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The purpose of this study was to survey the perceptions of secondary mathematics teachers on factors contributing to the achievement gap and ways to reduce this gap. National Council of the Teachers of Mathematics (NCTM) members were surveyed, and a total of 379 secondary teachers responded. Overall, respondents were most likely to attribute the achievement gap to student characteristics, such as differences in motivational levels, work ethic, and family support. Furthermore, teachers from schools with a higher population of White students were more likely to attribute the gap to student characteristics than were teachers in schools with higher percentages of minority students. Mathematics supervisors and university faculty were less likely to attribute the achievement gap to student characteristics than were middle and high school teachers. Instead, the supervisors and university faculty were more likely to endorse explanations related to curriculum and instruction than were secondary teachers. In terms of attributing the achievement gap to factors related to language, we found that the higher the percentage of Hispanic or Latino students in the respondents' schools, the more likely they were to endorse Language items. Suggestions for reducing the achievement gap centered on professional development for teachers, curricular changes, community building, and policies that included more funding equity and a reduction in class size.

Though various reform efforts for mathematics have been implemented in our public schools, an achievement gap still exists between White students and African American, Hispanic, and Native American students with respect to higher-level mathematics coursework (Schoenfeld, 2002). Disparities in mathematics achievement have been evident in assessment scores, course enrollment patterns, and allocation of human and material resources. Variations in achievement correlate with variations in course enrollment patterns and resources. That is, students who have access to advance mathematics courses, taught by a highly qualified teacher (human

resource), and who have access to adequate material resources show stronger achievement in mathematics than their peers (Ladson-Billings, 1998; Hughes 2003, Wenglinsky, 2004). Studies have revealed that the greatest factor in determining whether students earn a bachelor's degree is a strong academic curriculum at the high school level. Advanced placement courses in mathematics beyond Algebra II predict academic success at the college level (Viadero, 2002). Because a strong mathematics background has been linked to success in higher education, it is crucial to meet the needs of all students in secondary mathematics classrooms.

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

Factors Affecting the Achievement Gap in Mathematics

NAEP data have been further used to demonstrate that several factors, such as socioeconomic status, school policies, allocation of human and material resources, and classroom instructional practices may account for performance disparities (Oakes, 1990; Secada, 1992; Strutchens and Silver, 2000; Tate, 1997b). Other explanations target teacher expectations, teacher quality, tracking, testing, family characteristics, and student characteristics. It seems plausible that the gap in mathematics achievement is due to an interaction among several of these factors.

The lower mathematics achievement levels of minority students, particularly Black students, may be indicative of the curriculum and instruction that these students receive. Data collected on instructional practices indicate differences between how minority and White students are taught. The NAEP data suggest that many minority students are not experiencing instructional practices consistent with the recommendations suggested by the National Council Teachers of Mathematics (NCTM). In comparison, more White students are experiencing NCTM standards-based instruction (Lubienski, 2003). This differential instruction might be explained by teachers' expectations. Ferguson (1998) found that teachers' expectations, perceptions, and behaviors sustain and even expand the Black-White achievement gap, and concluded that the effects accumulate from kindergarten through high school. Lubienski (2001) found that the gaps between Black and White students as they relate to instructional practices were not attributable to socioeconomic differences, but to race.

Instructional practices are related to teacher quality because teachers who are highly qualified have strong pedagogical knowledge and strong mathematical knowledge (Darling-Hammonds & Sykes, 2003). Unfortunately, students in schools with a large numbers of minority students and low-income populations have fewer qualified teachers than schools that have large White populations (Darling-Hammonds & Sykes, 2003). Approximately 33% of high

school mathematics students in high minority schools and 30% of high school mathematics students in high poverty schools are taught by teachers without a teaching license or a major in mathematics (Wirt, Choy, Rooney, Provasnik, Sen & Tobin, 2004). This pattern can be contrasted with the figures reported in low minority and low poverty schools. Approximately 7% of high school mathematics students in low minority schools and 7% of high school mathematics students in low poverty schools are taught by teachers without a teaching license or a major in mathematics (Wirt et al, 2004). The fact that minority students are less likely to be taught by teachers with strong pedagogical and mathematical knowledge could be a contributing factor in the mathematics achievement gap.

Teachers form different expectations of students as a function of race, gender, and social class, and these expectations seem to be established in different ways (Baron, Tom, & Cooper, 1985; Secada, 1992). Jussim, Eccles, and Madon (1996) found that teacher expectations and perceptions had a significant effect on sixth grade students' grades and performance on a standardized mathematics assessment. They found that teacher expectations were almost three times greater for White than for African American students, and the effects were also large for girls and low-income students. In his study on teacher expectations and the achievement gap, Ferguson (1998) concluded that effects of teacher expectations could be substantial if the effects accumulate from kindergarten to high school. Similarly Berry (2003, 2004) reported that African American male middle school students experienced lowered expectations from their mathematics teachers. He contended that these lowered expectations affected their achievement in mathematics and their opportunities to gain access to high-level mathematics courses.

Tracking is a widely used policy in mathematics education that separates students for instruction based on perceived needs, potential, and academic performance (Donaldson, 1996; Oakes & Lipton, 1996; Tate, 1997b). Tracking and testing are closely connected, since many tests were developed to sort students into different tracks (Oakes & Lipton, 1996). Tracking propels students through the mathematics curriculum at different speeds (Oakes & Lipton, 1996). Although the goal for students in low track groups is to catch up to their peers, they spend more time on skill building and learning facts, whereas students in high track groups move to problem solving and progress farther in the curriculum (Thompson & O'Quinn, 2001). This differential accumulates through the years. Students in high track groups receive richer mathematics instruction and cover considerably more material, which then leads to advanced high school tracks and post high school expectations (Oakes and Lipton, 1996). Thus, different projected destinations influence educators' judgments about appropriate placements and course taking patterns. Tracking is evident by course prefixes such as "basic," "regular," "pre-," "honors," or "gifted." As students progress through middle and high schools, a disproportionate percentage of minority students are placed in low ability tracks (Mickelson, 2001). Minority students in low in ability tracks experience lower expectations, less advanced curricula, and more didactic instruction (Ladson-Billings, 1998; Tate, 1997a)

Attitude towards mathematics, readiness, and motivation are student characteristics used by researchers to account for the achievement gap in mathematics. Given their lower average achievement levels, a somewhat unexpected finding is that Black students consistently expressed the most positive attitudes towards mathematics among all student groups (Burton, 1984; Dossey et al., 1988; Johnson, 1984; Jones et al., 1984; Strutchens & Silver, 2000). This inconsistency highlights the fact that little is known about the ways Black students perceive themselves mathematically (Malloy, 1997; Martin, 2000). Using NAEP survey data, Lubienski (2001) found that Black students report spending more time on mathematics homework than White students. Furthermore, Lee (2002) found that Black, Hispanic, and White students are similar in readiness and motivation to learning.

Disparities exist in per pupil spending because school funding is based on property taxes in most states (Ladson-Billings, 1998). Consequently, well-funded schools are located

in areas with high property values. Furthermore, "property is a powerful determinant of academic advantage. Without a commitment to redesign funding formulas, one of the basic inequities of schooling will remain in place and virtually guarantee the reproduction of the status quo" (Ladson-Billings, 1998; p. 21). Lee (2004) used the 1990 and 1998 Common Core of Data to examine school spending and found that predominately Black and/or Hispanic school districts generally spend less on education that their predominately White counterparts.

When examining family characteristics, such as parental educational attainment, parental involvement in their children's education, and single parent households, liberal scholars argue that the culture of school is grounded in the ethos of the White middle class culture that values and demands certain ways of talking, writing, dressing, and interacting. (Delpit, 1995; Hughes 2003). Consequently, there is a mismatch between students' home culture and the dominant culture valued by schools. Valdes (1996) argues that this mismatch is particularly salient in the area of parental involvement in the schools, with cultural differences viewed as cultural deficits.

In reference to the family's socioeconomic status, Orr (2003) examined the Black-White achievement gap by investigating the effects of wealth on achievement. In this study, wealth is defined as the liquidity of economic capital that can be converted into cultural and social capital. Orr found that wealth has a positive effect on mathematics achievement. This finding supports Bourdieu's (1986) notion that economic capital can be converted into other forms of capital to reproduce status (Orr, 2003). Orr also found that race has a negative effect on achievement. That is, Black children scored lower on a standardized mathematics achievement test even after parental income, education, occupation, family characteristics, and wealth are taken into account. Similarly, Lee (2002) analyzed trends in the Black-White and Hispanic-White achievement gaps over a 30-year span and found that family characteristics do not fully account the achievement gap in mathematics and reading.

There is some relationship between English language proficiency and mathematics achievement. Fernandez and Nielson (1986) used the High School and Beyond 1980 data to examine the relationship between English language proficiency and mathematics achievement. They found that there was a significant relationship between English language proficiency and achievement in mathematics. In his review of studies on the relationship between language proficiency and mathematics achievement, Secada (1992) found significant correlations between language proficiency and mathematics achievement that ranged between .20 and .50. Bradby (1992) used the National Education Longitudinal Study (NELS) to examine how language characteristics of Asian and Hispanic students related to their mathematics achievement. Bradby found that as English proficiency increased for Hispanic students, the percentage of those students below basic mathematics level decreased. Because of the small sample size, Bradby (1992) did not find a statistically significant difference for Asian students.

Purpose and Overview of Present Study

Much of the research on the achievement gap in mathematics has focused on instructional practices, teacher expectations, teacher quality, tracking, testing, family characteristics, and student characteristics as determinants of the achievement gap. Though the research on the achievement gap in mathematics provides insights on the effects of the aforementioned factors, they do not promote understanding of how the secondary mathematics teachers perceive the achievement gap. We did not identify any other studies that systematically surveyed teachers to explore their explanations of the achievement gap in mathematics and ways to reduce this gap.

There are compelling reasons why understanding teachers' perceptions of the achievement gap and strategies for its reduction are significant. Teacher expectations and bias may play a role in the kinds of explanations offered and the types of instructional practices implemented to address this gap. A recent study by Downey and Pribesh (2004) reported that Black teachers' evaluation of Black students' behavior was more favorable than the evaluations made by

White teachers. Furthermore, their findings suggest that bias on the part of White teachers better explained the mismatch, as opposed to the misbehavior of Black students in White teachers' classrooms. Lipman (1998) argues that teacher participation in school restructuring is largely influenced by ideology, race, and power. Based on her case study of teacher participation in the restructuring of a junior high school, she made the following conclusion. "If restructuring is to transform the educational experiences of marginalized students, it will require both personal and social change- challenging educators' beliefs and assumptions as well as relations of power in schools and communities" (p. 3). In her ethnographic study of bilingual students, Valdes (1996) points to how cultural differences may lead to misunderstanding of Mexican students by White majority teachers. A cultural deficit model of the achievement gap signals more narrow educational interventions, such as fluency in standard English, rather than broader solutions, such as desegregation or the amelioration of funding inequities (Valdes, 1996).

Given that teachers' beliefs, expectations, instructional practices, and professional development activities influence their students' achievement, understanding their views is an important step in identifying strategies for alleviating the achievement gap in mathematics. Therefore, the purpose of this study was to survey the perceptions of middle and secondary mathematics teachers on the achievement gap in mathematics education. Our sample of teachers was drawn from the National Council of Teachers of Mathematics (NCTM) roster. For the purposes of this study, the achievement gap was defined as an indictor of disparities between groups of students usually identified (accurately or not) by racial, ethnic, linguistic or socio economic class with regard to a variety of measures (attrition and enrollment rates, drug use, health, alienation for school and society attitude toward mathematics, as well as test scores). More specifically the following research questions were addressed.

1. What do secondary mathematics teachers perceive to be the most important contributors to the achievement gap in mathematics?
2. Do these perceptions differ as function of student, school, and district characteristics (i.e., ethnicity and socioeconomic status of students, geographic setting, region of the country, size of district)?
3. Do secondary mathematics teachers' perceptions of the achievement gap differ from those of school/district mathematics supervisors or university faculty?
4. What suggestions do secondary mathematics teachers have for reducing the achievement gap?

Method

The present study relied on survey methodology, which yielded both quantitative and qualitative data. This study was part of a larger survey conducted by the NCTM's Achievement Gap Task Force. Data was collected via an online survey sent to a random sample of 5,000 non-student NCTM members. For this study, we focused on responses obtained from middle and high school mathematics teachers.

Participants

A total of 379 middle and high school mathematics teachers responded to the survey. Middle school mathematics teachers (grades 6-8) represented forty-one percent of the sample and high school mathematics teachers comprised 58 percent (grades 9-12). Respondents were mainly White (89%), female (69%) and have 4 years or more years of experience in their current position (73%). These demographic characteristics are also representative of the NCTM membership at large. Although the largest group of respondents described their schools as suburban (46%), more than half of the sample designated their schools as urban (25%) or rural (29%). In terms of school characteristics, respondents were asked to estimate the ethnic distribution and socio-economic level (% free or reduced lunch) of their schools' student body. On the average, about 66 percent of the students were White, 14 percent were African American, and 12 percent were Latino/ Hispanic. The average percentage of students in other ethnic groups was less than 10 percent. On the average, nearly 37 percent of the students were estimated to receive free or reduced

lunch, with percentages ranging from 0 to 100 percent.

Questionnaire

The data source was the questionnaire developed by the researchers. The first section contained items requesting information on demographic and employment characteristics. The next sections presented 23 rating scale items pertaining to factors contributing to the achievement gap. The NCTM definition of the achievement gap preceded the rating scale items. The items were organized into five sub-areas or scales (4-6 items per scale) and included (1) Background and Societal Influences, (2) Student Characteristics, (3) Curriculum and Instruction, (4) Politics and Policy, and (5) Language. Respondent were asked to rate the extent to which they agreed with the statement on 5-point Likert-type scale, ranging from "strongly disagree" (1) to "strongly agree" (5). The next three items were open-ended and asked respondents to provide their own definition of the achievement gap in mathematics, identify its major causes, and suggest strategies for addressing the gap. The final section was targeted to respondents based in a school or district. It contained five items related to the characteristics of the school or districts, including characteristics of the student population.

A factor analysis (principal components extraction method with varimax rotation) was conducted to empirically investigate the validity of the rating scale items. The results supported only 4 of the original 5 scales. The component matrix did not support the original scale called Background and Societal Influences. Two of these items were retained on Student Characteristics scale. A total of 5 items were discarded due to the lack of logical interpretation on a given scale, weak factor loadings, or strongly loading on more than one factor. The final solution of four factors, all with eigen values greater than one, accounted for 52 percent of the variance. Reliability coefficients (Cronbach's alphas) for each of the scales ranged from a low of .61 to a high of .85.

Procedure

On March 9, 2004, the sample of the NCTM membership received an email containing the URL link that opened the online survey. Access to the online survey was available until March 29, 2004. Eight hundred seventy members from the random sample visited the website and 623 members completed the survey. Of the 623 respondents, 379 were middle or high school teachers.

Results

The results are organized by research question. Both quantitative and qualitative data were used to address the first question on contributors to the achievement gap. The last question, asking respondents to suggest strategies for reducing the achievement gap, relied exclusively on open-ended, qualitative responses. The qualitative responses were analyzed using Atlas TI, a qualitative analysis software program. The remaining questions were addressed using responses from quantitative demographic and rating scale items.

Contributors to the Achievement Gap

Descriptive analyses were used to address the first research question. Table 1 presents the number of respondents, mean rating, and standard deviation for each item organized by scale. The overall mean rating is also presented for each the scales. The highest mean ratings were observed on the Student Characteristics scale. The overall mean rating was 4.18, with four of the six items on this scale showing means above 4.0. The most strongly endorsed items on this scale were "students with strong family support almost always do better academically" (M=4.50), and "some students are more motivated to learn than other students" (M=4.62). The high mean rating of items on this scale suggest that respondents were more likely to attribute causes of the achievement gap to student characteristics than to other factors. The next highest overall mean was observed for the Politics and Policy scale. On the Policy and Politics scale, the highest mean rating was obtained for the item, "socio-economic status plays a major role in student achievement" (M=4.11). The overall mean ratings on the Language (M=3.64) and Curriculum and Instruction scales (M=3.56) were similar, and suggest more moderate levels of agreement. The most strongly endorsed item on the Language

scale was "language difficulties hinder performance on standardized tests" (M=3.95). On the Curriculum and Instruction scale, the item about teachers' beliefs and commitment to equity received the highest mean rating (M=3.91).

Four themes emerged from the qualitative data when analyzing the secondary teachers' perceptions of the causes of the achievement gap: a) family background, (b) societal influences, (c) curriculum and instruction, and (d) student characteristics. Many of the secondary teachers described a multiplicity of factors as causes for the achievement gap. One teacher stated, " I believe the major factors of the achievement gap are family background (educational achievement and the value placed on it), the social culture (the value friends and community place on education), and the access to quality teaching."

The family background theme included topics such as parental involvement, socioeconomic status of families, and oppositional culture of families towards achievement. Under parental involvement, teachers stated that students' families did not support teachers or ensure children completed their schoolwork or studying in mathematics. "Lack of parental involvement and support in preschool and elementary school…parents fail to help with schoolwork, help children learn through games or by reading to them in the early years." Teachers seemed to view socioeconomic status and a culture opposed to achievement as connected. This is exemplified in the responses that depict poor families as not valuing academic achievement or making education a priority. One teacher stated, "Cultural and socioeconomic factors are the main cause of this problem among the young predominantly Hispanic students that I teach;" while another teacher stated, "parents do not think education is important, they do not think attendance is important—socioeconomic status has a big impact on the perception of the importance of school."

The societal influences theme reflects the demoralization of society through drugs, media, and family structure as causes of the achievement gap. One teacher blamed the "negative influences of media—TV, movies, music, etc." Another remarked that "drugs and alcohol also play in this because a kid can't learn if their brains are fried;" yet another teacher described, "multiple fathers, live-in boyfriends, probations officers, abuse, etc." as causes. The teachers seem to believe that the social influences are factors beyond their control, and in many cases not the fault of students.

The curriculum and instruction theme highlighted several causes of the achievement gap. One was low teacher expectations. Others included the lack of teacher training, understanding of diversity, and mathematics content knowledge. In addition, they contended that not enough time is allotted for mathematics instruction. They also contended that there was too much emphasis on the use of calculators and lack of emphasis on basic skills, which causes many students to underachieve. Conversely, other teachers considered the mathematics curriculum to be boring and too basic

The secondary teachers considered student characteristics such as work ethic, peer pressure, laziness, and lack of discipline as causes of the achievement gap. One teacher's response reflects this theme:

> Student's perception of education is as a passive action on their part. From my point of view, students will not take home books to study or review and homework is out of the question. So they don't spend enough time thinking about the concepts. They are lazy and give up way too easy. The majority expects to sit there and have the information poured into their heads.

Variations by school or district characteristics

Two types of analyses were used to address the third research question. A MANOVA was used to compare perceptions on the four scales as a function of the three categorical independent variables of school region (northeast, northwest, southeast, and southwest), geographic setting (urban, suburban, and rural), and number of schools in the district (0-25, 26-50, 51-100, over 100). Only the main effect for geographic region was significant ($F(8, 510)= 2.85$, $p<.05$). Significant differences were observed on the Politics/ Policy scales ($F(3,257)= 7.55$, $p<.05$). Post hoc contrasts indicated that respondents

working in urban schools were more likely to agree that factors related to politics and policy contribute to the achievement gap than were respondents in suburban settings.

Correlational analyses were conducted to investigate the potential relationships among student population characteristics (ethnicity and SES) and the four factor scores. Respondents were asked to report the percentage of students in their schools by ethnicity. Only the three ethnic groups that had means greater than 10 percent were included. The percentage of students receiving free or reduced lunch served as proxy for SES. As shown in Table 2, three correlations reached statistical significance. First, there was a negative correlation between the percentage of White students enrolled and the scores on the Language scale ($r = -.16$, $p<.05$). The larger the population of White students, the less likely they were to endorse language as important for explaining the achievement gap. The opposite was true for respondents in schools with large Latino/ Hispanic populations ($r = .15$, $p<.05$). The higher the percentage of students in this ethnic group, the more likely it was that respondents agreed with the items on the Language scale. The final significant correlation was found between the percentage of White students and scores on the student characteristic scale ($r = .13$, $p<.05$), suggesting that respondents in schools with higher percentages of White students were more likely to explain the achievement gap as due to student characteristics.

Differences Among Teacher, Supervisor, and University Faculty

To address the question of whether middle or high school mathematics teachers' perceptions of contributors to the achievement gap differed from those of district/school mathematics supervisors or university faculty a MANOVA was conducted. The independent variable was employment position (6-8 grade teacher, 9-12 grade teacher, district/ school supervisors, and university faculty) and the dependent variables were the four factor scores. The results showed a significant multivariate effect for position ($F(4, 1422)= 7.54$, $p<.05$) and significant univariate effects on the Student Characteristic ($F(3,475)=12.21$), Politics and Policy ($F(3,475)= 6.15$, $p<.05$), and Curriculum and Instruction ($F(3,475)= 11.68$, $p<.05$) scales. There were no significant interaction effects.

To facilitate interpretation of these results, the overall mean scores (not factor scores) on the three scales by position are presented in Table 3. Table 4 shows the significant differences in mean factor scores by group and scale. Post hoc contrasts revealed that both middle school and high school teachers had significantly higher mean ratings on the Student Characteristic scale than did district/ school supervisors or university faculty. These findings suggest that when compared to supervisors or university faculty, mathematics teachers were more likely to attribute the achievement gap to student characteristics such as motivation, interest, family support, and intellectual ability. This trend was reversed on the Curriculum and Instruction scale. Supervisors and university faculty were significantly more likely to attribute the achievement gap to factors related to curriculum and instruction than were middle or high school mathematics teachers. There were no significant differences between middle and high school teachers or between supervisors and university faculty on either scale. The results on the Politics and Policy scale again indicated that mathematics supervisors were significantly less likely to attribute the achievement gap to political and policy variables than were middle school teachers or university faculty. Supervisors also had lower scores on this scale than did high school teachers, but this difference did not reach statistical significance.

Suggestions to reduce the achievement gap

Four themes—(a) policies, (b) professional development and teacher characteristics, (c) curricular changes, and (d) societal influences and community building—emerged from the suggestions offered by the secondary mathematics teachers. Funding was frequently interwoven through all themes.

The policies theme included funding schools more equitably, reducing class sizes, grouping students by ability, and eliminating high-stakes standardized testing. One representative suggestion was to "provide adequate funding to create small classes guided by well trained and

well informed teachers." Several teachers contended that homogeneous grouping was appropriate so that students' individual needs are met.

The professional development and teacher characteristics theme focused on improving teachers' professional knowledge in mathematics content, pedagogy, and ability to work with diverse students and parents. One representative suggestion follows.

> Teachers need more professional development and better teacher training… Requiring that math teachers take more math will not help...they must be trained in how to teach math and what the math concepts are that they teach, or the math concepts that their students are going learn.

Another suggestion reflecting this theme was the provision of "massive professional development efforts with teachers hand-in-hand with community education. And all this must be supported with well developed, standards-based curricular materials." Teachers further suggested professional development for working with minority and poor students' families. More specifically, some teachers advocated more professional development in order to meet the needs of English Language Learners. One suggested the "use of sheltered instruction for English Language Learners, including those whose first language is English but whose language development is limited;" another teacher suggested, "have assessment materials that are in multiple languages."

The change in curriculum theme encompassed conflicting suggestions. While many teachers suggested shifting from basic skills to a standards-based curriculum, many others suggested a return to basic skills. Teachers in both camps often advocated for a national mathematics curriculum. The call for "the national implementation of NCTM standards, including teaching standards" was raised by the teachers who endorsed a national standards-based curriculum. "Get back to basics; get back to Saxon style texts that work towards mastery of skills" was a representative comment from teachers endorsing more basic skills.

A change in societal influences and the building community theme represented strategies such as educating parents, building stronger connections between schools and communities, and eradicating drugs and negative influence that plague communities. Overwhelmingly, teachers suggested that parent education in how to foster academic success with their homes and communities.

> Prepare the parents so they can help the student and begin to take an active role in their children's education. The parent has to be in the home controlling the child and making sure he/she is doing their assignments and it would help if the parent had the necessary education to help the child.

After-school community education programs, community based role models or mentors and community support programs for schools were further suggested.

Discussion

Although secondary mathematics teachers endorsed various explanations for the achievement gap, our results suggest that the most frequently endorsed factors were related to student characteristics. This trend was evident in both the quantitative ratings and the themes that emerged from the qualitative data. In particular, differences in students' motivational levels, work ethic, and family or parent support were cited. Given that Black students tend to score lower on mathematics achievement measures, the perception may be that Black students are not as motivated or do not work as hard as their counterparts in other ethnic groups. However, the NAEP survey findings indicate that Black students expressed the most positive attitudes towards mathematics (Struchens & Silver, 2000), reported spending more time on mathematics homework (Lubienski, 2001), and were similar in their readiness and learning motivation (Lee 2002) when compared to other ethnic groups. It may be the case that secondary teachers' perceptions of the motivation and work ethic of Black or other minority students are inaccurate. This may be especially true of teachers who do not have large numbers of Black students in their schools. We found a significant positive correlation between the per-

centage of White students enrolled in the respondents' school and scores on the Student Characteristic scale. Perhaps more importantly, the cause of the achievement gap appears to be more strongly attributed to student factors rather than more malleable causes that center on curriculum and instruction.

A related finding was observed when we contrasted secondary mathematics teachers' ratings with those of district or school mathematics supervisors and university faculty who instruct prospective teachers. Teachers had significantly higher scores on the Student Characteristic scale compared to supervisors and university faculty. In contrast, supervisors and university faculty had significantly higher scores on the Curriculum and Instruction scale. These results indicate that teachers are more likely to attribute the achievement gap to students' characteristics, whereas supervisors and university faculty are more likely to attribute the gap to differences in the exposure or access to quality curriculum and instruction. The supervisors and university faculty's perceptions are supported by Lubienski's findings (2003) suggesting that higher achievement among White students is explained by more exposure to NCTM standards based instruction than experienced by minority students. The implication is a discontinuity between what supervisors and faculty recommend for addressing the achievement gap and mathematics teachers' own perceptions and expectations for their students. Teachers expectations of their students and their belief that achievement differences are caused by characteristics of their students may make it less likely that they will modify their instructional practices to better align with NCTM standards and principles. Similarly, Ferguson (1998) concluded that teachers' expectations, perceptions, and behaviors sustain and even expand the gap in achievement between White and Black students.

We uncovered some differences in responses based on the demographic characteristics of the schools and districts. The significant correlation between the percentage of White students enrolled and Student Characteristic scores was already discussed. Other significant correlations were obtained on the Language scale. Not surprisingly, respondents in schools with high Latino/Hispanic populations were more likely to attribute the achievement gap to language issues, while teachers in mostly White schools were less likely to make this attribution. These perceptions are supported by Bradby's results (1992), which demonstrated that English language proficiency was related to mathematics achievement among Hispanic students. The only other school characteristic that yielded a significant difference was geographic setting. Secondary math teachers working in urban schools were more likely to agree that factors related to politics and policy influenced the achievement gap when compared to suburban teachers. It may be the case that public schools in urban districts tend to be more diverse and often segregated in terms of student characteristics, with funding inequities more salient. However, this explanation is speculative since we could not identify other studies empirically linking these factors.

Secondary mathematics teachers offered a myriad of suggestions to decrease the achievement gap. One suggestion was to group students into homogenous ability groups, which is reminiscent of tracking. Some researchers contend that tracking students based on ability results in lowered expectations and less effective instructional strategies that accelerate rather than reduce the achievement gap (Oakes & Lipton, 1996; Lubienski, 2003). However, some educational programs, geared toward reducing the achievement gap, feature grouping based on achievement levels and have been shown to be effective (e.g., Slavin 2002). Many teachers further recommended professional development for teachers as a way to reduce the achievement gap. Foci of professional development opportunities included improving knowledge of mathematics content, pedagogy, and diverse learners, including English language learners. These recommendations are supported by findings that relate effective instructional practices to strong pedagogical and mathematical knowledge of highly qualified teachers (Darling-Hammond & Sykes, 2003). Although changes in mathematics curricula were suggested, there was disagreement on the types of changes needed. Some suggested a movement back to the basic skills, while others advocated a nationwide imple-

mentation of NCTM standards that emphasizes higher order skills such as application, critical thinking, and problem solving. High-stakes testing may be one impetus for the call to a "back to basics" curriculum associated with more drill and practice rather than application or higher order thinking, which may be particularly detrimental to at-risk students (Bol & Nunnery, 2004). Another predominate theme that emerged in teachers' responses was the need to enhance community relations and educate parents in order to foster academic success in the home and community. The suggestion to "educate parents" seems to reflect the cultural deficit model (Valdes, 1996), implying that parents need to be "fixed." Enhancing community relations better reflects the position of more liberal, reform minded scholars who attribute much of the achievement gap to a mismatch between the students' home culture and the dominant culture valued by schools (Delpit, 1995, Hughes, 2003). Instead educators might seek to understand the cultural differences among families rather than "educate parents" as a way to help students succeed.

Our findings represent an initial attempt to understand secondary mathematics teachers' perceptions of the causes of the achievement gap and ways to address this gap. It seems plausible that efforts to reduce the achievement gap would be informed by understanding teachers' views and variations between how teachers and district/ school supervisors or university faculty perceive the gap. The educators involved in directing or training teachers tend to have different views than do the teachers themselves, with teachers more focused on student characteristics than on curriculum and instruction. Perhaps reducing misconceptions or focusing on strategies under educators' control would represent a first step in reducing the achievement gap.

Although our survey results yielded some potentially important findings, note of their limitations is warranted. First, the generalizabilty of findings from NCTM members to all secondary mathematics teachers is inappropriate. Because the response rate was low, the representativeness of our sample to all NCTM members is also questionable. However, our purpose was not necessarily to generalize to all math teachers but to get a sense of how they perceived the achievement gap and how it might be best addressed. Future studies may survey teachers who are not NCTM members as well as obtain a larger sample of NCTM members. Another direction for future research is to conduct one on one interviews with secondary mathematics teachers to obtain more in-depth, elaborate descriptions of how they would explain the achievement gap and how to best address it. Their input is invaluable because the success of interventions developed to reduce the achievement gap in mathematics largely hinges on the efforts of the teachers themselves.

References

Baron, R., Tom, D., & Cooper, H. (1985). Social class, race, and teacher expectations. In J. B. Dusek (Ed.), *Teacher expectancies* (pp. 251-269). Hillsdale, NJ Lawrence Erlbaum.

Berry, III, R. Q. (2004). The Equity Principle through the voices of African American males. *Mathematics Teaching in the Middle School 10*(2), 100-103.

Berry, III, R. Q. (2003). *Voices of African American Male Middle School Students: A Portrait of Successful Middle School Mathematics Students.* Unpublished Doctoral Dissertation, University of North Carolina at Chapel Hill, Chapel Hill, NC.

Bol, L. & Nunnery, J.A. (2004). The impact of high-stakes testing on restructuring efforts in schools serving at risk students. In G. Taylor (Ed.), *The impact of high-stakes testing on the academic futures of non-mainstreamed students (pp.101-117).* Lewiston, New York: Edwin Mellon Press.

Bradby, D. (1992). *Language characteristics and academic achievement: A look at Asian and Hispanic eight graders in NELS: 88.* Washington, DC: U.S. Department of Education.

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed) *Handbook of theory and research for the sociology of education* (pp. 241-256). New York: Greenwood Press

Burton, L. (1984). Mathematical thinking: The struggle for meaning. *Journal for Research in Mathematics Education, 15*(1), 35-49.

Campbell, J. R., Hombo, C. M., & Mazzeo, J. (2000). *NAEP 1999 trends in academic progress: Three decades of student performance.* Washington, DC: OERI U.S. Department of Education

Darling-Hammonds, L. & Sykes, G. (2003) Wanted: A national teacher supply policy for education: The right way to meet the "highly qualified teacher" challenge. *Education Policy Analysis Archives.* 11(33). Retrieved on September 17, 2004 from http://epaa.asu.edu/epaa/v11n33/.

Delpit, L. (1995). *Other people's children: Cultural conflicts in the classroom.* New York: The New Press.

Donaldson, K. (1996). *Through students' eyes: Combating racism in United States schools.* Westport, CT: Praeger.

Dossey, J. A., Mullis, I. V. S., Lindquist, M., & Chambers, D. L. (1988). *The mathematics report card.* Princeton, NJ: National Assessment of Educational Progress.

Downey, D.B., & Pribesh, S. (2004). When race matters: Teachers' evaluations of students' classroom behavior. *Sociology of Education, 77,* 267-282.

Fernandez, R M. & Nielson, F. (1986). Bilingualism and Hispanic scholastic achievement: Some baseline results. *Social Science Research, 15,* 43-70.

Ferguson, R. F. (1998). Teachers perceptions and expectations and Black-White test score gap. In C. Jencks & M. Phillips (Eds.) *The Black-White test score gap* (pp. 273-317). Washington DC: Brookings Institution Press

Hughes, S. A. (2003). An early gap in Black-White mathematics achievement Holding school and home accountable in an affluent city school district. *The Urban Review, 35*(4), 297-322.

Johnson, M. L. (1984). Blacks in mathematics: A status report. *Journal for Research in Mathematics Education, 15,* 145-153.

Jones, L. V., Burton, N. W., & Davenport, E. C. (1984). Monitoring the mathematics achievement of Black students. *Journal for Research in Mathematics Education, 15,* 154-164.

Jussium, L., Eccles, J., & Madon, S. (1996). Social perceptions, social stereotypes, and teacher expectations: Accuracy and the quest for the powerful self-fulfilling prophecy. *Advances in experimental social psychology 28,* 281-287.

Ladson-Billings, G. (1998). Just what is critical race theory and what's it doing in a nice field like education? *International Journal of Qualitative Studies in Education, 11*(1), 7-24.

Lee, J. (2002). Racial and ethnic achievement gap trends: Reversing the progress towards equity? *Educational Researcher, 31*(1), 3-12.

Lee, J. (2004). Multiple facets of inequality in racial and ethnic achievement gaps. *Peabody Journal of Education, 79*(2), 51-73.

Lipman, P. (1997). Restructuring in context: A case study of teacher participation and the dynamics of ideology, race, and power. *American Educational Research Journal, 34,* 3-37.

Lubienski, S. T. (2001). *A second look at mathematics achievement gaps: Intersections of race, class and gender in NAEP data.* Paper presented at the American Educational Research Association, Seattle, WA.

Lubienski, S. T. (2003). A closer look at Black-White mathematics gaps: Intersections of race and SES in NAEP achievement and instructional practices data. *Journal of Negro Education, 71*(4), 269-287.

Malloy, C. E. (1997). Including African American students in the mathematics community. In J. Trentcosta & M. J. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 23-33). Reston, VA: NCTM.

Martin, D. B. (2000). *Mathematics success and failure among African-American youth: The roles of sociohistorical context, community forces, school influence, and individual agency.* Mahwah, NJ. Lawrence Erlbaum Associates.

Mickelson, R. A. (2001). Subverting Swann: First- and second-generation segregation in the Charlotte-Mecklenburg Schools. *American Educational Research Journal, 38*(2), 215-252.

Oakes, J. (1990). Opportunities, achievement and choice: Women and minority students in science and mathematics. In C. Cazden (Ed.), *Review of research in education, 16* (pp. 153-222). Washington, DC: American Educational Research Association.

Oakes, J., & Lipton, M. (1996). Developing alternatives to tracking and grading. In L. I. Rendon & R. O. Hope (Eds.), *Educating a new majority: transforming America's educational system for diversity.* San Francisco: Jossey-Bass.

Orr, A. (2003). Black-White differences in achievement: The importance of wealth. *Sociology of Education, 76*(October), 281-304.

Schoenfeld, A. (2002). Making mathematics work for all children: Issues of standards, testing, and equity. *Educational Researcher, 31* (1), 13-25.

Secada, W. (1992). Race, ethnicity, social class, language and achievement in mathematics. In D. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 146-164). New York: Macmillian.

Slavin, R. E., (2002). Mounting evidence supports the achievement effects of Success for All. *Phi Delta Kappan, 83,* 469-471, 480.

Strutchens, M. E., & Silver, E. A. (2000). NAEP findings regarding race/ethnicity: Students' performance, school experiences, and attitudes and beliefs. In E. A. Silver & P. A. Kenney (Eds.), *Results from the seventh mathematics assessment of the National Assessment of Educational Progress* (pp. 45-72). Reston, VA: NCTM.

Tate, W. F. (1997a). Critical race theory and education: History, theory and implications. In M. Apple (Ed.), *Review of Research in Education* (pp. 195-247). Washington, D.C.: American Educational Research Association.

Tate, W. F. (1997b). Race ethnicity, SES, gender and language proficiency trends in mathematics achievement: An update. *Journal for Research in Mathematics Education, 28*(6), 652-679.

Thompson, C. L., & O'Quinn, S. D. (2001). *Eliminating the Black-White achievement gap: A summary of research.* Chapel Hill: The North Carolina Education Research Council.

Valdes, G. (1996). *Con respecto: Bridging the distance between culturally diverse families and schools.* New York, NY: Teachers College Press.

Viadero, D. (2000). Lags in minority achievement defy traditional explanations. *Education Week* [on-line]. Available: http://www.edweek.org/ew/ewstory.Cfm?slug=28causes.h19.

Wenglinsky, H. (2004) Closing the racial achievement gap: The role of reforming instructional practices. *Education Policy Analysis Archives,* 12(64). Retrieved [date] from http://epaa.asu.edu/epaa/v12n64/.

Wirt, J., Choy, S., Rooney, P., Provasnik, S., Sen, A., & Tobin, R. (2004). *The condition of education 2004* (NCES 2004-077). Washington, DC: U.S. Department of Education; Institute of Education Sciences.

Scale/ Item	n	Mean*	Standard deviation
Language			
Teacher preparation to teach LEP/ESL/bilingual students has an impact on student achievement.	362	3.74	.81
There are language barriers in mathematics curricula materials (e.g. textbooks)	369	3.45	.95
Language barriers impede effective communications of mathematics concepts.	369	3.64	.90
Standardized tests/assessments are biased in terms of language used.	368	3.43	1.04
Language difficulties hinder performance on standardized tests.	368	3.95	.84
Overall		3.64	
Student Characteristics			
Negative peer pressure causes some groups of students to not to want to do well in school.	370	4.16	.78
Students with strong family support almost always do better academically.	368	4.50	.69
Some students are more motivated to learn than other students.	369	4.62	.55
Students' intellectual ability is a factor that contributes to the achievement gap.	369	3.45	1.04
Students' interest in mathematics and related areas (i.e., technology, science, etc.) contributes to the achievement gap.	367	3.89	.73
Work ethics of students is a factor that causes some students to do well thus impacting the achievement gap.	366	4.46	.67
Overall		4.18	
Politics and Policy			
Socioeconomic status plays a major role in student achievement.	370	4.08	.89
Standardized testing contributes to the achievement gap because it does not accurately measure what some students know and can do in mathematics.	370	3.63	1.13
The location of schools (urban, suburban or rural) plays a role in the achievement gap.	369	3.81	.92
Differentials in funding allocations lead to a differential in learning outcomes among students.	363	3.23	.92
Overall		3.84	
Curriculum and Instruction			
Teachers have different expectations about the mathematics ability of some student groups.	370	3.46	1.02
There is unequal access to quality curricula materials.	370	3.31	1.23
Teachers' beliefs and commitment to equity contribute either positively or negatively to the achievement gap among groups of students.	368	3.91	.87
Overall		3.56	

*Based on a five-point scale.

Table 1. Descriptive Statistics for Items by Scale

	Language	Student Characteristics	Politics and Policy	Curriculum and Instruction
% White/ Caucasian (n=315)	.161* -	.126*	-.019-.070	
% African American (n=315)	.092	-.070	.029	.082
% Latino/Hispanic (n=315)	.151*	-.091	-.090	-.071
% Free/ Reduced lunch (n=270)	.107	-.092	-.048	.073

*p<.05

Table 2. Correlations Among Student Population Characteristics and Scale Scores

Position	Student Characteristics	Politics and Policy	Curriculum and Instruction
6-8 Teacher (n=152)	4.18	3.88	3.65
9-12 Teacher (n=218)	4.18	3.82	3.49
Supervisor (n=57)	3.79	3.62	4.01
Univ. Faculty (n=76)	3.96	3.99	4.04

Table 3. Mean Scale Scores by Employment Position

Scale and Group	Mean Difference*	Standard Error	Sig. Level
<u>Student Characteristics</u>			
6-8 Teachers> Supervisors	.60	.143	.001
6-8 Teachers > Univ. Faculty	.45	.131	.009
9-12 Teachers > Supervisor	.67	.137	.000
9-12 Teachers > Univ. Faculty	.52	.124	.001
<u>Politics and Policy</u>			
6-8 Teachers> Supervisors	.52	.156	.011
Supervisors < Univ. Faculty	-.70	.175	.001
<u>Curriculum and Instruction</u>			
6-8 Teachers< Supervisors	-.53	.149	.006
6-8 Teachers < Univ. Faculty	-.45	.136	.014
9-12 Teachers < Supervisor	-.66	.142	.000
9-12 Teachers < Univ. Faculty	-.58	.129	.000

* Factor scores.

Table 4. Significant Post hoc Contrasts for Employment Position by Scale