An Alternative to Gap-Gazing: Examining Differences Within Groups and Similarities Between Groups in Urban High Schools

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Abstract

This paper provides an illustration of how schools can use their extensive student databases in a way that goes beyond comparing differences between demographic subgroups. The urban district was already aware of the extent and nature of achievement gaps *between* demographic subgroups as published in accountability reports. They were in need of a more nuanced investigation of differences *within* subgroups to examine two areas of concern: a) decrease in student enrollment after 9th grade, and b) low student performance in high school mathematics. One result showed considerable math performance differences within the Black subgroup for students who *stayed* in the district all four years (cohort) versus students who *exited* the district at some point after 9th grade (non-cohort). Results within the White subgroup were similar.

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Introduction and Literature Review

Many educators, administrators, and researchers across the country believe we have reached a point where "gap-gazing" studies, focusing solely on identifying achievement differences between demographic subgroups, are no longer informative (e.g., Rodriguez, 2001). In her AERA presidential address Ladson-Billings (2006) argued that the focus on the "gap" is misplaced. She likened the achievement gap between Black and White students to an education debt that has accumulated over time. Other researchers such as Gregory, Skiba, and Noguera (2010), have suggested the need for additional research that addresses existing discrepancies in resources and quality between schools serving poor communities and those in more affluent areas.

A recent issue of the *Journal of Research in Mathematics Education* focused on different perspectives of gaps analysis and the direction that future research should take. One perspective is that the research on gaps needs to become more nuanced and results more accessible and useful to educators (Lubienski, 2008). "Instead of dismissing gap-focused research as mere gap-gazing, the mathematics education community should move toward richer sets of contextual factors and outcomes" (p. 354). Specifically, she suggests analyses that intersect race with socioeconomic status and gender as well as non-complex, but detailed, analysis to help practitioners determine when gaps begin, which groups to target, and which areas of classroom practice and instruction to address.

Gutierrez (2008) outlined the negative impact of gap-focused research. Dangers include "offering little more than a static picture of inequities, supporting deficit thinking and negative narratives about students of color and working-class students…and promoting a narrow definition of learning and equity" (p. 357). She describes the differences in research on between-group variance (gaps between Black and White students, for example) versus within-group variance (variation among Black students across schools or over time). The former analysis focuses on individual effects to determine success, whereas the latter suggests that school effects are useful in determining success. Instead of analyses that lead to negative conversations, Gutierrez (2008) is a proponent of more research on the differences among students within subgroups rather than between subgroups. She also encourages research on Black and other marginalized students who are excelling and advancing in math.

Regardless of the specific directions suggested by these perspectives, neither advocates eliminating large-scale gaps analysis. Statistical models using hierarchical linear analysis are recognized as necessary and important, but Gutierrez stated that "there have been so many, [they are] only accessible to a few, and we know the answers already" (p. 368). Lubienski and Gutierrez's (2008) ideas for future research overlap in terms of: a) uncovering gaps in educational opportunities, b) studying school contexts instead of variables that cannot be controlled by schools or researchers, c) emphasizing similarities between student subgroups and differences within a group, and d) validating that students of color and working-class students are worthy of study in their own right.

A report on the characteristics of minority secondary students who excel on the SAT and in the classroom is an example of such research (Bridgeman & Wendler, 2005). These researchers identified the top 10% of student scorers on the SAT and examined high school course-taking and performance data within the Black subgroup and within the White subgroup. The statistical analysis they used was not complicated, but produced powerful outcomes accessible and interpretable to everyone. Results showed more similarities than differences between Black and White students.

Overall, students of both ethnicities in Bridgeman and Wendler's study (2005) took similar types of courses and reached about the same level of success. Likewise, students who took rigorous math courses and performed well in them also tended to score high on the SAT. This was true for both Black and White students. Participation in school activities was also similar between the subgroups. The researchers state that "when we focus only on mean score differences (the average gap) among students, we tend to overlook the relatively high performing minority students. Many minority students achieve high SAT scores [and] pursue challenging courses in high school" (p. 1).

Purpose

The purpose of this paper is to provide an example of how schools can utilize their extensive longitudinal databases in ways that go beyond comparing differences between demographic subgroups. Efforts of assessment personnel in district offices are often focused on mandated accountability reporting. Unfortunately, this use of data does not usually produce results that are meaningful and useful to educators in improving their schools.

In the study described here, administrators and teachers in an urban school district had two concerns. One was the decrease in student enrollment in high school, especially after 9^{th} grade. Another concern was the low level of student math achievement on the state assessment. An investigation of these two areas was undertaken as part of a collaboration established between the district, a faculty member in a nearby university, and a community educational organization. Outcomes of the partnership included annual progress reports distributed to all parents in the district (e.g., A+ Schools, 2007) and supplementary reports (e.g., Parke, 2006; Parke, 2009;

Parke & Kanyongo, in press) that addressed specific district issues such as the two described here.

With regard to enrollment decreases, research shows that student mobility is one risk factor that continues to be identified as detrimental to student achievement. Mobility can be defined by the type of move, the timing, and the extent of the move (within versus outside the school system) (e.g., Alexander, Entwistle, & Dauber; 1996). Studies show that students who are mobile tend to have lower achievement scores and fall at least one year behind stable students (e.g., Hinz, Kapp, & Snapp, 2003; Temple & Reynolds, 1999). Moreover, schools and teacher suffer negative consequences when a large portion of the student population is mobile (Fowler-Finn, 2001; Stover, 2000; Titus, 2007). Teachers spend more time on remediation, less time on new topics, and are less likely to try out new strategies and innovations.

The district knew that a large portion of students enrolled in the first year of high school did not remain in the district schools and were mobile. However, there had not been a systematic investigation of the characteristics of students who stayed versus those who did not. A cohort of students can be defined in many ways. Mobility research helped to specifically define the cohort in this study as students who stayed in the district's high schools from 9th grade to 12th grade. The non-cohort was defined as students who attended 9th grade in the district but did not remain the entire the four years.

With regard to math performance, the district's other concern, they were already aware of the extent and nature of gaps between subgroups as published in various annual accountability reports. The Bridgeman and Wendler study (2005) helped to define the variables for which the 9th grade cohort students and 9th grade non-cohort students were compared. They included scores on large-scale math assessments, cumulative grade point average (GPA) in math courses, and percent of students taking advanced math courses (e.g., trigonometry, statistics, calculus). Finally, demographic and mathematics indicators were examined by school for the subgroup of students who excelled on the math assessment (i.e., scored in the top 25% of students in the district). A small portion of the complete analyses is included in this paper. Selected results for the following questions are presented.

- What are the characteristics (attendance, math course taken, and math failure rates) of all 9th grade Black *non-cohort* students who exited the district at some point during high school versus all 9th grade Black *cohort* students who stayed in the school district all four years?
- Same question as above, except for all 9th grade White *non-cohort* versus *cohort* students.
- How do each of the ten high schools in the district compare in terms of the characteristics described above as well as students who excel on a math assessment, advanced math courses taken, and cumulative math GPA?

Methodology

The "cohort" consisted of 1,566 9th grade students (49% of all 9th graders) who stayed in the district high schools for four consecutive years. They may have changed schools within the district, but did not leave. The remaining 1,655 9th grade students (51% of all 9th graders) were defined as the "non-cohort"; that is, students who exited the school system at some point during high school. They may have dropped out after 9th grade, transferred to a school outside the district, or repeatedly entered and exited the district over the years and eventually graduated or dropped out.

Variables for the first two questions were attendance in 9th grade, math course taken in 9th grade, and failure in at least one semester of the math course in 9th grade. Data were analyzed within the Black subgroup of students (n = 739 cohort and n = 1090 non-cohort) and the White subgroup (n = 780 cohort and n= 500 non-cohort) across all high schools in the district. Due to the small numbers of students of other ethnicities (e.g., Asian American, Hispanic), they were not included in these analyses.

For the third question, data was examined by disaggregating the ten district high schools to examine potential differences in educational opportunities based on the school a student attends. In addition to the variables described above, others included advanced math courses taken by cohort students, cumulative math GPA, and characteristics of students who excel on a math assessment.

As with any investigation of empirical data, a variety of statistical techniques may be used. For the purposes of investigating this district's concerns, the intention was to obtain descriptive, yet technically sound, results in order to provide school personnel and the community an easily interpreted picture of their schools that would encourage them to explore the data further. Gutierrez (2008), Lubienski (2008), and Bridgeman and Wendler (2005) were influential in focusing this study's analysis on comparison of characteristics within the Black and White subgroups, analyzing math data within each high school, and examining characteristics of Black and White students who excel in math.

Results for 9th Grade Non-Cohort versus 9th Grade Cohort Students

Overall, there were differences in attendance and math course failures for the 9th grade cohort students versus the 9th grade non-cohort students within each ethnicity subgroup. However, with regard to the type of math course taken, there were no differences between the cohort and non-cohort students. In nearly all cases, results for Black students were similar to those for White students. The specific results are presented below.

Attendance

Figure 1 shows that the majority of both Black and White non-cohort students were non-attenders (83% and 73%, respectively), a district classification of students who attended school less than 95% of the required days during the school year.

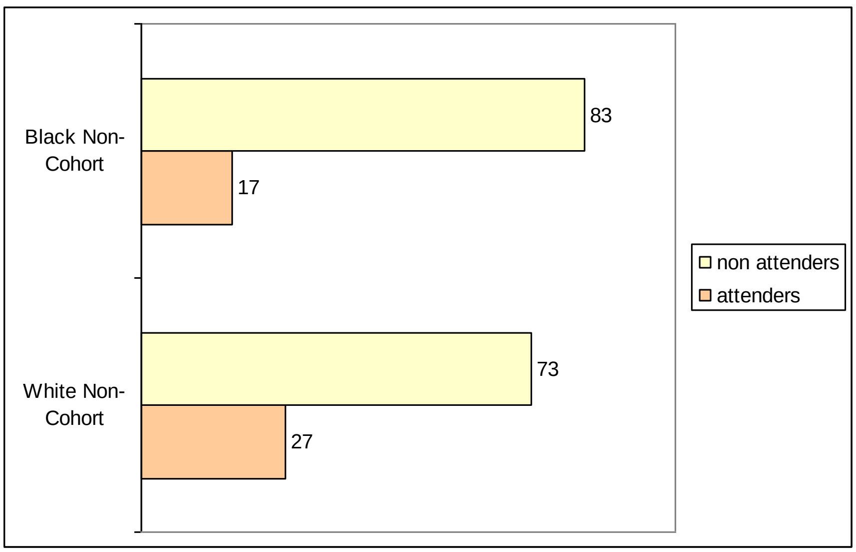

Figure 1. Percentage of Black and White 9th grade non-cohort students by attendance status.

Conversely, percentages of non-attenders were significantly smaller for cohort students. This was true for both ethnicities. Only 40% of Black cohort students were classified as non-attenders ($\chi2_{(1)}$ = 124.74, p<.001). Similarly, only 18% of White students were classified as non-attenders ($\chi2_{(1)}$ = 232.50, p<.001).

Math Courses

As shown in Figure 2, the pattern of math course-taking for Black non-cohort students is nearly identical to the pattern for White non-cohort students. For example, the percentage of Black students who took Algebra 1 in 9^{th} grade (65%) was statistically similar to the percentage of White students taking this course (67%) ($\chi 2_{(1)}$ = .28, p=.590). Smaller percentages of students in both ethnicity subgroups took General Math, Geometry, and Algebra 2 in 9^{th} grade.

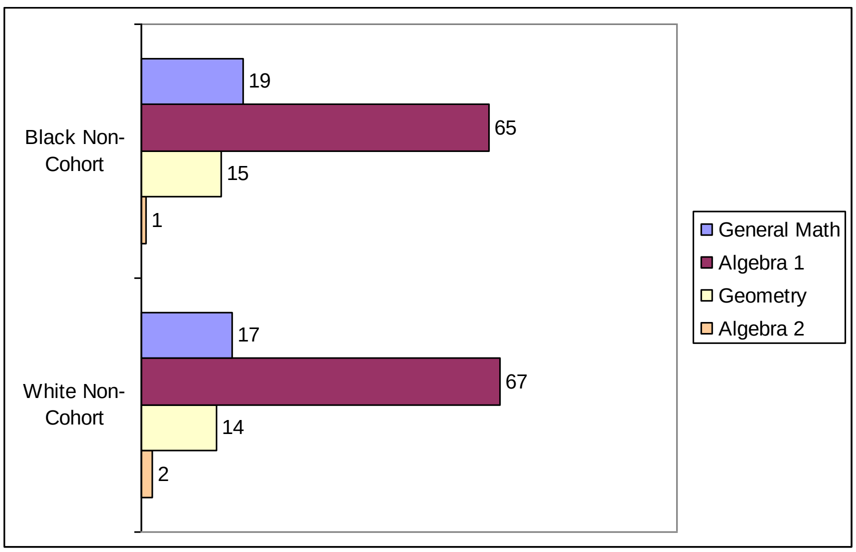

Figure 2. Percentage of Black and White 9th grade non-cohort students by math course taken.

Surprisingly, results for cohort students did not differ from those shown in Figure 2 for the non-cohort students. This was especially true within the Black subgroup. Cohort versus non-cohort percentages differed by only a few points for each math course (p>.05). Likewise, within the White subgroup, cohort and non-cohort percentages were similar for General Math and Algebra 2 (p>.05), however more White cohort students (39%) than White non-cohort (14%)

students took geometry ($\chi2_{(1)}$ = 62.09, p<.001); and fewer White cohort students (52%) than White non-cohort (67%) students took Algebra 1 ($\chi2_{(1)}$ = 11.98, p=.001).

<u>Failures in Math Courses</u>

Results for this variable were the most striking. For both Black and White non-cohort students, failure rates for math courses were high. Within the Black subgroup, Figure 3 shows that the percentage of students failing at least one semester increased as the level of the math course increased, from 51% of the students who took General Math to 80% of students who took Algebra 2.

Within the White subgroup, the percentages of non-cohort students failing General Math and Algebra 1 were statistically similar to the percentages within the Black subgroup (for General Math, $\chi2_{(1)}$ = 0.32, p=.571; for Algebra 1, $\chi2_{(1)}$ = 2.38, p=.123). Failure in Geometry occurred within the White non-cohort subgroup, but the percentage was smaller than that for the Black non-cohort students ($\chi2_{(1)}$ = 7.99, p=.005). The number of students taking Algebra 2 for both ethnicities was small, thus a statistical comparison of the percentages failing this course was not possible.

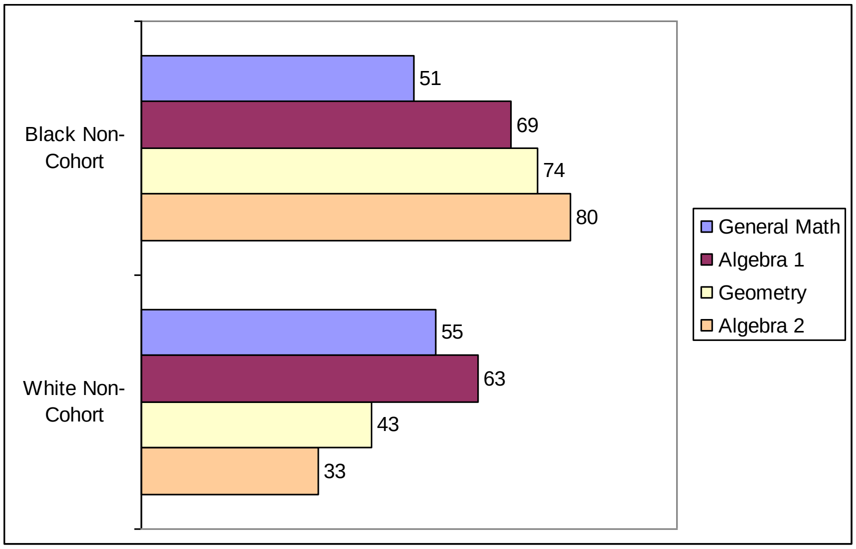

Figure 3. Percentage of Black and White 9th grade non-cohort students receiving at least one "F" grade in their math course.

As Figure 4 shows, results were quite different for cohort students. Percentages of students failing at least one semester of their math course were small for both ethnicities. The most interesting result was the low percentage of failures in Geometry for Black cohort students (13%), which was statistically similar to the 8% of White cohort students failing this course ($\chi 2_{(1)}$ = 2.292, p=.130).

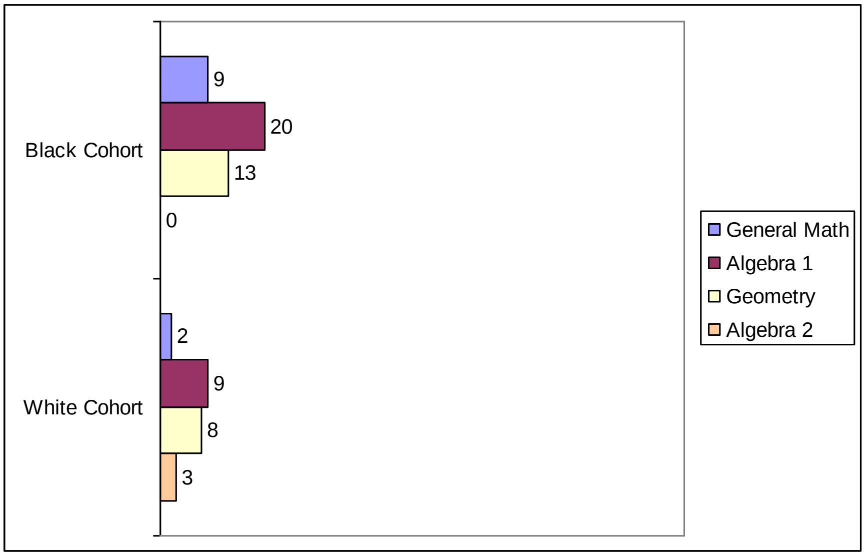

Figure 4. Percentage of Black and White 9th grade cohort students receiving at least one “F” grade in their math course.

Results Disaggregated by School

School results varied widely. First, the percentage of 9th grade non-cohort students in a school ranged from 18% to 77% within the Black subgroup and from 11% to 78% within the White subgroup. Thus, some high schools kept more of their students in the district throughout the high school years than others. Another major difference occurred for math failure rates. In Algebra 1, for example, the percentage of 9th grade Black and White non-cohort students who received a failing grade ranged from 45% to 80% across the ten high schools. The range was even wider for failures in geometry, 0% to 88%.

Large differences also occurred across schools with regard to students who excel on a 9th grade standardized assessment of mathematics. In one school, almost two-thirds of the students (62%) scored in the top 25%. However, another school had only 5% of their students scoring in the top 25%.

When interpreting these results along with additional school-level data, some outcomes were not surprising. For instance, one school that is often referred to as a "top-performing" school did indeed have positive results. It is a magnet school for the arts and has one of the smallest percentage of students from low-income families. The attendance rate is high, and serious disciplinary incidents are almost non-existent. This school had the smallest percentage of non-cohort students across all ten schools and the smallest percentage of students with failing math grades. Cohort students who stayed in the school scored above district average on the state math assessment, took advanced math courses, and had cumulative math GPAs above the district average. These results were true for both the Black and White student subgroups.

A few schools, however, had results that warranted further study at the classroom level. Three schools are highlighted here. For the past several years, School A has often been described as a "low-performing" school with attendance and discipline problems. Data from this study also showed discouraging results. For example, more than 75% of their 9th grade students did not remain in the district, the largest percentage across all ten schools.

Another particular result was especially troubling. Compared to all other district schools, School A had the largest percent of Black and White students taking geometry (23% and 18%, respectively), but receiving a failing grade in at least one semester (88% and 100%, respectively). This raises the question of whether students had the necessary prerequisite knowledge for learning geometry. Geometry is one of the district's core courses, but when taken in 9th grade it is considered "advanced". Research on course requirements and enrollment in math courses indicates that it may be detrimental to place students in a math course before they have the necessary skills (Finn, Gerber, & Wang, 2002; Lee, Croninger, & Smith, 1997). A look inside this school and its classrooms is necessary to answer questions about the criteria used to determine when a student takes geometry. If students have not demonstrated adequate prior knowledge, it is a disservice to them to be set up for failure. The content, instructional techniques, and assessment in the course should be examined.

The next case is School B which is neither a "top-performing" nor "low-performing" school based on state assessment results. It is not located in an affluent neighborhood and the majority of students come from low-income families. However, several results from this study were quite positive. First, it was one of the best schools at keeping both Black and White students in the district. Approximately 80% of the students who started 9th grade in this school did not leave the district. Why is this school able to keep their students throughout high school while other schools with similar student populations are not?

Secondly, unlike School A, School B had among the lowest failure rates in geometry for 9th grade cohort and non-cohort students. It would appear that students enrolled in geometry were academically ready to take the course. Third, with regard to results from analyses of Black cohort students, this school was performing better than all but the two "top-performing" schools (the arts magnet school and a neighborhood school in the most affluent area of the city). A high percentage of Black students took advanced math and a low percentage received failing grades. Furthermore, there was a high percentage of Black students in the top 25% of scorers district-wide on the math assessment. A qualitative look inside the math classrooms is now needed in order to determine how this school is able to serve their students better than other demographically similar schools.

The final case, School C, has a high percentage of low-income families and a high rate of serious discipline incidents. It is not considered a "low-performing" or "high-performing" school. Students' scores on the math assessment are near district average. However, the cumulative math GPA for Black cohort students from 9th to 12th grade was higher than all the other high schools, including the "top-performing" ones. Once again, it would be helpful to gather data from the mathematics classrooms to explore why test scores are average, but course grades are high.

Discussion

The district knew that some of their schools were academically serving students better than others based on standardized assessment scores. The value of this study was that it included other indicators of math performance and it provided concrete information on non-cohort versus cohort mathematics coursework data within demographic subgroups. Certain schools were targeted for more in-depth qualitative analysis of several specific issues.

First, mathematics content may vary widely from one classroom to another and from one school to another (Ma & Wilkins, 2007; Finn et al, 2002), and several versions of each math course may be offered. In this district, there were basic, standard, honors, and summer-class versions of Algebra 1. How do they differ? If a student takes and passes a Basic Algebra 1 course, can he/she be successful in a Standard Geometry course?

Secondly, results from our study showed a relationship between receiving at least one failing grade in a math course and being classified as a "non-cohort" student. Research has shown that urban students have difficulty recovering from failure in mathematics courses and many eventually drop out of school, especially when the failure occurs during their first year after a school transition, for example, from middle school to high school (Roderick & Camburn, 1999). Early failures in high school tend to be connected to other problems as well, such as lack of motivation, lack of parental support, and discipline. As mentioned previously, students need adequate preparation for the next level math course. Schools in this district varied widely in the percentage failing advanced courses in 9th grade. It would be worthwhile to compare the processes for enrolling in math courses at each school.

With regard to math course grades, cohort students in School C had the highest average math GPA of all district schools, while their scores on the state math assessment were near district average. Research has shown that grades and test scores have a moderate correlation at best, meaning that they tend to rank students somewhat differently. Willingham, Pollack, and Lewis (2002) found several factors that accounted for differences in observed grades and grades predicted from test scores. One is the inherent nature of large-scale assessments versus classroom assessments. The former covers a broad range of content learned over time, whereas the latter is typically more aligned to day-to-day instruction. Another factor is grading variations among schools and teachers. Additional elements may or may not play a role in assigning grades (e.g., attendance, effort, behavior, assignment completion, and class participation). What is the best measure of math performance – standardized tests or course grades? The answer, of course, is that no single measure of achievement should be used to make decisions. Rather, multiple measures of math performance allow all students to best demonstrate their knowledge.

Finally, additional variables can be incorporated into studies of schools. These include student academic self-concept, behavior, approach to school, motivation, and attitudes and beliefs towards mathematics. Upon first glance, these variables might be thought of as inherent to the students themselves, but in fact a positive school environment can have a large impact on how students view themselves academically and how they approach their school life.

Final Remarks

The meaningfulness of data maintained in schools' extensive electronic database systems depends on the ability to retrieve what is needed and produce results that are useful and easily understood. The purpose of our study was guided by the district's needs, which is a first requirement for the usefulness of data. It focused on the subject area of high school math, students who leave the district, and students who stay all four years. Regardless of the specific questions, however, the intention for sharing our study is to demonstrate an approach to data analysis that did not focus on what they already know (i.e., the existence of gaps across demographic subgroups) but rather a more detailed investigation of differences within subgroups and similarities between subgroups. Although the analysis was straightforward and simplistic, the process of obtaining data from the longitudinal database was complex. This is the value of college or university faculty partnering with practitioners. Most school districts lack the time, personnel, and resources to begin these types of studies. When faculty conduct the initial analyses to answer specific questions, results will provide districts with a starting point for further investigations inside schools and classrooms. Ultimately, as stated by Lubienski and Gutierrez (2008), there is the hope that we can "decrease the dangers of gaps analyses [and] increase the potential for…our work to have beneficial impacts" (p. 370).

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