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The first administration of the National Assessment of Educational Progress (NAEP) Mathematics Exam was in 1973. Since that time, the assessment has evolved into three separate programs: Main NAEP, Long-Term Trend NAEP, and State NAEP. Main NAEP reports on the country as a whole, State NAEP reports on individual states, and Long-Term Trend NAEP is a more fixed assessment that has not changed much since the 1980's. This allows for a more accurate comparison across the years, but does not account for changes in curriculum emphasis for which the prior two programs do account to some degree. This article reports on the 2005 State NAEP results for Washington, and compares these results to the national results from the Main NAEP.

Main NAEP is administered every two years to 4th, 8th and 12th graders in public and private schools. State NAEP, however, is administered to 4th and 8th graders in public schools only. Therefore, all national results presented in this paper will be from either 4th or 8th grade and from public schools.

Washington State has participated in the NAEP exam three times; 1996[1], 2003, and 2005. As with the national exam, state results are calculated from a representative sample of the total student population. For Washington, 5,700 students were tested in 2005 for 4th grade and 8th grade combined. This sampling was representative of the total student population of 159,000 at those grade levels.

Scale Scores and Achievement Levels

NAEP results are presented as a scale score between 0 and 500. Scale scores are performance scores which have been adjusted statistically with the advantage that it allows for comparisons across time. The National Assessment Governing Board (NAGB) assigns meaning to these numbers through achievement levels (National Center for Educational Statistics, n.d.-a). NAGB has set the levels for 4th graders as follows: 282 or higher is "advanced", 249-281 is "proficient", 214-248 is "basic", and below 214 is "below basic." Similarly for 8th graders, 333 or above is "advanced", 299-332 is "proficient", 262-298 is "basic", and below 262 is "below basic."

Washington Results

As with national results, Washington's 4th and 8th graders' scores in 2005 were significantly[2] higher than in 2003 and 1996 with 4th and 8th graders averaging scores of 242 and 285 respectively. The number of Washington 8th graders who scored at or above the proficient level has increased from 26% in 1996 to 36% in 2005. We see an even more impressive result in grade 4 where 42% of students were at or above proficient in 2005 compared to 21% in 1996 -a 21 point leap in 9 years.

Figure 1 gives a summary of the Washington and national results. From this graph, two important trends are

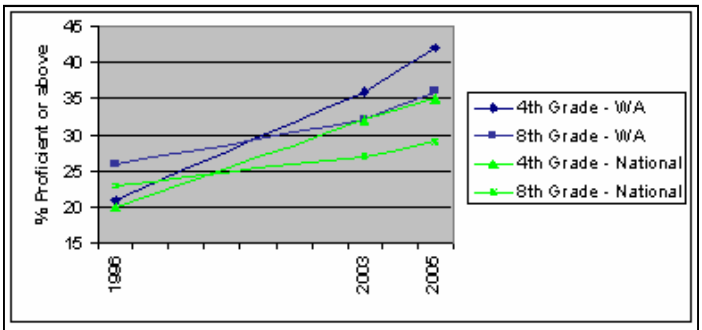

Figure 1. Percentage of students scoring proficient or above proficient

apparent. First, over time, the number of 4th and 8th graders at or above proficiency has increased for both Washington and the nation as a whole. Second, for all three years and at both grade levels, Washington has more students at or above proficiency than the nation as a whole.

Content Strands

The NAEP mathematics exam covers 5 content strands: number properties and operations; measurement; geometry; data analysis and probability; and algebra. NAGB determines the strands as well as the number of questions asked from each strand (National Assessment Governing Board, 2005). The proportions change from 4th grade to 8th grade. For example, fewer questions are asked from the number properties strand on the 8th grade assessment versus the 4th grade exam.

To provide more detail as to the types of questions asked in each strand, Table 1 gives a sample question description for each content strand. These questions were actual 2005 NAEP questions administered to 4th graders.

Table 2 shows Washington students' scale scores by

Table 1 *Question descriptions by content strand*

Content Strand	Example Question Description
Number Sense	Subtract a two-digit number from a three-digit number
Measurement	Determine the area of a figure on a grid
Geometry	Identify which shapes are cylinders
Data Analysis	Complete a bar graph from a description of data
Algebra	Identify the missing figure in a pattern

content area. In 2005, Washington students made significant gains in all 5 content areas in both grades when compared to 1996. When compared to 2003, results were mixed. 4th graders made significant gains in number properties, measurement, and data analysis; whereas 8th graders made significant gains in number properties, geometry, and data analysis. The common gain in both 4th and 8th grade was in number properties which may reflect an increased emphasis on basic skills in Washington schools. As Table 1 shows, this is the category which focuses on traditional number skills and includes basic arithmetic problems such as subtracting a two-digit number from a three-digit number.

For comparison, Table 2 also contains the national results by content strand. The pattern of improvement over time is similar to that of Washington. However, Washington students have outperformed their peers across the country in several strands. For example, in 8th grade, Washington is well ahead of the national averages for numbers and operations, measurement, and data analysis. In fact, Washington is numerically ahead of the national averages on every content strand (although some of these differences are only slightly in Washington's favor and may not be statistically significant).

In 2005, the scores of Hispanics[3] and blacks were significantly lower than those of whites in Washington. This achievement gap exists in all three years of NAEP's administration in Washington. The gap between whites and Hispanics has, unfortunately, not changed significantly in the past nine years. However, the gap between whites and blacks shrank 11 and 14 points for 4th and 8th grade respectively between 1996 and 2005. Both these changes were statistically significant.

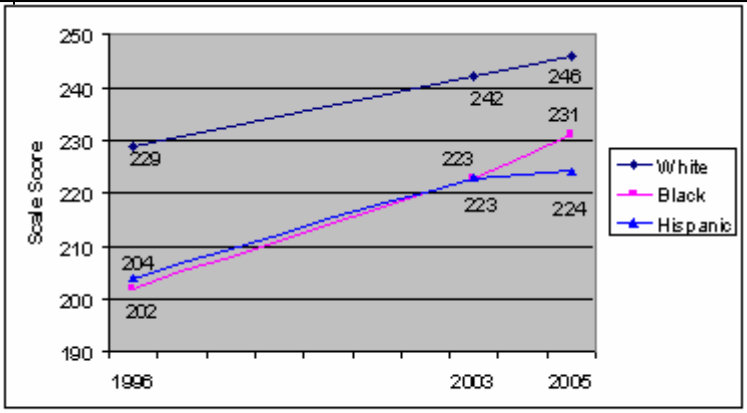

Figure 2. Washington scale scores by race/ethnicity—4th grade

In Figure 2, we can see these gaps in the NAEP scale scores for 4th grade over time. In 1996, the 4th grade gap between whites and Hispanics was 25 points, and in 2005 it was 23 points. Similarly for 8th grade, the gap in 1996 was 33 points and in 2005 it was 27 points. For 4th grade, the gap between white students and black students in 1996 was 27 points and in 2005 it was 16 points. For 8th grade, the differences were 38 and 23 for 1996 and 2005 respectively.

Table 2 *Scale scores by content strand*

	4th			8th		
	1996	2003	2005	1996	2003	2005
	National					
Numbers and Operations	219*	232*	235	272*	276	276
Measurement	224*	233*	236	268*	274	274
Geometry	224*	233*	236	268*	274*	275
Algebra	226*	240*	243	272*	279*	281
Data Analysis	223*	237*	241	270*	279*	280
Overall	222*	234*	237	271*	276*	278
	Washington					
Numbers and Operations	221*	236*	239	277*	279*	284
Measurement	227*	239*	243	277*	284	287
Geometry	228*	239	241	273*	278*	282
Algebra	230*	243	246	276*	281	284
Data Analysis	226*	240*	244	277*	285*	291
Overall	225*	238*	242	276*	281*	285

Note. * indicates that the score is significantly different than the 2005 result.

Achievement Gaps

Part of the *No Child Left Behind* legislation focuses on Achievement Gaps; that is the differences in achievement levels between white and minority students, and the difference in achievement levels between students of different socioeconomic status. NAEP results are a commonly cited measure of these achievement gaps.

Nationally, gaps exist between white and black students as well as between white and Hispanic students just as in Washington. However there are a few important differences to note. Nationally for 4th and 8th grade, the gap between white and blacks has not changed significantly since 1996. The 4th grade gap between whites and blacks in 1996 was 31 and in 2005 it was 26—a 5 point change; and the 8th grade gap went from 39 in 1996 to 33 in 2005—a 6 point change. However, these changes were not statistically

significant meaning that the differences may just be random chance as opposed to a real difference in black and white student performance. It is interesting to contrast this to Washington where, as noted above, the gap actually did shrink in a statistically significant way during the same time period.

Another gap exists when we compare students who are eligible for free and reduced lunch to students who are ineligible. This indicator of socioeconomic status shows a clear achievement gap. In Washington for 2005, the 4th grade gap was 19 points (231 compared to 250), and the 8th grade gap was 25 points (269 compared to 294). This gap has not changed significantly over time for 4th nor 8th grade. Nationally, the results are similar with an important difference in 8th grade. The gap between eligible and non-eligible shrank from 28 to 27—a statistically significant[4] change from 2003 to 2005.

Questionnaires

As part of the NAEP examination process, questionnaires are administered to students, teachers, and school administrators. In 2005, students were given 10 minutes to complete the questions which were at the back of each student's exam booklet. These questions ranged from demographic information to students' feelings about the exam. Teachers and administrators were given separate booklets with questions relating to teachers' demographics and classroom practices.

These questions provide an opportunity for comparison between practices in Washington and nationwide. For example, 72% of Washington 4th graders reported that they never or hardly ever used computers at school to learn math which is similar to the national result of 68%. Similarly, 83% of Washington 8th graders reported that they never or hardly ever used computers at school to learn math which is, again, not far from the national result of 78%. Students were also asked about calculator use. In Washington, 51% of 4th graders and 23% of 8th graders reported that they never used calculators on math tests. This compares to higher national results of 67% for 4th graders and 29% for 8th graders. It is also interesting to note that 47% of Washington 4th grade teachers responded that they never allowed calculators on math tests as compared to 73% nationally. These results concerning calculator use show a significant difference in the practice of Washington teachers versus the nation as a whole; that is, Washington teachers are more likely to permit calculator use on math tests.

Conclusion

Overall, for the 4th and 8th grades, Washington has improved significantly in mathematics over the period between 1996 and 2003 as well as between 2003 and 2005. These improvements place Washington ahead of the national average. In fact, of the 52 other states and jurisdictions that participated in the 2005 State NAEP for 4th grade, only 4 scored significantly higher than Washington and 28 scored lower than Washington (NCES,n.d.-b). For 8th grade, we see an even more impressive result for Washington which scored higher than 35 jurisdictions and lower than only 2 (NCES, n.d.-c). As for teachers' practices, we do not see much difference with computer use, but we do see much larger differences with calculator use on tests.

While the above is great news for Washington, we still see an achievement gap based on race and ethnicity. Although the gap between black students and white students has narrowed since 1996, the gap between Hispanics and white students has stayed the same for nine years. This means that although Hispanic student performance has improved, it is improving at a similar rate to white students, and thus the difference between the two is not shrinking.

Finally, while improvements have been made, it is important to note that over half of Washington 4th graders and nearly two-thirds of Washington 8th graders are below the NAEP proficient level. Thus while students' improvements, both overall and by race and ethnicity, are noteworthy, continued diligence is necessary to ensure that students continue to improve and that these achievement gaps disappear.

In 1996, accommodations were not permitted for students with disabilities or English language learners. This means that these students either took the exam with no accommodations or were excluded by the participating school district. While this makes it theoretically difficult to compare 1996 to the other years; in reality, the difference is usually small, and comparisons are often made nonetheless.

2 "Significant" or "statistically significant" means that the results were from a sample large enough that we are certain within some range that the results did not occur by chance. In the case of NAEP data, this is $p < .05$.

3 Race/ethnicity labels: black, white, and Hispanic are those used by NAEP and are not the author's.

4 The much larger sample size at the national level can show even a 1 point difference to be statistically significant.

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