

The Achievement Gap in Mathematics: A Significant Problem for African American Students

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ABSTRACT

The most significant problem of African American students in America's schools is the wide achievement gap in mathematics. Achievement of minority students lags behind that of Whites and non-minority students. This research will show facts as they exist today in America's schools relating to the achievement gap dilemma. It is well known and documented that children of color are underrepresented in gifted programs. On national assessments in mathematics, Black students' performance continues to lag behind that of White students, with uneven progress in closing the gap. Data collected on instructional practices indicate differences between how minority and White students are taught. The NAEP data suggest that many minority students are not experiencing instructional practices consistent with the recommendation suggested by the National Council Teachers of Mathematics (NCTM). American schools must provide an adequate learning environment. The authors emphasize that we must accept the challenge in finding a solution to the most significant problems in America's schools in the 21st century.

Introduction

The public education system remains separate and unequal despite extensive desegregation efforts over the past 50 years (Cooper, 1999; Darling-Hammond, 1995; Steele, 1992). Even though some schools have achieved success with racial integration, others remain stratified by race and social class (Oakes, 1990; Schofield, 1991). The segregation of students in racially mixed schools is the result of tracking or grouping students by perceived abilities (Oakes, 1985; Orfield, 1993; Wells & Grain, 1994).

The Achievement Gap in Mathematics

The purpose of this article is to discuss the achievement gap between minority and Whites students in mathematics. For instance, African American, Hispanic, and other language-minority students, placed in lower tracked classes in disproportionately high numbers, systematically receive fewer resources than their peers. Even though the merits of tracking continue to be debated, school segregation remains widespread, and an alarming number of students are at risk of school failure. For example, parents and educators are extremely concerned about special education segregation in public schools since 70% of special education students are African American students. Researchers have suggested that tracking creates class and race-linked differences in learning and is a major contributor to the persistent achievement gap between disadvantaged and affluent students and the gap between students of color and Caucasians (Cooper, 1999; Oakes, 1992). According to a 2004 report from the California Teacher Association (CTA), the widening achievement gap in California's public schools raises many questions about educational equality.

The report further indicated that in 1990, there was a 33-point gap between the scores of Black and White students on the National Assessment of Educational Programs (NAEP) mathematics test at the eighth grade level as compared to 2000 scores; the gap had grown to a 39-point gap. Similarly, Latino students were 28 points behind White students in 1990 and 33 points behind a decade later. In 2003, of the fourth and eighth grade students tested, African American and Latino students were found to perform on average, statistically, three years behind their White counterparts in math and language arts.

Over the past two decades, the underachievement of minority students in mathematics has been well documented (Secada, 1992; Tate, 1997). Tate (1997) examined the mathematics achievement of diverse groups from national trend studies and found that African American and Hispanic students continue to score at significantly lower levels than White and Asian American students. He further reported that while minority students have made achievement gains in recent years, these gains were on low-

level and basic mathematics skills. This is problematic since basic skill proficiency is not enough for “true knowledge and mastery of mathematics” (Secada, 1992, p. 630).

National Assessment of Educational Progress (NAEP)

Trends in the mathematics achievement suggest that the gap between some minority and White students persists and may even be widening. The National Assessment of Educational Progress (NAEP) mathematics assessment gauges student mathematics achievement in grades 4, 8, and 12 and is the only ongoing assessment of mathematics achievement in the United States. NAEP results show that minority students, particularly Black and Hispanics students typically score below their White peers in all mathematics content areas. The long-term trends show that achievement in mathematics improved a small to moderate extent for all students from 1973-1999 (Campbell, Hombrook & Mazzeo, 2000). Improvements for minority students have occurred mostly on those scales related to basic skills (Martin, 2000). Despite improvements across all ethnic groups, there were substantial gaps in mathematics achievement among different racial and ethnic groups. Moreover, these achievement differences grow as topics increase in complexity (Burton, 1984; Dossey, Mullis, Lindquist, & Chambers, 1988; Johnson, 1984; Jones, Burton, & Davenport, 1984; Strutchens & Silver, 2000). During the 1970's and the first half of the 1980's, NAEP data showed substantial academic improvement of Black and Hispanic students' scores and significant narrowing of the Black-White and Hispanic-White achievement gaps (Lee, 2002). During the 1990's progress in narrowing the mathematics achievement gap slowed down and the gap has begun to widen (Lee, 2002).

Lower mathematics achievement levels of minority students, particularly Black students, may be indicative of the curriculum and instruction that these students receive. Data collected on instructional practices indicate differences between how minority and White students are taught. The NAEP data suggest that many minority students are not experiencing instructional practices consistent with the recommendation suggested by the National Council Teachers of Mathematics (NCTM). In comparison, more White students are experiencing NCTM standards-based instruction (Lubienski, 2001). This differential instruction might be explained by teachers' expectations. Ferguson (1998) found that teachers' expectations, perceptions, and behaviors sustain and even expand the Black-White achievement gap, and concluded that the effects accumulate from kindergarten through high school. Lubienski (2001) found that the gaps between Black and White students as they relate to instructional practices were not attributable to socioeconomic differences, but to race.

Teacher Quality and Pedagogical Expertise

Instructional practices are related to teacher quality because teachers who are highly qualified have strong pedagogical knowledge and strong mathematical knowledge (Darling-Hammonds & Sykes, 2003). Unfortunately, students in schools with a large number of minority students and low-income populations have fewer qualified teachers than schools that have large White populations (Darling-Hammonds & Sykes, 2003). Approximately 33% of high school mathematics students in high minority schools and 30% of high school mathematics students in high poverty schools are taught by teachers without a teaching license or a major in mathematics (Wirt, Choy, Rooney, Provasnik, Sen & Tobin, 2004). This pattern can be contrasted with the figures reported in low minority and low poverty schools. Approximately 7% of high school mathematics students in low minority schools and 7% of high school mathematics students in low poverty schools are taught by teachers without a teaching license or a major in mathematics (Wirt et al., 2004). Minority students are less likely to be taught by teachers with strong pedagogical and mathematical knowledge could be a contributing factor in the mathematics achievement gap.

Teacher Expectations

Teachers form different expectations of students as a function of race, gender, and social class, and these expectations seem to be established in different ways (Baron, Tom, & Cooper, 1985; Secada, 1992). Jussim, Eccles, and Madon (1996) found that teacher expectations and perceptions had a significant effect on sixth grade students' grades and performance on a standardized mathematics assessment. They found that teacher expectations were almost three times greater for Whites than for African American and White students as they relate to instructional practices were not attributable to socioeconomic differences, but to race.

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Children of Color are Underrepresented in Gifted Programs

It is a well-known and documented fact that children of color are underrepresented in gifted programs (Baldwin, 1991; Bernal, 2002; Borland & Wright, 1994; Ford & Harris, 1999; Gallagher, 1994; Grantham, 2003; Maker, 1996; Morris, 2002). They are less likely to be nominated by teachers as potential candidates for gifted programs (Ford, Harris, Tyson, & Trotman, 2002) and, if nominated, are less likely to be selected for the program (Saccuzzo, Johnson, & Guertin, 1994), particularly when such traditional measures as IQ and achievement tests are used for identification (Ford et al.). The reasons for this are numerous and complex (Ford et al.) and include the same factors cited earlier for the achievement gap, which result in lower achievement of minority children. The lack of identification of gifted minority children contributes to the overall minority achievement gap in the United States and is significant waste of talent and ability.

A considerable amount of literature in the gifted field deals with the issue of altering identification procedures to increase the number of minority children in gifted education programs (Baldwin, 1994; Bernal, 2002; Borland & Wright, 1994; Ford, 1996; Ford & Harris, 1999; Frasier, 1987; Hiatt, 1994; Sarouphim, 1999; Van Tassel-Baska, Johnson, & Avery, 2002). Many researchers and practitioners suggest using multiple tests and alternative methods for finding gifted minority students, including performance-based assessment measures based on Gardner's theory of multiple intelligences (e.g., Baldwin, Sarouphim) or other models (Van Tassel-Baska et al.) and nonverbal ability assessments, such as the Naglieri Nonverbal Abilities Tests or Raven's Matrix Analogies Tests (Ford et al., 2002). Another body of literature in the gifted field has to do with the issues of providing a multicultural education and a multicultural curriculum and their impact on the achievement of gifted minority students (Ford et al., 2002). Major foci of the Javits funding over the past decade have been to increase the participation of minority

children in gifted programs and to develop model programs specifically designed to develop the talents and abilities of minority children (Ford, 1996; Hiatt, 1994).

John Ogbu (1992), a leading minority writer and researcher, suggested that, to address the achievement gap, special intervention programs should be instituted to help minority students learn specific attitudes, behaviors, and coping skills that enhance school success, including viewing high achievement as a means for advancement, not as a threat to one's identity or security. He also asserted that, for minority students, these special intervention programs can contribute to diluting a misconception that achieving is consonant with pretending to be White and accommodating to the mainstream culture, which places a high value on education and individual achievement.

In order to sustain this country's work force in science and engineering, it is essential that all available talent be used and more attention be placed on groups, such as Blacks, who are underrepresented in the American scientific community. Obviously, programs targeted at increasing black participation and performance in math and science-related fields will be important (Frankel, 1986).

Studies of Students in Mathematics, Science, and Computer Participation

In a review of studies of student mathematics, science, and computer participation and performance in grades four to eight, Lockheed, Thorpe, Brooks-Gunn, Casserly, and McAloon (1985) report a number of interesting findings. Briefly, they found that few studies focused on these grade levels. They could locate only 16 studies that examined ethnic differences in mathematics performance. These studies revealed a distinct pattern of performance, with Black students usually performing less well than Asians, Whites, and Hispanics. Only one study reported no ethnic differences. Six studies that examined sex differences within ethnicity were identified. Lockheed et al. concluded that differences in participation and performance attributable to ethnicity may be due largely to differences in family or socioeconomic status. In another study, Johnson (1984) examined the mathematics activities (i.e., reading about mathematics, having a mathematics-related hobby, etc.) of a sample of Black students in grade seven and eight and found overall low levels of participation, but no difference between sexes. In an analysis of 1981-82 National Assessment in Science data, Hueftle, Rakow, and Welch (1983) report that few studies have examined ethnic differences. They report that Black and White students indicate that they use computers in school at least once a week.

Overall, studies of students in the elementary/middle school grades reveal differences between blacks and whites in mathematics and science participation and performance; however, as Lockheed et al. (1985) argue, any conclusion drawn from these studies must be tentative because most do not control for family or socioeconomic background. It is important that Black students in these early years receive quality instruction in mathematics, science, and computer science. Children who are not taught science and mathematics well in their early years are unlikely to elect further courses in those subjects when they have a choice in high school (Turnbull, 1983).

Davis's study (1989) of Black student participation and performance in high school mathematics revealed some narrowing of the Black-White mathematics achievement gap. However, most of the improvement was limited to rote memory and quick recall and to Black students attending predominantly white high schools. She also found that taking advanced courses increased mathematics proficiency. Unfortunately, Davis found significant Black-White differences in patterns of advanced course taking. In addition, she found that Black students were more likely than their white counterparts to use computers for drill and practice rather than programming; especially Black students attending predominantly black schools.

College Degrees

A report by the National Science Foundation (1986) revealed that in 1984 Black college-bound seniors were slightly more likely than their White counterparts (41% versus 39%) to indicate an intended major in math or science. However, the study showed that Blacks earn a mere fraction of the degrees actually granted in science and engineering. Of the science and engineering degrees awarded in 1983, blacks earned 5.5 percent of the bachelor's, 3.8 percent of the master's and 2.2 percent of the doctoral degrees. These figures represent substantial underrepresentation given that Blacks accounted for 10 percent of overall undergraduate enrollment and 5 percent of graduate enrollment. In fact, since 1979, the proportion of Black earning science and engineering degrees at all levels has remained relatively unchanged. The study also showed that Blacks (89%) were more likely than Whites (79%) to earn their bachelor's degrees in science, while Whites were far more likely to earn degrees in engineering. Within science fields, however, more than four-fifths of Blacks earn degrees in just three fields: psychology, life sciences, or social sciences.

Intervention Programs

To improve the participation and performance of Black students in math and science, policy makers must know what to target and when to initiate intervention (Berryman, 1983). With regard to target, public and private funding should be directed toward programs that improve the quality of math and science instruction in elementary-middle school grades, especially in predominantly black school systems. This is important because math and science interests are formed during this early period, and the literature consistently reveals that Black students do not have the same opportunity as White students for quality instruction and facilities. The same holds for the high school level. From an educational policy position, Berryman (1983) suggests that by increasing mathematical and science high school graduation course requirements, Black student

preparation in these subjects would be improved. However, this presently seems an unlikely event in most states, so alternative strategies such as intervention programs must be used.

The struggle to close the gap in educational achievement between African American and Whites students could be enhanced by the current reforms or it could be seriously undermined. White overall educational attainment for Black Americans increased steadily between 1960 and 1990, this trend is reversing in some states that imposed graduation exams. By 1997, 87% of Black Americans between the ages of 25 and 29 completed high school with a diploma or an equivalency (NCES, 1998, p. 80); a trajectory that has closed much of the gap with White Americans in this regard. Dropout rates for 16-24 year old Black males students declined steadily between 1975 and 1990, but they have been increasing since 1990, reaching 13.3% in 1997 (NCES, 1999, p. 124). This trend may be related to the increasing use of exit examinations and the return of policies encouraging widespread grade retention without investment in improved teaching.

Concluding Remarks

In conclusion, the achievement gap between minority and White students remains a national issue. On national assessments in reading, writing, mathematics, and science, Black students' performance continues to lag behind that of White students, with uneven progress in closing the gap. In reading, large gains in Black students' performance throughout the 1970s and '80s have actually reversed since 1988, with scores registering declines for 13- and 17-year-olds since then. Scores in writing have also declined for eighth grade and eleventh grade Black students since 1988. Although there have been slight improvements in mathematics and science for 9 and 13-year-olds, the achievement gap has stayed constant or widened since 1990 (NCES, 1998, pp. 68-74). The lack of progress in student achievement during the 1990s is not surprising as the situation in many urban schools has deteriorated over the decade. Drops in real per pupil expenditures have accompanied tax cuts and growing enrollments. Meanwhile needs have grown with immigration, growing poverty, and increased numbers of students requiring second language and special educational services. In many cities, increasing numbers of unqualified teachers have been hired since the late 1980s; teachers who are even less prepared to deal with these needs than was the case when teaching force was more stable. American schools must accept the challenge of closing the achievement gap between minority and White students. The next century must reflect an upswing in the success of student learning in the African American community (Johnson & Kritsonis, 2006).

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