Exploring Disparities in Education Achievement: The Impact of School Funding

Washington Kids Count
Technical Report

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Overview

The gap in achievement between whites and certain racial/ethnic minority groups has been well documented. African-American and Hispanic students have consistently been shown to perform worse on standardized tests than their white or Asian peers. However, important factors beyond race and ethnicity may be contributing to this gap. Our primary interest in this study was to explore the racial/ethnic gap between minority and white students on standardized tests in the state of Washington as well as investigate how decisions made at the school and district level may impact student's test scores. While policy decisions can't change a student's demographics, policy decisions do help to create the environment in which the student learns. Our purpose was not to directly measure the quality of that environment, but to investigate how basic decisions that go into creating that environment influence test scores. We focused on two levels of environment in which a student must learn, the more direct school environment and the less direct district environment.

Gap Analysis

The Washington Assessment of Student Learning (WASL) is a standardized test administered by the Office of the Superintendent of Public Instruction (OSPI) to 4^{th}, 7^{th}, and 10^{th} grade students from early April to late May. The gap analysis focused on math and reading scores for 4^{th} and 7^{th} grade students. These scores included the 1997-98, 1998-99 and 1999-2000 school years. The regression analysis exploring differences in school and district level decisions focused on 7^{th} grade reading, writing, and math WASL scores administered in the 1998-99 school year.

The gap in test scores between racial/ethnic group was computed using the median WASL score for the group. It is important to note that this analysis has been traditionally computed

using mean scores (OSPI uses mean scores for this analysis). We used median scores because the median is robust against extreme outliers. While the mean is affected by outliers drawing it up or down, the median is the score in the middle of the distribution, therefore it is not affected by the magnitude of an outlier. The gap score was computed by subtracting the median WASL score for each racial/ethnic minority group from the median WASL score for white students. This score was then divided by the median WASL score for white students and converted into a percentage.

This comparison showed no difference between white students and Asian/Pacific Islander students. However, there were significant gaps between white students and African American, Hispanic, and Native American students on test scores for both math and reading. The largest gaps were seen in 7th grade math scores. While math scores in both 7th and 4th grade are large, the math disparity in 7th grade is notable. In the 4th grade, African American, Hispanic and Native Americans performed between 5 and 6% lower than white students for all three years studied with Native American students showing consistent gains in closing the gap. In 1997-98 school year, 7th grade African American students had test scores 9.26% lower than white students in math. This gap grew to 11% in the 1999-2000 school year. 7th grade Hispanic and Native American students have consistently had test scores 8 to 9% lower than white students. The disparity in reading score for both 4th and 7th grade students has been between 3 and 4% for the three years studied in this analysis.

While these gaps in test scores show disparities in education achievement for non-Asian minorities, exploring the gap in achievement does little more than document that a gap exists. The analysis that follows further explores the ethnic/racial differences described above as well as

explore what type of impact the decisions schools and districts are making are having on the tests scores of their students.

Description of the Data

Individual Level. The focus of this analysis was to look at the effects of different factors on basic education students' test performance. Therefore, all special education students and students enrolled in English as a Second Language (ESL) programs were excluded from the analysis. Students enrolled in alternative schools were also excluded from the analysis. Many of these students are in district supported home school programs or in specialized school settings, therefore these schools have staff distribution data that are outliers in comparison to middle or junior high schools. Students who attended districts with less than 500 enrolled students were also excluded. Washington state has a different revenue distribution formula for small school districts than for medium and large districts, therefore, revenue distribution between these districts is not comparable.

The final sample only included students who had a valid score on all three subject areas. This criterion was established so that a standardized mean score from the three subject areas could be computed as the primary dependent variable without estimating test scores. This criterion serves as a potential confound in the final sample because it could not be accurately assessed as to why a student was missing a score. While WASL missingness was treated as random in this analysis, the missingness may have been systematic thereby affecting the results. Analysis of students with missing data shows that minorities and males were over represented in students with missing test scores. While this seems to point to a systematic reason for scores to be missing, the distribution of the final sample was not fundamentally different than the population of 7^{th} grade students who took the WASL on all of the individual level independent variables (see table1).

The final sample consisted of 58,494 students, 77% of all the 7th grade students who took the WASL. The demographics of the sample and the demographics of the population of 7th grade students who took the WASL are shown in table 1. The final sample was roughly equivalent to the population. Hispanics were slightly underrepresented in the final sample because they are over represented in ESL programs. It appears that males were slightly underrepresented because they are over represented in Special Education programs and in the subset of students who were missing at least one test score.

The independent variables used at the individual level of this analysis were race/ethnicity and gender as identified by the student on the WASL. While the WASL also contains potentially important variables such as Title 1 status and primary language used at home, these items have a very low reporting rate making it problematic to use these variables as independent variables or as covariates.

School/Building Level. Data at the school/building level of the analysis were obtained from OSPI. These data included information about the students in the school and the distribution of staff resources within the school. Student information included the percentage of: the total student body who belonged to several ethnic racial groups, who were male, and who were enrolled in the free and reduced lunch program.

The staff resources data were obtained from unidentified, individual level personnel reports (form S-275) as reported to OSPI by the school. All staff resource data used in the analysis were calculated from this file. The independent variables from the staff data were average years of teaching experience, racial/ethnic distribution of teaching staff, and the average salary per pupil for supervisory staff, guidance staff, teaching staff, support services staff and

extracurricular activities staff. The construction and full definition for each staff group is shown in table 2.

Data transformation procedures were necessary for both the student ethnic/racial distribution variables and the teacher ethnic/racial distribution variables due to extreme skew in the ways that minorities were distributed between the schools. To address this problem, we created categorical variables which indicated the level of concentration in the school for each racial/ethnic group. For the student data, the percentage of the students belonging to each ethnic group was compared to the distribution of the specific ethnic group throughout the state. Based on this comparison, any given ethnicity could be categorized as very low, low, average, high and very high. The cut points for each racial/ethnic group is shown in table 3. The racial/ethnic concentrations for teachers was categorized by three categories for each racial/ethnic group except whites: above average, below average and none. Because all of the schools in this sample had at least one white teacher, the categories for white teachers were defined as above average, below average and two standard deviations below the mean. The cut points for these categories can also be found in table 3.

District Level. All district level data were obtained from OSPI district level financial reports and enrollment data. The financial reports are prepared annually by the districts and compiled by OSPI. These reports cover revenue sources and expenditure distribution. The independent variables from these reports used in this analysis were the 4 year average general fund expenditure per pupil figure, the amount districts spent for the 1998-1999 school year per pupil on basic education, special education, compensatory education, vocational education, skills centers, community services, food services and transportation. Additionally, we used revenue per pupil figures from local tax levies. District demographics used in the analysis included the

percentage of racial/ethnic groups enrolled in the district and the percentage of students in the district enrolled in the free and reduced lunch program. The district level ethnic/racial concentration figures were also converted into categorical variables following the same procedure used at the school level. The cut-points for these categories are shown in table 3. How expenditures in the district were distributed among groups of staff was examined. These staff groupings were the same as those used at the school/building level of the analysis with the addition of the superintendent staff (see table 2).

Description of the Analysis

A multi-level, multiple regression technique described by Weeks (1999) was used for this analysis. It was important to analyze these data using multiple regression because this allowed us to assess the effects of a single variable on test scores while simultaneously holding constant, or controlling for the effects of all other variables. The multilevel analysis allows us to assess varying levels of indirect influence on an individual's test scores. The reasoning of this analysis is that the most direct effect on a student is his or her own characteristics or, in this case, demographics. Beyond this, the student will also be indirectly influenced by the demographics of his or her school and decisions made at the school level. Even beyond this level, a student's test performance will also be indirectly effect by district level decisions.

This analysis involved three separate regression equations designed to represent each level of the analysis. The process through which the regression equations were solved began at the individual level, then proceeded to the school level, then finally the district level. At each level, the effects of the following level were controlled for by creating an independent variable which was a dummy code that indicated the school that the student attended (at the individual level) and

the district in which the school was located (at the school level). The dependant variables at each level of the equation was also tied to the previous level's results. At the individual level standardized WASL scores for each student was used. From this regression equation, predicted WASL scores were computed then averaged within schools. These average predicted scores served as the dependent variables for the school level regression equation. Again, at the school level, the predicted values from the regression equation was calculated and averaged within districts. The purpose of using predicted scores rather than actual scores at the school and district levels was to carry over the error variance between levels. By doing this type of analysis we were able to not only control for the indirect effects at each level but also the direct effects of demographics.

Results

Individual Level. Consistent with the findings of the gap analysis, Native American, African American, and Hispanic students performed significantly worse than white students, irrespective of gender (see table 4 for effect size). Males, irrespective of race/ethnicity, performed significantly worse than females. While demographics did show a significant effect on test scores, these variables only accounted for 5% of the total variance in test scores. The difference between schools accounted for a larger proportion of the variance than demographics (10%). This finding suggests that there are significant differences between schools and that the school environment plays a significant role in how an individual student will perform on the WASL.

School Level. The individual level analysis shows that school level factors are playing an important role in a student's test performance. The purpose of the school level analysis was to investigate what specific factors are contributing to those school level differences. This analysis

showed that the percentage of students in the school enrolled in the free and reduced lunch program and the district in which the school is located are the major factors contributing to between school variation. Higher levels of poverty in the school was associated with lower test scores. These two factors account for 79% of the variance seen at the school level with district differences accounting for 37% of that variance.

It is important to note that our analysis originally explored several school level factors including the demographics of the school, teacher experience, student/teacher ratio, staff demographics and staff distribution. All of these factors were found to be highly collinear with the percentage of children enrolled in the free and reduced lunch program and were thusly dropped from the analysis. In other words, it was found that all of these factors shared significant linearity with free and reduced lunch and therefore statistically overlapped. While collinearity makes it difficult to statistically assess the relative effects of these factors, it is interesting that all of these factors overlap with the percent of students enrolled in the free and reduced lunch program. Not only is this factor uniquely contributing to difference in school environment, but it may also be contributing to school level decisions of how staff is distributed and the school's student/teacher ratio. This is a relationship that should be explored in greater depth. Additionally, this finding also suggests that poverty maybe having a much bigger effect on test scores than race/ethnicity. The findings of the gap analysis and the individual level regression did not account for individual poverty or socioeconomic status. The school level finding suggests that poverty may be playing a bigger role in test score differences than race/ethnic characteristics. This too, should be explored in greater depth.

There is a caution about interpreting the magnitude of the effect seen with the percent of students enrolled in the free and reduced lunch program. While this analysis took a very

conservative approach to assessing collinearity, there is still a degree of collinearity between free lunch and several districts. This suggests that these district have high poverty concentrations. But statistically, this collinearity may be inflating the magnitude of the poverty effect

District Level. The school level analysis revealed significant differences between schools based on the district to which the school belonged. The purpose of this level of analysis was to investigate which of several factors was contributing to the variation seen between districts. It is important to note that the fact that there are big district level effects on the school suggests that schools within a district may not be that different. It also suggests that the most important (in reference to their impact on test scores) monetary decisions are being made at the district level not at the school level. This is not to say that school level decisions do not have an effect on test performance. It may be that the decisions that are being made at the school level are more related to environmental quality, which we have no measures of, as opposed to monetary decisions which we are investigating in this analysis.

As suggested by the school level analysis, differences between districts concerning the percentage of students enrolled in the free and reduced lunch program was a major factor accounting for test performance. Consistent with the school level analysis, this poverty measure overshadowed all race/ethnic effects and had the largest magnitude of effect on test scores of any of the factors analyzed (see table 4 for effect size). This finding further emphasizes the need to control for socioeconomic status when assessing racial/ethnic differences at the individual level, something we could not do in this analysis.

In addition to the effect of poverty on test performance, several monetary decisions made at the district level had an impact on test sores. Districts who spent more money over the course of four years had higher test sores. Additionally, districts who spent more money on basic

education, which includes teacher salaries and all other aspects of basic education instruction, in the 1998-1999 school year had higher test scores. Among staff expenditures, districts who dedicated more money to guidance staff had higher test scores (see table 2 for definitions). For non-basic education expenditures, higher spending specifically on special education and on transportation was associated with lower test scores in the district.

Summary

The above regression analysis shows that district level decisions concerning expenditure allocation are impacting students' test scores. However, this analysis falls short of explaining through what means these decision are impacting test scores. This is a question that needs further study. The regression analysis also shows that poverty within a school and within a district has a very substantial effect on test scores. This finding, coupled with the finding that racial/ethnic concentrations within a school or district did not have an effect on test scores, suggests that differences in economic status plays a bigger a role in how well students achieve than does racial/ethnic identification.

Table 1. Comparison of the population of students who took WASL versus the demographics of the students in the sample.

A. 7th Grade Population Who Took WASL

	Females	%	Males	%	Total*	%
African Americans	1602	2.11	1791	2.36	3399	4.48
Asian/Pacific Islander	2452	3.23	2526	3.33	4984	6.56
Hispanic	2899	3.82	3042	4.01	5955	7.84
Native American	951	1.25	1176	1.55	2131	2.81
White	27084	35.67	28358	37.35	55505	73.10
Multi-ethnic	1380	1.82	1393	1.83	2778	3.66
Unknown	452	0.60	492	0.65	1179	1.55
Total	36820	48.49	38778	51.07	75931	

*333 have unknown gender

B. 7th Grade Sample Included in the Regression Analysis

	Females	%	Males	%	Total*	%
African Americans	1231	2.10	1129	1.93	2360	4.03
Asian/Pacific Islander	1952	3.34	1869	3.20	3821	6.53
Hispanic	1871	3.20	1753	3.00	3624	6.20
Native American	645	1.10	670	1.15	1315	2.25
White	22970	39.27	21487	36.73	44457	76.00
Multi-ethnic	1141	1.95	1026	1.75	2167	3.70
Unknown	301	0.51	295	0.50	596	1.02
Total	30111	51.48	28229	48.26	58494	

*154 have unknown gender

Table 2. Staff group definitions.

Group Name	Group Definition	Employment Activity Code
*Superintendent Staff	Staff involved in superintendent and district wide duties including the Board of Directors, superintendents, and district level office staff	11, 12, 13, 14, 72
Supervisory Staff	Staff involved in supervising school employees including principals, instruction supervisors, and learning resources staff	21, 22, 23
Guidance Staff	Staff involved in counseling and well-being of students including school counselors, guidance counselors, psychologists, school nurses, and speech therapists	24, 25, 26
Teaching Staff	Staff members with direct basic education teaching contact with students	27
Support Services Staff	Staff involved in the support of teachers and maintenance of the school services including school secretaries, food services and transportation staff	41, 51, 52, 53, 54, 61, 62, 63, 64, 65, 67, 73, 74, 75
Extracurricular Staff	Staff involved in extracurricular activities including sport coaches and paid extracurricular group sponsors	28

* Only included in the district level analysis

Table 3. School and district level student and staff ethnic/racial category cut points.

A. School Level: Student Enrollment Percentage Range for Each Enrollment Category

	Very low	Low	Average	High	Very high
African Americans	0.00-0.41%	0.41-1.07%	1.07-2.00%	2.00-5.09%	5.09-100%
Asian/Pacific Islander	0.00-1.20%	1.20-2.28%	2.28-4.20%	4.20-11.08%	11.08-100%
Hispanic	0.00-2.18%	2.18-3.18%	3.18-4.98%	4.98-10.49%	10.49-100%
Native American	0.00-0.71%	0.71-1.28%	1.28-2.02%	2.02-3.31%	3.31-100%
White	0.00-65.38%	65.38-80.07%	80.07-86.98%	86.98-92.11%	92.11-100%

B. District Level: Student Enrollment Percentage Range for Each Enrollment Category

	Very low	Low	Average	High	Very high
African Americans	0.00-0.37%	0.37-0.71%	0.71-1.11%	1.11-2.23%	2.23-100%
Asian/Pacific Islander	0.00-0.85%	0.85-1.59%	1.59-2.26%	2.26-4.25%	4.25-100%
Hispanic	0.00-2.25%	2.25-3.54%	3.54-5.78%	5.78-15.69%	15.69-100%
Native American	0.00-0.80%	0.80-1.33%	1.33-2.05%	2.05-3.98%	3.98-100%
White	0.00-68.95%	68.95-82.15%	82.15-88.71%	88.71-92.69%	92.69-100%

C. School Level: Teacher Racial/Ethnic Percentage for Each Employment Category

	Low	Average	High
African Americans	0.00	0.01-2.14%	2.14-100%
Asian/Pacific Islander	0.00	0.01-1.92%	1.92-100%
Hispanic	0.00	0.01-2.40%	2.40-100%
Native American	0.00	0.01-2.00%	2.00-100%
White	0.00-74.48%	74.48-92.54%	92.54-100%

Table 4. Standardized coefficients at each level of the regression

A. Individual Level

School Effects Adjusted R^2 = .127

Total Adjusted R^2 = .180

	Coefficient	*t*-score	*p*-value
Constant		-36.373	<.001
*Males	-.137	-32.373	<.001
**African Americans	-.128	-31.897	<.001
**Asian/Pacific Islander	-.003	-0.785	.433
**Hispanics	-.139	-32.948	<.001
**Native Americans	-.084	-21.702	<.001
**Multi-Racial	-.051	-13.079	<.001
**Unknown Ethnicity	-.033	-6.894	<.001

* In comparison to how well females performed

** In comparison to how well white students performed

B. School Level

District Effects Adjusted R^2 = .530

Total Adjusted R^2 = .786

	Coefficient	*t*-score	*p*-value
Constant		9.990	<.001
% enrolled in free and reduced lunch	-.813	-14.862	<.001

Table 4. Standardized coefficients at each level of the regression, continued

C. District Level

Adjusted R^2 = .631

	Coefficient	*t*-score	*p*-value
Constant		-.552	.582
% enrolled in free and reduced lunch	-.516	-6.678	<.001
District enrollment	.025	.452	.652
Local levy revenue	.174	2.534	.012
4-year average expenditure	.153	2.846	.005
Basic education expenditure	.110	2.038	.045
Special education expenditure	-.107	-2.152	.033
Vocational education expenditure	-.030	-.598	.551
Skill centers expenditure	-0.38	-.811	.418
Other instructional expenditures	.024	.495	.621
Community services expenditure	.020	.406	.685
Support services expenditure	-.064	-.920	.359
Food services expenditure	-.093	-1.256	.211
Transportation expenditure	-.141	-2.921	.004
Expenditure for supervisory staff	-.080	-1.227	.222
Expenditure for guidance staff	.137	2.395	.018