2006 Presidential Address

From the Achievement Gap to the Education Debt: Understanding Achievement in U.S. Schools
by Gloria Ladson-Billings

The achievement gap is one of the most talked-about issues in U.S. education. The term refers to the disparities in standardized test scores between Black and White, Latina/o and White, and recent immigrant and White students. This article argues that a focus on the gap is misplaced. Instead, we need to look at the “education debt” that has accumulated over time. This debt comprises historical, economic, sociopolitical, and moral components. The author draws an analogy with the concept of national debt—which she contrasts with that of a national budget deficit—to argue the significance of the education debt.

I have spent a better part of this year reading the presidential addresses of a number of former AERA presidents. Most take the wise course of giving addresses about something they know well—their own research. Of course, I was not fully persuaded by their wisdom. Instead, I attempted to learn something new, and, unfortunately, the readers will have to determine whether I learned it well enough to share it with my professional colleagues.

The questions that plague me about education research are not new ones. I am concerned about the meaning of our work for the larger public—for real students, teachers, administrators, parents, policymakers, and communities in real school settings. I know these are not new concerns; they have been raised by others, people like the late Kenneth B. Clark, who, in the 1950s, was one of the first social scientists to bring research to the public in a meaningful way. His work with his wife and colleague Mamie formed the basis for the landmark Brown v. Board of Education (1954) case that reversed legal segregation in public schools and other public accommodations. However, in his classic volume Dark Ghetto: Dilemmas of Social Power, first published in 1965, Clark took social scientists to task for their failure to fully engage and understand the plight of the poor.

To my knowledge, there is at present nothing in the vast literature of social science treatises and textbooks and nothing in the practical and field training of graduate students in social science to prepare them for the realities and complexities of this type of involvement in a real, dynamic, turbulent, and at times seemingly chaotic community. And what is more, nothing anywhere in the training of social scientists, teachers, or social workers now prepares them to understand, to cope with, or to change the normal chaos of ghetto communities. These are grave lacks which must be remedied soon if these disciplines are to become relevant (emphasis added) to the stability and survival of our society. (p. xxxi)

Clark’s concern remains some 40 years later. However, the paradox is that education research has devoted a significant amount of its enterprise toward the investigation of poor, African American, Latina/o, American Indian, and Asian immigrant students, who represent an increasing number of the students in major metropolitan school districts. We seem to study them but rarely provide the kind of remedies that help them to solve their problems.

To be fair, education researchers must have the freedom to pursue basic research, just as their colleagues in other social sciences do. They must be able to ask questions and pursue inquiries “just because.” However, because education is an applied field, a field that local states manage and declare must be available to the entire public, most of the questions that education researchers ask need to address the significant questions that challenge and confound the public: Why don’t children learn to read? What accounts for the high levels of school dropout among urban students? How can we explain the declining performance in mathematics and science at the same time that science and mathematics knowledge is exploding? Why do factors like race and class continue to be strong predictors of achievement when gender disparities have shrunk?

The Prevalence of the Achievement Gap

One of the most common phrases in today’s education literature is “the achievement gap.” The term produces more than 11 million citations on Google. “Achievement gap,” much like certain popular culture music stars, has become a crossover hit. It has made its way into common parlance and everyday usage. The term is invoked by people on both ends of the political spectrum, and few argue over its meaning or its import. According to the National Governors’ Association, the achievement gap is “a matter of race and class. Across the U.S., a gap in academic achievement persists between minority and disadvantaged students and their white counterparts.” It further states: “This is one of the most pressing education-policy challenges that states currently face” (2005). The story of the achievement gap is a familiar one. The
numbers speak for themselves. In the 2005 National Assessment of Educational Progress results, the gap between Black and Latina/o fourth graders and their White counterparts in reading scaled scores was more than 26 points. In fourth-grade mathematics the gap was more than 20 points (Education Commission of the States, 2005). In eighth-grade reading, the gap was more than 23 points, and in eighth-grade mathematics the gap was more than 26 points. We can also see that these gaps persist over time (Education Commission of the States).

Even when we compare African Americans and Latina/o with incomes comparable to those of Whites, there is still an achievement gap as measured by standardized testing (National Center for Education Statistics, 2001). While I have focused primarily on showing this gap by means of standardized test scores, it also exists when we compare dropout rates and relative numbers of students who take advanced placement examinations; enroll in honors, advanced placement, and "gifted" classes; and are admitted to colleges and graduate and professional programs.

Scholars have offered a variety of explanations for the existence of the gap. In the 1960s, scholars identified cultural deficit theories to suggest that children of color were victims of pathological lifestyles that hindered their ability to benefit from schooling (Hess & Shipman, 1965; Bereiter & Englemann, 1966; Deutsch, 1965). The 1966 Coleman Report, *Equality of Educational Opportunity* (Coleman et al.), touted the importance of placing students in racially integrated classrooms. Some scholars took that report to further endorse the cultural deficit theories and to suggest that there was not much that could be done by schools to improve the achievement of African American children. But Coleman et al. were subtler than that. They argued that, more than material resources alone, a combination of factors was heavily correlated with academic achievement. Their work indicated that the composition of a school (who attends it), the students' sense of control of the environment and their futures, the teachers' verbal skills, and their students' family background all contribute to student achievement. Unfortunately, it was the last factor—family background—that became the primary point of interest for many school and social policies.

Social psychologist Claude Steele (1999) argues that a "stereotype threat" contributes to the gap. Sociolinguists such as Kathryn Au (1980), Lisa Delpit (1995), Michèle Foster (1996), and Shirley Brice Heath (1983), and education researchers such as Jacqueline Jordan Irving (2003) and Carol Lee (2004), have focused on the culture mismatch that contributes to the gap. Multicultural education researchers such as James Banks (2004), Geneva Gay (2004), and Carl Grant (2003), and curriculum theorists such as Michael Apple (1990), Catherine Cornbleth (and Dexter Waugh; 1995), and Thomas Popkewitz (1998) have focused on the nature of the curriculum and the school as sources of the gap. And teacher educators such as Christine Sleeter (2001), Marilyn Cochran-Smith (2004), Kenneth Zeichner (2002), and I (1994) have focused on the pedagogical practices of teachers as contributing to either the exacerbation or the narrowing of the gap.

But I want to use this opportunity to call into question the wisdom of focusing on the achievement gap as a way of explaining and understanding the persistent inequality that exists (and has always existed) in our nation's schools. I want to argue that this all-out focus on the "Achievement Gap" moves us toward short-term solutions that are unlikely to address the long-term underlying problem.

**Down the Rabbit-Hole**

Let me begin the next section of this discussion with a strange transition from a familiar piece of children's literature:

*Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and being armed with curiosity, she ran across the field after it, and fortunately was just in time to see it pop down a large rabbit-hole under the hedge. In another moment down went Alice after it, never once considering how in the world she was to get out again.*

*Lewis Carroll, Alice's Adventures in Wonderland*

The relevance of this passage is that I, like Alice, saw a rabbit with a watch and waistcoat-pocket when I came across a book by economist Robert Margo entitled *Race and Schooling in the American South, 1880–1950* (1990). And, like Alice, I chased the rabbit called "economics" down a rabbit-hole, where the world looked very different to me. Fortunately, I traveled with my trusty copy of Lakoff and Johnson's (1980) *Metaphors We Live By* as a way to make sense of my sojourn there. So, before making my way back to the challenge of school inequality, I must beg your indulgence as I give you a brief tour of my time down there.

**National Debt Versus National Deficit**

Most people hear or read news of the economy every day and rarely give it a second thought. We hear that the Federal Reserve Bank is raising interest rates, or that the unemployment numbers look good. Our ears may perk up when we hear the latest gasoline prices or that we can get a good rate on a mortgage refinance loan. But busy professionals rarely have time to delve deeply into all things economic. Two economic terms—"national deficit" and "national debt"—seem to befuddle us. A deficit is the amount by which a government's, company's, or individual's spending exceeds income over a particular period of time. Thus, for each budget cycle, the government must determine whether it has a balanced budget, a budget surplus, or a deficit. The debt, however, is the sum of all previously incurred annual federal deficits. Since the deficits are financed by government borrowing, national debt is equal to all government debt.

Most fiscal conservatives warn against deficit budgets and urge the government to decrease spending to balance the budget. Fiscal liberals do not necessarily embrace deficits but would rather see the budget balanced by increasing tax revenues from those most able to pay. The debt is a sum that has been accumulating since 1791, when the U.S. Treasury recorded it as $75,463,476.52 (Gordon, 1998). Thomas Jefferson (1816) said, "I . . . place economy among the first and most important virtues, and public debt as the greatest of dangers to be feared. To preserve our independence, we must not let our rulers load us with perpetual debt."

But the debt has not merely been going up. Between 1823 and 1835 the debt steadily decreased, from a high of almost $91 million to a low of $33,733.05. The nation's debt hit the $1 billion mark in 1863 and the $1 trillion mark in 1981. Today, the national debt sits at more than $8 trillion. This level of debt means that the United States pays about $132,844,701,219.88 in interest each year. This makes our debt interest the third-largest expenditure in the federal budget after defense and combined entitlement programs such as Social Security and Medicare (Christensen, 2004).
Even in those years when the United States has had a balanced budget, that is, no deficits, the national debt continued to grow. It may have grown at a slower rate, but it did continue to grow. President Clinton bragged about presenting a balanced budget—one without deficits—and not growing the debt (King, J., 2000). However, the debt was already at a frighteningly high level, and his budget policies failed to make a dent in the debt.

The Debt and Education Disparity

By now, readers might assume that I have made myself firmly at home at the Mad Hatter’s Tea Party. What does a discussion about national deficits and national debt have to do with education, education research, and continued education disparities? It is here where I began to see some metaphorical concurrences between our national fiscal situation and our education situation. I am arguing that our focus on the achievement gap is akin to a focus on the budget deficit, but what is actually happening to African American and Latina/o students is really more like the national debt. We do not have an achievement gap; we have an education debt.

Now, to be perfectly candid, I must admit that when I consulted with a strict economist, Professor Emeritus Robert Haveman of the University of Wisconsin’s Department of Economics, La Follette Institute of Public Affairs, and Institute for Research on Poverty, he stated: “The education debt is the foregone schooling resources that we could have (should have) been investing in (primarily) low income kids, which deficit leads to a variety of social problems (e.g. crime, low productivity, low wages, low labor force participation) that require on-going public investment. This required investment sucks away resources that could go to reducing the achievement gap. Without the education debt we could narrow the achievement debt. . . . The message would be that you need to reduce one (the education debt, defined above) in order to close the other (the achievement gap). A parallel is trying to gain a growing and robust economy with a large national debt overhang.” (February 6, 2006, e-mail)

In addition to this informal discussion with Haveman, I read a work by Wolfe and Haveman (2001) entitled Accounting for the Social and Non-Market Benefits of Education, which catalogues a series of what they term “non-market effects of schooling.” The authors contend that “the literature on the intergenerational effects of education is generally neglected in assessing the full impact of education.” Among the nonmarket effects that they include are the following:

- A positive link between one’s own schooling and the schooling received by one’s children
- A positive association between the schooling and health status of one’s family members
- A positive relationship between one’s own education and one’s own health status
- A positive relationship between one’s own education and the efficiency of choices made, such as consumer choices (which efficiency has positive effects on well-being similar to those of money income)
- A relationship between one’s own schooling and fertility choices (in particular, decisions of one’s female teenage children regarding nonmarital childbearing)

- A relationship between the schooling/social capital of one’s neighborhood and decisions by young people regarding their level of schooling, nonmarital childbearing, and participation in criminal activities. (pp. 2–3)

While these economists have informed my thinking, I have taken a somewhat different tack on this notion of the education debt. The yearly fluctuations in the achievement gap give us a short-range picture of how students perform on a particular set of achievement measures. Looking at the gap from year to year is a misleading exercise. Lee’s (2002) look at the trend lines shows us that there was a narrowing of the gap in the 1980s both between Black and White students and between the Latino/a and White students, and a subsequent expansion of those gaps in the 1990s. The expansion of the disparities occurred even though the income differences narrowed during the 1990s. We do not have good answers as to why the gap narrows or widens. Some research suggests that even the combination of socioeconomic and family conditions, youth culture and student behaviors, and schooling conditions and practices do not fully explain changes in the achievement gap (Lee).

However, when we begin looking at the construction and compilation of what I have termed the education debt, we can better understand why an achievement gap is a logical outcome. I am arguing that the historical, economic, sociopolitical, and moral decisions and policies that characterize our society have created an education debt. So, at this point, I want to briefly describe each of those aspects of the debt.

The Historical Debt

Scholars in the history of education, such as James Anderson (1989), Michael Pultz (1995), and David Tyack (2004), have documented the legacy of educational inequities in the United States. Those inequities initially were formed around race, class, and gender. Gradually, some of the inequities began to recede, but clearly they persist in the realm of race. In the case of African Americans, education was initially forbidden during the period of enslavement. After emancipation we saw the development of freedmen’s schools whose purpose was the maintenance of a servant class. During the long period of legal apartheid, African Americans attended schools where they received cast-off textbooks and materials from White schools. In the South, the need for farm labor meant that the typical school year for rural Black students was about 4 months long. Indeed, Black students in the South did not experience universal secondary schooling until 1968 (Anderson, 2002). Why, then, would we not expect there to be an achievement gap?

The history of American Indian education is equally egregious. It began with mission schools to convert and use Indian labor to further the cause of the church. Later, boarding schools were developed as General George Pratt asserted the need “to kill the Indian in order to save the man.” This strategy of deliberate and forced assimilation created a group of people, according to Pulitzer Prize winner N. Scott Momaday, who belonged nowhere (Lesiak, 1991). The assimilated Indian could not fit comfortably into reservation life or the stratified mainstream. No predominately White colleges welcomed the few Indians who successfully completed the early boarding schools. Only historically Black colleges, such as Hampton Institute, opened their doors to them. There, the Indians studied vocational and trade curricula.
Latina/o students also experienced huge disparities in their education. In Ferg-Cadina’s report Black, White, and Brown: Latino School Desegregation Efforts in the Pre- and Post-Brown v. Board of Education Era (2004), we discover the longstanding practice of denial experienced by Latina/o dating back to 1848. Historic desegregation cases such as Mendez v. Westminster (1946) and the Lemon Grove Incident detail the ways that Brown children were (and continue to be) excluded from equitable and high-quality education.

It is important to point out that the historical debt was not merely imposed by ignorant masses that were xenophobic and viciously racist. The major leaders of the nation endorsed ideas about the inferiority of Black, Latina/o, and Native peoples. Thomas Jefferson (1816), who advocated for the education of the American citizen, simultaneously decreed the notion that Blacks were capable of education. George Washington, while deeply conflicted about slavery, maintained a substantial number of slaves on his Mount Vernon Plantation and gave no thought to educating enslaved children.

A brief perusal of some of the history of public schooling in the United States documents the way that we have accumulated an education debt over time. In 1827 Massachusetts passed a law making all grades of public school open to all pupils free of charge. At about the same time, most Southern states already had laws forbidding the teaching of enslaved Africans to read. By 1837, when Horace Mann had become head of the newly formed Massachusetts State Board of Education, Edmund Dwight, a wealthy Boston industrialist, felt that the state board was crucial to factory owners and offered to supplement the state salary with his own money. What is omitted from this history is that the major raw material of those textile factories, which drove the economy of the East, was cotton—the crop that depended primarily on the labor of enslaved Africans (Farrow, Lang, & Frank, 2005). Thus one of the ironies of the historical debt is that while African Americans were enslaved and prohibited from schooling, the product of their labor was used to profit Northern industrialists who already had the benefits of education. Consider the real source of New England’s wealth (from Farrow, Lang, & Frank, p. 6):

- By 1860, New England was home to 472 cotton mills, built on rivers and streams throughout the region.
- Just between 1830 and 1840, Northern mills consumed more than 100 million pounds of Southern cotton. With shipping and manufacturing included, the economy of much of New England was connected to textiles.
- By the 1850s, the enormous profits of Massachusetts industrialists had been poured into a complex network of banks, insurance companies, and railroads. But their wealth remained anchored to dozens of mammoth textile mills in Massachusetts, southern Maine, and New Hampshire.

This pattern of debt affected other groups as well. In 1864 the U.S. Congress made it illegal for Native Americans to be taught in their native languages. After the Civil War, African Americans worked with Republicans to rewrite state constitutions to guarantee free public education for all students. Unfortunately, their efforts benefited White children more than Black children. The landmark Plyer v. Ferguson (1896) decision meant that the segregation that the South had been practicing was officially recognized as legal by the federal government.

Although the historical debt is a heavy one, it is important not to overlook the ways that communities of color always have worked to educate themselves. Between 1865 and 1877, African Americans mobilized to bring public education to the South for the first time. Carter G. Woodson (1933/1972) was a primary critic of the kind of education that African Americans received, and he challenged African Americans to develop schools and curricula that met the unique needs of a population only a few generations out of chattel slavery.

The Economic Debt
As is often true in social research, the numbers present a startling picture of reality. The economics of the education debt are sobering. The funding disparities that currently exist between schools serving White students and those serving students of color are not recent phenomena. Separate schooling always allows for differential funding. In present-day dollars, the funding disparities between urban schools and their suburban counterparts present a telling story about the value we place on the education of different groups of students.

The Chicago public schools spend about $8,482 annually per pupil, while nearby Highland Park spends $17,291 per pupil. The Chicago public schools have an 87% Black and Latina/o population, while Highland Park has a 90% White population. Per pupil expenditures in Philadelphia are $9,259 per pupil for the city’s 79% Black and Latina/o population, while across City Line Avenue in Lower Merion, the per pupil expenditure is $17,261 for a 91% White population. The New York City public schools spend $11,627 per pupil for a student population that is 72% Black and Latina/o, while suburban Manhasset spends $22,311 for a student population that is 91% White (figures from Kozol, 2005).

One of the earliest things one learns in statistics is that correlation does not prove causation, but we must ask ourselves why the funding inequities map so neatly and regularly onto the racial and ethnic realities of our schools. Even if we cannot prove that schools are poorly funded because Black and Latina/o students attend them, we can demonstrate that the amount of funding rises with the rise in White students. This pattern of inequitable funding has occurred over centuries. For many of these populations, schooling was nonexistent during the early history of the nation; and, clearly, Whites were not prepared to invest their fiscal resources in these strange "others."

Another important part of the economic component of the education debt is the earning ratios related to years of schooling. The empirical data suggest that more schooling is associated with higher earnings; that is, high school graduates earn more money than high school dropouts, and college graduates earn more than high school graduates. Margo (1990) pointed out that in 1940 the average annual earnings of Black men were about 48% of those of White men, but by 1980 the earning ratio had risen to 61%. By 1993, the median Black male earned 74% as much as the median White male.

While earnings ratios show us how people are (or were) doing at particular points in time, they do not address the cumulative effect of such income disparities. According to economists Joseph Altonji and Ulfrect Doraszelski (2005),

The wealth gap between whites and blacks in the United States is much larger than the gap in earnings. The gap in wealth has impli-
cations for the social position of African Americans that go far beyond its obvious implications for consumption levels that households can sustain. This is because wealth is a source of political and social power, influences access to capital for new businesses, and provides insurance against fluctuations in labor market income. It affects the quality of housing, neighborhoods, and schools a family has access to as well as the ability to finance higher education. The fact that friendships and family ties tend to be within racial groups amplifies the effect of the wealth gap on the financial, social, and political resources available to blacks relative to whites. (p. 1)

This economic analysis maps well onto the notion of education debt—as opposed to achievement gap—that I am trying to advance. So, while the income gap more closely resembles the achievement gap, the wealth disparity better reflects the education debt that I am attempting to describe.

The Sociopolitical Debt
The sociopolitical debt reflects the degree to which communities of color are excluded from the civic process. Black, Latina/o, and Native communities had little or no access to the franchise, so they had no true legislative representation. According to the Civil Rights Division of the U.S. Department of Justice, African Americans and other persons of color were substantially disenfranchised in many Southern states despite the enactment of the Fifteenth Amendment in 1870 (U.S. Department of Justice, Civil Rights Division, 2006).

The Voting Rights Act of 1965 is touted as the most successful piece of civil rights legislation ever adopted by the U.S. Congress (Grofman, Handley, & Niemi). This act represents a proactive attempt to eradicate the sociopolitical debt that had been accumulating since the founding of the nation.

Table 1 shows the sharp contrasts between voter registration rates before the Voting Rights Act of 1965 and after it. The dramatic changes in voter registration are a result of Congress’s bold action. In upholding the constitutionality of the act, the Supreme Court ruled as follows:

Congress has found that case-by-case litigation was inadequate to combat widespread and persistent discrimination in voting, because of the inordinate amount of time and energy required to overcome the obstructionist tactics inevitably encountered in these lawsuits. After enduring nearly a century of systematic resistance to the Fifteenth Amendment, Congress might well decide to shift the advantage of time and inertia from the perpetrators of the evil to its victims. (South Carolina v. Katzenbach, 1966; U.S. Department of Justice, Civil Rights Division, 2006)

It is hard to imagine such a similarly drastic action on behalf of African American, Latina/o, and Native American children in schools. For example, imagine that an examination of the achievement performance of children of color provoked an immediate reassessment of the nation’s best teachers to the schools serving the most needy students. Imagine that those same students were guaranteed places in state and regional colleges and universities. Imagine that within one generation we lift those students out of poverty.

The closest example that we have of such a dramatic policy move is that of affirmative action. Rather than wait for students of color to meet predetermined standards, the society decided to recognize that historically denied groups should be given a preference in admission to schools and colleges. Ultimately, the major beneficiaries of this policy were White women. However, Bowen and Bok (1999) found that in the case of African Americans this proactive policy helped create what we now know as the Black middle class. As a result of the sociopolitical component of the education debt, families of color have regularly been excluded from the decision-making mechanisms that should ensure that their children receive quality education. The parent–teacher organizations, school site councils, and other possibilities for democratic participation have not been available for many of these families. However, for a brief moment in 1968, Black parents in the Ocean Hill–Brownsville section of New York exercised community control over the public schools (Podair, 2003). African American, Latina/o, Native American, and Asian American parents have often advocated for improvements in schooling, but their advocacy often has been muted and marginalized. This quest for control of schools was powerfully captured in the voice of an African American mother during the fight for school desegregation in Boston. She declared: “When we fight about schools, we’re fighting for our lives” (Hampton, 1986).

Indeed, a major aspect of the modern civil rights movement was the quest for quality schooling. From the activism of Benjamin Rushing in 1849 to the struggles of parents in rural South Carolina in 1999, families of color have been fighting for quality education for their children (Ledson-Billings, 2004). Their more

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limited access to lawyers and legislators has kept them from accumulating the kinds of political capital that their White, middle-class counterparts have.

**The Moral Debt**

A final component of the education debt is what I term the "moral debt." I find this concept difficult to explain because social science rarely talks in these terms. What I did find in the literature was the concept of "moral panics" (Cohen, 1972; Goode & Ben-Yehuda, 1994a, 1994b; Hall, Critcher, Jefferson, Clarke, & Roberts, 1978) that was popularized in British sociology. People in moral panics attempt to describe other people, groups of individuals, or events that become defined as threats throughout a society. However, in such a panic the magnitude of the supposed threat overshadows the real threat posed. Stanley Cohen (1972), author of the classic sociological treatment of the subject, entitled *Folk Devils and Moral Panics*, defines such a moral panic as a kind of reaction to

A condition, episode, person or group of persons [that] emerges to become defined as a threat to societal values and interests; its nature is presented in a stylized and stereotypical fashion by the mass media; the moral barricades are manned by editors, bishops, politicians and other right-thinking people; socially accredited experts pronounce their diagnoses and solutions; ways of coping are evolved or... resorted to; the condition then disappears, submerges or deteriorates and becomes more visible. Sometimes the subject of the panic passes over and is forgotten, except in folklore and collective memory; at other times it has more serious and long-lasting repercussions and might produce such changes as those in legal and social policy or even in the way society conceives itself. (p. 9)

In contrast, a moral debt reflects the disparity between what we know is right and what we actually do. Saint Thomas Aquinas saw the moral debt as what human beings owe to each other in the giving of, or failure to give, honor to another when honor is due. This honor comes as a result of people's excellence or because of what they have done for another. We have no trouble recognizing that we have a moral debt to Rosa Parks, Martin Luther King, Cesar Chavez, Elie Wiesel, or Mahatma Gandhi. But how do we recognize the moral debt that we owe to entire groups of people? How do we calculate such a debt?

Typically, we think of moral debt as relational between nations. For example, at the end of World War II, Israel charged Germany not only with a fiscal or monetary debt but also with a moral debt. On the individual level, Fred Korematsu battled the U.S. government for 40 years to prove that Japanese Americans were owed a moral debt. In another 40-year span, the U.S. government ran a study of syphilis patients— withholding treatment after a known cure was discovered—and was forced to acknowledge its ethical breaches. In his 1997 apology to the survivors and their families, President Bill Clinton said, "The United States government did something that was wrong—deeply, profoundly, morally wrong. It was an outrage to our commitment to integrity and equality for all our citizens... clearly racist" (Hunter-Gault, 1997). Today, all human subject protocols reflect the moral debt we owe to the victims of that study.

David Gill (2000) asserts, in his book *Being Good*, that "we are living today in an ethical wilderness—a wild, untamed, unpredictable landscape" (p. 11). We bemoan the loss of civil discourse and rational debate, but the real danger of our discussions about morality is that they reside solely in the realm of the individual. We want people to take personal responsibility for their behavior, personal responsibility for their health care, personal responsibility for their welfare, and personal responsibility for their education. However, in democratic nations, that personal responsibility must be coupled with social responsibility.

What is it that we might owe to citizens who historically have been excluded from social benefits and opportunities? Randall Robinson (2000) states:

No nation can evade a race of people for hundreds of years, set them free bedraggled and penniless, pitch them, without assistance in a hostile environment, against privileged victimizers, and then reasonably expect the gap between the heirs of the two groups to narrow. Lines, begun parallel and left alone, can never touch. (p. 74)

Robinson's sentiments were not unlike those of President Lyndon B. Johnson, who stated in a 1965 address at Howard University: "You cannot take a man who has been in chains for 300 years, remove the chains, take him to the starting line and tell him to run the race, and think that you are being fair" (Miller, 2005).

Despite those parallel lines of which Robinson speaks, in the midst of the Civil War Abraham Lincoln noted that without the 200,000 Black men who enlisted in the Union Army, "we would be compelled to abandon the war in 3 weeks" (cited in Takaki, 1998). Thus, according to historian Ron Takaki (1998), "Black men in blue made the difference in determining that this 'government of the people, by the people, for the people' did 'not perish from the earth' " (p. 21). What moral debt do we owe their heirs?

Think of another example of the ways that the labor and efforts of people of color have sustained the nation. When we hear the word "plantation," our minds almost automatically reflect back to the antebellum South. However, the same word evokes the Palolo Valley on the Hawaiian island of Oahu, where there were camps named "Young Hee," "Ah Fong," "Spanish A," "Spanish B," and "Alabama" (Takaki, 1998). This last camp—"Alabama"—was a Hawaiian plantation worked by Black laborers. Each of the groups that labored in the Hawaiian plantations—the Native Hawaiians, the Chinese, the Japanese, the Filipinos, the Koreans, the Portuguese, the Puerto Ricans, and the Blacks—drove a sugar economy that sold a worldwide sweet tooth (Wilcox, 1998). What do we owe their descendants?

And perhaps our largest moral debt is to the indigenous peoples whose presence was all but eradicated from the nation. In its 2004–2005 Report Card, the Bureau of Indian Affairs indicates that its high school graduation rate is 57%, with only 3.14% of its students performing at the advanced level in reading and 3.96% performing at the advanced level in mathematics. One hundred and twenty-two of the 185 elementary and secondary schools under the jurisdiction of the Bureau of Indian Affairs failed to meet Average Yearly Progress requirements in the 2004–2005 school year (Bureau of Indian Affairs, Office of Indian Education Programs, 2006).

The National Center for Education Statistics report *Status and Trends in the Education of American Indians and Alaska Natives* (Freeman & Fox, 2005) indicates that the dropout rate among this population is about 15%, which is higher than that of Whites, Blacks, or Asian/Pacific Islanders. Only 26% of American Indi-
ans and Alaska Natives completed a core academic track in 2000, while 57% of Asian/Pacific Islanders, 38% of Latinos, 44% of African Americans, and 48% of Whites completed core academic tracks during the same year (Freeman & Fox).

Taken together, the historic, economic, sociopolitical, and moral debt that we have amassed toward Black, Brown, Yellow, and Red children seems insurmountable, and attempts at addressing it seem futile. Indeed, it appears like a task for Sisyphus. But as legal scholar Derrick Bell (1994) indicated, just because something is impossible does not mean it is not worth doing.

Why We Must Address the Debt

In the final section of this discussion I want to attend to why we must address the education debt. On the face of it, we must address it because it is the equitable and just thing to do. As Americans we pride ourselves on maintaining those ideal qualities as hallmarks of our democracy. That represents the highest motivation for paying this debt. But we do not always work from our highest motivations.

Most of us live in the world of the pragmatic and practical. So we must address the education debt because it has implications for the kinds of lives we can live and the kind of education the society can expect for most of its children. I want to suggest that there are three primary reasons for addressing the debt—(a) the impact the debt has on present education progress, (b) the value of understanding the debt in relation to past research findings, and (c) the potential for forging a better educational future.

The Impact of the Debt on Present Education Progress

In a recent news article in the business section of the Cleveland Plain Dealer, I read that affluent investors are more likely to be educated, married men (Torres, 2006). The article continued by talking about how Whites make up 88% of wealthy investor households, while Blacks and Latinos make up only 3%. Asian Americans, who are 3.7% of the adult population, make up 5% of wealthy investors. But more salient than wealthy investor status to me was a quote in the article from former Federal Reserve Chairman Alan Greenspan: "My biggest fear for this country's future, competitively speaking, is that we're doing a poor job in education. If we can resolve our educational problems, I think we will maintain the very extraordinary position the United States holds in the world at large" (Torres, p. G6).

As I was attempting to make sense of the deficit/debt metaphor, educational economist Doug Harris (personal communication, November 19, 2005) reminded me that when nations operate with a large debt, some part of their current budget goes to service that debt. I mentioned earlier that interest payments on our national debt represent the third largest expenditure of our national budget. In the case of education, each effort we make toward improving education is counterbalanced by the ongoing and mounting debt that we have accumulated. That debt service manifests itself in the distrust and suspicion about what schools can and will do in communities serving the poor and children of color. Bryk and Schneider (2002) identified "relational trust" as a key component in school reform. I argue that the magnitude of the education debt erodes that trust and represents a portion of the debt service that teachers and administrators pay each year against what they might rightfully invest in helping students advance academically.

The Value of Understanding the Debt in Relation to Past Research Findings

The second reason that we must address the debt is somewhat selfish from an education research perspective. Much of our scholarly effort has gone into looking at educational inequality and how we might mitigate it. Despite how hard we try, there are two interventions that have never received full and sustained hypothesis testing—school desegregation and funding equity. Orfield and Lee (2006) point out that not only has school segregation persisted, but it has been transformed by the changing demographics of the nation. They also point out that "there has not been a serious discussion of the costs of segregation or the advantages of integration for our most segregated population, white students" (p. 5). So, although we may have recently celebrated the 50th anniversary of the Brown decision, we can point to little evidence that we really gave Brown a chance. According to Frankenberg, Lee, and Orfield (2003) and Orfield and Lee (2004), America's public schools are more than a decade into a process of resegregation. Almost three-fourths of Black and Latina/o students attend schools that are predominately non-White. More than 2 million Black and Latina/o students—a quarter of the Black students in the Northeast and Midwest—attend what the researchers call apartheid schools. The four most segregated states for Black students are New York, Michigan, Illinois, and California.

The funding equity problem, as I illustrated earlier in this discussion, also has been intractable. In its report entitled The Funding Gap 2005, the Education Trust tells us that "in 27 of the 49 states studied, the highest-poverty school districts receive fewer resources than the lowest-poverty districts. . . . Even more states shortchange their highest minority districts. In 30 states, high minority districts receive less money for each child than low minority districts" (p. 2). If we are unwilling to desegregate our schools and unwilling to fund them equitably, we find ourselves not only backing away from the promise of the Brown decision but literally refusing even to take Plessy seriously. At least a serious consideration of Plessy would make us look at funding inequities.

In one of the most graphic examples of funding inequality, new teacher Sara Sentilles (2005) described the southern California school where she was teaching:

At Garvey Elementary School, I taught over thirty second graders in a so-called temporary building. Most of these "temporary" buildings have been on campuses in Compton for years. The one I taught in was old. Because the wooden beams across the ceiling were being eaten by termites, a fine layer of wood dust covered the students' desks every morning. Maggots crawled in a cracked and collapsing area of the floor near my desk. One day after school I went to sit in my chair, and it was completely covered in maggots. I was nearly sick. Mice raced behind cupboards and bookcases. I trapped six in terrible traps called "glue lounges" given to me by the custodians. The blue metal window coverings on the outsides of the windows were shut permanently, blocking all sunlight. Someone had lost the tool needed to open them, and no one could find another... (p. 7)  

Rothstein and Wilder (2005) move beyond the documentation of the inequalities and inadequacies to their consequences. In the language that I am using in this discussion, they move from focusing on the gap to tallying the debt. Although they focus on Black-White disparities, they are clear that similar disparities...
exist between Latina/os and Whites and Native Americans and Whites. Contrary to conventional wisdom, Rothstein and Wilder argue that addressing the achievement gap is not the most important inequality to attend to. Rather, they contend that inequalities in health, early childhood experiences, out-of-school experiences, and economic security are also contributory and cumulative and make it near-impossible for us to reify the achievement gap as the source and cause of social inequality.

The Potential for Forging a Better Educational Future

Finally, we need to address what implications this mounting debt has for our future. In one scenario, we might determine that our debt is so high that the only thing we can do is declare bankruptcy. Perhaps, like our airline industry, we could use the protection of the bankruptcy laws to reorganize and design more streamlined, more efficient schooling options. Or perhaps we could be like developing nations that owe huge sums to the IMF and apply for 100% debt relief. But what would such a catastrophic collapse of our education system look like? Where could we go from the ground up to build the kind of education system that would aggressively address the debt? Might we find a setting where a catastrophic occurrence, perhaps a natural disaster—a hurricane—has completely obliterated the schools? Of course, it would need to be a place where the schools weren’t very good to begin with. It would have to be a place where our Institutional Review Board and human subject concerns would not keep us from proposing aggressive and cutting-edge research. It would have to be a place where people were so desperate for the expertise of education researchers that we could conduct multiple projects using multiple approaches. It would be a place so hungry for solutions that it would not matter if some projects were quantitative and others were qualitative. It would not matter if some were large-scale and some were small-scale. It would not matter if some paradigms were psychological, some were social, some were economic, and some were cultural. The only thing that would matter in an environment like this would be that education researchers were bringing their expertise to bear on education problems that spoke to pressing concerns of the public. I wonder where we might find such a place?

Although I have tried to explain this notion of education debt, I know that my words are a limited way to fully represent it. How can I illustrate the magnitude of this concept? In his 1993 AERA Presidential Address, "Forms of Understanding and the Future of Educational Research," Elliot Eisner spoke of representation—not the mental representations discussed in cognitive science, but the process of transforming the consciousness into a public form so that they can be stabilized, inspected, edited, and shared with others" (p. 6). So we must use our imaginations to construct a set of images that illustrate the debt. The images should remind us that the cumulative effect of poor education, poor housing, poor health care, and poor government services create a bifurcated society that leaves more than its children behind. The images should compel us to deploy our knowledge, skills, and expertise to alleviate the suffering of the least of these. They are the images that compelled our attention during Hurricane Katrina. Here, for the first time in a very long time, the nation—indeed the world—was confronted with the magnitude of poverty that exists in America.

In a recent book, Michael Apple and Kristen Buras (2006) suggest that the subaltern can and do speak. In this country they speak from the barrios of Los Angeles and the ghettos of New York. They speak from the reservations of New Mexico and the Chinatown of San Francisco. They speak from the levee breaks of New Orleans where they remind us, as education researchers, that we do not merely have an achievement gap—we have an education debt.

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A Qualitative Investigation of Factors Promoting the Retention and Persistence of Students of Color in STEM

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The literature on science, technology, engineering, and mathematics (STEM) is abounding with the importance of increasing college access, retention, and persistence among students because of implications for America’s global competitiveness. Particular emphasis has been placed on college students of color who remain underrepresented in STEM education. Therefore, increasing college access, retention, and persistence for students of color in STEM is not merely a matter of United States’ economic competitiveness, but also a matter of equity. Using in-depth interview methods, this article delineates factors facilitating the retention and persistence of students of color in STEM education at a predominantly White institution. Implications for institutional practice and research are provided.

Keywords: STEM, students of success, academic success, minority scholars

Various reports, researchers, policymakers, and national leaders have expressed the importance of the United States increasing its production of workers skilled in science, technology, engineering, and mathematics (STEM) to be competitive in the global economy (Dancy, 2010; Fries-Britt, Younger, & Hall, 2010; Guess, 2008; Moore, 2006; Museus, Palmer, Davis, & Maramba, 2011; Öztürk, 2007; Palmer, Davis, Moore, & Hilton, 2010; Palmer, Davis, & Thompson, 2010). With its current rate of workers skilled in the STEM field, the U.S. may not be able to compete with other countries in the global marketplace (Öztürk, 2007).

According to the Organisation for Economic Co-operation and Development (OECD), many OECD member countries have experienced significant growth in the number of researchers, (an indication of skilled workers in STEM), even surpassing the U.S. For example, while the number of researchers increased in OCED countries by 23.0% from 1993 to 1997, researchers in the U.S. increased only 11.8% (National Science Foundation, NSF, 2003). Furthermore, thirteen countries currently outrank the U.S. in the ratio of students who receive their first degree in natural science and engineering (NSF, 2003). Degree attainment in science and engineering fields among students in the U.S. has dropped in many areas of the physical sciences, engineering, mathematics, and computer science at the undergraduate and graduate level (NSF, 2003).

Given the need to increasing its production of STEM workers, America must focus on increasing college access, retention, and persistence among traditionally underrepresented groups (e.g., Black, Hispanic, Native American, and Southeast Asian American) pursuing STEM education in college (Dancy, 2010; Museus et al., 2011; Perna et al., 2009). According to another report by NSF (2010), despite some progress, students of color continue to experience problems accessing higher education and persisting to graduation (Maramba, 2008; Museus, 2008; Palmer, Davis, & Hilton, 2009; Strayhorn, 2008) especially in STEM (Moore, 2006; Museus et al., 2011; Öztürk, 2007). For example, between 1995 and 2007, the proportion of science and engineering degrees awarded to Asian Pacific Islanders, Blacks, Hispanics, and Native Americans increased from 8% to 9%, 7% to 8%, 6% to 8%, and 0.5% to 0.7%, respectively (NSF, 2010).

Nonetheless, Blacks and Hispanics are particularly underrepresented in relation to their proportion in the total population (NSF, 2010). Moreover, while the “Model Minority Myth,”
which espouses a perception that Asian Americans are academically talented and hardworking compared to other populations of group, promulgates the assumption that Asian Americans are overrepresented in higher education (Maramba, 2008; Museus, 2008; Palmer, 2010), particularly in STEM education (Hurtado, Cabrera, Lin, Arellano, & Espinosa, 2009), within-group disparities in college enrollment and persistence are noticeable among subgroups, especially Southeast Asian Americans (e.g., Vietnamese, Laotian, Cambodian, and Hmong) in STEM (Museus et al., 2011).

U.S. Census Bureau (2008) projections have Black, Hispanic, Asian, and Native American populations expected to grow rapidly over the next few decades. In fact, those populations will comprise approximately 50% of the total U.S. population by 2050. Given this projected growth, it is imperative that the U.S. place a concerted effort on increasing college enrollment, retention, and persistence of students of color in STEM education (Hurtado et al., 2008; Museus et al., 2011). Notwithstanding, the success of students of color in STEM education is a moral and ethical imperative (Museus et al., in press).

This study examined salient factors of retention and persistence among college students of color enrolled in STEM education at a predominantly White institution (PWI). While many researchers (e.g., Chang, Cerin, Han, & Saez, 2008; Cole & Espinosa, 2008; Hurtado et al., 2007, 2008; Leslie, McClure, & Oaxaca, 1998; Simpson, 2000) have used quantitative methods to examine success factors for students of color in STEM education, this study employs qualitative methods. Qualitative studies provide a richness and depth often missed by quantitative studies (Charmaz, 2000). Therefore, the study’s findings may inform research on STEM students’ as well as the practices of college personnel who serve such students.

REVIEW OF LITERATURE

Research has shown that supportive educational environments during college are positively linked to retention and persistence of students of color in STEM education (Bonous-Hammarch, 2000; Cole & Espinosa, 2008; Fries-Britt et al., 2010; Gloria & Kurplus, 2001; Grandy, 1998; Hurtado et al., 2007; Leslie et al., 1998). More specifically, support for students of color include role models of color, knowledge and lesson sharing from advanced students of similar ethnic groups, and relationships with staff of color. Furthermore, support that students of color receive from peers, mentors, and faculty are critical in success in STEM education (Bonous-Hammarch, 2000; Fries-Britt et al., 2010; Grandy, 1998; Hurtado et al., 2007; Seymour & Hewitt, 1997). In particular, Bonous-Hammarch (2000) explained that students of color, who receive mentoring during high school and college, are more likely to succeed in STEM education during college. Nonetheless, Grandy (1998) emphasized that the support students of color receive from faculty may have little impact on their grades, but it is positively related to their commitment to STEM education.

Summer pre-college programs have been found to enhance the retention and persistence of students of color in STEM education. According to Palmer and colleagues (2010), the Pre-Accelerated Curriculum in Engineering (PACE, http://ess.eng.morgan.edu/prospectivestudents/pre_freshman_programs/pace/html) program, a six-week intensive pre-college summer program at Morgan State University, exposes engineering students to critical thinking skills, advanced mathematics courses, English courses, mandatory tutorial support, and research/training. PACE introduces students to the engineering curriculum and facilitates engagement with engineering undergraduate students and faculty. The engineering program also provides students with peer tutoring/mentoring. Accordingly, upper-class students assist faculty in providing freshmen and sophomores with the academic support to help them develop the self-efficacy and academic skills required to successfully complete the engineering courses. Research has shown that this program is correlated with increased persistence for STEM students (Palmer et al., 2010).

Similarly, the Pre-Freshmen Academic Enrichment Program at the University of Maryland, College Park (Ternes, 2001) had higher retention and graduation rates for science majors of color compared to non-participants (Museus et al., 2011; Perna et al., 2009). Additionally, the Meyerhoff Scholars Program at the University of Maryland, Baltimore County (www.umbc.edu/meyerhoff)
has enjoyed notoriety because of its ability to diversify the STEM pipeline (Maton, Hrabowski, & Schmitt, 2000; Museus, 2008). Specifically, participants who engaged in Meyerhoff have achieved higher grade point averages and earned admissions into graduate programs at higher rates than non-participants (Perna et al., 2009).

Another factor promoting the retention and persistence of students of color in STEM education is participating in research experiences as undergraduates (Barlow & Villarejo, 2004; Hurtado et al., 2008). The literature is replete with the benefits of students of color engaging in research and its impact on their success in STEM education. For example, not only does participating in research help attract and retain students in science, but it also enhances the educational experiences of undergraduate students, and serves as a linchpin to careers in science. Moreover, undergraduate students engaging in research has been shown to enhance knowledge and understanding of STEM disciplines, have greater contact with faculty, foster problem-solving, technical and presentation skills, facilitate self-confidence, and provide greater insight and clarification of career goals (Carter, 2002; Hurtado, et al., 2008; Kardash, 2000; Lopatto, 2003, 2004; Mabrouk & Peters, 2000).

Some research has shown that there is a small, but negative relationship between retention and persistence for students in STEM and advisors (Cole & Espinoza, 2008). Specifically, Grandy (1998) reported that because students had contact with advisors who were more knowledgeable in fields outside of science and engineering, they may be more inclined to switch to another major they perceive as enhancing their ability to contribute to society. Moreover, Bonous-Hammerth (2000) found that active involvement on campus outside of STEM related activities can have a negative impact on persistence for students of color. Involvement of this sort can impinge upon students’ ability to engage fully in their disciplines. Additionally, the availability for financial aid can be a hindrance or facilitator of persistence for all students (Palmer et al., 2009), specifically, students in STEM (Fenske, Porter, & DuBrock, 2000). According to Fenske and associates, “The National Action Council for Minorities in Engineering states the availability of adequate financial aid resources is among the top five factors related to minority persistence in Engineering” (p. 69).

Furthermore, while minority serving institutions (e.g., historically Black college and universities (HBCUs) and Hispanic serving institutions, Hurtado et al., 2009; Perna et al., 2009) have been found to facilitate persistence for students of color in STEM education, the ‘chilly campus climate’ of PWIs, specifically in the classroom, has been linked to attrition for students of color in STEM (Cabrera, Colbeck, & Terenzini, 2001). Specifically, Cabrera and colleagues explained that

"a classroom . . . permeated by prejudice . . . on the part of faculty and peers has emerged as [a] . . . factor accounting for differences in college adjustment, majoring in hard science, and persisting in college between White men, women, and minority students. (p. 334)"

**METHODOLOGY**

The authors conducted this study at a public, mid-size research intensive PWI, located in the northeast region of the United States. Approximately 12,000 students were enrolled when data were collected. Forty-five percent of students enrolled at this institution are White, and their Asian, Black, Hispanic, and their racially/ethnicly unknown counterparts comprise 13%, 6%, 7%, and 22%, respectively. Approximately 46% of White students matriculating at this institution complete a baccalaureate degree within 6 years, while that figure is 13% for Asian, 9% for Black and Latina/o students, and 25% for racially/ethnicity unknown students.

Using in-depth interview methods, the authors sought to explore the academic and social experiences of a particular group of students situated in a particular context (Lincoln, 2002). Therefore, the study’s epistemological approach was anchored in the constructivist tradition to construct knowledge, understanding, and meaning through human interactions (Lincoln, 2002). To some extent, grounded theory strategies were incorporated into the research process. These strategies were not confined to the interview process, but rather occurred throughout the entire
research process. Specifically, strategies of continuously asking questions, using research notes, exploring hunches, making constant comparative analysis, and memo writing were employed (Charmaz, 2000).

Participants

With the help of university administrators, the authors recruited students of color who majored in STEM, specifically, focusing on juniors and seniors who had attained a grade point average (GPA) of 2.5 or above. Additional participants were recruited through snowball sampling. Snowball sampling is the process of asking those who have participated in the study to refer others who meet the study's criteria (Creswell, 2003). The authors focused on upperclassmen students because they would be more in-depth about factors promoting their success in STEM. It is important to note that this is an on-going study. Thus far, 6 students whose experiences will be shared in this current study were recruited. Table 1 provides details about the participants. Pseudonyms were used to maintain the anonymity and confidentiality of each participant.

Table 1

<table>
<thead>
<tr>
<th>Name (pseudonym)</th>
<th>Age</th>
<th>Classification</th>
<th>Major</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kevin</td>
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<td>Senior</td>
<td>Bioengineering</td>
<td>3.1</td>
</tr>
<tr>
<td>Catherine</td>
<td>20</td>
<td>Junior</td>
<td>Biology</td>
<td>3.3</td>
</tr>
<tr>
<td>Darrell</td>
<td>21</td>
<td>Senior</td>
<td>Biology</td>
<td>3.5</td>
</tr>
<tr>
<td>Kelly</td>
<td>21</td>
<td>Senior</td>
<td>Psychobiology</td>
<td>3.9</td>
</tr>
<tr>
<td>Larry</td>
<td>21</td>
<td>Senior</td>
<td>Computer Science</td>
<td>3.5</td>
</tr>
<tr>
<td>Tiffany</td>
<td>21</td>
<td>Senior</td>
<td>Psychobiology</td>
<td>3.8</td>
</tr>
</tbody>
</table>

The sample consisted of one junior and five seniors. Specifically, the study included three Black males and three Southeast Asian females. Their majors ranged from biology to computer science. The average participant age was 21 years and the average GPA was 3.5.

Data Collection

One face-to-face, in-depth interview was conducted, which ranged from 90 to 110 minutes with each participant. As an incentive and recruitment method, all participants received a $10 gift certificate for their participation. Prior to beginning these interviews, participants signed a consent form, completed an open-ended questionnaire, and completed a demographic form. During interviews, the participants were asked about their academic and social experiences as they relate to STEM at the institution. The authors recorded observations regarding the ways in which participants responded to questions and their willingness to engage in the interview. Follow-up telephone interviews were also conducted with participants to ask them to elaborate on themes discussed or clarify issues that emerged during the interviews. All interviews were audio-taped and transcribed verbatim.

Data Analyses

The authors used constant comparative analysis on research notes, observations, and interview transcripts to identify recurring or unique topics (Strauss & Corbin, 1998). According to Jones, Torres, and Arminio (2006), constant comparative analysis engages the researcher in a process of collecting and analyzing the data simultaneously at "all stages of the data collection and..."
interpretation process, and results in the identification of codes" (p. 44). Specifically, as the data were collected and transcribed, the authors read through the research notes and made self-reflective notes in the margins to help form initial themes. These notes included questions and speculations about the data and themes that emerged. As the data became increasingly voluminous, ATLAS-ti (5.0), a qualitative data management software program was used, to organize, manage, and code the data. The authors used open coding, which involved analyzing the data line by line, to identify themes. The line by line coding allowed for themes to emerge from the data and become aggregated into response patterns (Strauss & Corbin, 1998). This process continued until the data reached a point of saturation—which is when it becomes redundant (Bogdan & Biklen, 1998). Furthermore, memo writing allows one to not only refine the categories, but also to understand the relationships among them. In discussing the findings, excerpts are presented from the participants’ responses verbatim to preserve the essence of the participants’ voices.

Credibility and trustworthiness. Several techniques were employed presented by Merriam (1998) to ensure credibility of the study. For example, the authors provided “thick description” so others interested can draw their own conclusions from the data. Moreover, providing thick description enables the reader to vicariously experience the participants’ social reality at the institution.

To ensure the data’s trustworthiness, member checks were conducted by returning the transcribed interviews to all participants so that they could review them for accuracy and clarity following the interviews (Jones et al., 2006). Specifically, participants were invited to add, delete, or otherwise comment on the transcriptions. Their feedback was used to enhance the integrity and preserve the authenticity of the participants’ voices. Lastly, these authors used feedback from five peer-debriefers, who held expertise in qualitative methods and are researchers on students of color in STEM, to ensure credibility. Debriefers were provided with raw transcripts from each participant. These debriefers engaged the researchers in a series of on-going discussions about the tentative meanings made of the participants’ experiences throughout the research process (Jones et al., 2006).

Limitations. Several limitations in this study are readily apparent. First, this study was conducted at one PWI with a small sample size. However, the authors provided thick descriptions so others can decide the transferability of this study to their institutions. Furthermore, interviews may not be an effective way to collect reliable information when the questions pertain to matters the participants perceive as personally sensitive. Notwithstanding, the authors proceeded with this approach because researchers (e.g., Guiffrida, 2004; Kuh & Love, 2000) explained the importance of qualitative inquiry when investigating the experiences of students of color. Finally, the accuracy of the findings is contingent upon how well the data were analyzed, although this is true for all research studies.

Findings

In this section, three main themes are summarized, which emerged from the interviews: (a) peer group support, (b) involvement in STEM related activities, and (c) strong high school preparation. The first theme includes participants’ descriptions of the value of peer group support and the positive influence peers have on academic success. The second theme explores the importance of involvement in STEM oriented activities on and off campus. In addition, their involvement in these specialized activities helped them expand their understanding of the STEM professions and opportunities. The third theme discusses the participants’ strong preparation in high school with science courses and the high expectations that their high school teachers placed on them. In the following section, themes are delineated and quotes from participants are presented to preserve the essential aspects of their experiences.
Peer Group Support

The participants spoke in-depth about the peer support they received in college. All of the participants mentioned that it was important to have peers who had the same goal of doing well and supporting each other in their STEM major. Peer support was described in two different ways: (a) served as support for their academic work and (b) provided a positive social network.

First, all of the participants discussed the importance of peer support groups and their positive connection to academic success. In particular, participants mentioned that studying together helped them comprehend and retain class material more effectively. Because much of the coursework involved complex equations and vast amounts of memorization, such groups helped tremendously in their pursuit to do well in their classes. For example, Catherine, a 20-year-old junior, biology major, whose goal was to apply to medical school, shared that her study group helped explain course concepts that she did not understand in lecture and helped with putting together everyone's ideas to understand a concept. She added that her peer support group also reaffirmed class material in which she already had a firm grasp. Specifically, she shared the following:

Group studying helps out a lot. For example, when there is a concept I thought I understood, but it turns out I really didn't, someone in the group ends up explaining it better for me. And sometimes you think you know something and three people in your study group have a different idea about it. Then, you just put all the ideas out there and you just try to piece it together to see what makes sense.

All the students talked about the intense pressure to do well on exams. Studying in peer groups helped alleviate the pressure because it gave students confidence in taking the exams. For example, Tiffany, a 21-year-old senior, psychobiology major, explained that studying in a group allowed her to feel self-assured when she took exams. It also helped her study material that she would have never considered as important had it not been for her study group. She noted:

you know in a study group, they bring out stuff that you never even thought about and then it ends up on the exam ... then you're just like, "Yes, thank goodness that person studied that or else I never would have realized." So some groups really help a lot and I feel good about it. I guess peers are very important when it comes to really helping each other out especially in STEM.

The students discussed the importance of having their peer support group consist of students in similar classes who are also goal-oriented. For example, Kelly, a 21-year-old senior, psychobiology major, shared that having the same classes with a group of students helped because she could then study with them. She said that because some students in the class had the same goal as her of keeping up with the work and doing well, study groups helped because they could also teach each student to understand the material better. Specifically, she stated:

Because they're in your class, you'll know in your discussions, it makes things a lot easier because you know if you don't understand something maybe they'll know it ... I feel like teaching someone else really helps you with learning the topic better ... me and my friend have the same classes together because we're both bio majors so I tell him about assignment deadlines and that stimulates him to be like, "we have a quiz coming up, so do you want to get together to study?" And that really helps. It sort of keeps me in check and I keep him in check.

Kevin, a 21-year-old senior, bioengineering major, agreed with the other participants about peer interaction and its relationship to studying. In fact, Kevin explained that as a student of color in STEM, he believed that studying in peer group is extremely important. He also mentioned the value of the social aspect of studying together. He shared that he was saddened to see a number of students of color in his classes at the beginning of his first year and by the end of his first year he observed that more than one-half dropped out or changed to non-STEM majors. He believed that study groups help students manage the large amounts of material they must retain. He mentioned
that study groups are important in retaining students in STEM majors and he valued the social aspect of studying together. As such, he explained:

Forming study groups for students of color in STEM can actually [help them] understand how much they should be studying. You go to class everyday and you realize a test is coming up, but you don’t realize the sheer volume of information that is going to be tested in the intro to bio and intro chemistry courses. Having more study groups that’s going to intensify studying [is important]. Somehow it also combines social aspects [too].

Similar to other students, Larry, a 21-year-old senior, computer science major, shared that he owed much of his success to his supportive friends, who helped him get through his classes. During his freshman year, Larry felt intimidated and felt “like I was behind, didn’t fit in . . . like everyone knew so much . . . it wasn’t easy for me to meet people to study with.” He mentioned that he studied with the few students of color in his classes, which allowed him to feel more comfortable in his computer science major. Larry explained that the ethnic makeup of his study group was Chinese, Black, Hispanic, and Native American students. He said that they are “almost like family, so we kind of built a family atmosphere you know. I kind of surrounded myself with the same people throughout college.” Upon reflection, Larry believed that the support kept him going and that that they were “all born in a position to graduate.” Currently, his friends, including himself, all have job offers. This student also discussed how he and his support group helped each other. There were times where he just wanted to go home after group meetings but instead, he stayed in the library to get more work done. “I learned a lot from them and about the kind of work ethic it really takes [to succeed].”

Involvement in STEM-related Activities

The second theme was the value that the participants placed on being involved in STEM-related activities. Being involved in extracurricular activities gave students a chance to extend their science knowledge to practical knowledge. Extracurricular activities included involvement in STEM student organizations, being a teaching assistant, participating in STEM summer programs, and interacting with alumni and those currently in STEM professional fields. All the students felt that these activities complemented their STEM courses. For example, Kevin described his experience in a summer research fellowship program. He believed that being a participant in the program served as a turning point for him. Before he entered the summer program, he was feeling discouraged because of the pressure of demanding chemistry and physics classes and studying for the Medical College Admission Tests (MCATs). After his summer experience, he felt the program positively reinforced his decision to be in the science field. He was excited to have hands-on experience such as taking part in surgeries, interacting with medical residents, and conducting rounds with them. He shared:

I had a chance to work with residents everyday and see patients and it kind of showed me the light at the end of the tunnel . . . so I knew that this is what I wanted to do and I became even more focused. . . . My doctor [with whom he did rounds] was a neurologist. He would take me on rounds . . . and I got to see a lot of patients and a lot of different cases.

Participants also stressed how being involved in lab experiments was enjoyable and helped them learn about hands on research. Darrell, a 21-year-old senior, biology major, for example shared that his research lab gave him another perspective on how to effectively investigate experiments similar to that of a principal researcher. He believed he gained valuable experience that would help him successfully apply for medical school. Specifically, he noted:

My independent research lab . . . that’s what absolutely opened my eyes to the field of research. What I took away from that was just how important research is and exactly why med schools are looking for
research experience. Not just because they want you to contribute to the field of research but it is more about being a doctor. You have to have that investigator’s mind to figure out problems like a principal investigator of a research lab.

The participants’ involvement in student organizations was also important, particularly pre-med or pre-health ethnic minority-oriented groups. These organizations not only provided more information about opportunities available to enhance the participants STEM experience but also engaged them in leadership roles. Some of the students held leadership positions in these organizations, which allowed them to gain skills valuable toward achieving their future goals. For other students, these student organizations provided information that would not normally be presented in their courses. For example, Darrell discussed a number of benefits students received from their involvement: “We got to attend a national medical association conference, network with doctors, and did clinical workshops.” Moreover, Catherine, who was the secretary of the pre-health society, felt her involvement reinforced her decision to become a doctor. She also shared that her experience expanded her understanding of medical school admissions process and meeting current medical students:

Right now I’m the secretary [of a pre-health ethnic organization]. One of the things I got involved with [help planning] was a conference in New York City. We got to meet medical school admissions and people from various other medical schools, you get to meet med students and get all these freebies. It was a lot of fun and I think that really, you know, propelled my career in medicine. I met all the students there and discuss a lot of different things like careers in health care, health care disparities.

These pre-health, pre-med organizations also increased students’ awareness of other STEM career options. For example, Tiffany shared her positive experience of getting involved in these types of organizations and expanding her career options in STEM:

I went to a general interest meeting and [they talked about] options if you get rejected from medical school. That’s why I began to look into optometry school because besides medical school I can have that option as a Plan B . . . I didn’t think about optometry school before then.

A few other students, however, did not get involved in extracurricular activities their first year because they felt that it might deter them from focusing on their courses. For example, Kevin admitted that he did not join any activities during his freshman year because he felt he just needed to “do his homework.” But he soon realized that joining a club might make him feel more comfortable with his major, therefore, he joined the National Society of Black Engineers (NSBE). He described that he felt he “could go there and people are willing to outreach to me, people want to hear what I have to say . . . and I didn’t ‘stick out.’” Being part of NSBE felt like he could “be himself” and provided a high level of comfort in the university that he did not have before joining the student organization.

Strong High School Preparation

All of the participants discussed the strong preparation they had in high school. They described both their participation in advanced science classes and the teachers who invested time to encourage them to pursue science-related fields. Others shared their involvement with high school programs that exposed them to health and medical disciplines. Still, others had parents who moved in order for their children to attend a science intensive high school. The following are some of the students’ descriptions of their intensive preparation for college in their high school years. Specifically, Larry shared:

We had a lot of AP courses. I would say [they had] goals to prepare you for college and I remember my AP high school teachers always saying “Well in college you’re going to have this amount of work so you’d better deal with it now.” In a sense it did help because I know my AP psych teacher made these
really extensive outlines of chapters. In a sense, it prepared me ‘cause the AP courses were a lot harder than regular high school courses.

Furthermore, Darrell shared that his mother moved the family because she wanted him and his brother to attend a “very good high school” that eventually prepared him well for college. This high school offered courses that allowed him to build a firm foundation for his science courses he would later take in college. He shared the following:

I think it [high school] prepared me very well. . . . In physics, I think I did really well because I had a really amazing physics teacher in high school, same in biology. . . . It [basic concepts] helped build upon it much faster than my other [college] classmates who maybe didn’t have a good physics or biology background . . . so that [AP classes] helped me when I came to the university.

In addition to Larry and Darrell, Kelly spoke of the various college preparation activities and programs that she attended during high school. She reflected on a discussion she had with a college student who gave her valuable advice about college study tips. She proudly shared that she continues to apply his advice to her current study regimen. She also described her experience in her high school that heavily emphasized college preparation:

I remember a lot of times there would be someone from some school or program that came into classes and would discuss interviewing techniques, how to write a college essay. So I would say that my high school was so focused on getting us into college . . . I met a med school student at a high school program. He said when he first got to college he shared that he thought that he can just have the weekend to study and he ended up getting a “D” on the exam . . . and I was like that’s not going to be me. He said the next time he used two weeks to study and got an “A.” So I [said to myself] two weeks before is a good time to study. When I went into college, that’s what I used and still use it now. It helped a lot. It keeps you from cramming.

Additionally, students spoke of particular teachers who encouraged them to prepare well for the future and what careers they might consider. For example, Darrell described his discussions with his law teacher in high school and how she helped him decide to get into the medical field. He shared:

I knew when I was in high school that I wanted to be a doctor or a lawyer after talking with my practical law teacher. She had her law degree from a really good law school and she passed the bar. [Through our discussions], I decided that I wanted to do something where I was going to be helping someone every day, so I chose medicine.

Students also discussed their extracurricular high school involvement that prepared them for science related fields. Some of these activities included volunteering at hospitals or participating in medical school career recruitment programs. These activities helped to reinforce their decision to enter health and medical related careers. For example, Tiffany engaged in an activity at Cornell Medical School. Her participation helped in her decision to pursue medicine as a career.

In high school, I participated in a program at Cornell Medical School. It was the health career recruitment and education, exposure program. They showed their gross anatomy lab and what it’s like to be a med student. Then they guide us into the whole college application process. It was like a mentoring program and that’s how I got interested.

Students also shared their positive experiences with guidance counselors at their high school. Although these counselors did not necessarily assist with academic concerns, guidance counselors helped facilitate the preparation for those who wanted to be STEM majors. Students mentioned that they met with these counselors on a regular basis. This sentiment was shared by a number of the participants. For example, students mentioned that because they were in honors classes, they had
counselors who made sure that they were on the college track, more specifically the STEM track. As Larry shared, “If you were lucky enough to be in the honors classes and have a good guidance counselor, like mine, she was helpful, approachable and always willing to talk and help you with anything.”

**DISCUSSION AND IMPLICATIONS**

In conducting this study, the authors sought to improve the understanding of factors that promote the retention, persistence, and success among college students of color pursuing degrees in STEM fields. The students who participated in this study identified pre-college academic outcomes and social experiences pertaining to their STEM fields of choice. These experiences centered more specifically on solid academic preparation in high school and additional formative experiences provided by peer engagement and participation in STEM-related activities. This study was advanced by analyzing interview data on secondary education preparation, personal and educational factors that both support and challenge desired academic outcomes, and collegiate opportunities to further foster the development study participants identified.

This study yielded three themes. First, the results indicate that peer support matters to participants’ success in critical ways both academic and social. With respect to academic engagement, participants likely mastered course content when lessons were reinforced in peer groups. The groups fostered safe, engaging climates for asking questions that participants did not, or were reticent to, ask during class. Participants also identified peer groups as providing healthy balance in a world where academic performance anxieties are normalized as participants feel pressured to master material to achieve educational and career-related goals. Participants also noted social benefits involved with peer group support among STEM students. Social benefits largely involved encouragement and motivation which participants felt was important to their constructions of self-efficacy and reinforced decisions to pursue STEM majors.

Second, study results showed that participants value involvement in STEM-related activities. Accordingly, these students suggest that college student affairs has an important role to play in facilitating this involvement. Emphasis participants placed on STEM-related student organizations on campus (e.g. Pre-med club, Biology club). Out-of-class engagement in these ways promotes community among like-minded students as well as communication skills which hold practical relevance to students’ STEM-related goals. Similarly, practical experiences during matriculation were salient to how study participants’ made meaning of themselves as students of color in STEM.

One way practical experiences mattered involves if and how academic programs connected philosophical foundations of the STEM fields to practice. According to participants, these experiences showed great promise in expanding their purview of the field and career options. Also, study participants felt that practical experiences around their STEM majors improved their senses of self-efficacy. Therefore, colleges and universities were in a valuable position to shape participants’ understandings of whom and what they can become professionally. Pairing academic work with a range of practical and extracurricular experiences (e.g. site visits/field trips, guest speakers, speaker panels, practicum experiences, internships) gives these students a more well-rounded experience in their academic programs. In addition, study data suggest that colleges and universities needed to meaningfully situate all STEM experiences in the broader career trajectory of these students. In other words, practical experiences are not only important for fulfilling course and major requirements, but are also valuable for building a future in students’ fields and knowledge of selves as professionals.

Third, participants indicated that retention and success in STEM is connected to elementary and secondary preparation. Accordingly, students of color credited their success to the strong academic preparation that they received in K-12 educational contexts. Furthermore, these students were exposed to school activities which only served to increase their awareness about STEM fields and how success in STEM subjects in schools matter for postsecondary and career success.
Colleges and universities have opportunities to team with schools in developing STEM pipelines which are not only important for enrollment but retention. Successful programs exist at universities including, The University of Michigan, Rochester Institute of Technology, University of Arizona, and New Jersey Institute of Technology. Many of these programs embed summer enrichment components, skill-building workshops, and tutoring programs.

Study participants remind colleges and universities that they must focus beyond enrollment and on issues of retention and graduation of students of color enrolled in STEM majors. Participants' statements about their experiences as STEM majors in college align in many ways with STEM majors in college generally. Specifically, study data support that these students require proactive student support services (e.g. tutoring, peer networks) and creative experiences to retain and succeed in STEM majors. Students' words suggested that senior-level administrators must express commitment to not only recruitment but also retention of students of color in STEM. Subsequently, they must support accountability-based plans of assessment and action. These devices are possible, and according to participants, colleges and universities are in position to build confidence, particularly among students of color in STEM majors.

The participants in this study would benefit if colleges and universities attempted to deconstruct climates of intimidation in which study participants felt their confidence in their abilities is challenged. Study participants suggest that these climates are fostered by complex and rigorous content, competition among students, and pressures to show they belong in the majors they declared. Faculty are encouraged to develop inclusive pedagogies which acknowledge for the different ways in which students learn and also help disrupt student feelings of intimidation (Fries-Britt et al., 2010). Similar efforts are also required in K-12 contexts in which these students began preparation for successful STEM careers. The data also suggest additional efforts colleges and universities may develop toward engaging students of color in STEM.

Finally, the students in this study would feel more engaged in STEM programs that fostered a sense of community among faculty, students, STEM alumni, and professionals in STEM fields. The students of color in this study felt validated within a community that affirmed their presence and abilities to succeed in fields they select. Personal, social, and academic supports were embedded in peer groups and in the work of mentors or advisers who helped move students through the pipeline. Although this study found factors, additional areas for research are apparent.

While the study described is qualitative in scope, large scale studies of students of color in STEM fields are also required to present a generalizable picture of students' experiences. All studies, whether quantitative or qualitative, should investigate successful pipeline programs in STEM that effectively transition students of color from secondary to postsecondary contexts. In addition, empirical study is needed on student background, particularly on how families and communities influence students' attitudes toward pursuing STEM fields.

CONCLUSION

College access and success among students of color in STEM is critically important to the nation’s economic competitiveness in the global economy as well as higher education equity agendas. These agendas require attention to the severe underrepresentation of students of color in higher education, specifically STEM fields. This article has discussed factors critical to the success of students of color in STEM at a PWI and provided recommendations for institutional practice and future research. While this article is predicated on one PWI with a modest sample size, institutional leaders, policymakers, and student affairs practitioners may find the recommendations significant in supporting access, retention, and persistence among students of color in STEM disciplines.

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