

Running Head: CLOSING THE GAP IN ACADEMIC PERFORMANCE

Closing the Gap: A Case Study of School Reforms

Nicholas B. McDonald
The American Education Corporation, Oklahoma City, OK

Thomas S. Trautman
The American Education Corporation, Oklahoma City, OK

INTRODUCTION

The vision of the “No Child Left Behind” act is that no child, or group of children, should be left behind in academic achievement. As a result, the performance of minority students is brought into focus and the gap between the “privileged” and “underprivileged” is now highlighted. Specifically, one of the main goals of NCLB is to close the gap in academic performance between minority and non-minority students. Lumberton Senior High School in Lumberton, North Carolina, set out to improve the achievement in all students with an emphasis on closing the achievement gap. Publicly available test data from the last five school years was examined to discover if in fact this goal was being met.

Lumberton Senior High School is located in Robeson County, North Carolina. The school had roughly equal numbers of African American, Native-American, and Caucasian students enrolled over the past five years. Additionally, the school engaged in a series of reforms with a special emphasis on utilizing new academic software, a school-wide focus on achievement, and enhanced enforcement of discipline. The key questions under investigation were (1) whether the students of the ethnic minorities improved academically over time and (2) whether the minority/non-minority achievement gap was closing over time.

Improvements at Lumberton

At the close of the 1990s the Lumberton Senior High School’s staff and teachers experienced a rapid succession of principals over a short period of time coupled with an increased awareness of the need for serious academic improvement. At the turn of the century, the rapid turnover of administration ceased with the appointment of a principal

who has been at the school for the last five years. In 1999-2000, the level of achievement was low at Lumberton. One broad measure of student success is the percentage of students passing End-of-Course tests. At Lumberton Senior High School, just over one third of the entire student body passed End-of-Course tests in the 1999-2000 school year.

With the new principal in place and the increasing demands of testing requirements, it was determined that this pass rate should change. The faculty and administration decided to focus on two main categories of reforms to improve the student success rate. The first category was to create a climate of academic excellence that emphasized first-rate academic performance. The second category was the enhancement of behavioral expectations that influence academic performance.

In order to promote the climate of academic excellence, the school administration decided upon four major changes to their teaching methodology. These changes were wide-spread and required the active acceptance and participation of the entire faculty at Lumberton High School. The first was the extensive use of educational software. Lumberton's staff reviewed many of the commercially available educational software systems and selected a program known as the *A+nyWhere Learning System (A+LS)*. This software provides instructional material that complimented what was received in the classroom and focused students on the key elements of their core academic studies. Additionally, *A+LS* provided students with immediate reinforcement and feedback about their individual performance on the core concepts of their classes. The *A+LS* software

system was implemented in most of the school's courses but was most systematically applied in the content areas of algebra and biology.

A second major innovation was the creation of preparatory courses for algebra and biology known as Foundations classes. Students were enrolled in these courses if they demonstrated performance below passing on the state achievement tests taken in 8th grade. These Foundations courses served as preparatory courses. In other words, the mathematics foundations class prepared the students for success in Algebra. Likewise, the foundation class for Biology built a solid base for the students to be successful in high school Biology. The *A+LS* software was extensively used in the Foundations classes. In short, the Foundations classes provided the students with a teacher-student interaction at a pace that was uniquely designed for each individual. The Foundation classes were substituted for elective course credit so that graduation was not delayed for any student who participated in these preparatory courses.

A series of voluntary Saturday classes known as the Saturday Academy was the third major component of this change in the academic climate. Any student and/or his or her caregivers could request participation in the Academy for remedial education or review. This alternative program made extensive use of the *A+nyWhere Learning System* and individual teacher-student interaction. Overall, these changes allowed the staff to communicate to the student body that academic excellence was not only desirable but an expected outcome for all students.

The fourth major change was the enhancement of student behavioral expectations that took on many forms but in general were intended to focus students on academic learning and reduce behavioral distractions within the school environment. For example, a dress code was implemented and enforced in order to reduce student distractions. In-school suspensions were employed for major violations, including habitual lateness to class, and the intervention was designed to re-focus students on academic subjects. The *A+nyWhere Learning System* was heavily used with these in-school suspended students, allowing the teachers to easily craft individual lessons appropriate to each of the student's needs. A greater emphasis on attendance was implemented. Procedures were implemented to re-focus student attention on academic learning when tardy and absentee rules were violated. Overall, there was a great reduction in the number of missed and late school days per student. These and other reforms were used to eliminate behavioral events that distracted from the climate and process of learning.

DATA ANALYSIS

The data was gathered from North Carolina's publicly posted test data (<http://www.ncpublicschools.org/>). The data included the number of students who passed each End-of-Course (EOC) test for each school year along with gender and ethnic background information. For the purposes of this analysis, Lumberton's Algebra I performance on the EOC tests over the five year span starting with school year 2000-2001 and ending with 2004-2005 was examined. A simple frequency count of the EOC Algebra I pass or fail test information was completed (see Table 1) and this data was transformed into an ordinal (binary) data set with failing equaling zero and passing

equaling one. In the posted data, there were 1,829 students. Of these, 655 were African American, 478 were Native-American, and 696 were Caucasian.

Table 1: The Number of Algebra One Passing or Failing Students by Ethnic Background by School Year.

School Year	Ethnic Background	Number of Students	Number Failed	Number Passed
2000-2001	African American	104	53	51
	Native American	93	45	48
	Caucasian	131	36	95
	Total	328	134	194
2001-2002	African American	141	62	79
	Native American	97	47	50
	Caucasian	153	51	102
	Total	391	160	231
2002-2003	African American	150	53	97
	Native American	99	35	64
	Caucasian	154	48	106
	Total	403	136	267
2003-2004	African American	120	38	82
	Native American	76	22	54
	Caucasian	101	13	88
	Total	297	73	224
2004-2005	African American	140	41	99
	Native American	113	26	87
	Caucasian	157	28	129
	Total	410	95	315

Two lines of statistical analysis were pursued.

The first line of analysis investigated if each ethnic grouping improved from its own 2000-20001 school year base-line performance for each of the following years. Data analysis for binary data has unique measurement scale considerations (e.g. see Cox and Snell, 1989); however, because each grouping of the yearly test data was independent

from each other, the Cochran's Q followed by McNemar pair-wise comparisons is not an appropriate analysis. Instead Chi-square tests were selected and these statistical tests were conducted within each ethnic grouping over the five year period. If significant results were found over all five years, then more Chi-square tests were conducted to compare the starting school year 2000-2001 to every other year. In order to control for Type I error rate, a Bonferroni correction was applied for each ethnic grouping. This resulted in the Chi-square p-values needing to be equal to or less than 0.01 to reach statistical significance. Effect size was determined by calculating Cramér's V for all significant contingency tables and the equivalent Cohen's d (Cohen, 1988) was estimated.

For the African American grouping, the Chi-square test for all 5 years was significant; $X^2(4) = 16.585, p = .002$ (producing a $V = .159$ which is equivalent to a Cohen's d of a little greater than .30), indicating that there was a year-to-year difference in test scores. The performance of African Americans as measured by the pass/fail frequencies was significantly higher than their 2000-2001 performance in the years 2002-2003 ($p = .013$; with a $V = .144$ which is equivalent to a Cohen's d of about .30), 2003-2004 ($p = .003$; producing a $V = .196$ which is equivalent to a Cohen's d of about .40), and 2004-2005 ($p = .001$; producing a $V = .220$ which is approaching a Cohen's d of about .50). The 2001-2002 pass/fail frequencies were not significantly better than the 2000-2001 baselines.

For the Native-Americans, the Chi-square test was significant; $X^2(4) = 22.419, p < .001$ (producing a $V = .217$ which is equivalent to a Cohen's d of a little greater than .40),

indicating that there was a yearly difference in test pass/fail frequencies. Native-Americans passed at significantly higher rates than their 2000-2001 performance in the years 2003-2004 ($p = .01$; producing a $V = .198$ which is equivalent to a Cohen's d of about .40) and 2004-2005 ($p < .001$; producing a $V = .266$ which is equivalent to a Cohen's d of over .50). The pass/fail frequencies were not significantly better for 2001-2002, although the trend was closer to significance in the year 2002-2003 ($p = .067$).

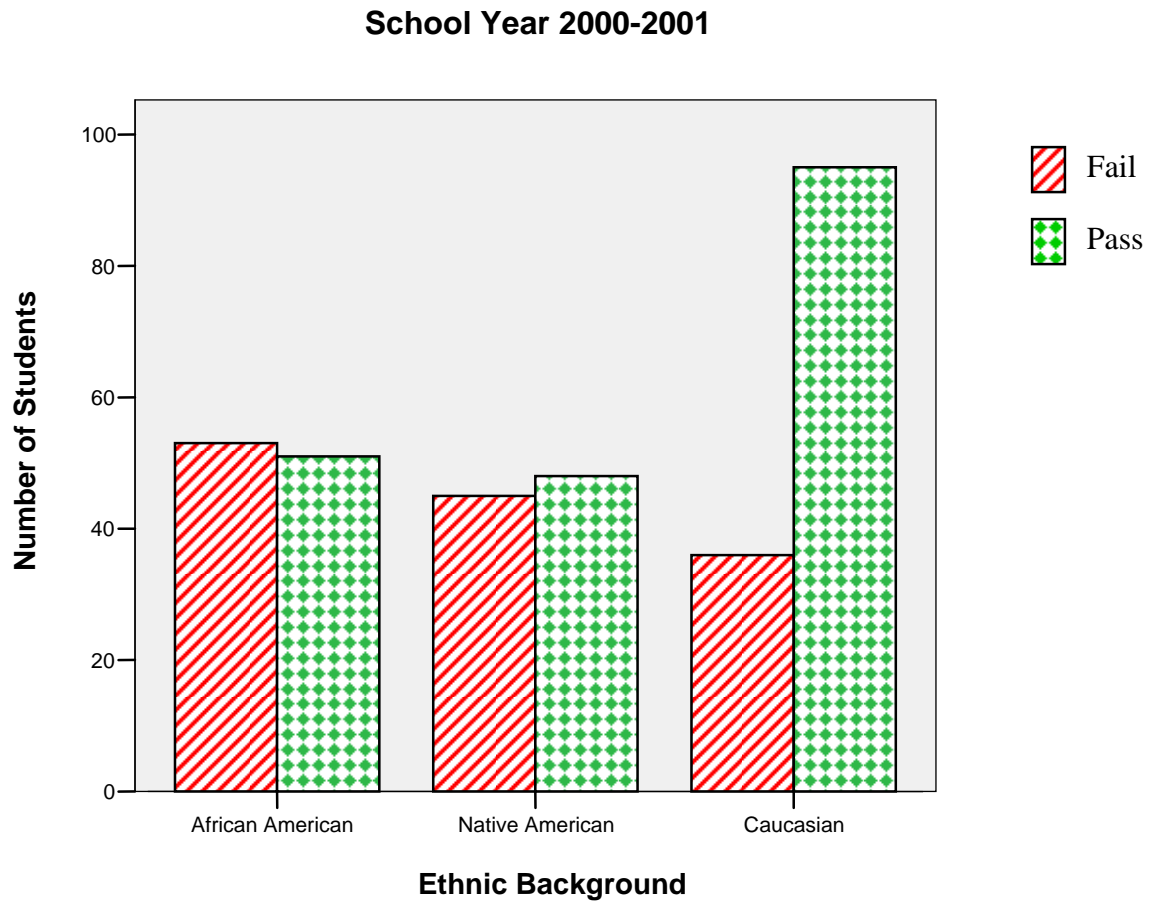
For Caucasians, the Chi-square test was significant; $X^2(4) = 21.253$, $p < .001$ (producing a $V = .175$ which is approaching a Cohen's d of about .40), indicating that there was a yearly difference in the pass/fail frequency distribution. Caucasians had significantly higher pass/fail frequencies than their 2000-2001 performance only in the year 2003-2004 ($p = .007$; producing a $V = .177$ which is approaching a Cohen's d of about .40), although the trend was reaching significance in 2004-2005 ($p = .05$). The frequencies were not significantly different in the year 2001-2002 or in 2002-2003.

The second line of analysis investigated if the 2000-2001 differential passing and failing frequencies by ethnic background disappeared over time. Please see Figures 1-5 for the fail/pass frequency by ethnic background for each of the school years. Non-parametric Chi-Square tests were conducted across ethnic groupings for each of the individual school years. If significant results were found with all three ethnic groupings included, then more Chi-square tests were conducted to compare each ethnic grouping in a pairwise fashion. In order to control for Type I error rate, a Bonferroni correction was applied for a year's multiple comparisons. This resulted in the Chi-square p-values

needing to be equal to or less than 0.0125 to reach statistical significance. Effect size was determined by calculating Cramér's V for all significant contingency tables and the equivalent Cohen's d (Cohen, 1988) was estimated.

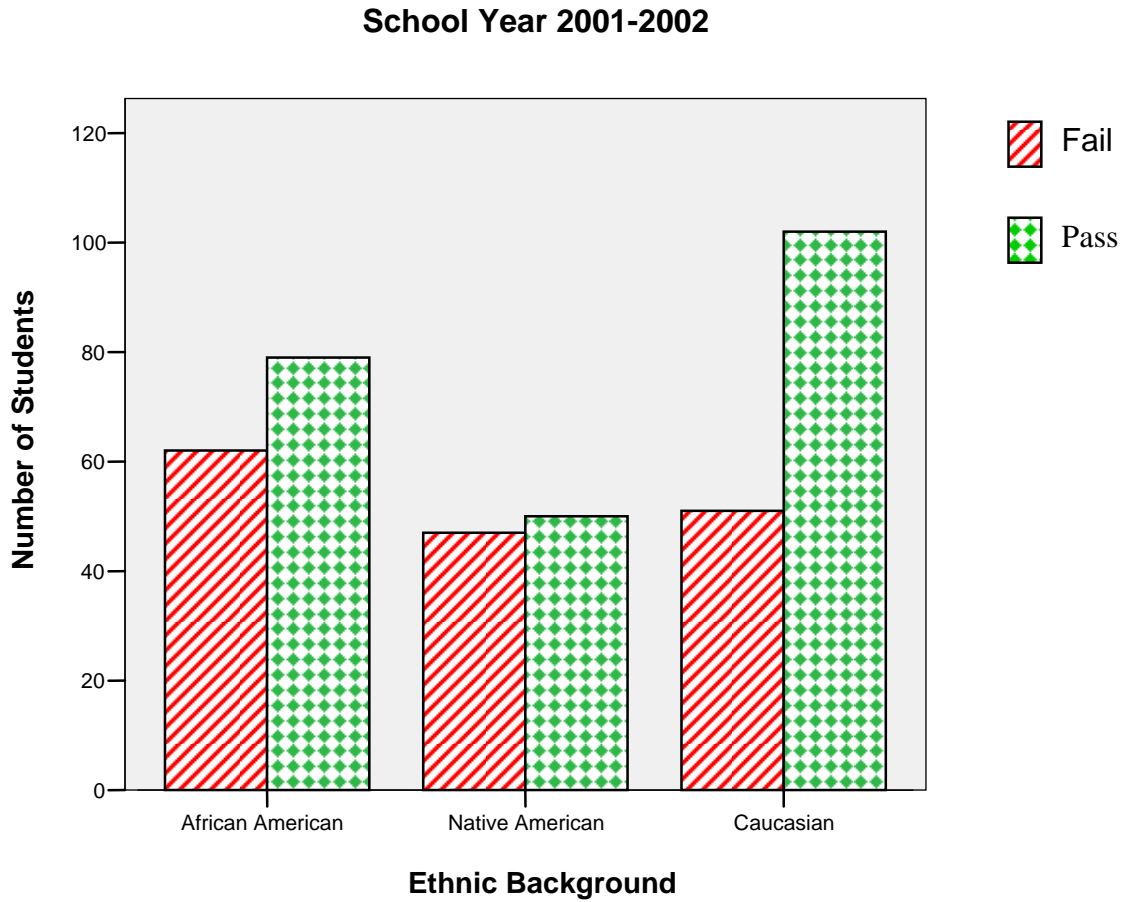
For the 2000-2001 school year there existed a significant difference among the ethnic groupings; $X^2(2) = 16.227, p < .001$ (producing a $V = .223$ which is equivalent to a Cohen's d approaching .50). Chi square multiple comparison tests revealed that the Caucasian group was significantly higher than either the African American ($p < .001$; producing a $V = .240$ which is equivalent to a Cohen's d of about .50) or the Native American ($p = .001$; producing a $V = .214$ which is equivalent to a Cohen's d of over .40) ethnic groupings. The African American and the Native American ethnic groups did not differ significantly from each other. Please see Figure 1.

Figure 1: Fail/Pass frequency by Ethnic Background for school year 2000-2001.

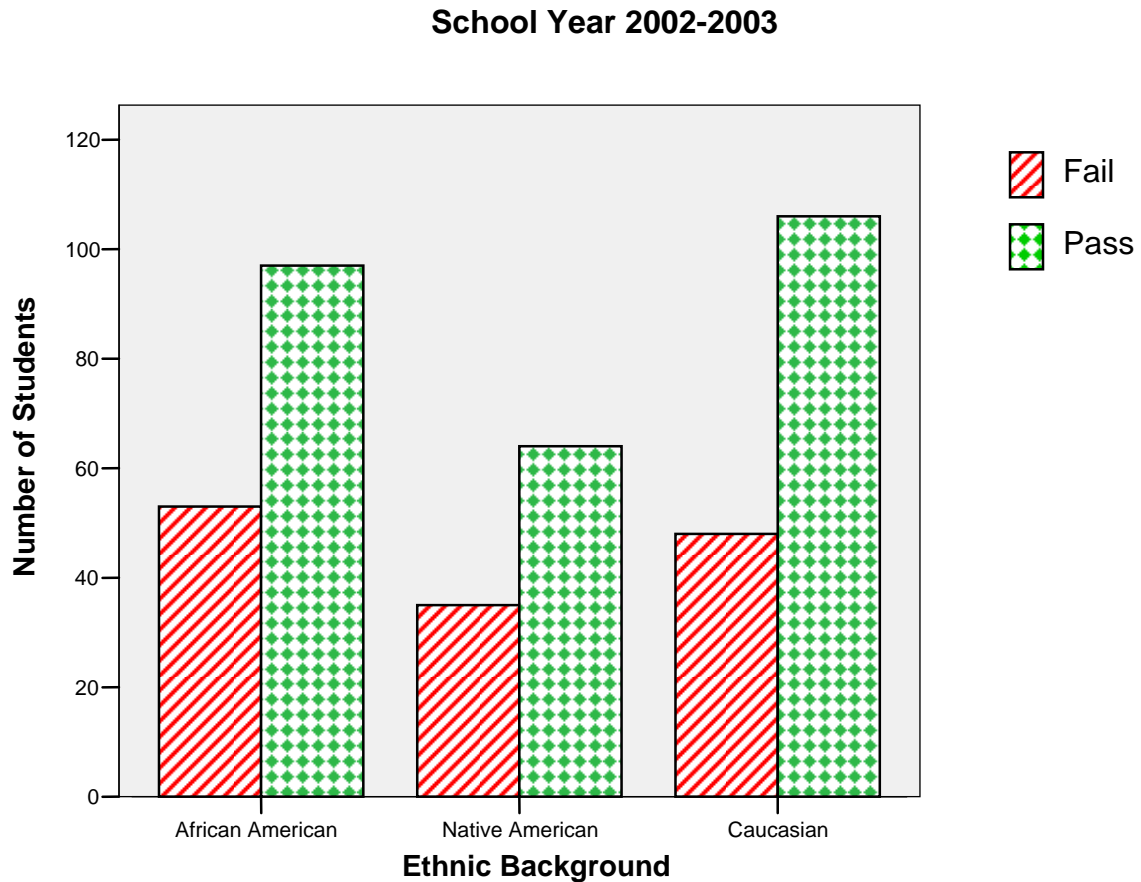


For the 2001-2002 school year there was a trend toward a significant difference among the ethnic groupings but it did not reach statistical significance; $X^2(2) = 6.463, p = .039$.

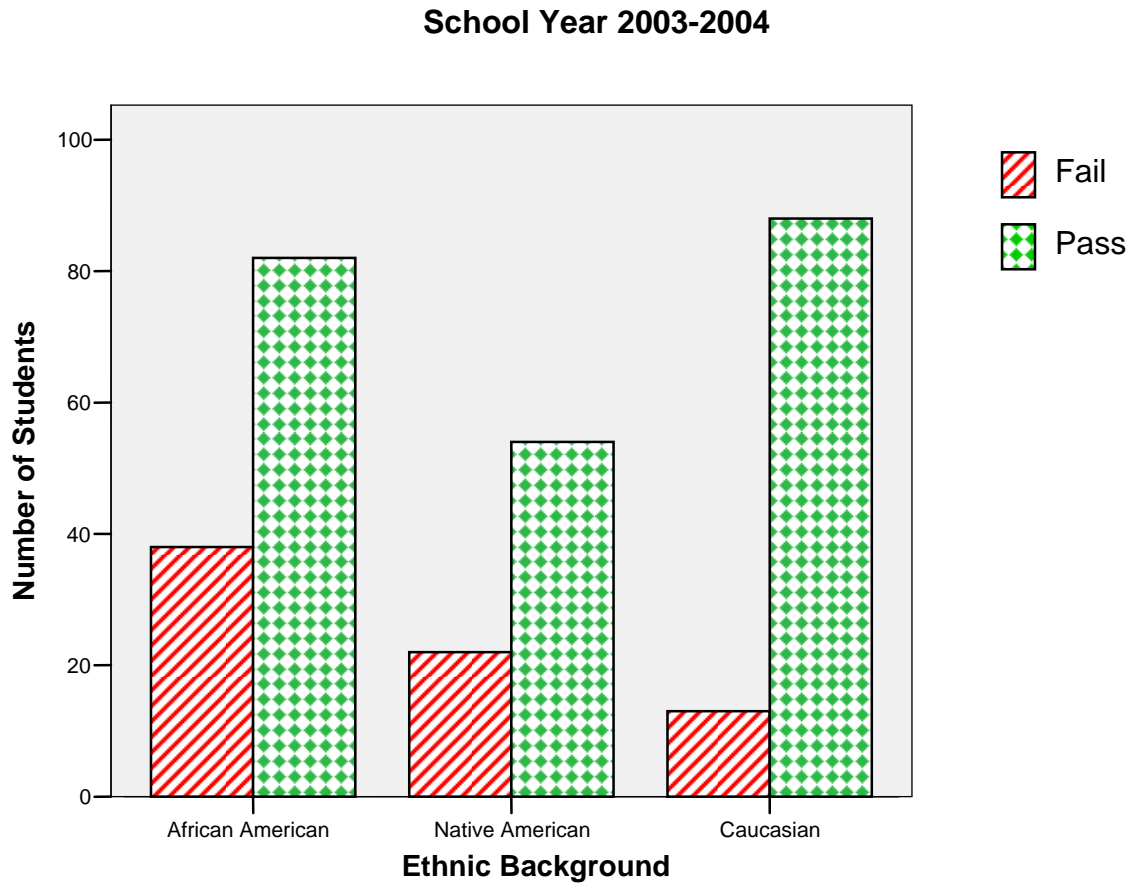
No further Chi-square comparison tests were conducted. Please see Figure 2.

Figure 2: Fail/Pass frequency by Ethnic Background for school year 2001-2002.

For the 2002-2003 school year there was no significant difference when the three ethnic groupings were simultaneously compared ($X^2(2) = 0.741, p = .69$) nor for any pair-wise comparison. Please see Figure 3.

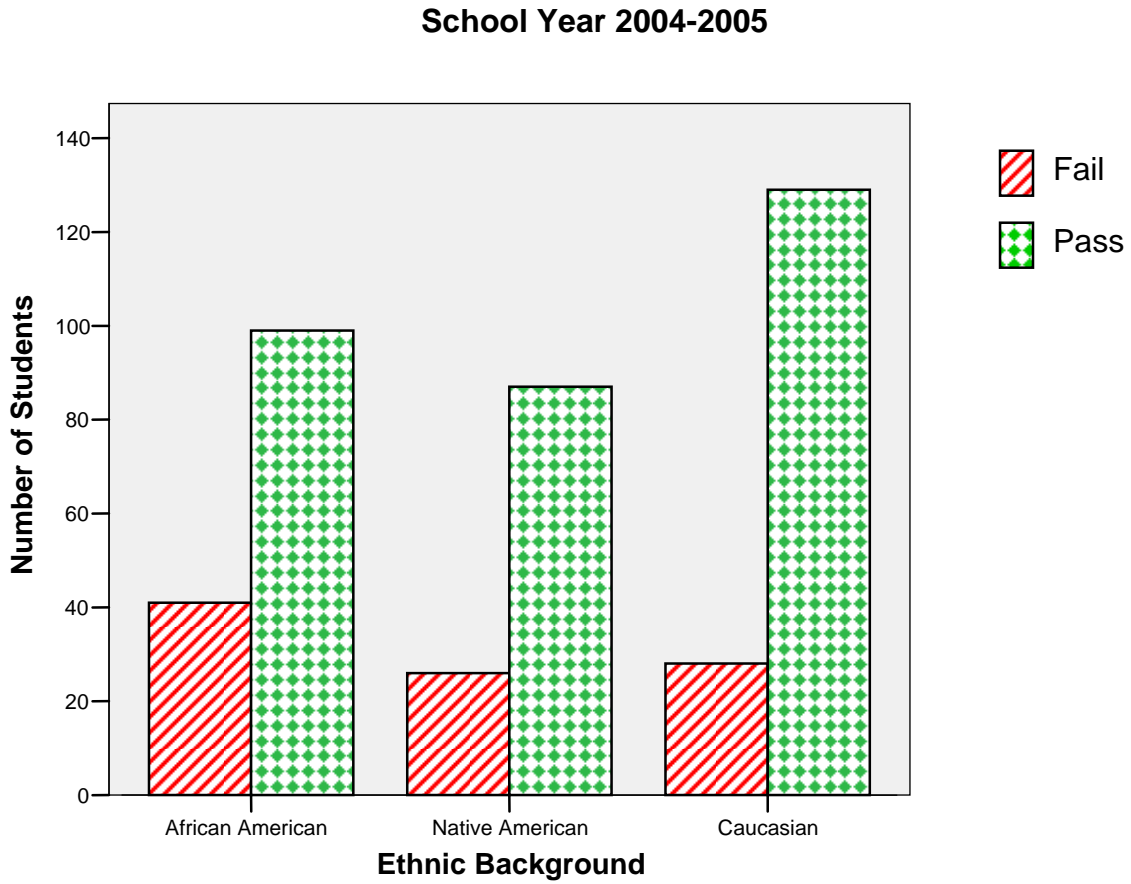
Figure 3: Fail/Pass frequency by Ethnic Background for school year 2002-2003.

For the 2003-2004 school year there existed a significant difference among the three ethnic groupings; $X^2(2) = 11.502, p = .003$ (producing a $V = .197$ which is equivalent to a Cohen's d of about .40). Pair-wise chi-square multiple comparison tests revealed that the Caucasian group was significantly higher than either the African American ($p = .001$; producing a $V = .222$ which is equivalent to a Cohen's d of over .40) or the Native American ($p = .008$; producing a $V = .200$ which is equivalent to a Cohen's d of over .40) ethnic groupings. The African American and the Native American ethnic groups did not differ significantly from each other. Please see Figure 4.

Figure 4: Fail/Pass frequency by Ethnic Background for school year 2003-2004.

For the 2004-2005 school year there was no significant difference among the three ethnic groupings; $X^2(2) = 5.454$, $p = .065$, although this result indicates a significant trend for a difference at the .10 level. Please see Figure 5.

Figure 5: Fail/Pass frequency by Ethnic Background for school year 2004-2005.



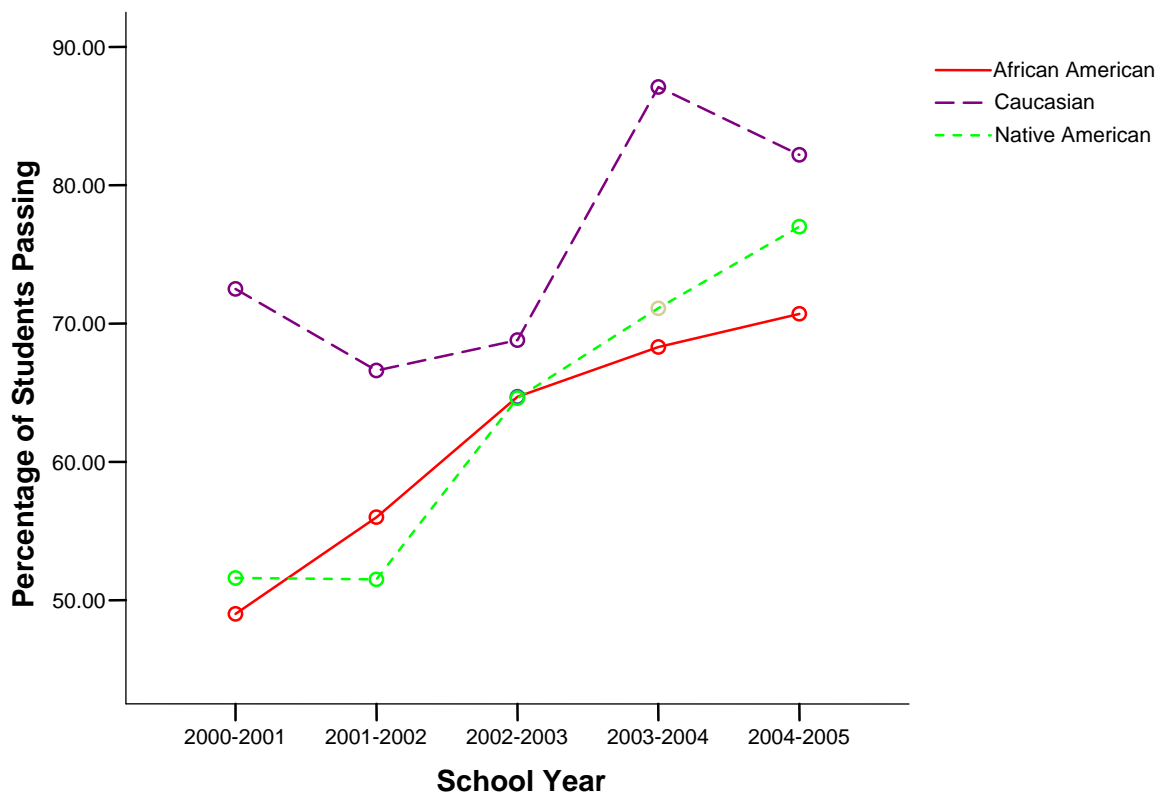
Two simple conclusions can be drawn from these results. First, all students improved their test performance over the five year time span as compared to their ethnic grouping’s performance in 2000-2001. Please see Table 2.

Table 2: Gain in Percentage of Passing Students by Ethnic grouping from baseline.

Ethnic Grouping	School Year 2000-2001	School Year 2004-2005	Gain in Percentage of Passing Students
African American	49.00%	70.70%	21.70%
Native American	51.60%	77.00%	25.40%
Caucasian	72.50%	82.20%	9.70%

Second, this analysis indicated that the Caucasian students had significantly higher overall test scores than the students with African American ethnic backgrounds for the school years 2000-2001 and 2003-2004. The Caucasian students were significantly higher than the Native American students for the school years 2000-2001, 2001-2002 and 2003-2004. By the spring of 2005, there was no statistically significant difference in the test score distributions between the ethnic groups indicating that the gap between the performance of minority students and that of the non-minority students has been greatly reduced. Please see Figure 6 for an illustration of this yearly improvement.

Figure 6: Yearly change in Percentage of Passing Students by Ethnic background.



DISCUSSION

These results indicate that both of the minority groups at Lumberton Senior High School are improving their test performance in Algebra I over the five school years when compared to their own earlier performance. These results further indicate that the significant difference between the performance of the non-minority and minority student groupings tended to decline over time. Statistical analysis shows that this improvement is real and important. One way that an achievement gap can be artificially closed is by reducing the level of the high performing group. This is not the case here. The higher performing Caucasian group is not decreasing over time. Rather, the minority student's test performance is increasing over time to approach the already satisfactory test performance frequencies of the Caucasian group.

These results imply that the reforms at Lumberton Senior High School are being successful. To confirm and elaborate on these highly suggestive results, a fully-randomized efficacy study is needed. While the conclusions from this study are not from a controlled experimental design, the results are strongly suggestive that Lumberton Senior High School is well on its way to "Leave No Child Left Behind."

References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Cox, R. R. and Snell, E. J. (1989). *Analysis of Binary Data*, 2nd edition. London: Chapman & Hall.

Footnotes

¹ ($p < .001$) means that the changes are less than 1 in 1000 that the difference was due to chance.