

The Influence of Math Self-Efficacy on the College Enrollments of Young Black Women

Crystal R. Chambers
MaryBeth Walpole
Nolan Outlaw

East Carolina University
Rowan University
East Carolina University

National studies indicate that units and level of rigor in mathematics coursework are the strongest predictors of college enrollment. However, for young Black women there are often structural barriers impeding access to rigorous mathematics coursework, potentially impinging on postsecondary enrollment. In the present study the authors analyze the relationship between math self-efficacy and student propensity to enroll in any postsecondary institution as well as the relationship between math self-efficacy and the propensity enroll in four-year postsecondary institutions for Black women high school students. To do so, the authors use the National Center for Education Statistics (NCES) Educational Longitudinal Survey of 2002 and find that for young Black women students, having a higher math self-efficacy is positively associated with enrollment in a four-year institution. Unfortunately, their math self-efficacy erodes over time and lower mathematics self-efficacies are negatively associated with postsecondary enrollment. As students who start in a four-year environment are more likely to complete the baccalaureate degree, encouraging mathematics self-efficacy development is a logical step toward improving Black women's educational attainment.

Keywords: *mathematics education, self-efficacy, gender, college enrollment*

In *The Toolbox Revisited*, Cliff Adelman (2006) asserted that units and rigor in mathematics coursework are the strongest predictors of college enrollment. Yet, for young Black women there are often barriers impeding access to rigorous mathematics coursework and undermining their confidence in their mathematics abilities. In the present study, the authors explore the math self-efficacy of young Black women and its influence on college enrollment; specifically, analyzing the relationship between math self-efficacy and the propensity to enroll in any postsecondary institution as well as the relationship between math self-efficacy and the propensity enroll in four-year postsecondary institutions for Black women high school students. To do so, the National Center for Education Statistics (NCES) Educational Longitudinal Survey of 2002 (ELS: 2002/2013) is used where it is found that for young Black women students, having a higher math self-efficacy is positively associated with enrollment in a four-year institution. Unfortunately, their math self-efficacy erodes over time and lower mathematics self-efficacies are negatively associated with postsecondary enrollment. As students who start in a four-year environment are more likely to complete the baccalaureate degree, encouraging mathematics self-efficacy development is a logical step toward improving Black women's educational attainment.

Work like this, focusing specifically on college enrollment for young Black women, is important because the U.S. has a goal of leading the world in the number of college graduates by 2020. Scholars examining the college choice process have long-noted variance in factors predicting college enrollment by race and gender, but have been unable to address underlying phenomena contributing to these results, much less disentangle race and gender effects (Bergerson, 2010; Bergerson, Heiselt, & Aiken-Wisniewski, 2013; Hamrick & Stage, 1998, 2004). By focusing singularly on young Black women, the authors are able to garner an understanding of the relationship between their mathematics self-efficacy and college enrollment. This allows for clarity of focus, providing leverage for intervention and strategies to support young Black women students.

A TALE OF TWO 7TH GRADERS

To help contextualize mathematics self-efficacy among Black girls the authors draw from case studies in the dissertation of Jones (2012).

In 7th grade Tyana loved to participate during class discussions and felt safe to ask questions without feeling embarrassed. Tyana had believed that only correct answers and few questions were valued during class discussions, but said that Mr. P. “broke me out of that mentality” . . . Tyana has become confident in her own ability and expects to be treated as a competent mathematics learner. She is affected by how teachers treat her. In 7th grade when Mr. P. misinterpreted her attitude and behavior in class, Tyana became discouraged which caused her to “just put my head down”. (Jones, 2012, pp. 220-221)

Jana [a 7th grader] liked mathematics and believed that she was capable of doing well. She was motivated and participated in mathematics activities and lessons that were challenging and fun—lessons she called “projects” that required her to work together in groups, with boys and girls, on problems over the course of several class periods. Jana said that this was new to her and usually helped her to “learn better.” Jana frequently wanted the teacher, Mr. P., to help her or her group and had often felt as though he didn’t give her or her group enough attention . . . Jana felt “forgotten” when she believed that she needed the teacher’s help. (Jones, 2012, p. 216)

What is particularly interesting in the latter case is the use of project-based learning, which can be a culturally relevant pedagogical strategy (Howard, 2003; Ladson-Billings, 1995). However, within the execution of this strategy the student, Jana, felt marginalized, perhaps indicating gender bias or a superficial level understanding of the strategy (Ladson-Billings, 2014; Sleeter, 2012). Across both cases, Dr. Jones captures a marginalization of academically bright Black girls in school generally, and mathematics classrooms specifically, a result that has been corroborated by other scholars (Campbell, 2012; Evans-Winters, 2011; Francis, 2012; Jones & Ford, 2014; Morris, 2007). Each author finds evidence of greater attention to student demeanor than academic development for Black female students in schools. In this literature review the authors discuss mathematics proficiency nationwide by gender and race followed by access to rigorous coursework and barriers student encounter, then turn to a discussion of access to rigorous mathematics for young Black girls and their mathematics self-efficacy. Research specifically focusing on Black female students is sparse, and the literature focusing on their access to and success in mathematics is even more difficult to find. The authors include the research specific to Black girls and young Black women when it is available, and otherwise consider implications based on the research focused on Black students, socioeconomic status (SES), and on female students.

REVIEW OF THE LITERATURE

Differences in student mathematics proficiency by race and by gender are long standing nationally and internationally. Girls tend to perform better in the classroom while boys tend to outperform girls on national tests (Martinez & Guzman, 2013; Organization for Economic Cooperation and Development [OECD], 2015). The gender gap in exam performance is small; however, the racial divide is wide with Black, Hispanic, and Native American students not faring as well as their White and Asian/ Pacific Islander counterparts (NCES, 2011, 2015a). Furthermore, Black and Hispanic students tend to be overrepresented in mid-level curriculum but underrepresented in the most rigorous curriculum by a factor greater than two (NCES, 2009). As such, access to rigorous coursework is a principle consideration in racial/ethnic mathematics performance gaps.

There are wide opportunity differences between schools, which impinges upon student access to high rigor coursework (Lipman, 2003; Perna, 2004; St. John & Chung, 2006). Oakes (1990) found that secondary schools with high concentrations of low-income students tended to have fewer mathematics courses, although there was not significant variance by racial concentration. Overall, SES mediates not only access to a more rigorous high school curriculum, but mediates

college access as well (Bergerson, 2010; McDonough, Antonio, Walpole, & Pèrez, 1998; St. John, Hu, & Fisher, 2011; Walpole, 2007). Yet, because Black students are overrepresented in low-income schools, they are disproportionately impacted.

Within schools, access to rigorous mathematics coursework is racially stratified. At the more rigorous end of the spectrum White students have more access to gifted (AIG), advanced placement (AP), and honors course work (Darity et al., 2001). At the lower end of the spectrum, Black students are disproportionately tracked into vocational and lower curricular tracks (Diette, 2012; Kao & Thompson, 2003; Noguera, 2004; Oakes, 1985; Oakes, Joseph, & Muir, 2003; Perna, 2004; Tate & Rousseau, 2002). As a result, Black students enroll in fewer mathematics courses and those taken tend to be less rigorous (Kao & Thompson, 2003).

Since the 1980s Black students have taken increasingly more math classes and enrolled in higher rigor courses than in previous decades (Battey, 2013). At the same time, the number of mathematics courses taken and level of rigor increased for all students. Thus, even as Black students take more courses, numerically and by rigor, higher rigor coursework is required to remain competitive for access to higher education, especially in the four-year sector (Kim, Kim, DesJardins, & McCall, 2015).

School personnel are gatekeepers to rigorous mathematics coursework, school counselors in particular. Yet, students in high poverty schools have less access to their counselors, typically due to higher caseloads among school counselors, and are less likely to get college preparatory counseling (McDonough, 1997; Riehl, Pallas, & Natriello, 1999; Woods & Domina, 2014). More specifically, Ogbu (2003) found that Black students felt that school counselors were less likely to refer them for gifted, honors, or AP coursework. However, Gafford Muhammad (2008) found that for young Black men, having a school counselor who believed they could succeed in college had as high an effect on college predisposition as having the support of one's father. Unfortunately, that support is not always available. Early research found school counselors were more likely to recommend students for more rigorous coursework based on appearance, decorum, and perceived (as opposed to assessed) academic ability (Cicourel & Kitsuse, 1963).

Teachers also contribute to student curricular access by recommending, persuading or dissuading students from rigorous curricular paths (Campbell, 2012; Yonezawa, 2000). In early childhood education, teachers select student curricular tracks within schools (Condron 2007; Hughes, Gleason, & Zhang, 2005), and this early tracking has consequences for access to rigorous courses throughout a student's educational experience (Oakes, 1990).

Catsambis (1994) suggested that young Black women are most hampered in their mathematics development due to limited exposure to rigorous coursework. During the early years, when students are initially sorted by ability young Black girls are perceived as less attentive and more disruptive than girls of other races or ethnicities (Francis, 2012). Viewing students in middle grades, Jones' (2012) case descriptions capture students' internalized perceptions of teacher condemnation for their behavior. Here teachers viewed these girls as disruptive, even while they sought aid in their mathematics coursework. These perceptions may be due to cultural mismatch and the ascription of behaviors such as communal problem-solving to poor behavior (Boykin, Tyler, & Miller, 2005; Francis, 2012; Tyler, Boykin, & Walton, 2006).

Fortunately, perceptions of student disruptiveness are not associated with recommendations for honors coursework, but these perceptions do generate attention to decorum (Fordham, 1993; Grant, 1984; Jones, 2012; Rollock, 2007; Sanders & Bradley, 2005) and could lead to disciplinary action (Blake, Butler, Lewis, & Darenshour, 2011; Crenshaw, 2015; Morris, 2007). Young Black women tend to receive more attention for their decorum than their academic acumen (Evans-Winters, 2011; Fordham, 1993; Francis, 2012; Morris, 2007). Disruptiveness is often mistaken for lack of attentiveness, and student attentiveness is significantly associated with teachers' recommendations for honors courses. Therefore young Black women are at a particular disadvantage for honors recommendations, although higher SES Black women have some advantage over their lower SES peers (Battey, 2013; Darity et al., 2001; Francis, 2012; Strayhorn, 2010).

In their assessment, Martinez and Guzman (2013) found that young Black women felt less challenged in mathematics. Their study of high school students is one of the few that distinguish the mathematics performance of young Black women from that of young Black men and other race women. In addition to being less challenged, Martinez and Guzman (2013) found young Black women were less likely to be enrolled in rigorous mathematics coursework. The authors then drew correlations to observed lower levels of classroom engagement. By contrast male and Asian female peers were more likely to be enrolled in more rigorous mathematics coursework, feel challenged, and be engaged in math classes. As gleaned from the literature race, class (real and perceived), as well as gender are factors confounding access to rigorous mathematics coursework for young Black women students.

The Role of Self-Efficacy

While young Black women as students are not as able to change structural deficiencies and inequalities within and between schools or the biases of school personnel, they tend to be hard workers who are diligent, academically engaged students (Chambers, 2009). Self-efficacy may help explain why young Black female students work as hard as they do in spite of the challenges they faced. Self-efficacy simply is a personal belief in one's abilities (Bandura, 1977, 1986). Bandura (1997) explained that when individuals are able to exert influence over circumstances in which "they can command some control, they are better able to realize desired futures and to forestall undesired ones (p. 1)." By contrast, "an inability to exert influence over things that adversely affect one's life breed apprehension, apathy, or despair" (Bandura, 1997, p. 1). Self-efficacy also relates to one's academic abilities and to one's personal beliefs in his or her academic abilities (Bandura, 1993, 1997). Higher academic self-efficacy is associated with higher achievement and greater momentum traversing academic challenges (Bandura, 1993, 1997; Zimmerman, 2000).

In the present study, the authors examine student academic self-efficacy in mathematics, exploring the relationship between student mathematics self-efficacy and college enrollment for young Black women students. Academic self-efficacy can be mediated by factors such as past success or failures as well as influenced by the perceptions of students' abilities by those around them (Bandura, 1997). Examining the relationship between student self-efficacy and mathematics performance in a single site, predominantly Black high school, Jones and Ford (2014) found that self-efficacy positively predicted mathematics achievement for Black girls, but not boys. Furthermore, the girls were able to distance their self-perceptions from how students were collectively viewed by others at school. This result stands to reason as Grant (1984) offered that young Black women work hard to be perceived as competent, and Chambers (2009) finds they make the most of resources at hand. In fact, young Black women are more likely than their other raced and gendered peers to follow through on their college aspirations, high school offerings notwithstanding (Chambers, 2009). As such, further examination of the relationship between self-efficacy and mathematics performance may be promising for improving academic outcomes for young Black women in mathematics and other academic subjects.

RESEARCH METHOD

This study used publicly available data from the Educational Longitudinal Study of 2002/2013 to answer questions the following questions:

1. What is the relationship between mathematics self-efficacy and enrollment in any postsecondary institution?
2. What is the relationship between mathematics self-efficacy and enrollment in a four-year postsecondary institution?

As the inquiry solely regards Black women, the sample population within this study is exclusive to them, examining Black women students in the 2002 base year survey, as well as the 2004 and 2006 follow-up surveys. Weighted samples yielded between 89,000 and 91,000 participants.

The research method was executed in two stages. First descriptive statistics were used to measure overall achievement and self-efficacy levels, using measures of central tendency and *t*-tests. The second stage included multivariate analysis, specifically forced entry logistic regression to examine variables associated with college attendance overall and specifically with four-year college attendance as compared to other postsecondary institutions, including two-year colleges and other postsecondary institutions. In keeping with the complex survey design, the weights utilized in each equation were the NCES recommended weights.

Logistic regression was appropriate because of the dichotomous nature of the dependent variables (0, did not attend college, 1, attended college; 0, attended a two-year or other postsecondary institution, 1, attended a four-year institution). The dependent variables are appropriate because, while Black women are considered successful in their college matriculation rates when compared to Black men, they are underrepresented in college enrollments overall. Whereas in 2012, 46% of White women and 41.7% of Latino women ages 18 to 24 enrolled in some form of higher education, only 38.7% of Black women did so (U.S. Census Bureau, 2013). Math achievement is an important predictor of college enrollment for all students (Adelman, 2006). Moreover, because students who begin at four-year colleges and universities are much more likely to complete a bachelor's degree (Walpole, 2007), understanding the relationship between young Black women students' math self-efficacy and enrolling at a four-year institution is an important contribution to the literature.

The number of cases included in the logistic regressions was small, between approximately 300 and 350, so a parsimonious equation was necessary. Independent variables in the equations included family SES in 2004 when the student would have been transitioning from high school to college, their standardized math achievement score, their math self-efficacy score, the highest math class completed, the student's degree aspirations, the student's plan for postsecondary enrollment following high school, and the sources of college information available to the student. Several categorical variables were recoded to ease the analysis and interpretation. Please see the Appendix for variables and coding.

Odds ratios for each of the independent variables were used in the analysis (Hosmer & Lemeshow, 1989; Menard, 1995; Mertler & Vannatta, 2002) with model quality statistics (chi square and predictive efficiency) following thereafter. The quality of both models was good, with predictive efficiencies above 75%, and significant chi squares. Bivariate correlations were run for all of the independent variables and there was some correlation among the variables. Therefore, collinearity tolerance and variance inflation factor (VIF) statistics were calculated. The tolerance for all variables each equation exceeded 0.1 and the VIF statistics did not exceed 1.6, both indicating the collinearity was not a problem (Field, 2013; Menard, 1995). Eigenvalues further indicated that collinearity was not problematic (Field, 2013).

RESULTS

Student degree aspirations varied from sophomore (2002) to senior year (2004), with bachelor's degree aspirations decreasing from 36% to 28%. Master's degree aspirations rose slightly from 17% to 21% and doctoral aspirations fell slightly, from 30% to 25% as shown in Table 1. In comparison, 2% aspired to a two-year degree in 2002, but by 2004 that climbed to 11%, signaling shifts in two directions: An increase in the number of two-year aspirants and decrease in the number of those aspiring to a bachelor's degree. It is also important to note that student family SES, as measured in 2004, was skewed negatively with 32% reporting a family SES in the lowest quartile, 30% in the second quartile, 25% in the third, and 14% in the highest quartile.

Table 1*Black Women High School Students' Highest Degree Aspirations, 2002, 2004*

Degree	2002	2004
Associate's	2%	11%
Bachelor's	36%	28%
Master's	17%	21%
Doctoral	30%	25%

When asked in 2004 about their plans after high school, two-thirds of the students planned to attend a four-year college following high school and 24% indicated a two-year college was their plan. This result, in combination with the findings in Table 1, suggests that some students intending to start at two-year institutions also have transfer and baccalaureate degree aspirations.

With regards to mathematics, by 2004, the year in which most sample participants were seniors, 35% of students reported algebra II as their highest math class, while another 42% indicated a course higher than algebra II, either trigonometry, pre-calculus, or calculus, as their highest math class. However, math standardized score quartiles were low, with 50% of students scoring in the lowest quartile, 28% in the second, 17% in the third, and 4% in the highest quartile. A paired samples *t*-test of students' standardized math scores and math self-efficacy scores was conducted to compare the mean scores for students in 2002 and 2004. As seen in Table 2, students' math scores and students' math self-efficacy decreased from 2002 to 2004.

Table 2*Standardized Math Scores and Mathematics Self-Efficacy (weighted N = 89720)*

	<i>Mean</i> 2002 (<i>SD</i>)	<i>Mean</i> 2004 (<i>SD</i>)	<i>Paired</i> <i>Mean</i> (<i>SD</i>)	<i>t</i>	<i>df</i>	Significance (2-tailed)
Standardized math scores	44.56 (7.92)	43.49 (7.89)	1.07 (3.72)	86.376	89719	.000***
Math self-efficacy	-.0730 (.95)	-.1368 (.94)	.064 (.99)	19.285	89719	.000***

Note. *SD* = standard deviation; *t* = *t* score; *df* = degrees of freedom; ****p* < .0001.

The two logistic regression models measuring whether a student attended any postsecondary institution and whether a student attended a four-year or a two-year (or other) institution were a good fit, each with a predictive efficiency above 75% and significant model Chi Squares. In each equation, all of the independent variables entered the equation and were significant; however, the odds ratios are intriguing as shown in Table 3.

Table 3*Odds Ratios: Black Women's College Attendance*

Variable Name (2004)	Model 1 DV= attended any postsecondary institution (n = 347)	Model 2 DV= attended four-year institution (n = 291)
Student degree aspirations	1.30***	1.46***
Highest math class	1.96***	1.79***
Postsecondary plans	2.79***	6.62***
College information sources	.92***	.91***
Family socioeconomic status	1.81***	.81***
Standardized math score	1.04***	1.09***
Math self-efficacy	.64***	1.30***
Model chi square	20118.***	29826.***
Predictive efficiency	85%	80%

Note. DV= dependent variable;*** $p < .0001$.

The dependent variable in the first equation was whether the students attended any postsecondary institution following high school. Factors included were student degree aspirations, highest math class, postsecondary plans, college information sources, family SES, prior achievement in the form of their standardized mathematics score in 2004 and their mathematics self-efficacy. Each factor was statistically significant with student plans to attend postsecondary education after high school and highest math class registering the largest positive effect sizes. These were followed by family SES and student degree aspirations. Odds ratios for college information sources and math self-efficacy fell below 1, signifying lowered odds of attendance at any postsecondary institution by these factors.

In the second equation, the dependent variable was whether the student attended a four-year college or university following high school. The same independent variables from the above equation were used. In changing the dependent variable, mathematics self-efficacy doubled, registering a positive odds ratio and a larger effect size. Student postsecondary plans after high school registered a large effect size, but the effect size of the highest math class diminished. The effect size for standardized math scores increased slightly. However, family SES joined college information sources in reducing the odds of attending a four-year institution.

DISCUSSION

Several causes for concern arose within the descriptive results. Students' degree aspirations decreased from sophomore year to senior year, with the percentage aspiring to a two-year degree rising over the same time period. Furthermore, concern comes from the *t*-tests, which indicate a significant decline in math achievement and in math self-efficacy from the sophomore year to senior year. Moreover, in their senior year in high school, over one-third of students report algebra II as their highest math class, the bare minimum for entering a four-year college, and one-half of students scored in the lowest quartile for math. As Black women are underrepresented in higher education (NCES, 2015b; U. S. Census Bureau, 2013), this work paints an unflattering data portrait of Black women's academic performance; yet it contributes to documentation of educational inequity.

While each of the variables was significant, there were similarities and differences across equations. In both, students' degree aspirations, the highest math class completed, standardized mathematics score and students' plans to attend college immediately following high school significantly increased the odds of postsecondary education enrollment generally, and enrollment in four-year institutions particularly. For student degree aspirations, postsecondary plans after high school and standardized mathematics scores, the odds increased in moving from enrollment in any institution to enrollment in a four-year institution. However, as was found in Kim and colleagues (2015), highest math course becomes less of a factor among students enrolling in four-year institutions. In fact, we may be coming to a time when algebra II is not sufficient for entry into a four-year institution. As described by Battey (2013), enrollment in higher rigor mathematics coursework is a necessary, but not sufficient condition for four-year college/university enrollment.

Another similarity across equations is that the variable college information sources decreased the odds of both outcomes. College information includes contacts with school personnel as well as community members, persons with which a student would consult to get more information about postsecondary education. Since the variable was coded positively, it may be that a student seeking a higher number of information sources indicates that the student is lacking a substantial amount of information and is in need or is not receiving enough of the necessary information to make a successful transition. This finding speaks to the competing roles of school counselors. Counselors are important college information resources, especially in lower-resourced communities. Yet, their time is spent on other tasks that often require immediate attention at the expense of time on traditional college counseling (Gafford Muhammad, 2008; McDonough, 1997; Woods & Domina, 2014). While community-based resources, such as churches and nongovernmental organizations, can help (Freeman, 2005), accessing information from these outlets requires active participation. Schools, however, have access to students; therefore, it may behoove schools to partner with organizations in their neighborhoods to supplement college counseling information when school resources are insufficient.

Results between the equations vary according to SES. The fact that higher family SES is associated with increased odds of attending any postsecondary institution is not surprising given the amount of research linking family SES and academic achievement (Bergerson, 2010; McDonough et al., 1998; St. John, Hu, & Fisher, 2011; Walpole, 2007). The more interesting finding is that the odds of attending a four-year college decrease as family SES increases. While the odds ratio does not indicate a big effect size, it is a significant and surprising finding. Perhaps this sample of Black females is weighing the costs and benefits of starting at a four-year versus a two-year or other institution, preferring non four-year institutions as a start. Further inquiry should account for the role of tuition, financial aid, and for-profit advertising in the college choice process among the Black middle class particularly.

Finally, higher math self-efficacy is associated with higher odds of attending a four-year college, but overall decreases the odds of attending any postsecondary institution. This finding seems counterintuitive. A plausible explanation is that while increased math self-efficacy improves the likelihood of attending a four-year college, the marginal effects of increased math self-efficacy are not strong enough to predict postsecondary attendance among young Black women. This may also allude to something more psychological in nature: a determination to achieve one's highest aspirations in spite of (rather than because of) how one assesses their own academic performance generally, and mathematics self-efficacy particularly. This explanation as a possibility is also supported by the large effect size for postsecondary plans, especially for attending a four-year institution. The effect size could be an indication of students' belief in themselves and determination to succeed regardless of prior mathematics achievement. This is different than the findings of Jones and Ford (2014); however, both studies point at the ability of young Black women to strive in spite of perceived challenges in math. While higher standardized test scores have a small positive association with enrollment at any postsecondary institution and a slightly higher effect size with enrollment at a four-year institution, on average young Black girls are not faring well on standardized mathematics exams: 50% of participants scored in the lowest quartile. It

stands to reason that over time confidence in mathematics ability wanes and they adjust degree aspirations; nonetheless, their follow through on postsecondary plans after high school remain strong.

Young Black women in this sample are taking the requisite mathematics courses for college entry: 78% take algebra II or higher. However, course-taking does not seem commensurate with concept mastery as demonstrated through exams. Such results for any individual can be disheartening, and erode one's confidence (Bandura, 1993, 1997; Zimmerman, 2000). While many, nevertheless, follow through with their postsecondary plans (Chambers, 2009), this study signals that we are losing young Black women baccalaureate aspirants to two-year institutions.

Implications are several and this list is inexhaustible. First, the change in the mathematics self-efficacy of young Black women in this sample over time is evident. Too often in schools, attention is given students who are having difficulty or those who excel. However, the erosion of one's mathematics self-efficacy may be a quieter phenomenon, particularly among students performing adequately, at or around average like many young Black women tend to do. This phenomenon is worthy of systematic evaluation to ensure that students have the psychological fortitude to achieve their highest potentials. This is especially true with respect to young Black women as they are more likely than their other raced and gendered peers to be overlooked academically. Second, given qualitative and mixed methods research examining interactions between young Black women and school personnel (Campbell, 2012; Evans-Winters, 2011; Francis, 2012; Jones, 2012; Jones & Ford, 2014; Martinez & Guzman, 2013; Morris, 2007), attention is warranted to not only the racial but also gendered aspects of culturally relevant pedagogical techniques in teacher and counselor education preparation programs, as well as in service teacher professional development. Too often school personnel are sidetracked by the appearance and decorum of young Black women, to the exclusion of academic acumen. As such, awareness and strategies to counter these tendencies, as well as the impact of these practices on young Black women would be helpful toward preventing self-efficacy erosion. Third, and specific to mathematics teacher education programs, culturally relevant strategies are necessary to bridge the divide between young Black women's course-taking and examination performance. This is where culturally relevant strategies should not only encompass those supporting student racial/ethnic identities, but gender identities as well. The focus on mathematics education is particularly critical given the strong association between mathematics performance and postsecondary enrollment. Finally, further research on the disconnection between course-taking and examination performance is warranted, as is scientifically based research to develop interventions and strategies to support students at the intersections of race and gender. This intersectional approach is important because trends vary along both dimensions. Beyond identity politics, intersectionality is about the inability to receive a remedy even as groups with which one shares identity traits are served because of the marginalization within ostracized groupings (Crenshaw, 1989; Dill & Zambrana, 2009). In this context, strategies for young women and girls generally, as they tend to focus on White students, may not be effective with non-White students. Similarly, strategies for young Black men may not be as effective with young Black women. While not a theoretical framework employed in this particular study, this study does point to further need for intersectional and critical race feminist research in education.

LIMITATIONS

A significant limitation of the present study is in the use of data publicly available. These authors were limited to student self-reports, as such, were not able to confirm student reports of mathematics course-taking with transcripts or more objectively verify family SES. Future research utilizing restricted files is warranted. In addition, there are fewer completed responses as the survey continued. For this reason, sample sizes within the logistic regression were smaller than in the descriptive analyses. Even with oversampling of minoritized populations it is difficult to maintain an adequate sample using national datasets. This is partly attributable to the numerical definition

of minority; however, encouragement to improve survey completion rates would help research on minoritized populations.

CONCLUSION

We started with the stories of two middle school Black girls who enjoyed and felt successful in their mathematics classes, but were negatively impacted by teachers: one ignored, the other disciplined for decorum. In the present study, over time, the mathematics self-efficacy of young Black high school women declines. While analysis at the level of national datasets cannot help us tease out the why, we do know that even while low, math self-efficacy is not a barrier to postsecondary education generally. Yet, having a higher math-efficacy is positively associated with enrollment in a four-year over other higher education institutions. As students who start in a four-year environment are more likely to complete the baccalaureate degree, encouraging mathematics self-efficacy development through supporting mathematics proficiency is a logical step toward improving the educational attainment of young Black women. In addition, given work on the over attention to decorum and under attention to academic development, young Black women could use support in developing an identity embodying their academic potential, especially in the area of mathematics.

Appendix
Variables and Coding
<ul style="list-style-type: none"> • Student Expectations: 1=Don't know; 2=Less than or equal to high school; 3=Some college; 4=BA/BS; 5= Masters; 6=PhD/MD/Other advanced
<ul style="list-style-type: none"> • Highest Math Class Completed: 1=Less than algebra II; 2=Algebra II; 3=>Algebra II
<ul style="list-style-type: none"> • Postsecondary Plan: 1=No plan/Don't know; 2= Less than or equal to a two-year college; 3= Four-year college
<ul style="list-style-type: none"> • College Information Sources: 1= No plan; 2= No sources; 3=1 source; 4=2 sources; 5=3 sources; 6=4 sources
<ul style="list-style-type: none"> • Family SES: Continuous
<ul style="list-style-type: none"> • Standardized Math test score: Continuous
<ul style="list-style-type: none"> • Math Self-Efficacy score: Continuous

REFERENCES

- Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, DC: U.S. Department of Education.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84, 191-215.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, 28, 117-148.
- Bandura, A. (1997). *Self-efficacy in changing societies*. Cambridge: Cambridge University Press.
- Battey, D. (2013). Access to mathematics: "A positive investment in whiteness." *Curriculum Inquiry*, 43, 332-359.
- Bergerson, A. A. (2010). College choice and access to college: Moving policy, research, and practice to the 21st century. *ASHE Higher Education Report*, 35, 1-152.

- Bergerson, A. A., Heiselt, A. K., & Aiken-Wisniewski, S. (2013). Refocusing college choice: Women's reflections on their postsecondary education choices. *NASPA Journal about Women in Higher Education*, 6, 185-211.
- Blake, J. J., Butler, B. A., Lewis, C. L., & Darensbourg, A. (2011). Unmasking the inequitable discipline experiences of urban Black girls: Implications for urban stakeholders. *Urban Review*, 43, 90-106.
- Boykin, A. W., Tyler, K. M., & Miller, O. (2005). In search of cultural themes and their expressions in the dynamics of classroom life. *Urban Education*, 40, 521-549.
- Campbell, S. L. (2012). For colored girls? Factors that influence teacher recommendations into advanced courses for Black girls. *Review of Black Political Economy*, 39, 389-402.
- Catsambis, S. (1994). The path to math: Gender and racial-ethnic differences in mathematics participation from middle school to high school. *Sociology of Education*, 67, 199-215.
- Chambers, C. R. (2009). Making a dollar out of fifteen cents: The early educational investments of young Black women. In Bush, V. B., Chambers, C. R., & Walpole, M. (Eds.), *From diplomas to doctorates: The success of Black women in higher education and its implications for equal educational opportunities for all* (pp. 39-53). Sterling, VA: Stylus.
- Cicourel A. V., & Kitsuse J. I. (1963). *The educational decision-makers*. Indianapolis: Bobbs Merrill.
- Condron D. J. (2007). Stratification and educational sorting: Explaining ascriptive inequalities in early childhood reading group placement. *Social Problems*, 54, 139-160.
- Crenshaw, K. W. (1989). Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago Legal Forum*, 1989, 139-167.
- Crenshaw, K. W. (2015). *Black girls matter: Pushed out, overpoliced and underprotected*. New York: Center for Intersectionality and Social Policy Studies. Retrieved from http://static1.squarespace.com/static/53f20d90e4b0b80451158d8c/t/54dcc1ece4b001c03e323448/1423753708557/AAPF_BlackGirlsMatterReport.pdf
- Darity, W., Jr., Castellino, D., Tyson, K., Cobb, C., & McMillien, B. (2001). *Increasing opportunity to learn via access to rigorous courses and programs: One strategy for closing the achievement gap for at-risk and ethnic minority students* (Report No. UD-034-611). Raleigh: North Carolina State Department of Public Instruction. Retrieved from ERIC database. (ED459303)
- Diette, T. M. (2012). The whiter the better? Racial composition and access to school resources for Black students. *The Review of Black Political Economy*, 39, 321-334.
- Dill, B. T. & Zambrana, R. E. (2009). *Emerging intersections: Race, class, and gender in theory, policy, and practice*. New Brunswick, NJ: Rutgers University Press.
- Evans-Winters, V. E. (2011). *Teaching Black girls: Resiliency in urban classrooms* (Rev. ed.). New York: Peter Lang.
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th Ed.). Los Angeles: Sage.
- Fordham, S. (1993). "Those loud black girls": (Black) women, silence, and gender "passing" in the academy. *Anthropology and Education Quarterly*, 24, 3-32.
- Francis, D. V. (2012). Sugar and spice and everything nice? Teacher perceptions of Black girls in the classroom. *The Review of Black Political Economy*, 39, 311-320.
- Freeman, K. (2005). *African Americans and college choice: The influence of family and school*. Albany: State University of New York Press.
- Gafford Muhammad, C. (2008). African American students and college choice: A CRT perspective on the Hossler-Gallagher model. *NASSP Bulletin*, 92, 81-94.
- Grant, L. (1984). Black females "place" in desegregated classrooms. *Sociology of Education*, 57, 98-111.
- Hamrick, F. A., & Stage, F. K. (1998). High minority enrollment, high school lunch-rates: Predisposition to college. *The Review of Higher Education*, 21, 343-357.

- Hamrick, F. A., & Stage, F. K. (2004). College predisposition at high-minority enrollment, low-income schools. *The Review of Higher Education*, 27, 151-168.
- Hosmer, D. W. & Lemeshow, S. (1989). *Applied logistic regression*. Hoboken, NJ: Wiley.
- Howard, T. C. (2003). Culturally relevant pedagogy: Ingredients for critical teacher reflection. *Theory into practice*, 42, 195-202.
- Hughes J. N., Gleason K. A., & Zhang D. (2005). Relationship influences on teachers' perceptions of academic competence in academically at risk minority and majority first grade students. *Journal of School Psychology*, 43, 303-320.
- Jones, J. V. (2012). *Case stories of mathematical and racial identity among Black girls in a small urban school district* (Order No. 3549845). Available from ProQuest Dissertations & Theses Global (1284168990).
- Jones, M. H., & Ford, J. M. (2014). Social achievement goals, efficacious beliefs, and math performance in a predominately African American high school. *Journal of Black Psychology*, 40, 239-262.
- Kao, G., & Thompson, G. S. (2003). Racial and ethnic stratification in educational achievement and attainment. *Annual Review of Sociology*, 29, 417-442.
- Kim, J., Kim, J., DesJardins, S. L., & McCall, B. P. (2015). Completing algebra II in high school: Does it increase access and success? *The Journal of Higher Education*, 86, 628-662.
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32, 465-491.
- Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: aka the remix. *Harvard Educational Review*, 84, 74-84.
- Lipman, P. (2003). *High stakes education: Inequality, globalization, and urban school reform*. New York: Taylor and Francis.
- Martinez, S., & Guzman, S. (2013). Gender and racial/ethnic differences in self-reported levels of engagement in high school math and science courses. *Hispanic Journal of Behavioral Sciences*, 35, 407-427.
- McDonough, P. M. (1997). *Choosing colleges: How social class and schools structure opportunity*. Albany: State University of New York Press.
- McDonough, P. M., Antonio, A. L., Walpole, M., & Pèrez, L. X. (1998). College rankings: Democratized knowledge for whom? *Research in Higher Education*, 39, 513-537.
- Menard, S. (1995). *Applied logistic regression analysis* (Sage University Paper Series). Thousand Oaks, CA: Sage.
- Mertler, C. A., & Vannatta, R. A. (2002). *Advanced and multivariate statistical methods*. Los Angeles, CA: Pyrczak.
- Morris, E. W. (2007). "Ladies" or "Loudies"? Perceptions and experiences of Black girls in classrooms. *Youth and Society*, 38, 490-515.
- National Center for Education Statistics. (2009). *Race/ethnicity: Curriculum levels*. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved from http://www.nationsreportcard.gov/hsts_2009/race_curr.aspx
- National Center for Education Statistics. (2011). *Mathematics 2011: National assessment of educational progress at grades 4 and 8*. U. S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved from <http://nces.ed.gov/nationsreportcard/pdf/main2011/2012458.pdf>
- National Center for Education Statistics. (2014). *Digest of education statistics*. Washington, DC: U.S. Department of Education.
- National Center for Education Statistics. (2015a). *2015 Mathematics and reading assessments*. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved from http://www.nationsreportcard.gov/reading_math_2015/#mathematics?grade=4

- National Center for Education Statistics. (2015b). *Digest of education statistics*. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved from http://nces.ed.gov/programs/digest/d15/tables/dt15_306.10.asp?current=yes
- Noguera, P. A. (2004). Racial isolation, poverty, and the limits of local control in Oakland. *Teachers College Record*, 106, 2146-2170.
- Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven, CT: Yale University Press.
- Oakes, J. (1990). *Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science* (Report No. US-027-750). Santa Monica, CA: Rand. Retrieved from ERIC database. (ED329615)
- Oakes, J., Joseph, R., & Muir, K. (2003). Access and achievement in mathematics and science: Inequalities that endure and change. In Banks, J., & Banks, C. (Eds.), *Handbook of research in multicultural education* (2nd ed., pp. 69-90). San Francisco: Jossey-Bass.
- Ogbu, J. U. (2003). *Black American students in an affluent suburb: A study of academic disengagement*. Mahwah, NJ: Routledge.
- Organization for Economic Cooperation and Development (OECD) (2015). *The ABC of gender equality in education: Aptitude, behavior, confidence*. PISA, OECD. Retrieved from <http://www.oecd.org/pisa/keyfindings/pisa-2012-results-gender-eng.pdf>.
- Perna, L. W. (2004). The key to college access: A college preparatory curriculum. In Tierney, W. G., Corwin, Z., & Colyar, J. (Eds.), *Preparing for college: Nine elements of effective outreach* (pp. 113-134). Albany: State University of New York Press.
- Riehl, C., Pallas, A. M., & Natriello, G. (1999). Rites and wrongs: Institutional explanations for the student course- scheduling process in urban high schools. *American Journal of Education*, 107, 116-154.
- Rollock, N. (2007). Why Black girls don't matter: Exploring how race and gender shape academic success in an inner city school. *Support for Learning*, 22, 197-202.
- Sanders, J. L., & Bradley, C. (2005). Multiple-lens paradigm: Evaluating African American girls and their development. *Journal of Counseling and Development*, 83, 299-304.
- Sleeter, C. E. (2012). Confronting the marginalization of culturally responsive pedagogy. *Urban Education*, 47, 562-584.
- St. John, E. P., & Chung, A. S. (2006). Access to advanced math. In St John, E. P. (Ed.), *Education and the public interest* (pp. 135-162). Netherlands: Springer.
- St. John, E. P., Hu, J. & Fisher, A. (2011). *Breaking through the access barrier: How academic capital formation can improve policy in higher education*. Mahwah, NJ: Routledge.
- Strayhorn, T. L. (2010). The role of schools, families, and psychological variables on math achievement of Black high school students. *The High School Journal*, 93, 177-194.
- Tate, W., & Rousseau, C. (2002). Access and opportunity: The political and social context of mathematics education. In English, L. D. (Ed.), *Handbook of international research in mathematics education* (1st ed., pp. 271-300). Mahwah, NJ: Routledge.
- Tyler, K. M., Boykin A. W., & Walton, T. R. (2006). Cultural considerations in teachers' perceptions of student classroom behavior and achievement. *Teaching and Teacher Education*, 22, 998-1005.
- U. S. Census Bureau. (2013). *Current population surveys: Table 302.60: Percentage of 18- to 24-year-olds enrolled in degree-granting institutions, by level of institution and sex and race/ethnicity of student: 1967 through 2012*. Retrieved from http://nces.ed.gov/programs/digest/d13/tables/dt13_302.60.asp.
- Walpole, M. B. (2007). Economically and educationally challenged students in higher education: Access to outcomes. *ASHE Higher Education Report*, 33, 1-144.
- Woods, C.S. & Domina, T. (2014). The student-counselor ratio and the high school-to-college pipeline. *Teacher's College Record*, 116, 1-30.
- Yonezawa S. (2000). Unpacking the black box of tracking decisions: Critical tales of families navigating the course placement process. In Sanders, M. G. (Ed.), *Schooling students placed*

at risk: research, policy, practice in the education of poor and minority adolescents (pp. 109-140). Mahwah, NJ: Erlbaum.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, 25, 82-91.

AUTHORS

CRYSTAL R. CHAMBERS is an Associate Professor of Educational Leadership at East Carolina University in Greenville, North Carolina.

MARYBETH WALPOLE is Professor and Chair of Educational Services and Leadership at Rowan University in Glassboro, New Jersey.

NOLAN OUTLAW is an Adjunct Professor of Mathematics at East Carolina University.

All comments and queries regarding this article should be addressed to chambersc@ecu.edu

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.