675 | 77.05 | 81.01 | 66.23 | 81.11 | 53.53 |
|  |  |  |  |  |  |

1. **The outcomes are also inversely proportional to the size of the schools. The smallest schools have the highest outcomes across the board and the largest schools have the lowest outcomes across the board.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| School Size | Avg Maths Score | Avg Reading Score | % Pass Maths | % Pass Reading | % Pass Maths & Reading |
|  |  |  |  |  |  |
| Small < 1000 | 83.83 | 83.97 | 93.95 | 96.04 | 90.14 |
| Medium 1000-2000 | 83.37 | 83.87 | 93.62 | 96.77 | 90.62 |
| Large 2000-5000 | 77.48 | 81.20 | 68.65 | 82.13 | 56.57 |
|  |  |  |  |  |  |

1. **The outcomes for reading across all schools are better that the outcomes for maths.**

This is consistent with declining standards of achievement in STEM (Science, Technology, Engineering and Mathematics) subjects and widening disparity between privileged and under-privileged students over the last twenty years. [No. 4]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type of School | Avg Maths Score | Avg Reading Score | % Pass Maths | % Pass Reading | % Pass Maths & Reading |
|  |  |  |  |  |  |
| Charter & District | 78.98 | 81.87 | 74.98 | 85.80 | 65.17 |
|  |  |  |  |  |  |

1. References

[No. 1] The National Centre for Education Statistics

<https://nces.ed.gov/fastfacts/display.asp?id=30>

[No. 2] [National Assessment of Educational Progress](https://nces.ed.gov/nationsreportcard/)

[No. 3] The 2020 Credo study by Stanford University

<https://credo.stanford.edu/sites/g/files/sbiybj6481/f/2020_report_wa_08232020.pdf>

[No. 4] Raising the bar: Increasing STEM Achievement for all Students

<https://successfulstemeducation.org/resources/raising-bar-increasing-stem-achievement-all-students>