

How Public School Funding Will Decide the Success of Our Future Leaders and the Bright Minds of Tomorrow

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Abstract

Education is the foundation of an equal-opportunity society and is essential to the development and success of young people. Across the world, public secondary education is funded using various methods of distribution; however, some funding systems may be more effective than others. This study will analyze different education funding systems and their effectiveness in delivering students the best experience and overall success. Our objective is to perform a comparative analysis between the equal distribution method of public school funding in Canada and the varying distribution method of public school funding in the United States of America (US) using open-source education data gathered from both countries between 2007 and 2017. We analyzed the data using multiple regression models with the goal of identifying advantages and disadvantages to both systems. If this impartiality gave every student a fair chance to succeed or given the data, it led to a worse overall quality in education, experience, and success during and after their secondary education. From there, using an integrative thinking method [1], we will determine some new ideas that will improve funding system from a student-success and impartiality point of view, providing novel perspectives about public school funding that can be scaled at various levels of education.

Keywords Big Data, funding systems, comparative analysis, educational success, integrative thinking method.

1 Introduction

The funding of education in Canada and the United States is vastly different, even within each country

as different provinces and states operate using different systems. This report examines how the two funding systems affect overall student success by looking at retention rates, academic performance, and academic engagement.

In Canada, secondary education is organized by the ministries of education in each of the thirteen jurisdictions - 10 provinces and 3 territories. Each province or territory has around two departments of education, led by a minister from the elected members of the legislature. These departments provide financial and administrative frameworks for their province or territory. Public education is free to all Canadian residents up to the secondary level. Funding for public education comes from territorial or provincial governments, or is a mix of the board's taxation. The funds for each school board are allocated based on demand factors such as special needs, location, and number of students [2].

Public schools in the United States are funded based on a mix of local, state, and federal sources. However, rather than the funds being allocated based on demand, a large portion of the funds on a local level comes from local property taxation [3]. Moreover, private donations are a large factor that contribute to a schools funding in the United States as well. This form of funding makes some schools very well equipped to support their students, while others may be struggling with outdated equipment and other financial barriers.

By considering three success metrics — retention rates, academic performance and academic engagement — this report aims to examine how these funding systems affect the success of their students and to determine the most effective method of education based on the way they are funded. Analyzing retention rates and graduation statistics will highlight how each funding system may affect drop-out or graduation rates among secondary school stu-

dents. Academic performance achievement and information about GPA and standardized testing will reveal how funding may affect a student’s learning. Finally, academic engagement will show if a certain amount of funding will affect a student’s commitment to learning. It is important to differentiate academic performance, which examines information on standardized tests and GPA, from academic engagement, which examines a student’s interest in learning, as a student may be very willing to learn but may not have the means to get good grades based on their circumstances. We hypothesize that the student success metrics will be superior in Canada because education funding is allocated based on demand factors of specific schools. This should contribute to helping struggling students succeed as there is equal access to resources, funding, and education.

2 Materials & Methods

To collect our data, we used various methods of collecting using Python and its various libraries. For some open-source government data, they provided direct downloads to CSV files of raw data. For other data sets, we used Python and Beautiful Soup to scrape tables of open and public raw data into CSV files for our analysis. Once we collected all of our data, we used Python and various powerful libraries, such as Pandas, PostgreSQL, and Matplotlib to structure, visualize, and analyze the data and understand the relationship between the success of students and funding systems in secondary education. We extracted data spanning 10 years from 2007 to 2017 from various reputable sources from both countries. For the Canadian data, we scraped and collected public data from government sources, such as the 2016 census [4], Ministries of Education [5], and Statistics Canada [6]. For the US data, we scraped and collected public data from government sources and NGOs, such as the NCES (National Center for Education Statistics), the United States Census Bureau, and the World Bank [7][8][9]. We also extracted and collected data by each category of success; retention rates, academic performance, and academic engagement. Using Pandas, we organized these data sets from each category based on each country into a structure called a DataFrame. We then joined the tables and ran linear regression models to determine if correlations exist between how each school system is funded in both countries and how that affected each factor of success. Using data and results from both countries, we did a comparative data analysis to determine which funding system yielded the best student outcomes and prepared students best for their lives ahead.

3 Results

Using linear regression, our model showed that there was a strong correlation in how education funding systems greatly affect our three metrics of student success. Proceeding with the results, based on raw data and pure comparison, Canada had better results in academic engagement metrics, such as school attendance, secondary education duration, and provincial graduation rates. In contrast, the model showed that statically, the United States had better results overall in retention rate and academic performance metrics, such as overall GPA and reading, mathematics, and science literacy rates at a national level. Based on these results, our model classified and compared each success metric from each country.

$$\eta = \frac{(\text{greatest_metric_result} - \text{smallest_metric_result})}{(\text{smallest_metric_result})} \times 100$$

Figure 1: Efficiency Percentage Formula

The model then returned which country was more efficient as a percentage (n) using the formula for each category as shown in Figure 1. The model’s efficiency percentage results of each country can be found in Figure 2.

Country	Academic Performance	Retention Rates	Academic Engagement
Canada	- 9.93% less efficient than the US	- 3.13% less efficient than the US	+12.13% more efficient than the US
United States of America	+ 9.93% more efficient than Canada	+ 3.13% more efficient than Canada	- 12.13% less efficient than Canada

Figure 2: Efficiency Percentage Per Country

4 Discussion

It was predicted that because the Canadian funding is based on demand factors of specific schools, it would lead to superior student success metrics. However, based on our model and data from both countries, it was found that students in the United States had a better academic performance and retention rate compared to students in Canada.

In the United States, academic performance was 9.93% greater in terms of pure GPA and Core High School Subjects results compared to Canada. The average GPA across these three subjects in the US was much higher at 2.99 versus 2.72 (Figures 3 and 4).

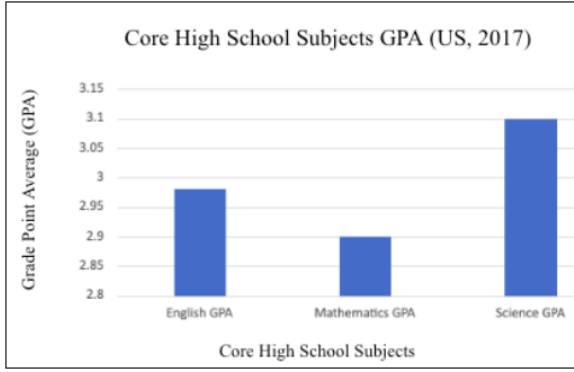


Figure 3: United States Core Subjects GPA, 2017

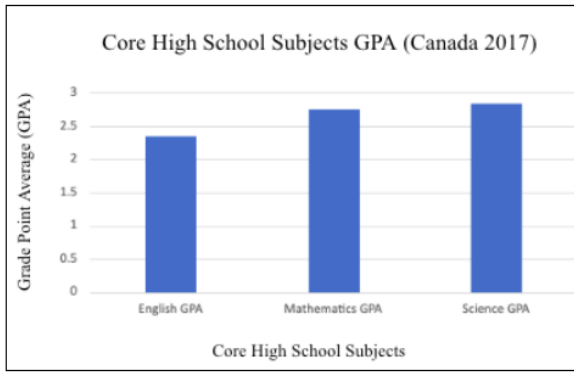


Figure 4: Canada Core Subjects GPA, 2017

Given pure raw data, the model also concluded that the United States had a better overall retention rate percentage. The overall graduation rate in the United States was much higher (85.2 % in 2017) compared to Canada (79.8% in 2017).

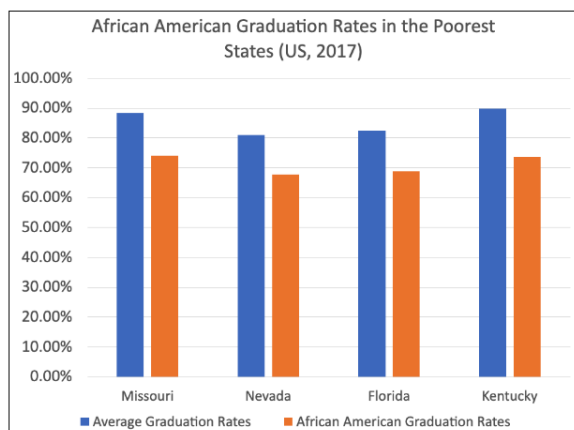


Figure 5: US African-American Graduation Rates

However, our data failed to represent minority, underrepresented, and underprivileged groups such as low-income students, African-American students, and students with disabilities. Our data shows that, in the United States, these groups of students are statistically underfunded as they gen-

erally come from under served communities and states.

In the United States, students with disabilities had a graduation rate of just 63.8% in 2017 compared to Canada's rate of 68.4%. This is quite drastic considering the average graduation rate in the United States is 85.2%, a difference of 16.8% versus a difference of 11.4% in Canada. For low-income students, the difference in graduation rates percentage is about 9.7% in the US and 4.1% in Canada for 2017. Given the poorest states in the US according to income per capita, African-American Students have had a much lower overall graduation rate as well shown in Figure 5. This shows that, while equally funded schools may not increase the overall graduation rates for high school students, it narrows the gap in opportunity between students with different situations and backgrounds.

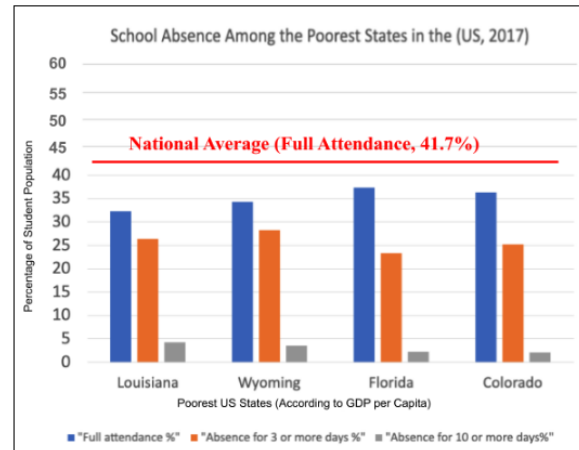


Figure 6: US Absence Among the Poorest States

On the other hand, Canadian students prevailed in terms of academic engagement metrics compared to the US. In Canada, our data showed that full-time school attendance as a percentage of the student population was 46.8% versus 41.8% in the US. This gap is further divided in the US as a result of their funding system. Among the four poorest states in the US according to GDP per capita, the full-time attendance rate was at an average of 35.4%.

At first glance, based on our model, our hypothesis that Canada's education system would lead to better student outcomes was wrong. However, when we analyzed the data further, we uncovered some differences in both countries that added depth to our findings. In the end, our hypothesis was partly correct as we predicted that Canada's equal access to resources, funding, and education would lead to more even outcomes among students. While the data showed that the US had better academic performance and retention rates at a national level, the metrics we analyzed regarding academic engage-

ment did however favour the Canadian education funding system. We also discovered that student outcomes were much more consistent in Canada regardless of background, disabilities, or geographic location compared to the US.

Some struggles and weaknesses we had in our study was access to specific types of data and success metrics. In general, educational data is fairly well documented, however, it lacks more specific data for specific regions and metrics. Moreover, data did not exist for some underdeveloped regions, possibly skewing the accuracy of the national averages. Unfortunately, each factor did not have the same number of provinces/states so there were a differing number of data points between regression analyses.

Conclusions

According to our model, the United States had better results overall in two of the three metrics of student success, so one could conclude that the United States' education system is superior based on a raw data comparison. However, in our discussion, we drew additional conclusions about why some metrics stood out more in each country.

We learned that in the United States, there was a considerable discrepancy compared to Canada in overall graduation rates within the 52 states. Furthermore, this theme of inconsistency was exposed when we looked at various minority, underrepresented, and underprivileged groups such as low-income students, African-American students, and students with disabilities. On the other hand, Canada performed worse compared to the United States in academic performance metrics. Overall, students performed worse across all provinces and territories in Canada based on standardized test scores and GPAs. In general, we learned through this comparative analysis that each education funding system has its defining advantages and disadvantages. Using an integrative thinking method, we concluded that the best funding system would not choose one approach over the other. Instead, we can combine the positive aspects of both ways to form a new idea. One possibility could be to implement anonymous donation systems that would distribute wealth across regions rather than to specific schools, directing more funding towards challenging students with more standardized tests, and providing equal access to resources and student support no matter their background or geographic location.

Future studies should aim to find more specific metrics that may be more correlated to funding and further optimize students' success. Due to the impracticality of finding data for particular metrics and regions, future studies could analyze more countries and larger areas to more accurately de-

termine a better funding system that successfully supports students' success to be the future leaders and the bright minds of tomorrow.

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