The Political Economy of Teacher Quality in School Mathematics

African American Males, Opportunity Structures, Politics, and Method

William F. Tate IV  
Washington University, St. Louis, Missouri

Mathematics education is linked to modern technological advancement, citizenship, and matters of political economy. Access to quality mathematics teachers can have a profound influence on African American males. This article focuses on several salient issues related to the question “What is a qualified teacher?” In particular, the article describes common concerns and challenges associated with teacher quality and the advancement of African American males and other traditionally under served demographic groups in mathematics.

Keywords: African American males; mathematics education; teacher quality

If teaching can be entrusted to those who have just completed a four-year liberal arts college program, coupled with a brief internship and a course in psychology, then we have no serious problem staffing our schools. In brief, if anybody who successfully emerges at a college commencement with his sheepskin in his pocket can be certified to teach, then the supply can be made to balance the demand. There are apparently some influential people in this country who would settle for this solution and be content. Lower taxes would result, although the ultimate effect on the gross national product might not be so favorable. So we have to examine what is meant by qualified and able.

Elsbree, 1959, p. 328

Professor Elsbree held a faculty position and served as the director of the Division of Administration and Guidance at Teachers College-Columbia University. Elsbree’s remarks were made in the context of the post-Sputnik political environment. He argued that few people realized that there was no more important social question

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facing the United States than how to staff the public schools with fully qualified teaching personnel. Furthermore, Professor Elsbree noted that there were no dramatic emergencies in public education to focus the attention of the average citizen on the seriousness of the human resource problems in teaching. Communities and politicians respond to floods, famines, or dramatic crimes, but, unfortunately, insufficient numbers of qualified teachers do not capture the imagination of the general public. Furthermore, because the injurious effects of poor teaching are in most cases not immediately transparent, the complacency that exists is difficult to alter.

Elsbree argued that the Russian space missile aroused the apathetic citizen hereofore indifferent to the quality of education in the United States, but, to his dismay, the effect was to place emphasis on a narrow aspect of the social problem. More specifically, the science education reform and, in particular, the school mathematics initiatives associated with Sputnik were largely associated with the "college-capable" student (Devault & Weaver, 1970; Kliebard, 1987; National Council of Teachers of Mathematics [NCTM], 1959). The code words college capable signaled to the education establishment that the reforms were targeted to a select group of students and communities. Nevertheless, this effort should be examined in light of the intergenerational nature of learning and achievement growth.

According to L. S. Miller (1995), educational attainment is a function of the quality of education-relevant opportunity structure over several generations. The pace of educational advancement depends on multiple generations of children attending good schools. Thus, reform efforts targeted for students perceived as college capable merely accelerate the intergenerational resource value-added of largely White, middle-class, suburban students deemed college ready (Shapiro, 2004). This is not to say these students should be denied opportunity structures, such as high-quality teachers; rather, it indicates the importance of providing qualified teachers to less affluent communities and demographic groups that have been traditionally underserved in mathematics.

On February 4, 2003, this challenge was captured in the Brief Amicus of the Council of the Great City Schools (CGCS) submitted to the Court of Appeals of the State of New York (http://www.cgcs.org/pdfs/NYBrief.pdf). As part of the CGCS brief amicus, the CGCS quoted New York State Commissioner of Education Richard Miller (2002), who stated,

The more advantaged districts spend over $3,000 more per student and pay their teachers $20,000 more annually. Students in more advantaged districts are substantially more likely than students in less advantaged districts to perform with distinction on Regents examinations, and they are more than twice as likely to plan to attend four-year colleges. State aid formulas help to ensure that those districts with the least ability to raise resources locally, on average, receive the largest allocations of aid from the State. However, with few exceptions, the formulas do not consider the extra help in achieving the standards needed by children placed at risk by poverty and limited English proficiency. (pp. vi-vii)
According to the CGCS brief amicus, when the state of New York itself examined the characteristics of low-performing schools placed under review, they found that 79% of such schools had insufficient supplies and materials, 75% had uncertified teachers, and 71% had inexperienced teachers. Among the strategies the state of New York has found successful in these schools is the use of financial incentives to attract certified teachers. In this case, certified teacher is tactily equated with being qualified to teach. Yet as Elsbree stated in 1959, not everyone concurs with this equation in the realm of public school education.

This article focuses on several salient teacher quality issues. In particular, it focuses on the following question: “What is a qualified mathematics teacher?” In addition, this article focuses on the concerns and challenges related to providing qualified mathematics teachers for African American males. Why is this focus important? Before discussing this question in the article, a brief review of important considerations in the mathematics education of African American males is warranted.

The educational advancement of African Americans is often framed in terms of opportunity to learn (OTL) indicators using time and quality considerations as metrics to better describe the learning process. For example, policies, practices, and experiences that negatively influence African American males’ opportunities to learn mathematics include disparities in suspensions and expulsion rates, inadequate health care, dropping out, and inappropriate special education placement (Denbo & Beaulieu, 2002; Richardson, 2003; Tate, 2005; Verdugo & Henderson, 2003). Each of these practices can have an adverse impact on content coverage and time on task in mathematics. Content coverage and time on task are important OTL factors in mathematics (Suter, 2000; Tate, 1995). These two time factors explain the amount of time allocated to the learner for the learning of a mathematics task. Both are important predictors of academic achievement as measured by standardized tests. In addition, two related and more specific time focused predictors of African American male performance in large-scale assessments of mathematics have been (a) increased time on task in cognitively demanding mathematics and (b) number of college preparatory courses taken in mathematics (Secada, 1992).

There has been significant progress with respect to African American students’ enrollment patterns in college preparatory mathematics coursework. For example, according to estimates by Roey and colleagues (2001), 43% of African American high school graduates in 1982 had earned credit in algebra, compared to nearly 64% in 1998. In addition, their study indicated that 29% of African American high school graduates in 1982 had earned credit in geometry, compared to 72% in 1998. This increase in college preparatory course taking can be attributed to major state policy changes in graduation requirements (Massell, 1994; Smith & O’Day, 1991). In particular, many states called for all students to have courses in algebra and geometry rather than lower-level courses such as consumer mathematics and mathematics for life skills. The latter courses were generally part of a vocational track and could be taught by instructors with limited mathematics preparation. New state requirements
calling for additional college prep mathematics coursework put new pressure on school districts to increase the number and quality of secondary and middle mathematics teachers. Quality teaching and excellent teachers are important factors within the OTL literature. Both are generally viewed as instructional delivery variables.

Simply stated, the OTL literature defines quality of instructional delivery and, more specifically, those pedagogical strategies that affect students’ academic achievement as classroom factors (Brophy & Good, 1986; Stevenson & Stigler, 1992). The qualifications of mathematics teachers and how they deliver instruction are vital to understanding African American males’ learning of mathematics. The distribution of teachers and their quality should be of utmost concern for researchers and educators interested in the mathematics attainment of African American males. Important policy changes calling for more rigorous mathematics graduation requirements have created opportunities for African American males in the college preparatory mathematics curriculum. African American males’ opportunities to take courses with increased cognitive demand are essential for learning and developing mathematically (RAND, 2003; Silver & Stein, 1996). In addition, the mathematics college preparatory graduation requirement of at least geometry has the potential to position more African American males to continue their academic experience into postsecondary education (Pelavin & Kane, 1990). A critical OTL question is “Who will teach them?”

This article is organized into two major sections. The first section is a discussion of the political economy of school mathematics. The focus of this section is the relationship among intergenerational achievement patterns, resources, and opportunity structures related to school mathematics, including teacher quality. This is followed by a discussion of recent presidential platforms, particularly agenda setting by those seeking the nation’s highest office on the topic of school mathematics and teacher quality. In the next major section, the policy literature that is focused on teacher qualifications is closely reviewed. Although the research literature does not always use language consistent with standards-based school mathematics reform as articulated by the National Council of Teacher of Mathematics (NCTM, 2000), policy research provides unique insight into the state of affairs of urban schools, those schools with high concentrations of children living in poverty, and those demographic groups underserved in the area of school mathematics, such as African American males. The goal of this article is to make more transparent the need for excellent research that bridges studies of teacher qualifications and OTL structures of African American males in mathematics.

**Political Economy and School Mathematics**

In this early part of the 21st century, the impact of the extension of product and labor markets, expanded global competition, and infusion of technology in the latter part of the past century have significantly changed all sectors of the economy
(Carnevale & Desrochers, 2003). Each of these forces has influenced the structure of employment opportunities and the way people work, increasing the demand for skill and educational advancement. In the knowledge economy, access to quality jobs and income in the United States is partly a function of an academic preparation, including soft skills, general education beyond high school, occupational training, and subsequent access to learning and technology in the work setting. Education, training, and technology often proceed in a linear and complementary fashion with respect to labor production and earnings. There is a positive relationship between educational attainment and formal on-the-job training. College graduates are almost twice as likely to receive formal company training than are high school graduates (Erk, 1993). In addition, Erk (1993) found that those who train more generally earn more, on average, than more educated workers who do not. The earning differences also are linked to technology and educational background. Workers who use computers earn more, and the greater the level of educational attainment, the larger the wage premium for technology use (Carnevale & Desrochers, 2003).

What is clear is that the knowledge economy has greater opportunities for those with appropriate educational experiences in K-16 (Bowen & Bok, 1999; Meister, 1998). Unfortunately, the intergenerational effect of underdeveloped systems of education continues to plague many demographic groups (e.g., African Americans, Hispanics, and low-SES students) that form the majority school population in urban communities (Lubienski, 2002). Lack of education and OTL are particularly problematic for African American males. For example, in 1996, more than one third of African American male dropouts ages 20 to 35 did not directly contribute to the knowledge economy because on an average day they were in prison (Western & Pettit, 2000). Among the risk factors associated with African American male dropout is being tracked into low-level remedial coursework (Verdugo & Henderson, 2003). Tracking as a school organizational practice is often coupled with students in the lower tracks receiving instruction from the least qualified mathematics teachers in a school or school district (Tate & Rousseau, 2002).

It is not the intent here to review existing trend studies of mathematic achievement (e.g., Lubienski, 2002; L. S. Miller, 1995; Secada, 1992; Tate, 1997). Rather, the point is to discuss why differential performance in the discipline of mathematics that is inextricably linked to the knowledge economy is difficult to eradicate and warrants sustained political, cultural, and economic investment. L. S. Miller (1995) argued that there are three intertwined concepts that should be taken into consideration when attempting to build effective strategies to accelerate ethnic minority student performance on the basis of academic achievement data. All three concepts apply to African American males:

1. Generally, differences in academic achievement patterns among African American males and low-SES groups reflect the fact that the variation in family resources is greater than the variation in school resources. Miller’s analysis of achievement
patterns and resource allocations indicates that most high-SES students receive several times more resources than most low-SES students receive, and much of this resource gap is a function of family resources rather than school resources.

2. Demographic group educational attainment is an intergenerational process. From this perspective, education-related family resources are school resources that have accumulated across multiple generations. On average, investments in the current generation of African American males in the form of intergenerationally accrued education-relevant family resources are significantly less than comparable investments in White and Asian children.

3. Educational attainment is in large part a product of the quality of education-relevant opportunity structures over several generations. The pace of educational advancement depends on multiple generations of African American males attending good schools.

Today, educational attainment includes a renewed emphasis on mathematics, science, and technology. The importance of the new literacy—mathematics, science, and technology—to the knowledge economy and people of color is succinctly captured by former Student Nonviolent Coordinating Committee leader Robert Moses, who argued that economic access and full citizenship are functions of math and science literacy (Moses & Cobb, 2001). In addition, he posited that math literacy in urban and rural communities was a contemporary analog to Black voter registration in Mississippi during the 1960s.

It should be clear to the citizenry of the United States that calls by public officials, policy analysts, and business leaders for improved quantitative reasoning skills among African American males also directly apply to what their teachers must know, understand, and be able to teach (Tate & Johnson, 1999). Demanding mathematics standards represent a serious human resource capacity challenge for public education in this country. (Darling-Hammond, 1997)

For example, in 1996, deMello and Broughman reported that, in 34 states, at least 30% of the public school districts did not require a college major or minor in the field to be taught when screening or considering teacher applicants. In addition, Ingersoll and Gruber (1996) found that roughly one fourth (26.6%) of all public school students enrolled in mathematics classes in grades 7 to 12, or about 4.1 million of the 15.5 million students enrolled, were taught by teachers without at least a minor in mathematics or mathematics education. Although it is difficult to document the effects of this fact, the research on intergenerational achievement suggests that a closer examination of the distribution of teachers without at least a minor in mathematics will be central to policy development for African American males (L. S. Miller, 1995). Is there a distribution pattern related to teacher quality and student demographic background? In 1990-1991, teachers classified as “out of field” taught 40% of high school mathematics courses in high poverty schools.

The challenge of teacher quality was not limited to poor schools. The distribution of teachers varied on the basis of the racial composition of the students in schools.
Table 1
Estimated Percentage of Full-Time Public School Math Teachers in Grades 7 Through 12 Who Reported Having an Undergraduate or Graduate Major or Minor in Their Main Teaching Assignment Field, by Selected School Characteristics, 1993-1994 and 1998

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<td>All targeted public school teachers</td>
<td>77</td>
<td>0.9</td>
<td>82</td>
<td>2.1</td>
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<tr>
<td>Central city</td>
<td>76</td>
<td>2.2</td>
<td>81</td>
<td>4.4</td>
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<tr>
<td>Urban fringe, town, rural</td>
<td>77</td>
<td>2.2</td>
<td>83</td>
<td>3.3</td>
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<tr>
<td>Percentage minority enrollment 5% or less</td>
<td>79</td>
<td>1.6</td>
<td>85</td>
<td>4.4</td>
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<tr>
<td>Percentage minority enrollment greater than 50%</td>
<td>71</td>
<td>2.8</td>
<td>76</td>
<td>5.6</td>
</tr>
<tr>
<td>Percentage of students in school eligible for free or reduced lunch less than 15%</td>
<td>81</td>
<td>1.9</td>
<td>87</td>
<td>3.4</td>
</tr>
<tr>
<td>Percentage of students in School eligible for free or reduced lunch 60% or more</td>
<td>70</td>
<td>3.8</td>
<td>69</td>
<td>6.4</td>
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Source: Derived from Lewis et al. (1999).

Mathematics majors taught nearly 70% of mathematics classes in low-minority schools. In contrast, mathematics majors taught only about 42% of these classes in high-minority schools. Also, in 1990-1991, the amount of out-of-field teaching was not equally distributed across different types of classes and groups in schools. Both student achievement levels and type or track of classes were related to access to qualified teachers (Ingersoll & Gruber, 1996). In each case, the pattern was the same—perceived low-ability students and low-track courses frequently had more out-of-field teaching than did perceived high-ability students and high-track courses. If teachers perceive African American males as low ability, then they are at greater risk of low-track placement and out-of-field mathematics teachers.

More recent data analyzing out-of-field teaching in mathematics in 1993-1994 and 1998 suggest that some progress has been made, but the distribution pattern of qualified teachers remains consistent with the 1990-1991 findings. Table 1 provides summary information about how in-field versus out-of-field teaching varies by certain school characteristics in 1993-1994 and 1998.

Again, there is a persistent pattern of more out-of-field mathematics teaching in 7-12 associated schools, with high-poverty or high-ethnic-minority student concentrations. These patterns have persisted throughout the decade of the 1990s. The trends suggest that out-of-field teaching in mathematics may have a negative influence on African American learning opportunities. What federal proposals have been offered, during this period of crisis, to resolve this serious intergenerational equity challenge in the area of school mathematics? The next section of the article provides some insight on this question.
Presidential Proposals, Teachers, and Mathematics Education

What has been the political response to the challenges of finding and retaining quality mathematics teachers? A close examination of recent presidential platforms provides some insight into federal policy proposals related to teacher quality and school mathematics. In both the 2000 and 2004 presidential platforms of the Democratic and Republican parties, policy proposals included calls for legislative action or private sector initiatives to increase the quality and quantity of teachers or potential teachers with mathematical skills. Table 2 provides a brief overview of the proposals outlined by each candidate of the two major political parties in 2000 and 2004.

Both Al Gore’s and John Kerry’s plans called for financial incentives to entice new teacher recruits in high-need areas of study, including mathematics. This strategy is consistent with recent research by Milanowski (2003), which suggested that starting teacher salaries discourage prospective teachers. His study also indicated that college students have a variety of reasons for not being attracted to teaching beyond low salaries. These include strong preference for another career path, doubts about their ability to perform as teachers, and discomfort with aspects of the nature of the position (e.g., being responsible for others or standing in front of a class). For a significant minority of these college students, even very large increases in entry salary is not likely to entice them to teaching. However, the survey results indicated that the entry pay for math teachers would not have to be raised to the same levels as engineering, computer science, or the higher-paid health occupations to attract some of these students. But the salary increases have to be more than 5% to 10% to attract a substantial proportion of them. A beginning teaching salary increase of about 25% would be needed to attract nearly 1 in 5 respondents. The amount of increase does differ by student major, with higher increases needed to attract more engineering students than pure and applied science students. This is likely because of the higher salaries the former are expecting to receive for employment opportunities in engineering.

The Kerry plan included a proposed professional examination as an entry requirement into the profession of teaching. His proposal was not unlike the plan implemented in the state of Arkansas during William Jefferson Clinton’s tenure as Arkansas governor. Both the Clinton and Kerry plans included additional financial resources for teachers and teacher testing. In many respects, the Arkansas education plan implemented during then-governor Clinton was similar to the current federal initiative—No Child Left Behind—proposed by President George W. Bush as part of his platform. Both policy initiatives framed the problem as one requiring more rigorous standards, school-level report cards based on student test scores, and targeted help for schools that failed to produce acceptable student performances on tests. Furthermore, both Clinton’s and Bush’s plans required schools that continue to perform below designated levels to be decertified and students transferred to other institutions.
## Table 2
### Proposed Presidential Education Plans

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<td><strong>Recruit teachers by raising pay where we need teachers most.</strong>&lt;br&gt;This plan called for supporting teachers in high needs schools with financial assistance in the form of college tuition or student loan payoff, or a hiring bonus for those willing to switch careers. This component included advocating for alternative certifications programs so career switchers did not have to start their education over again.</td>
<td><strong>Recruit teachers by raising pay where we need teachers most.</strong>&lt;br&gt;The plan calls for recruiting quality teachers in high-need schools and for subject areas such as math and science by offering pay hikes of at least $5,000. They also want to establish a new teacher corps for recent college graduates.</td>
<td><strong>Establish states standards and accountability systems.</strong>&lt;br&gt;No Child Left Behind legislation requires states to develop a plan to ensure that every student becomes proficient at math and that achievement gaps are closed between students of different socioeconomic backgrounds. States, districts, and schools are using their accountability plans to measure the progress of student achievement and to report student and school progress to parents. The legislation includes teacher qualification requirements.</td>
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<td><strong>Improve technology skills of teachers.</strong> Expand teacher training in Internet use.</td>
<td><strong>Retain teachers through better preparation and support.</strong> The plan calls for mentoring that pairs veteran teachers with new teachers and the implementation of career ladders that increase responsibility for successful teachers.</td>
<td><strong>Create a presidential math and science scholars fund.</strong> The plan calls for establishing a new public–private partnership to provide $100 million in grants ($50 million in federal funding to be matched with $50 million in private funding) to low-income students who study math or science. Under this plan, approximately 20,000 low-income students would receive up to $5,000 each to study math or science.</td>
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The Clinton Arkansas plan also included mandatory teacher testing for all teachers—new teachers and veteran professionals alike. One lesson learned from the Arkansas implementation process is that it is not a politically trivial matter to terminate teachers who fail a test. According to Morris (2004), almost 50% of the Arkansas teachers tested would have failed to pass the assessment on the basis of the standard established prior to the test. Understanding the political fallout and educational challenge from a nearly 50% failure rate, Governor Clinton commissioned a poll to determine the voters’ perceptions of acceptable teacher test failure. The poll revealed that they expected about a 10% failure rate, and the pass rate was adjusted downward accordingly. This standard-setting process was far removed from the objectivity associated with testing and notions of merit that permeate American discourse. This was a problem not only in Arkansas but also in other states that adopted similar policies. For example, Texas established different pass scores for teachers in each discipline. Prospective mathematics teachers did not need to score as high on their examinations as did prospective social studies teachers. The rationale is clear—supply and demand.

Public perception combined with very real human resource limitations make it difficult to justify the removal of teachers—even those deemed not qualified on the basis of examination. All three presidential platforms had an underlying theme in the area of education. Continued economic vitality is linked to an expanded and improved pool of teachers. Most of the political rhetoric from the two major candidates for the presidency in 2004 suggested that there is an economic need for more demanding standards in school mathematics for students and teachers. Yet it is not clear that these proposed policies and current policy would adequately address the teacher quality and demand issues for African American males in school mathematics.

**What Is a Qualified Mathematics Teacher?**

Determining teacher qualification has been accomplished using several methods. One approach is to simply define a set of collegiate experiences and related outcome measures. This approach defines qualified on the basis of a candidate’s degree attainment (e.g., bachelor’s degree or master’s degree), whether the teacher has demonstrated sufficient knowledge on a licensure examination, and so forth. Many professional organizations have produced documents concerning teacher qualification that articulate recommended college credits in mathematics or broader programmatic design features of teacher preparation programs. The mathematics education of prospective middle school and high school teachers is one school subject that has stimulated numerous sets of recommendations (e.g., Mathematical Sciences Education Board, 1996; NCTM, 1991; RAND, 2003). The recommendations vary in how they are used to frame the most salient features of the preparation process.
In this article, documents that recommend specific academic experiences as the basis for constructing qualified to teach mathematics are used to illustrate the static approach to defining quality. The static method, generally, is a function of one or more organizations commissioning a select group of experts to review existing research literature, national and state standards for teaching, and other relevant publications to determine a broad set of recommendations for teacher preparation. For example, the American Mathematical Society (AMS; 2000), in cooperation with the Mathematical Association of America (MAA), produced a set of recommendations that described the special nature of mathematical knowledge needed for teaching. The recommendations represented an effort by two of the leading professional organizations of mathematicians to inform the public, other mathematicians, and educators about advances in the mathematical sciences and related implications for the preparation of teachers. The report recommended that all prospective middle-grade teachers of mathematics should be required to complete 21 semester hours of mathematics, which includes at least 12 semester hours on fundamental principles of school mathematics appropriate for middle school teachers—that is, numbers and operations, algebra and functions, measurement and geometry, and data analysis and probability. These courses are considered foundational in the school mathematics curriculum and appear throughout the K-12 program of study.

The joint AMS–MAA report also recommended prospective high school teachers complete an undergraduate major in mathematics, which includes a 6-hour capstone course connecting college mathematics to high school courses. The traditional undergraduate degree in mathematics was originally designed with a focus on preparation for graduate study in the mathematical sciences. In contrast, the report recommends that the traditional undergraduate mathematics degree be tailored for secondary mathematics teachers to include (a) a historical perspective of the development of the field of mathematics, (b) common psychological factors that lead to student misconceptions of mathematical concepts, (c) technologies that advance mathematical thinking, and (d) transparent connections across mathematical topics.

An example of the latter recommendation is a linear algebra course that makes clear the interplay among matrices, systems of equations, vectors, and applications such as least squares curve fitting in data analysis. Generally speaking, the traditional undergraduate mathematics degree lacks the four recommendations above, yet the recommendations appear to be consistent with a more coherent set of pedagogical content knowledge. The AMS–MAA report called for secondary school mathematics teachers to have a deep understanding of fundamental mathematical ideas in the grades 9 to 12 curricula, including (a) algebra and number theory, (b) geometry and trigonometry, (c) functions and analysis, (d) data analysis, statistics, and probability, and (e) discrete mathematics and computer science.

For both middle school and high school mathematics, the AMS–MAA recommendations for the preparation of teachers reflect an effort to define quality factors associated with teacher education, and, more specifically, they provided a framework
for defining qualified mathematics teachers. In addition, the recommendations call for major shifts in mathematics coursework for teacher candidates and interactions between education and mathematics faculty, and the AMS–MAA recommendations reference a combination of research studies in mathematics education, documents that are largely derived from philosophical perspectives associated with the discipline of mathematics and recent literature related to changes in political economy that influence certain areas of study in school mathematics (e.g., technological shifts). This static approach to defining qualified mathematics teachers is quite common. Yet recent shifts in methodological approaches to the study of teaching and increased accountability pressures have resulted in more real-time dynamic approaches to defining quality associated with the teaching of mathematics.

The dynamic approach to defining quality factors associated with good teaching is linked to student performance on outcome measures. Dynamic approaches vary in methodological application, yet, generally, they employ some measure of student performance with an effort to describe teacher practice. Those who possess the qualities associated with student growth in mathematics are viewed as qualified. Cochran-Smith (2004) provided a clear explanation of what is referred to in this article as the dynamic approach to defining quality. She argued that the No Child Left Behind Act of 2002 and its related agenda call for teacher quality definitions supposedly built on empirical evidence about the teachers' value added to students' scores on standardized tests and on cost-benefit analysis of limited human and fiscal resources.

Central to the dynamic approach to defining qualified mathematics teacher is the policy concept of alignment (Elmore & Rothman, 1999). Policy alignment in the domain of teacher education is a simple notion that reduces teacher quality into a logical relationship. First, the dynamic approach implicitly assumes that a qualified teacher will have mastery of the subject matter that is assessed on the local assessment of student knowledge. Second, student test score growth under the guidance of the teacher serves as a proxy describing the value or quality of the teacher. This argument is part of an emerging literature referred to as value-added modeling. Research on value-added models, conducted by William L. Saunders and colleagues, has been central to discussions of the dynamic approach (e.g., Wright, Horn, & Saunders, 1997). The focus of value-added models is the measurement of student academic gain. The value-added modeling may examine academic gain at the level of the individual student, classroom, teacher, school, or district. Thus, it is possible to examine African American male student performance with the value-added method.

Modeling academic gain is in contrast to analyzing test data to measure students' performance against an absolute standard of achievement, or to rank order student performance, or to evaluate a school's performance in traditional accreditation audits. For example, Wright et al. (1997), building on the Tennessee Value-Added Assessment System, used statistical mixed-model methodologies to conduct multivariate, longitudinal analyses of student achievement to make estimates of school, class size, teacher, and other effects. In particular, their study examined the relative magnitude
of teacher effects on student achievement while analyzing the influences of in-classroom heterogeneity, student achievement level, and class size on academic growth. The findings suggested that teacher effects are dominant factors affecting student academic growth and that the classroom context variables of heterogeneity among students and class sizes have minimal influence on academic growth. Thus, the major finding is that teachers make a difference. Research and evaluation conducted in the Dallas Independent School District (DISD) has contributed to the value-added literature (Webster, 1997). The school district has designed an evaluation plan that includes the following requirements: (a) It must be value-added, (b) it must have multiple outcome variables, (c) schools must be held accountable only for students who have been continuously enrolled in their instructional programs, and (d) schools must not gain an advantage by starting with high-scoring or low-scoring students, minority or White students, high or low socioeconomic level students, or limited English proficient or non–limited English proficient students. In addition, factors such as student mobility, school overcrowding, and staffing patterns, over which schools have no control, must be taken into consideration.

Within the four evaluation requirements, a number of statistical models were explored by the DISD Research, Planning, and Evaluation Department (Webster, Mendro, Orsak, & Weerasinghe, 1997). For example, Webster et al. (1997) compared teacher and school effective estimates using ordinary least squares regression models and hierarchical linear models as part of the school evaluation process. The intent here was not to review the technical issues associated with the analyses in this article. Rather, the goal was to point out that the desire to statistically model teacher effectiveness is an ongoing endeavor with the potential to inform our understanding of the learning opportunities of African American males in school mathematics. In the case of DISD’s research on teacher effectiveness, there has been significant pressure applied by school board members and local politicians to have the names of individual teachers released to the public and to have those deemed ineffective based on the modeling to be dismissed from the school district. In effect, the teacher effectiveness indices serve as the mechanism to determine “qualified” and “unqualified” teachers. According to Rowan (2004), indices, such as those produced in the DISD model, may not offer the clear possibility of making sound personnel decisions about individual teachers. In particular, this type of value-added modeling has unresolved complexities, including statistical accuracy, political legitimacy, and, ultimately, questions about fairness.

Advocates for value-added modeling argue that the approach provides several benefits over other methods of analyzing student academic performance, including the following:

1. Value-added modeling redirects the focus of empirical validation of student performance from debates over demographic factors to core questions of student progress.
2. Value-added modeling provides a method to recognize outstanding teachers as measured by academic gain.
3. Value-added methods are less connected to student demographics and more strongly linked with teacher effectiveness; thus, the methods can provide a fairer accountability measure for schools and teachers.

4. Value-added models have the capability to produce detailed information and, therefore, can better serve the interests of both school districts and the educational research community (see http://www.effwa.org/pdfs/value-added.pdf).

Value-added modeling is designed based on the assumption that a good teacher can create learning experiences no matter the demographic background of students. Much of the value-added research literature confirms this thesis: Teacher quality is the most important variable in determining how much students learn. Value-added modeling and the policy perspective associated with the method are not without critics. For example, Kennedy (2003) argued that the Sanders’s program of research on teacher effectiveness assumes that differences among classrooms in student achievement are caused by teachers and can therefore be categorized as “teacher effects.” Because the researchers have access to prior student achievement data, they can remove classroom differences in prior achievement. However, they cannot account for differences in classroom personalities or the effect of one or more resistant students on the teacher’s capacity to teach the rest of the class. Similarly, Cochran-Smith (2004) acknowledged that teaching has technical components, but teaching also is an intellectual, cultural, and contextual activity that requires skillful decisions about subject matter including the development of human relationships and the ability to generate and utilize local knowledge. Her assertion was validated by numerous studies of exemplary teachers (e.g., Fennema & Franke, 1992; Knapp, 1995; Ladson-Billings, 1994). Yet the political pressure to provide clear measures of academic growth is very real and appears to have support across the political and business spectrum. Moreover, support for quantifiable dimensions of teacher quality and specifically teacher qualification remains strong. However, much of the value-added literature fails to say what kind of qualifications lead to effectiveness or what kind of teaching practices lead to effectiveness (Kennedy, 2003).

Although value-added models stress the role of student academic growth, other studies of teacher quality have highlighted the performance of high-performing schools with the goal of detailing the instructional practices of teachers throughout these settings. A common theme of this research approach is to create information for and about specific localized settings. The “best-practice” movement is a performance-oriented approach to defining teacher quality. The typical methodological strategy associated with this approach is to identify a set of schools that have performed better than a specific threshold on some measure of student achievement. At this point, subsets of schools are selected for their performance and demographic characteristics. For example, in the document *Hope for Urban Education* (U.S. Department of Education, 1999), nine high-poverty schools (i.e., Title I schoolwide programs) were selected because they performed better than the average for all
schools in their states. This was a unique pool in that many studies of high-poverty schools are matched comparisons with other high-poverty schools. The Hope for Urban Education study selected only outstanding high-poverty schools. The next step in the methodology is to conduct detailed qualitative analyses of the school setting (e.g., interviews with staff, students, and community members, reviews of internal documents, and classroom observations) and outline common traits.

For example, a comparison of mathematics teachers in higher and lower performing schools conducted by the North Central Regional Educational Laboratory (NCREL, 2000) revealed important quality factors related to instruction. The findings are summarized in Table 3.

It is important to note that the NCHEL findings must be understood in light of the centrality of students' mathematical reasoning in higher-performing schools. Higher-performing schools and teachers provided a learning environment that supports sustained engagement on rigorous mathematical tasks. Teaching as characterized in the higher-performing schools is complex and demanding. In contrast, teaching in lower-performing schools is routine and limited with respect to teacher–student discourse patterns. Furthermore, instructional practices in lower-performing schools did not center on students' mathematical understanding and thinking.

Although the NCHEL study relied on outcome measures to determine school and teacher performance categories—higher or lower performing on the outcome metric—the methodology included qualitative dimensions. Observation of practice, structured and unstructured interviews, and other related techniques can provide important cultural insights not possible with other methods of study. The NCHEL study provides glimpses into the nature and orientation of teacher behavior but are less reliable than are many statistical techniques for verifying cross-case teacher effectiveness and individual teacher effectiveness. Yet observational research has a long history in education research and other fields of social science. Classroom observation and the collection of artifacts—teacher logs, homework, and so on—have been central to the documentation of teaching practice and determining quality teaching. The observational approach can be limiting in that collecting baseline data is costly, and thus a national profile of instruction is challenging to develop (see Trends in International Mathematics and Science Study videotape lessons).

**Final Remarks**

Is the teacher quality problem in 7-12 school mathematics analogous to the more common problems politicians and communities face, such as floods, crimes, and so on? It is certainly as serious if viewed as part of this nation's intergenerational achievement and opportunity structure challenge. Darling-Hammond (1995) argued that African American and low-income students in urban communities are most likely to attend schools staffed by inadequately prepared, inexperienced, and ill-qualified teachers because of funding disparities, factors associated with local power, and labor
Table 3
A Comparison of Mathematics Teachers in Higher- and Lower-Performing Schools

<table>
<thead>
<tr>
<th>Higher-Performing Schools</th>
<th>Lower-Performing Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers and students engage in two-way discussions about mathematics.</td>
<td>Limited conversations that tend to be one way:</td>
</tr>
<tr>
<td>Classes are learning communities. There are established norms in place. Students and</td>
<td>The teachers tell information to students or look for answers and move on.</td>
</tr>
<tr>
<td>teachers are learning together. Teachers push for student understanding of mathematical</td>
<td>Classes have few learning community characteristics. Individual students are more</td>
</tr>
<tr>
<td>concepts and procedures. Teachers have high expectations that all will learn. They review</td>
<td>disconnected from classroom activities. Teachers lead math tasks; however,</td>
</tr>
<tr>
<td>concepts often, explain things in detail, encourage student thinking, and assess student</td>
<td>meaningful-oriented conversations are not present.</td>
</tr>
<tr>
<td>understandings, and reteach when necessary.</td>
<td>The teacher expectation is that there will be outside sources of help that will meet the</td>
</tr>
<tr>
<td>Teachers build continuity in the mathematical domain over time.</td>
<td>needs of struggling students.</td>
</tr>
<tr>
<td>Students are familiar with classroom practices and expectations and take initiative in</td>
<td>Little or no continuity is provided related to mathematics content over time.</td>
</tr>
<tr>
<td>their progress. They know where to find enrichment materials when finished with an</td>
<td>Teachers spend significant time reminding students of expectations.</td>
</tr>
<tr>
<td>assignment and get started on their own.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Derived from North Central Regional Educational Laboratory (2000).

market conditions. The data related to the distribution of teachers defined as qualified on a very simple metric (at least a minor in mathematics) provide a clear picture of inequality, with African American males along with children living in poverty at greatest risk of receiving the least from the current opportunity structures. This is consistent with the intergenerational inequalities ever present in American education. The challenge for researchers is to design research methods that can better support decision making related to the intergenerational achievement challenge, particularly the teacher inequality problem as it relates to African American males.

Both the static and dynamic research approaches outlined in this article uniquely contribute to the study of teaching quality, teacher qualification, and teacher effectiveness. What is the best approach to the study of mathematics teacher qualification? Should there be multiple approaches to the study of teacher qualification? If so, what would be a sustainable line of inquiry? These questions should be the focus of future research and development efforts designed to improve the performance of African American males in school mathematics. There are at least five assumptions that should guide this work: (a) African American male achievement in school mathematics is intergenerational, (b) teacher quality is positively related to student...
achievement, (c) understanding classroom practice is a vital aspect of determining quality teaching for African American males, (d) the goal of education should be to provide quality teachers across generations of African American males, and (e) the need to assess teacher quality in classrooms, in schools, in school districts, and across the nation will remain strong as long as African American males are required to attend. These five basic assumptions provide a rationale for the continued study of teacher qualification policy, OTL structures, and related investments in African American male schooling.

References


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William F. Tate IV is the Edward Mallinckrodt Distinguished University Professor in Arts & Sciences at Washington University in St. Louis. His research interests include human resource development in SMET fields and the political economy of metropolitan education.