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Abstract

This research was conducted to examine the influence of parental involvement, in the form of parent conversations, on mathematics achievement for high school girls. Data from the High School Longitudinal Study of 2009 (HSLS:09) public-use file provided a sample of 13,694 students, including 6,592 girls for our analyses. A scale for measuring parent conversations was developed and regression analyses were conducted to examine whether this scale variable predicted mathematics achievement. Results indicated that conversational parental involvement was a significant predictor of mathematics achievement for Black and White girls, but not Hispanic and Asian. Implications for research and policy initiatives are discussed.

Keywords

STEM policies, parental involvement, social, academic achievement, urban education, mathematics, identity

True to American (or world) ideology, parents are considered an essential factor in the academic success of their children. According to researchers (e.g., Hara & Burke, 1998; Hill & Craft, 2003; Park & Holloway, 2017), parental involvement in a child's educational life is positively associated with academic achievement. Given the weight of importance placed on parental involvement over the past 50 years since the landmark Coleman Report (1966), it comes as no surprise that researchers and policymakers continue to push for increased levels of parental involvement. Furthermore, when a student is struggling academically, educators and administrators often may assume that a parent is not involved in a child's academic life, particularly if parents are unable to attend school functions such as Back-to-School Night, Open House, or Parent-Teacher Conferences. Arguably, parents play a critical role in providing support at home; however, far too often attention is placed on "who" is missing at school events, or at home to support with homework, as opposed to who serves in the role of parent and even how the student defines parental involvement (Howard, 2019).

There is consensus regarding a need to more effectively involve parents in the educational process of all children in all school settings; however, the lack of parent involvement is often identified as an exacerbated problem in urban schools (Boutte & Johnson, 2014; Fantuzzo, McWayne, Perry, & Childs, 2004; Jeynes, 2007). As noted by Boutte and Johnson (2014), the term urban can be used to refer to schools in communities that have high population density in a particular region. Therefore, urban in this context refers to the schools and communities characterized by size and the diverse demographics of the population, such as differences in racial, ethnic, and cultural environments. Urban school settings also exist where students' languages, experiences, religions, and abilities are highly diverse (Milner, 2008; 2010). Finally, parents from low-income populations who are faced with the challenge of how to meet

the primary needs of their family while supporting their child's educational progress are also included in this context (Garcia, 2004). Parental involvement typically is confronted as a problem in urban schools as a direct result of limited resources and/or a perceived lack of support at home; however, this one-size-fits all approach to defining parental involvement does not serve all students well and neglects the various social practices that may comprise parental involvement (Barton, Drake, Perez, St. Louis, & George, 2004; Howard, 2019;Lightfoot, 2004).

How researchers and policymakers define "parental involvement" may impact whether a one-size-fits-all approach is utilized when seeking to improve parental involvement through wider educational policy initiatives. For example, extended family members often are integral to the parental structure (Young, Young, & Capraro, 2017); however, they are not always included in research related to the influence of parental involvement on achievement. Consequently, when supporting girls with their academic achievement during a time when they are underrepresented in certain fields such as Science, Technology, Engineering, and Mathematics (STEM), efforts made by policymakers and educators to somehow involve parents as academic motivators often miss the mark. Although there are differing approaches to exploring the issues, researchers and practitioners consider parent involvement an essential component in school reform (Hamlin, 2017; Jasis & Ordoñez-Jasis, 2012).

This study was conducted in response to gaps in the literature and increasing concerns about parental involvement for high school girls. Understanding the factors related to the achievement of girls in STEM is essential for the development and persistence of young girls as professionals in STEM fields. Although the central focus of this article is STEM achievement and parental involvement for all girls, it is important to note that conversations specifically about girls of color are prevalent in education, policy circles, and in a growing body of research

(Ireland et al., 2018; McGee & Spencer, 2015; Mickelson, Cousins, Williams, & Velasco, 2011). Black girls specifically are one of the groups most included in research from a deficit perspective when examining parental involvement and achievement (Watson & Bogotch, 2015). Additionally, researchers, educators, and administrators often assume that parents (or family) are blood relatives, even though this is not always the case for all girls (Howard, 2019).

Although there is a growing body of research around high school girls and the influence of parental involvement on achievement, prior work has either suggested that a lack of parental involvement for girls of color has negatively impacted their achievement or that their parents are less involved (or needed more) than their counterparts (Howard, 2015; 2019). Life contexts influence whether a parent becomes involved, specifically for urban high school students of color (Reynolds, Crea, Medina, Degan, & McRoy, 2014). How parental involvement plays out differs between homes. For example, parental involvement as an investment of time spent between family (not just parents) and students is less prominent in the literature about high school girls in general. Parental involvement certainly is an important variable to consider regarding children's social and academic development; however, how it has been defined and measured across racial and ethnic backgrounds has implications when making judgments on students' achievement.

Theoretical Framework

According to Bandura's social learning theory (1977), parents often influence the behavior of their children as models that provide examples of behaviors to observe and imitate. Bandura and Walter (1963) indicated that a subtle component of parental engagement, related to parent expectations, is expressed in what parents choose to do in their own lives and visible in how they care for their children. Parents taking a moment to express compassion through a conversation is a nuance of parental involvement, whereas the literature often gives more

attention to more overt actions. Bandura and Walter argued that a verbal display of love and acceptance positively affects children, more so than specific techniques that may be applied in parenting practices. The role of external positive reinforcement, when parents engage with their children, is emphasized in Bandura's social learning theory. Building on the work of Bandura, Jeynes (2007; 2010; 2014) suggested that academicians and educators need to further "understand the salience of subtle aspects of parental involvement in raising student achievement" (p. 750).

The present study extends the research of Jeynes (2007; 2010; 2014) with the notion that parents (or families) can support the achievement of their high school daughters by specifically engaging in conversations as opposed to showing up to school events. According to Jeynes (2010; 2011a), social scientists have underestimated the extent of parental involvement among children and youth of color for over three decades. Additionally, educators and researchers need to broaden their concept of parental involvement. Lack of parent involvement (or what is perceived to be lacking) is sometimes identified as an "urban problem." In this study, we give attention to the potential variance in how families of different racial and ethnic backgrounds define parental involvement. Support at school is imperative as is some form of support at home from whomever a high school girl considers to be family. The purpose of this study is to examine an alternative model of parental involvement and the ways in which it may be related to STEM achievement for high school girls. The research questions in this study are as follows:

1. How are nontraditional parental involvement factors related to high school girls' academic achievement?
2. Do nontraditional parental involvement factors predict achievement for high school girls differently when race is considered?

Furthermore, this article addresses the problematic issue of enforcing a shared definition of parental involvement when making policy and practice decisions related to girls and STEM. Before delving into the details of the data for this study, the traditional definition of parental involvement is outlined, followed by a discussion of how parental involvement has historically been linked to achievement, policy, and STEM.

Defining Parental Involvement

Parental involvement is defined in the literature as parenting behaviors that may directly or indirectly influence a child's academic, cognitive and social development (Cheung & Pomerantz, 2012; Fantuzzo, McWayne, Perry, & Childs 2004). Three distinct characteristics of parental involvement are prominent in the literature: (a) participation in schools; (b) communication between parents and schools; and (c) home educational activities (Epstein, 2005; Howard & Reynolds, 2008; Jeynes, 2007; Vukovic, Roberts, & Wright, 2013; Williams & Sanchez, 2012). Participation in schools refers to a parent's presence at school functions, their volunteer support, as well as Parent Teacher's Association (PTA) membership. Parental involvement in schools, as defined by administrators and educators, also includes parents' communication with teachers, such as written correspondences via letter or email and phone calls. Home educational activities include parents assisting their child with homework or engaging in dialogue about daily occurrences at school. For example, parental involvement can include parents asking their children about homework and encouraging good grades (Ing, 2014). Parental involvement also includes emotional and spiritual support given at home, as well as meeting a child's daily physical needs (Armor, 2006).

Current research continues to demonstrate the essential challenges and motivational factors that explain how parent behaviors make up the definition of 'parental involvement' (Jay,

Rose, & Simmons, 2017). Hill and Tyson (2009) conducted a meta-analysis that focused on academic socialization for middle school students and found ethnic variations in parental involvement. As noted in the introduction, a concerted discussion of the impact of parental involvement for high school students is less prominent in the literature. Mistretta (2017) addressed the potential importance of parent-child conversations as a way to inform teacher preparation and professional development frameworks for shifting teachers' mindsets and practices when working with families. This body of work is an essential first step towards a closer examination of how parental involvement is defined, especially during a time when there is apparent agreement about the significance of family conversations with regard to achievement. Positive parent-child conversations regarding achievement, as an extension of parental involvement, can potentially impact the academic success of students. In particular, according to Jeynes (2010; 2011a; 2011b) parents of children and youth of color tend to express their involvement in a different fashion than parents of majority, white families and, as such, social scientists have underestimated the style, extent and impact of parental involvement among children and youth of color.

The dominant narrative of girls of color has focused on poor perceptions of their parents' involvement versus the reality of who (or how someone) is involved in their home life. Prior research on the achievement of girls has also focused on poor academic performance associated with family or cultural factors (e.g., Ogbu, 1992; Taylor, Hinton, & Wilson, 1995), family configuration such as mother only or father only (e.g., Battle & Scott, 2000; Jeynes, 2000), and socioeconomic status (e.g., Blair, Blair, & Madamba, 1999; Farley, 2000). It is imperative to address that the traditional definition of parental involvement includes assumptions about who

are “parents” and ignores the fact that legal guardians, caregivers, and extended family often serve in this role, especially when considering the urban context.

Parental Involvement and Achievement

Research on parental involvement and achievement has focused largely on youth prior to high school (e.g., Vedder-Weiss & Fortus, 2011; 2012; 2013; Zimmerman, 2012). Although some research indicates that parental involvement tends to decrease as students move from middle school to high school, developmental and educational researchers have asserted that parental involvement across all levels of K-12 education is essential and affects the motivation and achievement of students (Collins & Laursen, 2004; Seginer, 2006; Toren, 2013) and that students whose parents are actively involved in their education have demonstrated higher levels of academic performance than students with less involved parents (Jeynes, 2007; Mandara et al., 2009).

Parental involvement in their child's education can potentially encourage academic achievement by (a) supporting the child’s increased self-perception of cognitive competence and (b) engaging with the teacher and school to promote an important student-teacher relationship (Bakker, Denessen, & Brus-Laeven, 2007). Parenting practices, such as creating a school-friendly home atmosphere, also have been linked to higher levels of achievement (Mandara et al., 2009). According to prior research, relationships and interactions regarding school are another important investment for parents when it relates to supporting the academic success of their children (Hornby & Lafaele, 2011; Orr, 2003). The term “investment” traditionally includes reading with children, helping with homework, or participating in school activities for younger students. Parents who engage in these activities may also be more concerned about the quality of their children's school or the educational resources available to the children at home (Jeynes,

2010; Orr, 2003). Less prominent in the literature is how the term investment is defined with regard to parental involvement for high school students.

In a meta-analysis, Jeynes (2007) concluded that two components of parental involvement had significant relationships to higher academic achievement: (a) parental involvement as an investment of time; and (b) parental involvement related to parenting style and expectations. For certain students (such as African American and Latino students) the correlation between parental involvement and academic achievement tended to be greater than it was for other racial/ethnic groups; however, the overall results indicated that parental involvement was associated with academic achievement regardless of race/ethnicity. Other researchers have also asserted that parental involvement is highly related to academic outcomes (e.g., Henderson & Mapp, 2002; Lee & Bowen, 2006).

Parental Involvement and Policy

The potential significance of parental involvement on academic achievement for students has been noted among researchers, as well as by policymakers (Howard & Reynolds, 2008). A parent's involvement in a child's education has been associated with positive outcomes; these outcomes include (a) higher grade-point averages; (b) improved achievement in mathematics, reading, and writing; and (c) improvement in the student's behavior such as an increase in social skills and casual relationships (Anderson & Minke, 2007). Although information about a parent's decision on whether to become involved in their child's education is still mostly unknown, there has been a significant increase in school and district policies that attempt to increase parental involvement. For example, both the No Child Left Behind Act (NCLB) in 2002 and the Every Student Succeeds Act (ESSA) in 2015 included provisions for family and parent involvement and consultation.

One main focus of both NCLB and ESSA was on raising the achievement of low-income and disadvantaged students through the encouragement of parental involvement (ESSA, 2015). Section 1118 of NCLB focused specifically on the requirement of schools, districts, and states to increase communication with families under certain funding programs. In 2015, NCLB was replaced by the ESSA. Similar to NCLB, ESSA sought to raise achievement for low-income and disadvantaged children; however, ESSA made new provisions that further identified the need to include all family members and those closest to the student who may influence student decision-making and achievement. Another provision made in ESSA was that schools would receive funds if they conducted outreach to all parents and family members. Furthermore, each school district that receives Title I funds (commonly inclusive of urban schools) was mandated to distribute to parents and families a written parent and family involvement policy which would establish the agency's expectations and objectives for meaningful parent and family involvement (ESSA, 2015). ESSA also involves parents in the activities of Title I schools by requiring the schools to establish a parent advisory board comprised of a representative group of parents or family members to represent the needs of the population served by the district, and to review and revise the district's parent and family involvement policy.

Over the years, educational policies have continued to focus on school-based involvement (Herrold & O'Donnell, 2008), or home-based involvement specifically linked to parents helping their children with homework (Jeynes, 2010; 2013). Recent federal policy has moved towards a shift in family involvement requiring schools to develop "school-family compacts" that outline how schools and families can collaborate to support student achievement (Mapp & Kuttner, 2013; Mistretta, 2017).

Parental Involvement and STEM

Parental involvement is enacted in different ways in the homes of students and encouraged in multi-faceted ways by schools and through educational policy. In addition to research related to policy and parent involvement and how parents can influence academic achievement, there is extensive literature on the need to recognize and support girls in STEM, specifically in mathematics and science (e.g., Brickhouse, Lowery, & Schultz, 2000; Gunderson, Ramirez, Levine, & Beilock, 2012; Osborne, Simon, & Collins, 2003; Tichenor, Welsh, Corcoran, Piechura, & Heins, 2016). Interactions with parents can positively influence girls' attitudes and confidence about school, specifically in the area of math achievement (Tichenor et al., 2016); however, limited research exists regarding the relationship between parental involvement (especially in the form of parent conversations) and STEM achievement for high school girls. Parents may have a stronger influence on the choices students make related to their schooling and careers compared to teachers, counselors, friends, other family, or individuals working within their fields of interest (Jeynes, 2013; Trusty, 1996).

General Method

Overview

In the studies reported here, data from the National Center of Education Statistics High School Longitudinal (HSLS:09) study were used. The HSLS:09 focuses on understanding students' trajectories from the beginning of high school into postsecondary education and beyond. The data include results from study-administered surveys, academic transcripts, and data banks. The analyses include data from the first three waves of data collected in the longitudinal study between 2009 and 2014. Study 1 examines survey items in the dataset that address parental involvement to establish a parental involvement scale based on Conversational Parental

Involvement (CPI). Study 2 examines the relationship between the CPI scale and the academic achievement of high school students overall, as well as for girls by race.

Procedure

The analyses for these studies were conducted using the public-use dataset for the HSLS:09. This dataset includes scales on several psychological and educational constructs but does not include a scale on parental involvement. In Study 1, we conducted principal components factor analysis (PCFA) using SPSS version 22 on HSLS:09 data collected from high school students and their parents on their parental involvement practices. Study 2 was conducted using data from three waves of the HSLS:09 dataset. Regression analyses, utilizing the scale produced from Study 1 and employing complex survey dataset procedures in Stata version 15, were used to examine the predictive power of the CPI scale on student academic achievement.

Data Analyses

In Study 1, factor analysis was conducted on 11 items drawn from a parent survey administered as part of the second wave of data collection in the HSLS:09. This procedure resulted in the four-item CPI scale modeled around reported frequency of categories of conversations parents had with their students. In Study 2, the CPI scale was examined for its possible relationship to students' grade-point averages in math courses through 12^{th} grade, which were compiled from their high school transcripts. These analyses were conducted for all students, for girls only, and for girls by race to discern any differences in the relationship by subpopulations.

Study 1

Participants

Data from the High School Longitudinal Study of 2009 (HSLS:09) were used in this study to examine parental involvement as a predictor of achievement for high school girls in STEM, specifically in mathematics achievment. For the analyses, data from questions answered by girls and their parents were extracted by the researchers for this article from the full HSLS:09 public-use dataset. The National Center for Education Statistics (NCES) instituted the Secondary Longitudinal Studies Program (SLSP) in response to the need for statistics and data on the state of education in the United States, as well as a need for policy-relevant, nationally representative samples of high school students. The purpose of the NCES SLSP is to evaluate students' educational, vocational, and personal development at different phases of their educational careers. The program also aims to study familial, social, institutional, and cultural factors that may have an impact on the development of students and to provide a "basis for further understanding correlates of educational success in the United States" (Ingles et al., 2011). The High School Longitudinal Study of 2009 is the fifth study in the SLSP program. The time span covering the collection of data for the above longitudinal studies extends four decades.

The HSLS:09 focuses on understanding students' trajectories from the beginning of high school into postsecondary education and beyond. The data from the HSLS:09 include results from study-administered assessments, surveys, and data collected before this research project. The extant data come from a random sample of more than 21,000 students (entering 9^{th} grade) from 944 public, charter, and private schools in the United States. In 2009, the base year participants (in ninth grade) completed a mathematics assessment in algebraic skills, reasoning, and problem-solving. Additional data were collected via phone and online surveys administered

to the students, parents, math teachers, science teachers, school administrators, and counselors. The first follow-up data from the HSLS:09 were collected in the spring of 2012 when most participants from the sample were in 11th-grade. Similar to the base year, participants completed an online survey about their educational expectations, math and science efficacy, and plans for postsecondary education. High school transcripts subsequently were collected for participants in the 2013-14 academic school year (Ingels et al., 2015).

Procedure

The HSLS questionnaire contained individual questions for parents; however, there were no parental involvement scales, making it difficult to measure the levels of intensity for clusters of questions related to parental involvement. One of the forms of factor analysis that is often used in the social sciences is principal components factor analysis (PCFA; Pallant, 2016; Urdan, 2017). Although PCFA and exploratory factor analysis (EFA) share similarities, PCFA was used in this research to reduce a set of factors when variables were highly correlated and to account for most of the variance of the observed variables. The researchers of the HSLS:09 survey also conducted principal component analysis to develop the scales that did exist in the dataset, from the student questionnaire responses (Ingles et al., 2011). Furthermore, PCFA implies a formative measurement model where item scores are assumed to be the cause of a construct (Dancey & Reidy, 2011; Fokkema & Greiff, 2017). EFA is a technique that identifies and measures variable constructs that cannot as robustly be measured directly; however, single items (e.g., How often did you help your child with homework?) could have been used to directly measure parent involvement. For these reasons, we conducted PCFA using SPSS on a set of 11 items from the HSLS:09 Parent Survey to create a parental involvement scale.

The HSLS:09 Parent Survey contained limited items related to parents' behaviors regarding their involvement in their child's schooling. A majority of the questions were about the student's home life, such as income and observed student behaviors; therefore, the first 11 items for the PCFA were selected based on face validity and prior research by Jeynes related to the less salient factors considered (e.g., parent conversations) when measuring parental involvement. Nine items were related to how often a parent discussed different academic issues with the student (Parent Conversations), and two were related to a parent's level of confidence in helping (Confidence Helping) the student with math or science homework (See Table 1 for specific items).

The eleven items from the Parent Survey were subjected to PCFA. Before performing PCFA, the suitability of the data for factor analysis was assessed. The first factor was distinguished by strong factor loadings for 4 of the 9 Parent Conversations (PC) items with factor loadings greater than .70, moderate factor loadings for the remaining five items (between .397 - .70), and none for the Confidence Helping (CH) items. This factor explained 36.8% of the total variance in the items. The second factor had strong factor loadings for the two items on CH and none of the other items, and explained an additional 14.2% of the variance.

Table 1

Factor Loadings for Varimax Orthogonal Three-Factor Solution

Item	Factor loading
Factor 1: Parent Conversations	
P2disccareer: How often discussed careers he/she might be interested in	.793
P2discclgapp: How often discussed applying to college/other schools after high school	.748
P2discclgexam: How often discussed preparing for college entrance exams	.739
P2disccourses: How often discussed selecting courses or programs at school	.731
P2discevents: How often discussed community/national/world events	.700
P2discjobs: How often discussed job that he/she might want to take after high school	.690
P2disctrouble: How often discussed things that were troubling him/her	.630
Factor 2: Confidence in Helping	
P2mthhweff: Confidence in helping with math homework 2011-2012/when last enrolled	.892
P2scihweff: Confidence in helping with science homework 2011-2012/when last enrolled	.860
Factor 3: Overlapping Items	
P2contactsch: How often contacted teen's school since start of 2011-2012 school year	.712
P2hwoften: How often helped teenager with homework	.487

Note. N=13,694

The third factor produced overlapping items with 3 of the 9 PC factors with loadings of greater than .30. This factor explained 9.2% of the variance. An inspection of the scree plot revealed a clear break after the second component. Using Catell's Scree Test (Figure 1), it was decided to retain two components for further investigation.

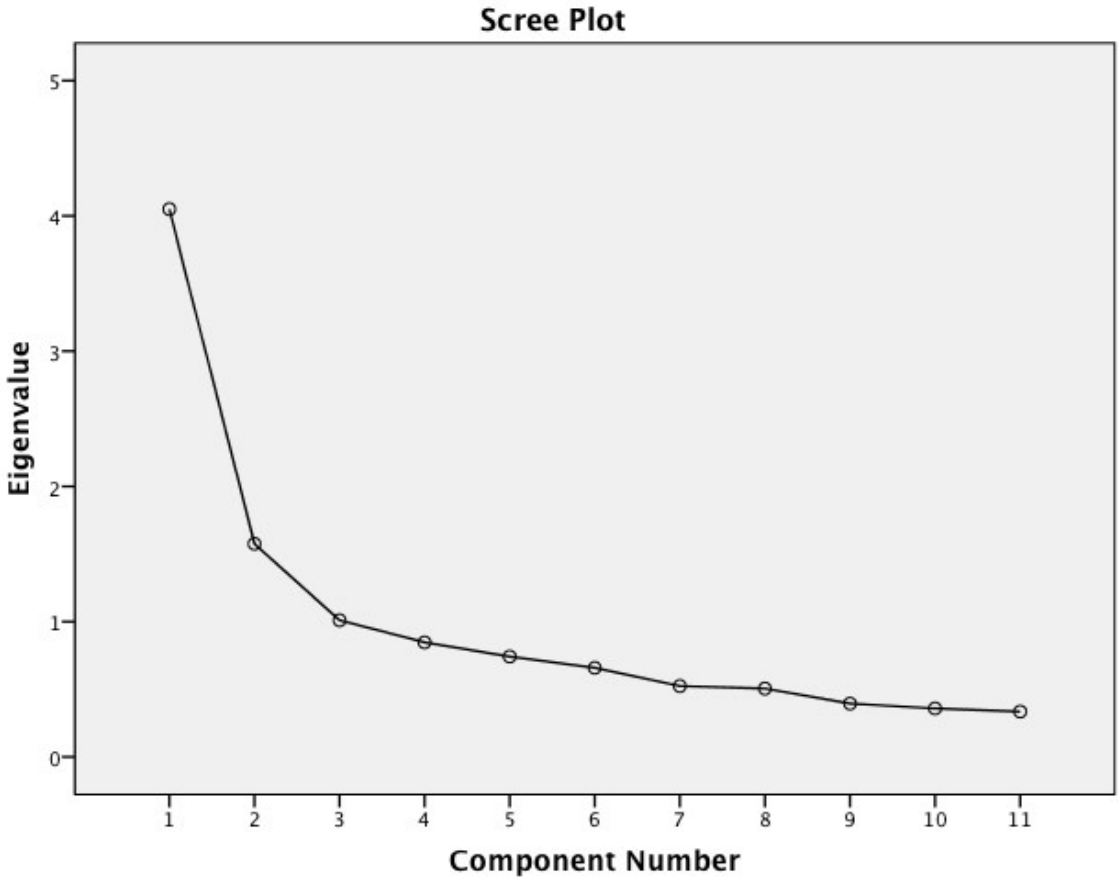

Figure 1: Screeplot used for Catell's (1966) scree test to determine how many components to retain for further analysis.

The two-component solution explained a total of 51.1% of the variance, with PC factors (Component 1) contributing 36.8% and CH factors (Component 2) contributing 14.3%. The subsequent PCFA produced strong factor loadings for 4 PC items (Table 2).

Table 2

Factor Loadings for Varimax Orthogonal Two-Factor Solution

Item	Factor loading
Factor 1: Parent Conversations	
P2disccareer How often discussed careers he/she might be interested in	.793
P2discclgapp How often discussed applying to college/other schools after high school	.748
P2discclgexam How often discussed preparing for college entrance exams	.739
P2disccourses: How often discussed selecting courses or programs at school	.731
P2discevents: How often discussed community/national/world events	.700
P2discjobs: How often discussed job that he/she might want to take after high school	.690
P2disctrouble: How often discussed things that were troubling him/her	.630
P2hwoften: How often helped teenager with homework	.456
P2contactsch: How often contacted teen's school since start of 2011-2012 school year	.397
Factor 2: Confidence in Helping	
P2mthhweff: Confidence in helping with math homework 2011-2012/when last enrolled	.892
P2scihweff: Confidence in helping with science homework 2011-2012/when last enrolled	.860

Note. N=13,694 and $\alpha = .82$ for entire measure

Results

The interpretation of the two components solution was consistent with the previous meta-analysis of Jeynes (2007), with parental involvement items related to parent attempts to engage with their children loading on Component 1 and items related to parents' confidence in helping loading on Component 2. The results of this analysis support the use of four items from

Component 1 with strong factor loadings greater than .70 for a Conversational Parental Involvement Scale (CPI – dataset variable PInv). Reliability analysis revealed that the four extracted items formed a reliable scale (Cronbach's alpha = .82) and the alpha would not improve with the removal of any of the items. All four items had item-total correlations greater than .60. The final four items selected for the CPI scale were as follows:

1. How often discussed selecting courses or programs at school
2. How often discussed preparing for college entrance exams
3. How often discussed applying to college/other schools after high school
4. How often discussed careers he/she might be interested in

The parental involvement scale established in this study (CPI), based on conversational parental involvement, provided an instrument critical to the analyses performed in Study 2.

Study 2

Participants

Data from the High School Longitudinal Study (HSLS:09) public-use dataset included a sample of 13,694 students, including 6,592 girls included in our analyses. The sample of girls included subpopulations of students who identified as Black (n = 712), Hispanic (n = 907), Asian (n = 552), and White (n = 3177).

Measures

Dependent variable. The HSLS:09 study variable X3TGPAMAT was the dependent variable for all of the regression analyses conducted. This is a composite variable providing the GPA for all high school math classes taken as indicated on student transcripts collected in 2013-14, which was the year following the cohort's expected graduation year.

Independent variables. The socio-economic status composite variable (X2SES) in the HSLS:09 is derived from parental education level, parental occupation, and family income. The HSLS:09 variable X2SES5Q is derived from the X2SES variable as it recodes the values into quintiles. Researchers have identified SES as a significant factor associated with students' academic performance, across racial groups (e.g., Frederickson & Petrides, 2008; Linnehan, Weer, & Stonely, 2011; Sung, Padilla, & Silva, 2006), therefore, it was included to identify its unique contribution to the dependent variable. The other predictor variable included in the analyses was the CPI scale variable (PInv) established in Study 1, to discern its unique contribution to the dependent variable.

Procedure

The HSLS:09 uses a complex sampling design, which necessitates the use of sample weights and adjusted standard errors to ensure that estimates made from the data are representative of the population, and that hypothesis testing yields accurate results. The standard error calculation procedure used in these analyses is the Balanced Repeated Replication (BRR) method, conducted in Stata 15, utilizing the main sampling weight (pweight = W3W1W2STU) and its associated set of 200 replicate weights (brr weight = W3W1W2STU001 - W3W1W2STU200) appropriate for these analyses. Standard regression procedures were conducted to examine the relationship between the CPI scale on students' high school GPA for mathematics courses (HSLS variable X3TGPAMAT). Given the influence SES can have on academic achievement, we included an HSLS:09 SES quintile variable (X2SESQ5) in our regression analyses as a predictor of clinical importance. Regression analyses were conducted on the entire dataset for all students for whom we had complete data (boys and girls), as well as for all girls, and girls by race (Black, Hispanic, Asian, and White). Tolerance and Variable Inflation

Factor (VIF) statistics were calculated for all models and all variables were well within acceptable criteria, indicating that multicollinearity is not an issue for these regression analyses.

Results

Regression results for all students (Tables 3 & 4) reveal that SES and parental involvement were both significant predictors of math GPA, explaining 13% of the dependent variable variance. Beta values indicate that SES was the stronger predictor for all groups combined.

Table 3
Means, Standard Deviations, and Intercorrelations for Math GPA and Predictor Variables for All Students

Variable	*M*	*SD*	1	2
Math Grade Point Average (X3TGPAMAT)	2.35	0.94	.30*	.27*
Predictor variable				
1. Socioeconomic Status Quintile (X2SESQ5)	2.98	1.50	-	.34*
2. Parental Involvement (PInv)	12.69	3.02		-

*p < .001.

Table 4
Regression Analysis Summary for SES and Parental Involvement Variables Predicting Math GPA for All Students

Variable	*B*	*BRR* SE B*	β	*t*	*p*
Socioeconomic Status Quintile (X2SESQ5)	0.16	0.01	.25	11.21	<.001**
Parental Involvement (PInv)	0.06	0.01	.18	7.54	<.001**

Note. R^2 = .13 (Observations *n*=13,694; Population *N*=1,582,251; p < .001).
*Balanced Repeated Replication Standard Error. **p<.001

Regression results for all girls (Tables 5 & 6) reveal similar results in that SES and parental involvement were both significant predictors of math GPA, explaining 14% of the

dependent variable variance. Beta values indicate that SES was the stronger predictor for the subpopulation including all girls.

Table 5
Means, Standard Deviations, and Intercorrelations for Math GPA and Predictor Variables for All Girls

Variable	*M*	*SD*	1	2
Math Grade Point Average (X3TGPAMAT)	2.47	0.80	.32*	.25*
Predictor variable				
1. Socioeconomic Status Quintile (X2SESQ5)	2.99	1.29	-	.35*
2. Parental Involvement (PInv)	12.86	2.59		-

*p<.001.

Table 6
Regression Analysis Summary for SES and Parental Involvement Variables Predicting Math GPA for All Girls

Variable	*B*	*BRR* SE B*	β	*t*	*p*
Socioeconomic Status Quintile (X2SESQ5)	0.18	0.02	.27	8.86	<.001**
Parental Involvement (PInv)	0.05	0.01	.15	4.53	<.001**

Note. R^2 = .14 (Observations *n*=6,592; Population *N*=776,577; p<.001).
*Balanced Repeated Replication Standard Error. **p<.001.

Regression results for Black girls (Tables 7 & 8) reveal markedly different results in that parental involvement was a significant predictor of math GPA, but SES was not. Combined, these variables explain 9% of the dependent variable variance. Beta values indicate that parental involvement was more than twice as strong a predictor as SES for the Black girl subpopulation of students.

Table 7
Means, Standard Deviations, and Intercorrelations for Math GPA and Predictor Variables for Black Girls

Variable	*M*	*SD*	1	2
Math Grade Point Average (X3TGPAMAT)	2.04	0.67	.19**	.28*
Predictor variable				
1. Socioeconomic Status Quintile (X2SESQ5)	2.54	1.04	-	.29**
2. Parental Involvement (PInv)	13.20	1.92		-

*p < .01. **p < .001.

Table 8
Regression Analysis Summary for SES and Parental Involvement Variables Predicting Math GPA for Black Girls

Variable	*B*	*BRR* SE B*	β	*t*	*p*
Socioeconomic Status Quintile (X2SESQ5)	0.07	0.05	.12	1.46	<.146
Parental Involvement (PInv)	0.09	0.04	.29	2.35	<.020**

Note. R^2 = .09 (Observations *n*=712; Population *N*=117,306; p = .013).
*Balanced Repeated Replication Standard Error. **p<.05

Regression results for Hispanic girls (Tables 9 & 10) indicate that SES was a significant predictor of math GPA, but parental involvement was not. Combined, these variables explain 8% of the dependent variable variance. Beta values indicate that for Hispanic girls, SES was more than twice as strong a predictor as parental involvement.

Table 9
Means, Standard Deviations, and Intercorrelations for Math GPA and Predictor Variables for Hispanic Girls

Variable	*M*	*SD*	1	2
Math Grade Point Average (X3TGPAMAT)	2.18	0.57	.20*	.17
Predictor variable				
1. Socioeconomic Status Quintile (X2SESQ5)	2.21	0.90	-	.33*
2. Parental Involvement (PInv)	12.02	2.25		-

*p < .001.

Table 10
Regression Analysis Summary for SES and Parental Involvement Variables Predicting Math GPA for Hispanic Girls

Variable	*B*	*BRR* SE B*	B	*t*	*p*
Socioeconomic Status Quintile (X2SESQ5)	0.15	0.06	.22	2.68	.008**
Parental Involvement (PInv)	0.02	0.03	.09	0.88	.377

Note. R^2 = .08 (Observations *n*=907; Population *N*=168,712; p < .001).
*Balanced Repeated Replication Standard Error. **p<.01

The results for Asian girls (Tables 11 & 12) provide yet another pattern; neither SES nor parental involvement was a significant predictor of math GPA, combining to explain only 3% of the variance in math GPA.

Table 11
Means, Standard Deviations, and Intercorrelations for Math GPA and Predictor Variables for Asian Girls

Variable	*M*	*SD*	1	2
Math Grade Point Average (X3TGPAMAT)	3.03	0.87	.16*	.13
Predictor variable				
1. Socioeconomic Status Quintile (X2SESQ5)	3.96	1.69	-	.38**
2. Parental Involvement (PInv)	13.25	3.44		-

*p<.05. **p = .001.

Table 12
Regression Analysis Summary for SES and Parental Involvement Variables Predicting Math GPA for Asian Girls

Variable	*B*	*BRR* SE B*	B	*t*	*p*
Socioeconomic Status Quintile (X2SESQ5)	0.07	0.07	.12	1.01	.311
Parental Involvement (PInv)	0.02	0.03	.07	0.63	.532

Note. R^2 = .03 (Observations *n*=552; Population *N*=27,095; p = .238).
*Balanced Repeated Replication Standard Error.

Finally, as the largest group in the data sample, the regression results for White girls (Tables 13 & 14) reveal results similar to that of the group consisting of all girls. SES and parental

involvement were both significant predictors of math GPA, explaining 11% of the dependent variable variance. Beta values indicate that SES was a slightly stronger predictor for this subpopulation of girls.

Table 13
Means, Standard Deviations, and Intercorrelations for Math GPA and Predictor Variables for White Girls

Variable	*M*	*SD*	1	2
Math Grade Point Average (X3TGPAMAT)	2.73	0.78	.30*	.26*
Predictor variable				
1. Socioeconomic Status Quintile (X2SESQ5)	3.44	1.23	-	.33*
2. Parental Involvement (PInv)	13.16	2.59		-

*p<.001.

Table 14
Regression Analysis Summary for SES and Parental Involvement Variables Predicting Math GPA for White Girls

Variable	*B*	*BRR* SE B*	B	*t*	*p*
Socioeconomic Status Quintile (X2SESQ5)	0.14	0.02	.21	6.08	<.001**
Parental Involvement (PInv)	0.06	0.01	.19	5.40	<.001**

Note. R^2 = .11 (Observations *n*=3,177; Population *N*=388,421; p<.001).
*Balanced Repeated Replication Standard Error. **p<.001.

Summary and Concluding Discussion

The first research question addressed in this study was: How are nontraditional parental involvement factors related to high school girls' academic achievement? Study 1 provided a conversational parental involvement scale with good internal consistency with which to measure the impact of this nontraditional approach to operationalizing parental involvement. Regression results in Study 2 indicated that the CPI scale was a significant predictor of math GPA for all students, both male and female, when all groups were analyzed together. Follow-up analyses addressed the second research question: Do nontraditional parental involvement factors predict academic achievement differently for girls of different races? Subpopulation analyses indicated

that the nontraditional measure created in Study 1 (CPI scale) predicted academic achievement differently for girls of different races. The CPI scale was a significant predictor of high school mathematics GPA for Black and White girls but was not a significant predictor for Asian and Hispanic girls. Beta values indicated that the influence of parental involvement for Black girls, as measured by the CPI scale, was more than twice as large as the influence of SES. This differed from the results for all other groups wherein SES was a stronger predictor of achievement than parental involvement. Thus, the impact of this nontraditional measure of parental involvement on STEM achievement is more pronounced for Black girls than for any of the other groups examined. These results suggest that traditional indicators of parental involvement may be insufficient to measure the full impact that parents may have on students' achievement through nontraditional support approaches. Furthermore, communication practices that may be more pronounced in some cultures than in others may be instrumental in providing positive support for girls' achievement in STEM subjects.

In summary, this study was conducted in response to gaps in the literature and concerns about parental involvement for high school girls as it relates to their academic success. Understanding the factors related to the achievement of girls in STEM is essential for the development and persistence of young girls as professionals in STEM fields. As previously noted, the differences between the groups of high school girls in this study indicated that parental involvement may differentially predict mathematics achievement between races/ethnicities.

General Discussion

The present study affirms that verbal interactions can positively impact students, as indicated by Bandura and Walter (1963); it extends the research of Jeynes (2007; 2010; 2014) with the notion that parents can support the achievement of their children by specifically

engaging in conversations about course selections, college selection, entrance exams and future careers. Building on the work of Bandura and Jeynes, the results of this study further emphasize the importance of understanding the subtle aspects or parental involvement especially as it relates to the continued support of girls in STEM. The design of the original items in the HSLS:09 Parent Survey may indicate there is work to be done to better understand the potential impact of parental involvement on student achievement. Lack of parent involvement is sometimes identified as an "urban problem," yet if attention is given to the potential variance in how families of different racial and ethnic backgrounds define and exhibit parental involvement it may be determined that this is actually not the problem that warrants the most attention. A potential challenge for researchers is to unpack the notion that parental involvement is defined in the same manner for all students, regardless of race, region, or socio-economic status. Perhaps researchers should focus on multiple definitions of subtle family involvement (and support) that extend beyond open house or back-to-school to include specific actions such as providing compassionate and verbal support related to academic engagement in STEM. As noted by Jeynes (2010), it is possible that the warmer and subtler element of parental involvement may in fact be more important than the current foci that are emphasized.

Although this research used data from a nationally representative sample of high school girls, extending this study through a mixed methods approach, in which high-achieving girls in high school or STEM graduates are interviewed about how they define parental involvement, may provide further insight regarding the relationship between parental involvement and achievement for high school girls. According to previous research, parental involvement (in various forms) has been shown to influence achievement. This study included the development of a reliable parental involvement scale that addresses a potentially more nuanced definition of

parental involvement that can be used for future studies. To more fully understand the relationship between parental involvement and academic outcomes for high school girls, researchers perhaps should focus on understanding parental involvement with greater attention given to less overt forms of involvement. Additionally, closer attention to who is defined as a parent (or family) is needed, especially in the urban context where assumptions are made about who are family members and whether their involvement meets educator expectations.

Limitations

The data in this study were focused on students who completed the HSLS survey questionnaire. The limitations of this study are related to the measurement of parental involvement. First, the parental involvement ratings were obtained through self-report. Although garnering self-report regarding parental support may provide useful data, self-perceptions are limited in scope and subject to recollection and potential social desirability. A related limitation is that the items on the survey regarding parental involvement are rather general. In particular, although a parental involvement scale was developed through factor analysis for this study, the items primarily focused on parents' responses of how often they discussed course and career selection with their child. Thus, the data do not provide any information about the specific content nor the depth of those discussions. Lastly, the dependent variable of high school mathematics GPA does not capture other, long-term outcomes such as college attendance or attainment of careers in STEM fields.

Future Research Direction and Policy Implications

In consideration of national efforts to address the need for supporting girls and women in STEM fields, this research may be timely. Inferences can be drawn from the relationships identified in the results, but specific causal relationships cannot be determined. Nonetheless, the

use of a nationally representative database positions the findings to be considered as more generalizable than similar findings with a smaller sample size. The HSLS:09 focuses specifically on the transition of youth through the paths that lead students to pursue and persist in STEM courses and careers. As previously mentioned, the NCES (2011) encourages researchers to examine the data in the HSLS:09 and the relationships among tested achievement, choice, access, and persistence. Current policy initiatives target middle-school students - and much of the prior research related to parental involvement focuses on early childhood and middle school students. Examining the impact of parental involvement on high school girls may provide more insight into the predictors of their STEM course selections and career trajectory.

Given the importance of the representation of girls in STEM, and the policy emphasis placed on STEM education and parental involvement, the findings from this study indicate that parental involvement in the form of communication (conversations) between high school girls and parents may need to be expanded upon in future research and policy initiatives. Educators, administrators, and policymakers can take deliberate actions to encourage and support more nuanced forms of parental involvement in policy and practice. Although it is difficult to "teach" how to engage in a compassionate conversation, educators and administrators can demonstrate this through their own conversations with parents and families. The variance in how families of different racial and ethnic backgrounds define and exercise parental involvement also requires attention. Assumptions made about traditional definitions of "how" parental involvement is defined is an important issue that should be addressed between parents, students, educators, administrators, and policymakers.

In the end, parental involvement may affect a student's achievement in STEM disciplines. To increase the involvement of parents and families toward STEM achievement for

high school girls, educational policy in the United States should strive, without making ill-informed assumptions, to employ broader strategies to engage parents in their child's learning. Family members often serve as partners in the learning process of students; family-to-child conversations and an investment of time can be important to the success of girls in STEM. Although researchers have suggested that gaps in achievement for girls and other underrepresented groups are beginning to narrow, our education system does not adequately address the many inequities in schooling practices for high school girls. Questions related to the relative influence of parental involvement strategies and how the term is defined need to be addressed further, in addition to the greater implications for future policy initiatives that are focused on parental involvement supports and interventions for high school girls.

On a concluding note, all the initiatives and research discussed presuppose that parent or parent surrogates (such as other family members or foster parents) are available and/or willing to be involved in a student's education (or indeed their life). The reality is that some parents are not available, due perhaps to financial, mental health or legal issues. When parents can and are willing to participate, we should welcome and support them, particularly given the research that supports the positive impact parental involvement can have on the achievement and welfare of children. Educators own our own borders in schools; therefore, we can define which parental involvement activities we encourage and value. When parents are not available, the school can provide mentorship and guidance for students. Future nationally-based research should focus not only on parent variables that may influence student outcomes, but other variables such as teacher and school support that serve to foster achievement in STEM and other fields, including and regardless of the level of parental involvement.

References

Addy, S., Engelhardt, W., & Skinner, C. (2013). Basic facts about low-income children (Children under 18 years, 2011). Retrieved from http://www.nccp.org/publications/pdf/text_1074.pdf

Anderson, K. J., & Minke, K. M. (2007). Parent involvement in education: Toward an understanding of parents' decision making. *The Journal of Educational Research*, *100*(5), 311–323.

Armor, D. J. (2006). Brown and Black-White Achievement. *Academic Questions, 19*(2), 40-46.

Bakker, J., Denessen, E., & Brus-Laeven, M. (2007). Socio-economic background, parental involvement and teacher perceptions of these in relation to pupil achievement. *Educational Studies, 33*(2), 177-192.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A., & Walters, R. H. (1963). *Social learning and personality development*. New York: Holt, Reinhart and Winston.

Barton, A.C., Drake, C., Perez, J.G., St. Louis, K., George, M. (2004). Ecologies of parental engagement in urban education. *Educational Researcher, 33*(4), 2-12.

Battle, J., & Scott, B. (2000). Mother-only versus father-only households: Educational outcomes for Black men. *Journal of Black Men, 5*, 93-116.

Boutte, G. S., & Johnson, G. L. (2014). Community and family involvement in urban schools. In: H. R. Milner, & K. Lomotey, (Eds.). *Handbook of Urban Education* (pp. 167-187). New York: Taylor & Francis-Routledge.

Blair, S. L., Blair, M. C. L., & Madamba, A. B. (1999). Racial/ethnic differences in high school students' academic performance. Understanding the interweave of social class and ethnicity in the family context. *Journal of Comparative Family Studies, 30*, 539-555.

Brickhouse, N. W., Lowery, P., & Schultz, K. (2000). What kind of a girl does science? The construction of school science identities. *Journal of Research in Science Teaching, 37*, 441-458.

Cheung, C., & Pomerantz, E. M. (2012). Why does parents' involvement in children's learning enhance children's achievement? The role of parent-oriented motivation. *Journal of Educational Psychology, 104, 820-832.*

Cohen, L., Manion, L., & Morrison, K. (2018). *Research Methods in Education.* New York, NY: Routledge.

Coleman, J., Campbell, E.Q, Hobson, C.J, McPartland, J., Mood, A.M, Weinfeld, F.D., & York, R.L. (1966). *Equality of Educational Opportunity.* United States Department of Education.

Collins W.A., & Laursen B. (2004). Parent–adolescent relationships and influences. In: R. Lerner, & L. Steinberg, (Eds.). *Handbook of adolescent psychology* (pp. 331-362). New York: Wiley.

Epstein, J. L. (2005). Attainable goals? The spirit and letter of the No Child Left Behind Act on parental involvement. *Sociology of Education, 78*(2), 179-182.

ESSA. (2015). Every Student Succeeds Act of 2015, Pub. L. No. 114-95 § 114 Stat. 1177 (2015-2016).

Fantuzzo, J., McWayne, C., Perry, M. A., & Childs, S. (2004). Multiple dimensions of family involvement and their relations to behavioral and learning competencies for urban, low-income children. *School Psychology Review, 33*(4), 467-480.

Farley, J. E. (2000). *Majority-minority relations*. Upper Saddle River, NJ: Prentice Hall.

Fokkema, M., & Greiff, S. (2017). How performing PCA and CFA on the same data equals trouble: Overfitting in the assessment of internal structure and some editorial thoughts on it. *European Journal of Psychological Assessment*, *33*(6), 399-402.

Frederickson, N., & Petrides, K. V. (2008). Ethnic, gender, and socio-economic group differences in academic performance and secondary school selection: A longitudinal analysis. *Learning and Individual Differences, 18*, 144-151.

Garcia, D. C. (2004). Exploring connections between the construct of teacher efficacy and family involvement practices. *Urban Education, 39*(3), 290-315.

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. Sex Roles, 66(3), 153-166.

Hamlin, D. (2017). Parental Involvement in High Choice Deindustrialized Cities: A Comparison of Charter and Public Schools in Detroit. *Urban Education*. https://doi.org/10.1177/0042085917697201

Hara, S.R., & Burke, D.J. (1998). Parent involvement: The key to improved student achievement. *The School Community Journal, 8*, 9-19.

Herrold, K., & O' Donnell, K.O. Parent and family involvement in education, 2006-07 school year, from the National Household Education Surveys Program of 2007. Institute of Education Sciences: National Center for Education Statistics [September 21, 2008] from http://nces.ed.gov/pubs2008/2008050.pdf.

Henderson, A.T., & Mapp, K.L. (2002). *A new wave of evidence: The impact of school, family, and community connections on student achievement*. Austin, TX: Southwest Educational Development Labaratory.

Hill, N.E., & Craft, S.A. (2003). Parent-school involvement and school performance: Mediated pathways among socioeconomically comparable African American and Euro-American families. *Journal of Educational Psychology, 9,* 74–83.

Hill, N. E., & Tyson, D. F. (2009). Parental Involvement in Middle School: A Meta-Analytic Assessment of the Strategies that Promote Achievement. *Developmental Psychology*, *45*(3), 740-763.

Hornby, G., & Lafaele, R. (2011). Barriers to parental involvement in education: An explanatory model. *Educational Review, 63*(1), 37–52.

Howard, N. R. (2015). "The Influences of Mathematics Self-Efficacy, Identity, Interest, and Parental Involvement on STEM Achievement in Algebra for Female High School Students". Chapman University, College of Educational Studies, CA. Dissertation.

Howard, N. R. (2019). Terms of engagement: Redefining parental involvement and STEM Identity for Black girls. In N. M. Joseph (Ed.), *Understanding the Intersections of Race, Gender, and Gifted Education: An Anthology By and About Talented Black Girls and Women in STEM*. Charlotte, NC: Information Age Publishing. (In Press)

Howard, T. C., & Reynolds, R. (2008). Examining parent involvement in reversing the underachievement of African American students in middle-class schools. *Educational Foundations, 22*(1-2), 79-98.

Ing, M. (2014). Gender differences in the influence of early per differences in the influence of the early perceived parental support on students mathematics and science achievement and STEM career attainment. *International Journal of Science & Mathematics Education, 12*(5), 1221-1239.

Ingels, S. J., Pratt, D. J., Herget, D. R., Burns, L. J., Dever, J. A., Rodgers, J. E., Leinwand, S. (2011). *High School Longitudinal Study of 2009 (HSLS:09), Base-Year Data File Documentation* (NCES 2011-328). Washington, DC: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch

Ingels, S.J., Pratt, D.J., Herget, D., Bryan, M., Fritch, L.B., Ottem, R., Rogers, J.E., and Wilson, D. (2015). *High School Longitudinal Study of 2009 (HSLS:09) 2013 Update and High School Transcript Data File Documentation* (NCES 2015-036). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Retrieved [date] from http://nces.ed.gov/pubsearch.

Ireland, D. T., Freeman, K. E., Winston-Proctor, C. E., DeLaine, K. D., McDonald Lowe, S., & Woodson, K. M. (2018). (Un)Hidden Figures: A Synthesis of Research Examining the Intersectional Experiences of Black Women and Girls in STEM Education. *Review of Research in Education*, *42*(1), 226–254.

Jasis, P. M., & Ordoñez-Jasis, R. (2012). Latino parent involvement: Examining commitment and empowerment in schools. *Urban Education, 47*(1), 65-89.

Jay, T., Rose, J., & Simmons, B. (2013). Why parents can't always get what they (think they) want. *Proceedings of the British Society for Research into Learning Mathematics, 33*(2), 31–36.

Jay, T, Rose, J., Simmons, B. (2017). Finding "Mathematics": Parents questioning schoo-centered approaches to involvement in children's mathematics learning. *School Community Journal, 27*(1), 201-230.

Jeynes, W. (2007). The relationship between parental involvement and urban secondary school student academic achievement: A meta-analysis. *Urban Education, 42*(1), 82-110.

Jeynes, W. (2010). The salience of the subtle aspects of parental involvement and encouraging that involvement: Implications for school-based programs. *Teachers College Record, 112*(3), 747–774.

Jeynes, W. (2011a). Fostering parental involvement among some of the students who need it most. *Phi Delta Kappa, 93*(3), 38-39.

Jeynes, W. (2011b). *Parental involvement and academic success*. New York, NY: Routledge.

Jeynes, W. (2013). A meta-analysis of the efficacy of different types of parental involvement programs for urban students. *Urban Education*, *47*(4), 706–742.

Jeynes, W. (2014). Parent involvement for urban students and youth of color. In: H. R. Milner, & K. Lomotey, (Eds.). *Handbook of Urban Education* (pp. 149-166). New York: Taylor & Francis-Routledge.

Knight-Abowitz, K. (2011). Achieving public schools. *Educational Theory*, *61*, 467–489.

Lee, J. & Bowen, N. K. (2006). Parent involvement, cultural capital, and the achievement gap among elementary school children. *American Educational Research Journal, 43*, 193-218.

Lightfoot, D. (2004). "Some Parents Just Don't Care": Decoding the Meanings of Parental Involvement in Urban Schools. *Urban Education*, *39*(1), 91–107. https://doi.org/10.1177/0042085903259290

Linnehan, F., Weer, C. H., & Stonely, P. (2011). High school guidance counselor recommendations: The role of student race, socioeconomic status, and academic performance. *Journal of Applied Social Psychology, 41*(3), 536-558.

Mandara, J., Varner, F., Greene, N., & Richman, S. (2009). Intergenerational family predictors of the Black-White achievement gap. *Journal of Educational Psychology, 101*(4), 867-878. doi: 10.1037/a0016644

Mapp, K. L., & Kuttner, P. J. (2013). *Partners in education: A dual capacity-building framework for family–school partnerships*. Austin, TX: SEDL, in collaboration with the U.S. Department of Education.

Mickelson, R. A., Cousins, L., Velasco, A., & Williams, B. (2011). "Taking Math and Science to Black Parents: Promises and Challenges of a Community-Based Intervention for Educational Change", In William Tate IV, (Ed.), *Research on Schools, Neighborhoods, and Communities: Toward Civic Responsibility*. Washington, DC: American Educational Research Association.

Milner, H. R. (2008). Disrupting deficit notions of difference: counter-narratives of teachers and community in urban education. *Teaching and Teacher Education, 24*, 1573-1598.

Milner, H. R., & Tenore, F.B.. (2010). Classroom management in diverse classrooms. *Urban Education, 45*(5), 560-603.

Mistretta, R. (2017). Conversations with family members about math. *School Community Journal, 27*(1), 181-200.

NCLB. (2002). No Child Left Behind Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425.

Ogbu, J. U. (1992). Understanding cultural diversity and learning. *Educational Researcher*, 5-14.

Orr, A. J. (2003). Black-White differences in achievement: The importance of wealth. *Sociology of Education, 76*(4), 281-304.

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: a review of the literature and its implications. *International Journal of Science Education, 25*, 1049-1079.

Park, S., & Holloway, S. D. (2017). The effects of school-based parental involvement on academic achievement at the child and elementary school level: A longitudinal study. *Journal of Educational Research*, *110*(1), 1–16.

Reynolds, A. D., Crea, T. M., Medina, J., Degnan, E., & McRoy, R. (2015). A Mixed-Methods Case Study of Parent Involvement in an Urban High School Serving Minority Students. *Urban Education*, *50*(6), 750–775. https://doi.org/10.1177/0042085914534272

Seginer, R. (2006). Parents' educational involvement: A developmental ecology perceptive. *Parenting: Science and Practice, 6*, 1-48.

Sung, H., Padilla, A. M., & Silva, D. M. (2006). Foreign language education, academic performance, and socioeconomic status: A study of California school. *Foreign Language Annals, 39*(1), 115-130.

Taylor, L. C., Hinton, I. D., & Wilson, M. N. (1995). Parental influences on academic performance in Black students. *Journal of Child and Family Studies, 4*, 293-311.

Tichenor, M., Welsh, A., Corcoran, C., Piechura, K., & Heins, E. (2016). Elementary girls' attitudes toward mathematics in mixed-gender and single-gender classrooms. *Education*, *137*(1), 93-100.

Toren, N. K. (2013). Multiple dimensions of parental involvement and its links to young adolescent self-achievement and academic achievement. *Psychology in the Schools*, *50*(6), 634-649.

Trusty, J. (1996). Relationship of parental involvement in teens' career development to teens' attitudes, perceptions and behavior. *J. Res. Dev. Educ. 30*(1), 63–69.

Vedder-Weiss, D., & Fortus, D. (2013). School, teacher, peers, and parents' goals emphases and adolescents' motivation to learn science in and out of school. *Journal of Research in Science Teaching, 50*, 952–988.

Vukovic, R. K., Roberts, S. O., & Wright, L. G. (2013). From parental involvement to children's mathematical performance: the role of math anxiety. *Early Education and Development*, *24*, 446–467.

Watson, T.N., & Bogotch, I. (2015). Reframing parental involvement: What should urban school leaders do differently? Leadership and Policy in Schools, 14(3), 257-278. doi: 10.1080/15700763.2015.1024327

Williams, T. T., & Sánchez, B. (2012). Parental Involvement (and Uninvolvement) at an Inner-City High School. *Urban Education*, *47*(3), 625–652. https://doi.org/10.1177/0042085912437794

Young, J. L., Young, J. R., & Capraro, M. M. (2017). Black Girls' Achievement in Middle Grades Mathematics: How Can Socializing Agents Help? *Clearing House*, *90*(3), 70–76.

Zimmerman, H. T. (2012). Participating in science at home: Recognition work and learning in biology. *Journal of Research in Science Teaching, 49*, 597–630.