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Neighborhood and School Influences On Academic Achievement and Educational Attainment

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Neighborhood and School Influences

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Biography

Crystal Coker was born in Chicago, Illinois, on August 21, 1981. She graduated from Bishop Amat High School in La Puente, California. She received her Bachelors of Arts degree from the University of California, Irvine, in 2003, and Masters of Arts from New York University in 2005.

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Abstract

Research has shown that poverty is a greater predictor of educational disparities than race, despite the national focus on racial disparities. Further, living in disadvantaged neighborhoods that are characterized by qualities such as high poverty and unemployment can place a double burden on already poor students, further undermining educational achievement and future success. Neighborhood disadvantage is linked to a range of poor academic outcomes, yet only recently has research begun to explore the processes underlying the relationship between neighborhood disadvantage and these outcomes. Drawing on ecological theory, the following study proposes to examine how multiple settings relate to student outcomes. Given the importance of schools on student outcomes and the lack of attention given to schools in the neighborhood literature, this study will examine how school climate and school type relate to neighborhoods and student outcomes. Specifically, this study proposes that neighborhood disadvantage is associated with poor academic outcomes (11^{th} grade GPA and postsecondary educational attainment) and that this relationship is mediated by school climate (academic climate, school order, and the condition of school facilities). Thus, the relationship between neighborhood disadvantage and student outcomes will be explained by school climates that undermine learning among students within these neighborhoods. Further, this study proposes that school choice disrupts neighborhood processes by providing access to schools with positive climates that support student learning, thereby alleviating the indirect effects of poverty on student outcomes. This study draws on data from the Education Longitudinal

Study of 2002 (ELS:2002). The sample includes 11,490 students from 730 schools. In order to account for the nested nature of the data, multilevel models are used to examine the relationship between neighborhoods and schools on student GPA in 11th grade and educational attainment (or highest degree earned) ten years later. Results revealed a negative relation between neighborhood disadvantage and both GPA and educational attainment. However, this relationship was not mediated by school climate. Neighborhood disadvantage was negatively associated with school climate, but school climate was not predictive of GPA or educational attainment. Additionally, school choice was not found to moderate the relation between neighborhood disadvantage, school climate, and student outcomes. These findings have important implications for policy and practice. The negative effects of neighborhood disadvantage on school climate and student outcomes suggest that policies that address poverty concentration should be considered in order to support students. Further, although school climate was not predictive of achievement or attainment, the negative effects of neighborhood disadvantage on school climate indicate that schools should seek to provide all students with positive climates in which to learn, particularly in disadvantaged areas.

Introduction

Americans are more educated now than ever. Educational attainment, or the level of education completed, has increased with the vast majority (90%) of Americans possessing a high school diploma or its equivalent (Kena et al., 2014). Between 1990 and 2013, the attainment of a bachelor's degree or higher rose from 23% to 34% (Kena et al., 2014). Yet, significant educational inequality remains as some groups are advancing more rapidly than others. For example, while the percentage of young adults with a bachelor's degree or higher increased for both Blacks (13% to 20%) and Whites (26% to 40%) from 1990 to 2013, the gap in the attainment of this level of education increased from 13% to 20% (Kena et al., 2014). While many educational reform efforts have targeted educational inequality, little progress has been made in closing this gap.

One reason for the lack of progress in closing the racial achievement gap may be that many of the issues that students face lie outside of school (Gabrieli, 2014). Several studies have found that poverty is a stronger predictor of educational outcomes than race (Bailey & Dynarski, 2011; Reardon, 2011), and minority students are more likely to come from poor homes than their White counterparts. Further, poor minorities are more likely to live in neighborhoods characterized by a concentration of poverty (Lareau & Goyette, 2014; Sampson & Wilson, 1995). Thus, a focus on race overlooks the importance of disparate contexts that give rise to inequality. Given a steady rise in poverty rates from 2002 to 2012 (Bishaw, 2013), research examining the processes underlying the relationship between living in poor contexts and student outcomes may be even more critical.

The overall rise in poverty in the U.S. over the last decade has also been associated with an increase in the number of people living in poverty areas, or census tracts with a poverty rate of 20% or more (Bishaw, 2014). While the number of people living in poverty areas decreased from 20% to 18%, from 1990 to 2000, the number of people living in these areas increased from 18% to 26%, from 2000 to 2012 (Bishaw, 2014). Thus, the number of people living in areas characterized by a concentration of poverty has not only increased, but exceeded its previous peak (Bishaw, 2014). Further, there has been a change in the geography of concentrated poverty. While concentrated poverty remains highest in urban areas, the suburbs have experienced the greatest growth in concentrated poverty (Kneebone, 2014). Along with this shift has been a change in the demographics of concentrated poverty. While the percent of Blacks (50.4%) and Latinos (44.1%) living in concentrated poverty areas continues to exceed that of Whites (20.3%), the percent of Whites living in poverty areas nearly doubled, from 11.3% in 2000 to 20.3% in 2010, over the past decade (Bishaw, 2014). .

Being poor and living in a poor community can place a double burden on families beyond what their individual circumstances would dictate (Jargowsky, 2013; Kneebone, 2014) as the poor not only face the burden of insufficient income but the disadvantages of those around them. Poor neighborhoods are often associated with lower levels of education, higher levels of unemployment, single parent households, as well as other social issues such as violence (Sampson

& Wilson, 1995). As a consequence, youth in these communities may be exposed to limited role models and deal with neighborhood stressors. Further, neighborhood poverty may undermine or weaken neighborhood institutions, such as local schools (Sampson & Wilson, 1995). Thus, poor neighborhoods create a disadvantage for youth due to a concentration of stressors within these areas.

Neighborhood Disadvantage

Neighborhood disadvantage has been discussed and operationalized in many different ways. For example, Jencks and Mayer (1990) use terms such as "disadvantage", "poor", and "low-SES" synonymously to refer to neighborhoods that are socially and economically disadvantaged. Sirin (2005) identified research on socio-economic status (SES), income, disadvantage, and poverty for their meta-analysis exploring the relation between SES and academic achievement. Leventhal and Brooks-Gunn (2000) use SES to encompass affluence/high-SES and poverty/low-SES. Neighborhood disadvantage is frequently used in the literature to measure the effects of neighborhood poverty (e.g., Ainsworth, 2002; Crowder & South, 2003; Elliott et al., 1996; Harding, 2011). Thus, there is a great deal of overlap between terms and they are often used interchangeably to discuss poverty or disadvantage associated with living in a poor neighborhood.

How neighborhood poverty or disadvantage is measured is often a function of theoretical or analytical significance (Leventhal & Brooks-Gunn, 2000). For example, Ainsworth (2002) measured neighborhood disadvantage as economic deprivation (a composite of joblessness and poverty) and racial/ethnic diversity. Ainsworth's (2002) conceptualization was driven by theory emphasizing the role of racial/ethnic heterogeneity in the formation of norms and values (e.g., (Elliott et al., 1996) and Wilson's (1990) emphasis on the importance of joblessness in the creation of urban poverty. Using a factor analytic approach, Owens (2010) identified ten census variables used in past research and found that they loaded onto two factors, what he termed "concentrated disadvantage" and "educational and occupational attainment". Thus, neighborhood disadvantage has been measured in different ways and includes economic and non-economic measures.

In their review of the literature, Leventhal and Brooks-Gunn (2000) found that socio-economic aspects of neighborhoods, racial/ethnic diversity, and residential instability were most frequently studied in neighborhood effects research, such as studies of neighborhood disadvantage. Specifically, they found that socio-economic dimensions of neighborhoods were the most robust predictors of student outcomes (Leventhal & Brooks-Gunn, 2000). For example, in examining multiple dimensions of neighborhood disadvantage, Ainsworth-Darnell (1999) found that economic deprivation (a composite of unemployment and poverty level) and positive role models, such as the percentage of college graduates in the neighborhood, were significantly related to student outcomes while racial/ethnic diversity and residential stability were not significant predictors. Leventhal and Brooks-Gunn (2000) found that socio-economic aspects of neighborhoods are most frequently measured as a composite of poverty rate, percentage of residents with a high school or college degree, percentage of female-headed households, and unemployment rate. Elliott et al. (1996) argue that while poverty concentration is a central characteristic of neighborhood disadvantage, neighborhood disadvantage is a multidimensional cluster of traits, including unemployment and single-parent homes. Wilson (1990) also emphasized both the importance of joblessness and the breakdown of the family structure, as evidenced by households headed by a single female, that contribute to social issues within areas of concentrated poverty. Thus, while measurement of neighborhood disadvantage may vary across studies, as well as the conceptualization and measurement of socio-economic dimensions of disadvantage, the current study will take into account those aspects of neighborhoods that have been most frequently studied and found to be predictive of student outcomes, such as poverty rate, percentage of residents with a high school or college degree, percentage of female-headed households, and unemployment rate.

Neighborhood disadvantage and educational outcomes. Disadvantaged neighborhoods have been linked with a range of school outcomes including school dropout (Crowder & South, 2003; Rendón, 2014), high school graduation (Wodtke, Harding, & Elwert, 2011), test scores (Aikens & Barbarin, 2008; Catsambis & Beveridge, 2001), college aspirations (Stewart, Stewart, & Simons, 2007), and educational attainment (Owens, 2010). For example, Wodtke and colleagues (2011) found that living in a disadvantaged neighborhood had a negative impact on the chances of graduating from high school among a national sample of youth. Also using a national sample of youth, Catsambis and Beveridge (2001) found that greater levels of neighborhood disadvantage were predictive of lower math scores among eighth grade students. Stewart and colleagues (2007) found that neighborhood disadvantage was associated with lower educational aspirations among a local sample of African American high school students. Thus, there has been consistency in findings across study and sample types. However, much of this work has focused on testing linear correlations between disadvantage and student outcomes and, less research has examined the mechanism underlying the relationship between neighborhoods and students outcomes. Therefore, there is a need for more research on neighborhood disadvantage to better understand the relationship between neighborhoods and student outcomes.

Jencks and Mayer (1990) argue that linear models are useful in determining *whether* neighborhood SES is related to an outcome, but nonlinear models are needed to predict the potential effects of interventions and policies that promote economic integration. For example, if poor school outcomes are a linear function of disadvantage, economic integration policies would be beneficial for poor youth but detrimental for affluent youth. In his review, Galster (2010) found evidence that the effects of neighborhood poverty do not begin to appear until poverty levels reach 20% and rapidly increase until poverty levels reach 40%, at which point the effects of poverty begin to level off. Yet, much of the research on neighborhood disadvantage and education has not taken into account nonlinear trends. Thus, more research examining nonlinear trends is needed in order to understand whom interventions and policies should target.

Additionally, understanding why neighborhood disadvantage is associated with negative student outcomes can aid in the development of effective interventions and policies that support student success. Despite evidence for the relationship between neighborhoods and educational outcomes, little research has attempted to examine why neighborhood disadvantage is associated with educational failure. Biddle (2014) asserts that neighborhood disadvantage creates problems that cause educational failure and that youth may be both directly and indirectly affected by neighborhoods through other contextual factors. For example, while neighborhood disadvantage may directly impact student performance, neighborhoods may also affect the viability of schools which in turn affect student performance (Wilson, 1990). Ecologically based theories emphasize the importance of multiple systems in shaping youth development and provide a framework for studying contextual factors on youth outcomes (e.g., Bronfenbrenner, 1979).

Theory

Ecological theory proposes that one must consider the ecological system in which an individual grows in order to understand his/her development (Bronfenbrenner, 1977, 1979, 1994). Bronfenbrenner (1977, 1979) suggests that the ecological environment consists of a set of nested structures with the innermost level, or microsystem containing the developing individual. According to Bronfenbrenner (1976, 1979), microsystems are directly experienced by the individual and include settings such as the home, school, and neighborhood. Development is then influenced not only by the individual settings but also by the relations between settings, what Bronfenbrenner (1977, 1979) defines as the mesosystem.

Within the education context, ecological theory states that the extent to which youth learn is a function of systems at two levels – 1) the relation between characteristics of the learner and their environment (e.g., home, school, neighborhood) and 2) the relations and interconnections between these environments (Bronfenbrenner, 1976; McCoy, Roy, & Sirkman, 2013; Trickett, 1997). These relations, which Bronfenbrenner (1976) describes as “person-environment” and “environment-environment” relations (p.9), comprises the ecology of education and is an important and necessary part of educational research because what happens, or does not happen, within the educational settings is largely dependent on other ecological spheres (Bronfenbrenner, 1976).

The family serves the primary context for development (Bronfenbrenner, 1986) and educational research examining environment-environment relations has examined family-school relations. For example, students from low-income households are less likely to be placed in age-appropriate classrooms (Pagani, Boulerice, & Tremblay, 1997), perhaps because parents lack the economic resources to invest in educational materials and activities that provide for a cognitively stimulating home environment (Magnuson & Duncan, 2002). Thus, a lack of educational preparation at home affects what takes place in the school environment. However, as youth enter adolescence they begin to spend more time outside the home amongst peers, and are subjected to more extra-familial influences (Halpern-Felsher et al., 1997; Lerner & Castellino, 2013). Thus extra-familial contexts may begin to play a greater role in students' academic behaviors and outcomes as they mature. Indeed, in a longitudinal study, Aikens and Barbarin (2008) found that family characteristics were the strongest predictor of initial reading scores among young children, but that school and neighborhood characteristics (e.g., poor neighborhood conditions such as boarded up buildings and trash or litter in the street) were greater predictors of reading growth as children matured. Yet, there has been a lack of research examining neighborhood-school relations (Johnson, 2012).

Building on an ecological framework, Wilson (1990) and Sampson and Wilson (1995) suggest that concentrated poverty limits access to institutions and resources that reflect mainstream society and facilitate social mobility. Wilson (1990) argues that poor communities are troubled by low achieving schools and tend to be avoided by outsiders, resulting in social isolation from mainstream patterns of behavior. This social isolation alters the relationship between schooling and postsecondary employment, thereby adversely affecting the development of educational and job-related skills (Wilson, 1990). In these neighborhoods, Wilson (1990) argues, teachers become frustrated and do not teach, and students do not learn. Thus, students living in disadvantaged neighborhoods are less likely to have access to an education where they are challenged academically and prepared for postsecondary opportunities that facilitate socioeconomic advancement.

Schools

The characteristics of schools that are related to positive learning outcomes has been greatly debated (Mayer, Mullens, & Moore, 2001). The "Equality of Educational Opportunity" report (Coleman et al., 1966), otherwise known as the Coleman Report, a national study commissioned by the U.S. Department of Education, brought issues of school effects to the forefront by concluding that teacher and school characteristics are of little importance to student achievement. Since the Coleman Report studies have both supported and refuted Coleman's findings (Mayer et al., 2001). More recent research suggests that schools and teachers do matter, however the characteristics of schools and teachers that matter are difficult to identify (Dobbie & Fryer Jr, 2011; Gamoran & Long, 2007).

There are many different aspects of schools that can affect the educational outcomes of students. Studies have tended to focus primarily on school resources and inputs such as per pupil expenditure, class size, level of education among teachers, and teacher experience or years teaching (Dobbie & Fryer Jr, 2011; Ladd & Loeb, 2013). However, studies of high achieving, predominantly low-income and minority, urban schools have found that these factors have little to no relationship to student achievement (Dobbie & Fryer Jr, 2011), perhaps because schools can use their resources in very different ways (Ladd & Loeb, 2013). For example, funding could be used for smaller classes with less experienced teachers or for more experienced teachers at the expense of smaller class sizes. Thus, measures of school processes and practices may be more useful in measuring aspects of school that are most important to learning (Ladd & Loeb, 2013).

Qualitative studies can be useful in exploring practices within schools that lead to improved learning outcomes. Qualitative studies have pointed to factors such as data-driven instruction, school culture, and student expectations as important components of school-related learning outcomes. Dobbie and Fryer (2011) used interviews with principals, teachers, and students, as well as classroom observations to gather information on practices within charter schools in New York. They found that resources, processes, and climate, such as access to tutors, increased instructional time, and high expectations or believing that all students can learn were characteristic of effective charters. Similarly, in their case study of schools in two low-income communities, Clewell and Perlman (2007) found that the academic climate (e.g., high expectations for learning) and safe and orderly school environments set high achieving schools apart from their lower achieving counterparts. These factors have also been identified as dimensions of a school's climate (Thapa, Cohen, Guffey, & Higgins-D'Alessandro, 2013).

School climate has received significant attention over the past few years as a strategy for improving schools and supporting student learning (Thapa et al., 2013). School climate has been identified by the Institute for Educational Sciences as a strategy for dropout prevention (Dynarski et al., 2008). The U.S. Department of Education has invested in school climate reform to support conditions for learning through the Safe and Supportive Schools (S3) grant, which supports statewide school climate measurement and improvement efforts (Thapa et al., 2013). With S3 funding, a number of states are focused on school climate reform to improve learning conditions in their schools with the most need. Thus, school climate may serve as a useful frame for studying aspects of schools that support student success.

School climate has been defined as the quality and character of school life (Cohen, McCabe, Michelli, & Pickeral, 2009) and described as a multifaceted concept that involves different aspects of the educational experience, such as the physical, academic, and socio-emotional environment. The physical aspects of school climate refer to the upkeep, appearance, or conditions of the school facilities. The academic climate reflects factors such as academic expectations and support, and the socio-emotional component reflects student behavior or disciplinary issues. A positive school climate can be characterized by an appealing physical environment, academic-oriented and academically supportive environment, and an orderly socio-emotional environment.

Research has connected school climate to physical, psychological, and academic outcomes (Thapa et al., 2013). For example, in their review of the literature, Thapa and colleagues (2013) found that school climate was associated with students motivation to learn, less aggression and violence, and supported academic achievement. In another review of the literature, Cohen and colleagues (2009) found that a positive school climate was associated with academic achievement, school success, effective violence prevention, and teacher retention. Further, the National Center for Safe and Supportive Learning Environments (American Institutes for Research, 2016) has deemed a positive school climate as critical for school success. Therefore, this study draws on school climate as a framework for studying school characteristics that foster positive educational outcomes.

Disparities in the academic climate. Education researchers have documented disparities in learning conditions within schools in disadvantaged neighborhoods for decades. Bowles and Gintis (1976) indicated that these schools have different methods of teaching, attitudes toward students, and environments than schools in more affluent environments. For example, McNeil (1968) randomly assigned student teachers to poor inner city schools and affluent schools and found that teaching in inner city schools was associated with greater negative attitudes toward children. Solomon, Battistich, and Hom (1996) examined the attitudes, beliefs, perceptions, and practices of teachers in urban and suburban schools and found that teachers of students from poor communities utilized less engaging teaching practices and viewed students as less capable. This deficit-model thinking, or the idea that academic failure is the result of deficiencies within the student, is one of the most persistent theories of school failure among economically disadvantaged minority students (Valencia, 2012). While deficit thinking is often rejected today, it takes many forms and continues to shape school policy and practice (Valencia, 2012). For example, deficit thinking can be observed in the form of “compensatory education”, or educational practices that seek to build the skills and attitudes of poor youth rather than addressing structural changes within the school (Ryan, 1976). Darling-Hammond (2010) asserts that in order for students to put forth effort, they must feel that they can succeed; thus high expectations are important for student achievement. Indeed, studies have shown that when students believe that they can succeed they work harder and perform better academically (Niehaus, Rudasill, & Adelson, 2012).

Disparities in the physical and socio-emotional environment. The physical condition and appearance of schools is an important part of school safety. For example, maintenance issues and vandalism can pose safety hazards to students. Further, a clean and maintained school communicates a message of respect and responsibility as well as contributes to the positive development of students (California Department of Education, 2002). Indeed, in his qualitative study of school disrepair, Daniel (2006) found a connection between the condition of the school and student motivation, behavior, and achievement. His interviews with students revealed that the condition of learning facilities was important to them as students expressed expectations that schools should be clean and kept neat. Students further expressed that facility disrepair affected their mood, ability concentrate, and their desire to come to school. Similarly, Durán-Narucki (2008) found that facility disrepair was associated with increased absences from school and subsequently lower standardized test scores.

Darling-Hammond (2010) notes that poor students often must learn in dilapidated facilities which can affect their motivation and ability to achieve academically. In his observations of schools in poor and affluent areas, Kozol (2012) observed students from disadvantaged backgrounds were more likely to attend schools marked by overcrowding and unsanitary conditions. For example, Kozol (2012) observed broken windows, holes in the ceilings, and the smell of rot and sewage in some schools in some of the most disadvantaged neighborhoods.

Further, students in disadvantaged neighborhoods are more likely attend to schools with greater levels of disorder (Barnes, Belsky, Broomfield, & Melhuish, 2006). A safe school environment that is free of disorder is important for teachers to teach effectively and for students to learn (Planty, DeVoe, Owings, & Chandler, 2005). For example, Daniel's (2006) analysis of student interviews found that students viewed misbehavior, tardiness, and fighting among other students as distracting to teachers which takes away from student learning. Indeed, several studies have linked school disorder with lower achievement (Barnes et al., 2006; Urick & Bowers, 2014).

School characteristics as mediators. Despite the importance of schools in shaping educational outcomes and the disparities in educational environments between disadvantaged and more advantaged neighborhoods, there has been a lack of research examining school characteristics as a mediator of the relation between neighborhood disadvantage and academic outcomes (Leventhal & Brooks-Gunn, 2000; Johnson, 2012; McCoy, Roy & Sirkman, 2013). In one of the few studies that has looked at school characteristics as mediators, Ainsworth (2002) found that school atmosphere, as measured by student-teacher morale and the extent to which teachers find it difficult to motivate students, significantly mediated the relationship between neighborhood advantage (e.g., proportion of college graduates, proportion of employed persons with professional or managerial positions, and residential stability) and student academic behaviors and achievement in high school. However, they did not look at neighborhood disadvantage, a related but arguably distinct construct measuring poverty concentration or economic deprivation as opposed to affluence. Johnson (Johnson, Jr., 2013) argues concentrated disadvantage and advantage are not simply "'flip sides of the same coin' that mirror each other in their relationship to education" (p. 565), as studies have suggested that disadvantage and advantage may have unique relationships to education. For example, Ainsworth (2002) found that neighborhood advantage predicted time spent on homework and test scores among high school students, while disadvantage only predicted test scores. Johnson (Johnson, Jr., 2013) further argues that disadvantage and advantage are distinguished by their theoretical underpinnings. For instance, theories such as social isolation theory are used to explain dynamics within areas of concentrated disadvantage only. These measurement and theoretical differences, as well as differing relations to educational outcomes, suggest a need to examine mediators of neighborhood disadvantage. Further, in Ainsworth's (2002) study of school mediators, school atmosphere did not fully mediate the relationship between neighborhoods and student outcomes indicating that there is still much about schools to be explored. These findings and the lack of research examining school characteristics as mediators indicates that research examining multiple components of the school environment is warranted in order to better understand the processes underlying the association between neighborhood disadvantage and educational outcomes (McCoy, Roy & Sirkman, 2013).

School Choice. In addition to a need for research examining the mediating effect of school characteristics, an examination of potential moderators, such as choice, can aid in understanding how policies aimed at creating better opportunities influence the relationship between neighborhood disadvantage, schools, and student outcomes. In response to school inequalities, reform efforts have sought to provide parents and students with more choice in their education (Ozek, 2009). School choice can be defined as enrollment in a chosen public school (as opposed to an assigned school) or as enrollment in a private school (Grady & Bielick, 2010). The No Child Left Behind Act of 2001 (NCLB) (a revised Elementary and Secondary Education Act of 1965 stemmed from the War on Poverty) includes a choice provision intended to improve academic outcomes among disadvantaged students by allowing them to attend better schools and to put pressure on failing schools to improve academically or risk declines in enrollment and, subsequently, funding (Loeb, Valant, & Kasman, 2011). Choices under NCLB include public school choice (e.g., open enrollment programs that allow parents to send their children to public schools outside of their neighborhood), charter schools, magnet schools, private school (e.g., vouchers), and homeschool ("School Choices for Parents," 2009). Specifically, charter schools are public schools that provide free education under a charter granted by the state legislature or other authority, while magnets are schools that target students from different racial/ethnic backgrounds to address racial isolation and/or are focused around a specific theme (Hoffman, 2008). Proponents of school choice argue that alternatives to neighborhood schools may provide students with access to better schools, therefore buffering the effects of disadvantage on student outcomes (Saltman, 2012). However, there is evidence that greater choice may exacerbate racial and economic segregation and does not necessarily result in better options or decisions (Kotok, Frankenberg, Schafft, Mann, & Fuller, 2015; Rotberg, 2014).

Ozek (2009) studied the effects of a local school districts' open enrollment policy and found that choosing to attend a school other than their assigned neighborhood school had no effect on test scores among disadvantaged students. Ozek (2009) argues that one reason for these findings may be that it takes time for parents to learn the system and make good choices for their students. Further, studies have found that students and families tend to make schooling decisions based on proximity, and students from disadvantaged neighborhoods may have limited options (Nathanson, Corcoran, & Baker-Smith, 2013). However, Hastings and Weinstein (2008) found that when parents are given information about schools, such as performance data, they are more likely to choose better schools that lead to increased student achievement. Thus, choice may be beneficial when students and families are adequately informed about their schooling options.

Walberg's (2007) review suggests that choice is beneficial and concludes that choice works. Walberg (2007) found that charters, voucher programs, private schools, and inter-and intra-school competition (e.g., open enrollment) were generally associated with greater achievement, typically as measured by standardized test scores. Teske and Schneider (2001) come to similar conclusions in their review, stating that the best studies of choice (e.g., randomized designs) document gains in achievement. Further, while not all studies find that choice leads to greater achievement, none of the studies documented significant decreases in achievement (Teske & Schneider, 2001). Thus, at the very least, choice may not be harmful to students and has the potential to boost student performance in school.

Walberg (2007) notes that most of the studies on choice look at single states or metropolitan areas and less work has been done at the national level. In one of the few studies to measure the effects of choice nationally, Walberg (2007) reports that greater choice was associated with greater achievement. For example, Greene (2000) developed the Education Freedom Index[1] to measure choice across 50 states and found that states with greater choice also displayed higher standardized test scores.

More research is needed on school choice, particularly at the national level. Studies comparing choice versus traditional enrollment on schools and student outcomes can aid in understanding how national choice policies impact the educational experiences and outcomes of the nation's youth. Additionally, most studies have focused on the effects of choice on standardized test scores (Teske & Schneider, 2001). Research examining other indicators of success, such as postsecondary attainment, can provide a better understanding of the long-term impact of choice.

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[1] The Education Freedom Index is a weighted average of five education options: the availability of charter school options, the availability of government-assisted private school options (e.g., vouchers), the ease of homeschooling, the ease of choosing a different public school district by relocating, and the ease of choosing a different public school district without relocating.

Rationale

Research evidence consistently shows that neighborhood disadvantage is associated with poor school outcomes. Theory suggests that lack of access to schools that promote academic success may explain this relationship. Thus, education policies have attempted to address the issue of school inequity by providing students and families with more control over their education through choice. Research can aid in understanding the relationship between poverty and education and in the development of evidence-based policies and interventions. However, empirical research has lagged behind theory and practice.

There has been a dearth of research on the mechanisms underlying the link between poverty and education, and especially in examining the role of schools. This study seeks to address gaps in the literature. First, an examination of nonlinear relationships can help us better understand the relationship between neighborhood disadvantage and student outcomes by highlighting the levels at which disadvantage becomes particularly detrimental to students. Secondly, the extent to which school characteristics mediate the relation between neighborhood disadvantage and student outcomes can shed light on the process underlying neighborhood disadvantage, or understanding why neighborhood disadvantage is associated with poor outcomes. Understanding the process has practical implications in that it can aid in the development of interventions aimed at supporting youth from disadvantaged backgrounds. Finally, exploring the role of school type can aid in understanding the extent to which choice policies can compensate for the effects of neighborhood disadvantage.

In order to address the above, data on student communities, schools, and outcomes are needed. The Education Longitudinal Study of 2002 (ELS:2002) is unique in that it provides information at multiple ecological levels on school characteristics and student outcomes in high school and into adulthood. Further, given that the ELS:2002 is a national study, findings may be generalizable to communities and schools across the country.

Hypotheses

This study seeks to address the gaps in the literature by examining the relation between neighborhood and school contexts and by seeking to understand the processes by which neighborhood characteristics may influence student outcomes (Figure 1).

I. Hypothesis 1: The relationship between neighborhood disadvantage (census data) and educational outcomes (GPA and student reported educational attainment) will be curvilinear. More specifically, the negative relationship between neighborhood disadvantage and student outcomes will not appear until levels of disadvantage reach moderate to high levels.

II. Hypothesis 2: The relationship between neighborhood disadvantage and student secondary (GPA) and post-secondary (educational attainment) outcomes will be mediated by the school climate (condition of school facilities, school order, and principal-reported academic climate).

III. Hypothesis 3: The mediation effect (hypothesis 2) will be moderated by school type such that enrollment in choice schools will be associated with a better school climate and, in turn, better secondary and postsecondary outcomes compared to students in neighborhood schools. In other words, neighborhood disadvantage will be associated with poor student outcomes, through a poor school climate, for students attending neighborhood schools, but not for students attending choice schools.

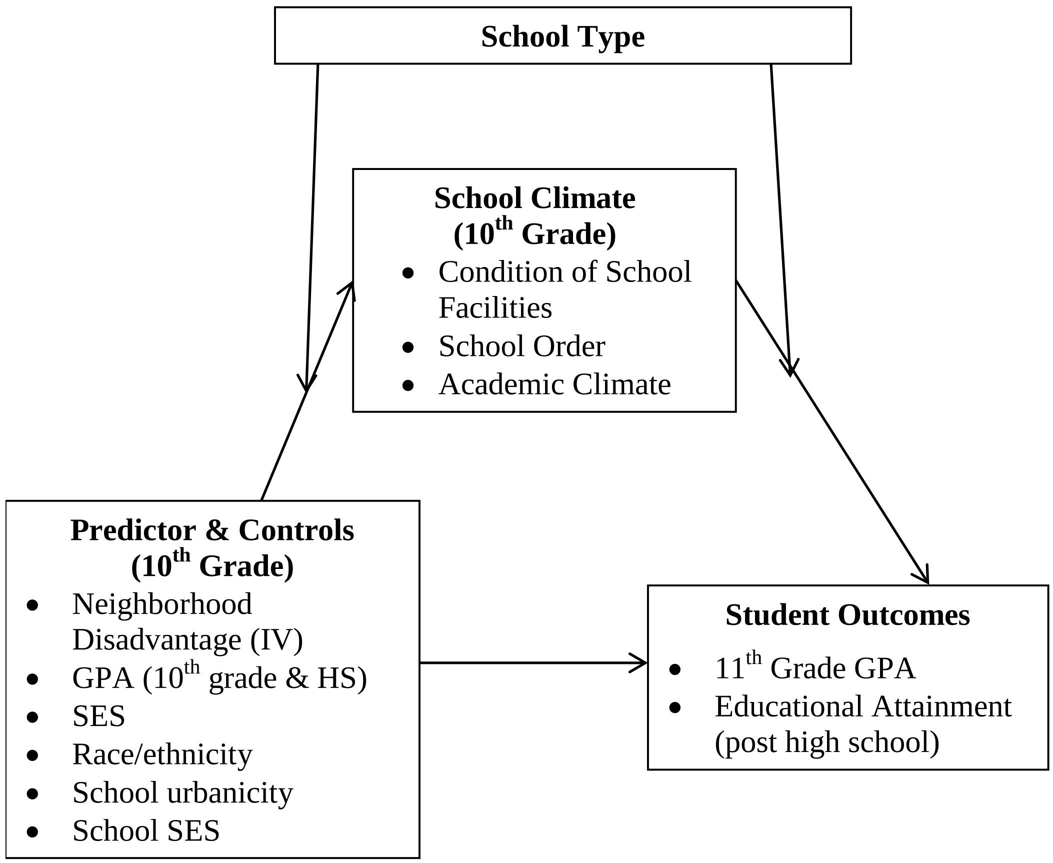

Figure 1. Proposed model

Methods

The data for the current study is taken from the Education Longitudinal Study of 2002 (ELS:2002), a longitudinal study of high school students sponsored by the National Center for Education Statistics (NCES) of the Institute of

Educational Sciences, U.S. Department of Education. The purpose of ELS:2002 is to provide trend data about critical transitions experienced by high school students as they proceed through secondary to postsecondary education or their careers (Ingels, Pratt, Rogers, Siegel, & Stutts, 2004). To this end, ELS:2002 began in 2002 with 15,362 tenth grade students in 752 schools and followed them for ten years. Students were surveyed twice in high school, in 2002 and 2004, and followed for several years after high school in order to understand later outcomes (e.g., educational attainment) in relation to earlier high school experiences.

In addition to being longitudinal, ELS:2002 is multilevel in that it involves multiple reporters. In the base year, 2002, students, parents, and school principals were surveyed. The use of multiple reporters provides detailed information from different perspectives on home and schools allowing researchers to examine how they relate to student outcomes. Further, ELS:2002 can be linked with census data at the tract level to obtain detailed information about the neighborhoods where students live. Thus, ELS:2002 is useful for examining the relationship between multiple contexts and student outcomes in high school and into adulthood.

Study Sample

The current study draws on a subsample of 730 schools and 11,490 students from 5,760 census tracts across the United States. In order to address the issue of school climate, schools were limited to comprehensive public schools, public magnet schools, public schools of choice, charter schools, and private schools.[2] These schools were selected because this study aims to examine school climate and the moderating effect of choice strategies. Magnet schools, public schools of choice, charter schools, and private schools[3] are the alternatives to traditional neighborhood schools provided for under NCLB ("School Choices for Parents," 2009). Second, this study aims to examine the relationship between communities and schools on student outcomes during (GPA) and after high school (educational attainment at the final wave of data collection, or ten years after the study began). Therefore only students who participated for the duration of the study were retained. This allowed for the examination of the relationship between community and school characteristics on the long term educational outcomes of youth.

Measures

Predictor. One predictor, neighborhood disadvantage, was examined.

***Neighborhood disadvantage*.** ELS:2002 includes student-level census tracts for students from the base year. Following the lead of previous research which has measured neighborhood disadvantage as a composite of neighborhood level factors associated with poverty (e.g., Ainsworth, 2002; Harding, 2011; Owens, 2010), census tracts were merged with data from the 2000 census to form a composite of neighborhood disadvantage. Specifically, neighborhood disadvantage is measured as a composite of four census variables: the proportion of families living below poverty, proportion of civilians 16 years and over who

[2] Other school classifications include year-round, vocational, boarding, Indian reservation, military, and alternative schools
[3] For low-income students, several states offer vouchers that cover or offset the cost of private education (Walberg, 2007).

are unemployed, proportion of the population 25 years and older without a high school degree, and the proportion of families headed by a single female. While neighborhood disadvantage has been measured in different ways Leventhal and Brooks-Gunn (2000) found that these factors were most frequently used to measure neighborhood disadvantage. Further, Owens (2010) found that these variables all loaded onto one factor which he termed “concentrated disadvantage”. Finally, Sampson and Wilson (1995) and Wilson (1990) highlight the importance of family disruption, as evidenced by single female headed households, lack of education, and high unemployment in high poverty areas. Examination of neighborhood disadvantage demonstrates strong reliability (α=.81).

Mediators. Three separate mediators were examined together in order to measure different dimensions of school climate.

***Condition of school facilities*.** The physical environment was assessed by the facilities checklist, which consisted of 18 items that were completed for each school by an ELS:2002 interviewer during the 2002 base year, to assess the conditions of school facilities. In order to facilitate comparability across schools, interviewers were asked to complete the checklist in the middle of the day, such as after a morning session of the larger ELS:2002 administration or before an afternoon session (Planty et al., 2005). Questions asked about the level of cleanliness and maintenance at the entrance of the school, the classroom, and the bathrooms. Therefore, interviewers were required to enter one classroom when class was not in session and a bathroom appropriate for their sex during a time when most students were in class. The interviewer was asked to check “Yes, observed" or "No, did not observe" to each item. Sample items include, trash on the floor, broken lights, chipped paint on the walls/doors/ceilings, and ceilings in disrepair. This measure has demonstrated a Cronbach's alpha of .73 indicating good internal consistency (Bowers & Urick, 2011). Prior to the baseline year, the facilities questionnaire was piloted 53 schools in five states to evaluate and refine the instrument (Burns et al., 2003). Further, a review panel of substantive, methodological, and technical experts reviewed the instrument providing further support for face validity (Ingels et al., 2004).

School order. School order was reported by principals during the 2002 base year. School order was assessed by 19 items measured on a five point scale ranging from "never happens" to "happens daily". Sample items included tardiness, absenteeism, vandalism, student bullying, and gang activities. Cronbach's alpha for this scale is good at .88 (NCES, n.d.). Urick and Bowers (2014) also demonstrated strong internal consistency for this scale (α=.87) on a subset of the ELS:2002 sample. Pilot testing prior to the main study (Burns et al., 2003) and review of items by a review panel (Ingels et al., 2004) provide evidence face validity .

Academic climate. Principals reported on the academic climate during the 2002 base year. The extent to which there is a climate of achievement was assessed by five questions measured on a five point Likert-type scale ranging from "not at all accurate" to "very accurate". For example, administrators were asked whether, "student morale is high", "teachers at this school press students to achieve academically", and "student place a high priority on learning." This scale has shown strong internal consistency (α=.86) (NCES, n.d.). Urick and Bowers (2014) also demonstrated strong internal consistency (α = .85) among a subsample of principals who participated in ELS:2002. Further, they found evidence of a relationship between principal academic climate and a separate measure of student academic climate, both of which were predictive of mathematics achievement, providing support for convergent validity.

Moderator. School type was included as a moderator in order to test the hypothesis that choice would moderate the relationship between neighborhoods, schools, and student outcomes.

School choice. School choice is defined as enrollment in a chosen public school (as opposed to an assigned school) (Grady & Bielick, 2010). School choice was obtained through school type, which includes comprehensive public schools, magnet schools, public schools of choice, charter schools, and private schools. School type was reported by the principal in the 2002 base year and principals were asked to check all that apply. Therefore a school can be both a comprehensive public school and a magnet school. In the case of cross-classification, any school identified as a magnet, public school of choice, and/or charter school will be considered a choice school rather than as a comprehensive public school (Davis, 2008). Because ELS:2002 does not provide student-level programmatic information, there is no way to determine whether students in schools cross-classified as comprehensive public schools and a choice school chose to attend the school. Therefore choice is used to indicate that a school enrolls students outside its attendance boundaries.

Dependent Variables. Student outcomes were examined at high school (GPA) and at the third follow up, or ten years after the base year (educational attainment).

11th Grade GPA. In ELS:2002, GPA is obtained through student transcripts and is based on a four point scale (A=4.0, F=0.0). Students' transcripts were collected from schools in the fall of 2005. Eleventh grade GPA was used in order to control for students previous achievement and because of the practical significance of 11th grade GPA in college admissions.

Educational Attainment. Educational attainment was reported by students during the third follow-up, in 2012, when students were approximately 26 years old. Educational attainment was assessed by a single item, "highest level of education earned" and ranges from 1 (no high school credential) to 10 (doctoral degree). Doctoral degree included research and professional degrees (e.g., PhD, EdD, JD, MD). Given that students were approximately 26 years old at the final follow-up, students may have been in the process of completing advanced degrees. However, this item only accounted for the highest degree completed and did not consider degrees in progress.

Control Variables. Background factors were controlled for at both the student and school levels. These factors include high school performance, gender, race/ethnicity, socio-economic status, region, and urbanicity.

High School Performance. In order to control for previous achievement, 10th grade GPA was used to predict 11th grade GPA. Overall high school GPA was used to predict educational attainment ten years after the study base year.

Overall high school GPA has been shown to predict postsecondary outcomes (Hossler & Stage, 1992; Noble & Sawyer, 2002, 2004). GPA was obtained through student transcripts and is based on a four point scale (A=4.0, F=0.0). Students' transcripts were collected from schools in the fall of 2005.

Student Demographics. At the individual level student gender, ethnicity, and family SES were controlled for. Gender and ethnicity were obtained from the student questionnaire in the base year. For gender, students reported whether they were male or female. Student race is a categorical variable that includes African American/Black, Asian/Pacific Islander, White, Hispanic/Latino, and Other.

Socio-economic status is a composite variable created by NCES from parent questionnaire data. SES is based on fathers' education and occupation, mothers' education and occupation, and family income. The parent survey asked parents to indicated the highest level of education for themselves and their spouse/partner. Response options ranged from one, "did not finish high school", to eight, "completed PhD, MD, or other advanced degree". Mother and father occupation was assessed with by 16 items. Sample items include "clerical", "laborer", "homemaker", "professional" (e.g., dentist, physician, lawyer), "sales", and "school teacher". The 1961 Duncan Index was used to determine occupational prestige. Income ranged from one, (none), to thirteen, ($200,001 or more). The SAS command Proc Standard was used to create standard z-scores for each variable resulting in values having a mean of zero and a standard deviation of one. Z-scores were averaged resulting in an SES that ranged from -2.11 to 1.82.

Region and urbanicity. Regional and locale differences have been found in students' education patterns. For example, there may be regional and locale differences in the availability of choice options (Grady & Bielick, 2010) as well as performance on standardized tests (NCES, 2001). Thus, region (Northeast, South, Midwest, and West) and urbanicity (urban, suburban, and rural) are included as control variables. Region and urbanicity were obtained by NCES from the Common Core of Data (CCD)[4] and the Private School Survey[5] and merged with ELS:2002 data.

School socio-economic status. The percent of students eligible for free or reduced lunch has frequently been used as a proxy for school level SES (Davis, 2008; Snyder & Musu-Gillette, 2015). However, this indicator of school SES can be problematic in studies for several reasons. The National School Lunch program provides free or reduced price lunch to eligible students attending public and non-profit private schools. Children of families with an income at or below 130% of the poverty level are eligible for free meals and those from families with an income between 130% and 185% of the poverty level are eligible for reduced price lunch (United States Department of Agriculture, 2013). Thus, eligibility for free or reduced price lunch is based on family income while SES is a broad measure of social and economic status that includes indicators such as parental education level (Harwell & LeBleau, 2010). Further, the Community Eligibility Provision allows for free meals to all students in high poverty schools and

[4] The Common Core of Data contains data collected annually, by the National Center for Education Statistics (NCES), from all public schools, public school districts, and state agencies in the United States.
[5] The Private School Survey contains data collected on private schools in the United States by NCES.

districts, thereby increasing the participation rate in the free or reduced. To address these issues, student level SES was aggregated to the school level. Aggregated student SES has been used as an indicator of school SES in numerous studies (e.g., Davis, 2008; Goddard, Tschannen-Moran, & Hoy, 2001; Rowan, Raudenbush, & Kang, 1991) and may offer a more precise measure of school-level SES as it accounts for social and economic factors beyond family income.

Procedure

The ELS:2002 used a nationally representative, two-stage stratified probability sample. The target population for the study was 10th grade students in public and private schools. In the first stage of sample selection, schools were selected from the CCD with a probability of selection proportional to their enrollment size. Public schools were stratified by the nine U.S. Census divisions[6] and by urbanicity (urban, suburban, and rural). Private schools were stratified by Census region (Northeast, Midwest, South, and West) and urbanicity.

Prior to study recruitment, endorsements were sought from organizations thought to be influential to study participants.[7] Endorsing organizations were included in letterhead sent to states, districts, and schools. Before contacting schools, Chief State School Officers (CSSOs) of each state and the District of Columbia were contacted for approval. If asked, state officials were provided

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[6] The nine Census divisions are New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific.

[7] Endorsements were provided by the American Association of School Administrators, American Association of School Librarians, American Federation of Teachers, Council of Chief State School Officers, Council of the Great City Schools, National Association of Independent Schools, National Association of Secondary School Principals, National Catholic Educational Association Department of Secondary Schools, National Education Association, National PTA, National Resource Center for Safe Schools, National School Boards Association.

with the number of schools and districts selected from their state. All 50 states and the District of Columbia gave permission to proceed to the district level. Once state approval was secured district superintendents were contacted about the study. Of the 829 districts having eligible sampled schools, 693 (83.6%) gave permission to contact schools (Ingels et al., 2004).

Once district approval was secured, school principals were contacted and 61.6% of schools agreed to participate. The final sample included 752 schools. Once schools agreed to participate, a survey day and two make-up days were scheduled. Survey days were conducted between mid-January 2002 and early June 2002 so that schools could have flexibility in choosing a date when they were less busy (Ingels et al., 2004).

In the second stage of selection, sophomores were randomly selected from enrollment lists provided by schools. Asian American students were oversampled to ensure the sample was large enough to compare with African American, Latino, and White students. Information packets were sent to parents containing permission forms when mailing addresses were available, otherwise packets were sent to the schools for distribution to parents. Informational materials and permission forms were provided in English and Spanish to parents of students who had been identified as Latino by their school enrollment lists. These materials were translated into Mandarin, Vietnamese, Korean, and Tagalog and included with an English version of the letter and brochure for parents of students who were identified as Asian American. Of the 17,591 eligible students sampled, 15,362 participated in the base year for a participation rate of 85.6% and of

15,362 parents sampled, 13,488 completed the parent questionnaire for a parent participate rate of 87% (Ingels et al., 2004).

Student questionnaire administration. Approximately 135 survey administrators were trained over a period of two days to collect data in the schools (Ingels et al., 2004). Each survey administrator was assigned schools and provided with information about the school and about the survey day and make-up days. Each survey administrator recruited, hired, and trained a survey administrator assistant to help with data collection (Ingels et al., 2004). The survey administrator and assistant administered the student questionnaire in a group setting in a room designated by the school for the survey administration. Survey make-up days were staffed by either the survey administrator or the assistant. Prior to survey administration, the survey administrator read a script to students describing the study, giving informed consent, and giving instructions for completing the questionnaire.

Principal questionnaire administration. Packets were sent to schools along with a postage paid-return envelope. Packets included a lead letter informing participants that a study representative would contact them to address any questions or concerns, study brochure, ELS:2002 Uses of Data booklet, and the administrator questionnaire. Voluntary completion of the questionnaire was in effect the act of consent (E. Christopher, personal communication, April 7, 2015). Administrators voluntarily completed the questionnaire if they wanted to participate. The majority of questionnaires, 663, were received by mail and an additional 80 administrators completed an abbreviated form via phone, for a 99% administrator response rate.

Parent questionnaire administration. Parent questionnaires were mailed on the school's scheduled survey day to all parents for whom addresses were provided by schools. For schools that did not provide parent addresses (2%), the parent questionnaire was sent out after the student questionnaire had been completed. The questionnaire was available in English and Spanish and instructions asked for the parent that was most knowledgeable about the student to complete the questionnaire. As with the principal questionnaire, voluntary completion of the questionnaire was in effect an act of consent (E. Christopher, personal communication, April 7, 2015). Parent data was received from 13,488 of the participating students for a parent participation rate of 87.4% (Ingels et al., 2004).

Preliminary analysis

Prior to hypothesis testing, data were examined for missing data, and normality, linearity, and homoscedasticity assumptions were tested. Next, the intra-class correlation (ICC) was obtained to assess the extent to which there was dependency in the data due to nesting within schools and neighborhoods. Finally, multi-level models were specified by examining descriptive statistics and building the base model.

Missing data

Missing data is a common occurrence in research. While it is important to minimize missing data through careful planning and monitoring of the data collection process, missing data are often unavoidable. In survey research, like the ELS:2002, there may be several reasons for missing data, such as respondents' refusal or simple failure to answer certain items. In longitudinal studies respondents may be lost because they moved or they no longer wish to participate in the study.

NCES attempted to address missing data in ELS:2002 on several variables through survey design and imputation, particularly for important demographic variables. For example, student background questions were asked in both the baseline and first follow-up surveys. Thus, missing data in the base year was filled in with data from the first follow-up. Missing data for gender and race were also addressed through logical imputation which utilizes available information to impute to fill in missing data. When school rosters provided information on student's background, this information was used to impute student's gender and race/ethnicity. Finally, missing data was statistically imputed through weighted sequential hot decking, which draws on respondents' data (donors) to impute values for non-respondents. However, these efforts were primarily aimed at background or standard classification variables (e.g., race/ethnicity, gender, SES) typically used in data reporting (Ingels, Pratt, Rogers, Siegals, Stutts, 2005). Therefore further efforts must be made to address missing data.

There are a number of approaches to addressing missing data including listwise deletion, imputation, and maximum likelihood estimation. Of these approaches, listwise deletion, where cases with missing data are dropped from analysis, has been a common practice among researchers (Snijderes & Boskers, 2012) and is the default setting of many statistical programs (Tabachnik & Fidell, 2001). However, deleting incomplete cases can bias results by affecting standard errors and statistical power (Snijders & Boskers, 2012). Imputation methods involve replacing a missing value with another value such as the grand mean or group mean (i.e. mean imputation). However, imputation has a number of limitations such as reduced variance of the variable and its correlation with other variables (Cohen, Cohen, West, & Aiken, 2003; Tabachnik & Fidell, 2001).

Multiple imputation is a method of imputing missing data that entails imputing multiple values for a given missing value. Multiple imputation uses random sampling from the cases with complete data to identify the distribution of the variable(s) with missing data. Then *m* random samples are taken from the distribution to provide estimates of the variable for *m* newly created, complete, data sets (Tabachnick & Fidell, 2001). Statistical analyses are performed separately on the *m* new data sets and the pooled estimates are reported. However, multiple imputation can be cumbersome (Raudenbush & Bryk, 2002) and produces a different result each time it is used (Allison, 2012).

Much like multiple imputation, maximum likelihood (ML) estimates the distribution of the complete data given the missing data (Raudenbush & Bryk, 2002). However, rather than creating multiple data sets, these estimates are used to estimate model parameters (Raudenbush & Bryk, 2002). Maximum likelihood is the default estimation method for multilevel models in many statistical software (Heck & Thomas, 2015), thus, enabling multilevel models to effectively handle data with missing values. In addition to providing a simpler approach to missing data (Allison, 2012; Raudenbush & Bryk, 2002), ML is deterministic and will provide the same result every time it is used (Allison, 2012).

Due to NCES efforts to minimize missing data, complete data was available for the majority of variables in the present study. Overall, missing data was minimal (3.75%) in the current study. Tabachnick and Fidell (2001) argue that when missing data from a large data set is 5% or less, different procedures for handling missing data will yield similar results. Missing data was limited to the mediators, academic climate (16.7%), school order (15.6%), and facility conditions (0.6%), the control, 10^{th} grade GPA (8.5%), and the outcome 11^{th} grade GPA (13.3%). Due to missing data ML was used to estimate model parameters in the current study.

Assumptions

The assumptions of normality, linearity, and homoscedasticity of error terms underlie the multilevel model. More specifically, residuals are assumed to be normally distributed and linear. Homoscedasticity refers to the assumption that the variance of the residuals are constant. These assumptions can be checked by examining the residuals at each level through visual examination of plots (Snijders & Boskers, 2012). Additionally, visual inspection can be supplemented by summary statistics (Bell, Schoeneberger, Morgan, Kromrey, Ferron, 2010). Violation of assumptions may not bias level two parameter estimates, but can influence their standard errors (Raudenbush & Bryk, 2012). Further, level one random coefficients and variance components may be distorted (Raudenbush & Bryke, 2012).

SAS Macro MIXED_DX (Bell et al., 2010) was used to examine residuals and model assumptions. The SAS Macro MIXED_DX produces a variety of visual (e.g., scatter plots, QQ-plots) and numerical (Levene's test, normality tests) output for the level one and level two models.

11th grade GPA

Visual inspection of level one residuals suggested potential violations of normality. The histogram of residuals suggested that the residuals may be positively skewed. However, skew (-0.32) was within the acceptable range of -/+2. In contrast, kurtosis (2.36) exceeded the acceptable range indicating that the distribution of residuals were kurtotic. Further, the Q-Q plot further showed evidence of potential violations of normality. The Shapiro-Wilk test of normality suggested potential violations of normality supported visual inspection of residuals (W=0.82, p<.001). Further, Levene's test (F=1.87, p<.001) indicated potential violations of homogeneity of variance. However, inspection of a scatter plot of residuals supported the assumption of homogeneity of variance. Given potential violations of the normality assumptions, robust standard errors were used for the main analysis.

Level two residuals appeared to be normal, linear and homoscedastic. The histogram of residuals revealed an approximately normally distribution, and the Q-Q plot indicated that the residuals were normal and linear. Skew (-0.14) and kurtosis (0.39) further supported the assumption of linearity. However, the Shapiro-Wilk test of normality suggested potential violations of normality

(W=0.99, *p*=.01). A scatter plot of residuals supported the assumption of homoscedasticity.

Attainment

Skew (0.26) and kurtosis (0.20) for level one residuals suggest normality. However, examination of the residual Q-Q plot suggested that the residuals may be skewed and Shapiro-Wilk test of normality suggested potential violations of normality (W=.0.94, *p*<0.001). A scatter plot of level one residuals suggested homoscedasticity; however, Levene's test indicated potential violations of homoscedasticity (F=1.17, *p*=0.002). Both Shapiro-Wilk and Levene's test are sensitive to sample size. In large samples, such as the current study, these tests have been found to be sensitive to even slight deviations from normality and do not necessarily indicate that the deviation from normality is sufficient to bias estimates (Field, 2009). Further, skew and kurtosis values are within an acceptable range, suggesting that the deviation from normality may not be sufficient to bias estimates.

Level two appeared to approximate a normal distribution as indicated by skew (0.25) and kurtosis (1.04) values. Further, a Q-Q plot of residuals suggested that normality and linearity. However, the Shapiro-Wilk test of normality suggested potential violations of normality (W=0.00, *p*=<0.001). Examination of a scatter plot of level two residuals suggested homoscedasticity.

Intraclass Correlation Coefficient

At the school level, there was an average of 15.83 students per school, and the number of students per school ranged from one to forty-five. Nearly all schools (98%) had at least three students. At the neighborhood level, there was an average of two students per census tract, and the number of students per census tract ranged from one to twenty-two. More than half (59.8%) of the 5,800 census tracts contained only one student and nearly a quarter (22.2%) contained at least three students.

To further examine the extent to which there was dependency in the data based on nesting of students within schools and neighborhoods, the intraclass correlation coefficient (ICC) was calculated. The ICC is calculated by testing the null, or unconditional means models, where no predictors are included in the model. The ICC indicates the amount of variation in outcomes (GPA and Attainment) that can be explained by level 2 variables (schools and neighborhoods). Three unconditional means models were tested for each outcome (GPA and educational attainment) in order to examine the extent to which variance in student outcomes could be explained by students' schools and/or neighborhood.

The first two models, assume a two-level hierarchical structure where students are nested in schools (ignoring neighborhoods). The school only model revealed substantial variability in 11^{th} grade GPA and educational attainment between schools. Specifically, the ICC for 11^{th} grade GPA (0.14) suggests that 14% of the variance in GPA lies at the school level while the ICC for educational attainment (0.15) suggests that 15% of the variance in GPA and attainment, respectively, can be explained by schools.

The second set of models also assumes a two-level hierarchy where students are nested in neighborhoods (ignoring schools). In the neighborhood only model, the ICC for GPA (0.15) suggests that 15% of the variance in student GPA can be explained by the neighborhood where they reside. In this model, the ICC for educational attainment (.15) suggests that 15% of the variance in educational attainment can be explained by neighborhood differences.

In the final set of models, the null cross classified multilevel model (CCMM) was examined. In contrast to the traditional multilevel model where students are nested in one, and only one, context (e.g., schools or neighborhoods), the CCMM allows for individuals to be nested in multiple contexts which are not themselves nested. In the CCMM the ICC can be calculated for schools (intra-school correlation coefficient) and neighborhoods (intra-neighborhood correlation coefficient). The intra-school correlation coefficient refers to the correlation in outcomes between students who attend the same school, but live in different neighborhoods. Similarly, the intra-neighborhood correlation coefficient refers to the correlation in outcomes between students who live in the same neighborhood, but attend different schools. Finally, the intracell correlation coefficient can be calculated, which refers to the correlation in outcomes between students who attend the same school and live in the same neighborhood.

Examination of the null CCMM revealed that the variance in student outcomes was driven largely by schools rather than neighborhoods. For 11th grade GPA, the neighborhood level variance was reduced to 3% after running a CCMM that considered schools, while the school level variance was 13%.

Similarly, the null model for educational attainment reduced the neighborhood variance to 2% while the intra-school correlation (0.15) suggested that schools explained 15% of the variance in educational attainment. Lastly, the intracell correlation suggests that 12% of the variance in 11^{th} grade GPA and 17% of the variance in educational attainment can be explained by both neighborhoods and schools.

These analyses suggest that there is sufficient variance at level two to warrant multilevel modeling and that this variance is primarily limited to schools. Given the nested nature of the data (i.e., students within schools), multilevel modeling (MLM) was used to take into account dependency in the data (Snijders & Bosker, 1999). Unlike ordinary least squares regression which assumes independence of observations, MLM is suitable for nested data because it models variability at different levels of analysis, therefore, allowing for the examination of individual and contextual effects. In MLM, level one represents the smallest or most basic unit of measurement (e.g., students). Level two represents the larger unit within which level one units are clustered (e.g., schools, neighborhoods). Thus, level one variables are said to be nested within level two. In the current study, level one includes individual level controls (gender, ethnicity, and family SES). Due to the lack of variance in student outcomes at the neighborhood level, the predictor, neighborhood disadvantage, was also included at level one. Level two includes the mediator variables (condition of school facilities, safety, and academic climate) and school level controls: urbanicity (urban, suburban, rural), region (e.g., Midwest, Northeast), and school level SES.

Model Specification

Building the multilevel model includes identifying the right variables and specifying the fixed and random parts of the model (Snijders & Boskers, 2012). Fixed predictor effects on the outcome are held constant across groups (e.g., schools) while random predictor effects on the dependent variable are allowed to vary between groups. For example, examining the fixed effects of SES on grades may suggest that grades increase as SES increases. However, if SES were specified as random, a significant random effect for SES would suggest that the relationship between SES and GPA varies between schools or is different in school A than school B. This partitioning of fixed and random effects allows for the examination of within group (fixed effects) and between group variability (random effects). Model specification involves working up from level one by specifying the fixed parts of the model (Snijders & Boskers, 2012).

Raudenbush and Bryk (2002) state that building the level one model is "an interplay of theoretical and empirical considerations" (p.256). Thus, variable selection is driven by the research and preliminary examinations of the model (Raudenbush & Bryk, 2002; Snijders & Boskers, 2012). Specifically, analysis should begin by focusing on level one predictors while omitting any predictors at level two (Raudenbush & Bryk, 2002). In other words, the level one model is examined unconditional at level two (Raudenbush & Bryk, 2002). Raudenbush and Bryk (2002) suggest that two questions must be posed of the level one data: 1) whether there is a fixed effect and 2) whether there is evidence of slope heterogeneity, or a random effect. Thus, initial model building can begin by examining the fixed effects model followed by an examination of potential random effects (Snijders & Boskers, 2012). In deciding whether to omit a variable, Raudenbush and Bryk (2002) argue that there must be no evidence of a fixed or random effect in order for a predictor to be removed from the model.

Snijders and Boskers (2012) warn that, within a multilevel design, a significant effect of a level one predictor may be in actuality, entirely or partially, a contextual effect. Thus, they suggest examining contextual, or the between-group effect, for level one explanatory variables. This distinction specifying within and between group variability of a predictor can be modeled by including the group mean level one variables at level two (Snijders & Boskers, 2012). In addition to including group means of level one variables, specification of the level two model takes a similar approach to level one specification in that variables are identified based on the research and then tested and included or removed based on significance in the model or substantive importance (Snijders & Boskers, 2012).

Centering level one variables can facilitate the examination of effects at each level. In other words, centering can aid in understanding the relative influence of individual versus contextual factors on an outcome. In the current analysis, the level one predictor, neighborhood disadvantage, and covariate, SES, were group mean centered, or centered within cluster (CWC). Centering within cluster subtracts the group mean from the raw score thereby partialling out any between-group variability in the predictor. The result is a “pure” estimate of the level one effect, or within-group variability (Enders & Tofighi, 2007). As such, level one predictors that have been centered within cluster are uncorrelated with level two predictors.

Inter-item correlations, means, and standard deviations are presented in Table 1 for predictors and outcomes. Multicollinearity does not appear to be present as all correlations are smaller than 0.80. However, the strong correlation between school level SES and disadvantage was further examined by obtaining the variance inflation factor (VIF) which was below 10 (1.4) indicating that multicollinearity was not an issue (Field, 2009). Average high school GPA for the sample was a C average (M=2.7) and, on average, the sample had attained an undergraduate certificate or an Associate's degree (M=4.5) ten years after the base year (eight years after high school).

Of the schools included in the study, 280 indicated that they were comprehensive public schools that only enrolled students in their attendance boundaries and 170 were private schools. There was significant overlap between public schools of choice (220), magnet (80), and charter schools (10). Of the 80 magnet schools, 30 also indicated that they were a public school of choice and one indicated being a charter. Of the ten charter schools, five also reported being a public school of choice. Given the small number of charter schools and the overlap between charters, magnets, and public schools of choice, these three types of schools were collapsed. Thus, in order to examine school choice, school type was reduced to three categories: comprehensive public schools (neighborhood schools), public schools of choice (public schools of choice, magnets, and charter schools), and private schools. Table 2 shows the characteristics of the total sample as well as sample characteristics by school type.

Table 1.

Interitem correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Disadv$_{cwc}$	-	-0.21	-0.13	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.12*	-0.09*
2. SES$_{cwc}$		-	0.29*	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22*	0.24*
3. HS GPA$_{cwc}$[a]			-	0.91*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78*	0.49*
4. 10th gr. GPA$_{cwc}$				-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69*	0.45*
5. Disadv$_{agg}$					-	-0.66*	-0.48*	-0.52*	-0.34*	0.20*	-0.21*	-0.20*	-0.25*
6. SES$_{agg}$						-	0.51*	0.56*	0.51*	-0.12*	0.33*	0.21*	0.34*
7. 10th gr. GPA$_{agg}$							-	0.94*	0.33*	-0.13*	0.30*	0.39*	0.27*
8. HS GPA$_{agg}$[a]								-	0.34*	-0.12*	0.28*	0.41*	0.30*
9. Climate									-	-0.09*	0.43*	0.15*	0.19*
10. Facility										-	-0.12*	-0.06*	-0.05*
11. Order											-	0.13*	0.15*
12. 11th gr. GPA												-	0.58*
13. Attain[b]													-
Mean	0.00	0.00	0.00	0.00	0.00	0.09	2.74	2.72	0.01	0.05	3.67	2.80	4.49
SD	0.57	0.61	0.78	0.76	0.67	0.44	0.41	0.43	0.16	0.09	0.41	0.83	1.94

Note. Agg = aggregated to the mean; *CWC* centered within cluster (group mean centered)
[a]Overall high school GPA. [b]Ten years after 2002 baseline.
*$p < .001$.

Table 2

Sample Characteristics

	N(%)			
	Total	**Public Neighborhood N=280**	**Public Choice N=280**	**Private N=170**
Level 1 (N=11,490)				
Race/Ethnicity				
American Indian/ Alaskan Native	60(0.5)	20(0.5)	30(0.7)	10(0.3)
Asian, Hawaii/Pac. Islander	1,0780(9.4)	450(10.1)	510(11.6)	120(4.6)
Black/African American	1,440(12.6)	600(13.6)	660(11.6)	180(6.8)
Latino	1,620(14.1)	620(13.9)	740(17.0)	260(9.5)
Multi-racial	540(4.7)	190(4.4)	210(4.9)	130(4.8)
White	6,760(58.8)	2,540(57.5)	2,210(50.6)	2,010(74.0)
Gender				
Male	5,430(47.2)	2,060(46.7)	2,020(46.4)	1,340(49.4)
Female	6,100(52.8)	2,350(53.3)	2,340(53.6)	1,370(50.6)
Level 2 (N=730)				
Region				
Northeast	130(17.2)	60(19.7)	30(11.5)	40(22.6)
Midwest	190(25.8)	60(21.1)	80(28.3)	50(29.2)
South	270(37.2)	110(40.9)	100(36.9)	50(31.5)
West	140(19.8)	50(18.3)	70(23.3)	30(16.7)
Urbanicity				
Urban	240(32.9)	60(21.1)	100(34.1)	90(50.6)
Suburban	350(48.3)	150(53.0)	130(47.0)	70(42.9)
Rural	140(18.7)	70(25.8)	50(19.0)	10(6.5)

Note: Sample sizes are rounded

GPA

The level one predictor, neighborhood disadvantage, was entered into the level one model along with the level one covariates, gender, SES, and 10th grade GPA (see Table 3). The fixed effects for these variables were significant. The predictor, neighborhood disadvantage, was then allowed to vary. The random effect for neighborhood disadvantage was significant, indicating that the relationship between neighborhood disadvantage and 11th grade GPA varied between schools.

The level two covariates, region, urbanicity, mean SES, and mean 10th grade GPA were entered into the model. Additionally, school type was entered as a control and mean neighborhood disadvantage was entered into the model to test for any potential contextual effects for neighborhood disadvantage. 10th grade GPA was the only level two control to reach significance. Therefore, region, urbanicity, and SES were removed from the model for the main analysis. However, mean neighborhood disadvantage and school type were retained in the model because of their importance in the current study.

Attainment

The level one predictor, neighborhood disadvantage, was entered into the level one model along with the level one covariates, gender and SES (see Table 4). Additionally, GPA was entered into the model as a level one covariate. Race/ethnicity ($F=6.40$, $p<0.001$), SES ($F=170.44$, $p<0.001$), and GPA ($F=2912.53$, $p<0.001$) were significant predictors of educational attainment. Neighborhood disadvantage ($F=0.72$, $p=0.40$) and gender were nonsignificant ($F=0.94$, $p=0.33$). Neighborhood disadvantage was retained because of its importance in the current study.

At level two, mean neighborhood disadvantage and the covariates, region, urbanicity, and SES were entered into the model. Additionally, mean GPA was added at level two as a control. All level two variables were significant predictors of educational attainment.

Table 3

11^{th} grade GPA model specification

	Model 1 Level 1 predictors	Model 2 Random slopes	Model 3 Level 1 and 2 predictors
Fixed Effects			
Intercept	2.74(0.02)***	2.74(0.02)***	2.69(0.01)***
$\text{Disadvantage}_{cwc}$	-0.02(0.01)*	-0.02(0.01)	-0.02(0.01)*
SES_{cwc}	0.05(0.01)***	0.05(0.01)***	0.05(0.01)***
Gender_{girl}	0.08(0.01)***	0.08(0.01)***	0.08(0.01)***
Race_{Native}	-0.12(0.07)	-0.13(0.07)	-0.13(0.08)
Race_{Asian}	-0.01(0.02)	-0.01(0.02)	0.02(0.02)
Race_{Black}	-0.10(0.02)***	-0.10(0.02)***	-0.04(0.02)*
$\text{Race}_{Hispanic}$	-0.09(0.02)***	-0.09(0.02)***	-0.04(0.02)*
$\text{Race}_{Multiracial}$	-0.05(0.02)	-0.05(0.03)	-0.04(0.02)
10^{th} grade	0.76(0.01)***	0.76(0.01)***	0.86(0.02)***
GPA_{cwc}			
$\text{Disadvantage}_{agg}$			0.00(0.02)
SES_{agg}			0.01(0.02)
$\text{Urbanicity}_{Rural}$			0.02(0.02)
$\text{Urbanicity}_{Suburban}$			0.02(0.02)
$\text{Region}_{Midwest}$			0.01(0.02)
$\text{Region}_{Northeast}$			0.00(0.02)
Region_{South}			0.00(0.02)
$\text{School Type}_{Choice}$			0.02(0.01)
$\text{School Type}_{Private}$			0.03(0.02)
10^{th} grade			0.86(0.02)***
GPA_{agg}			
Random Effects			
Intercept		0.12(0.01)***	0.01(0.00)***
$\text{Disadvantage}_{cwc}$		0.01(0.00)*	0.01(0.00)*
Covariance		0.00(0.00)	0.00(0.00)*
Residual		0.23(0.00)***	0.22(0.00)***

Note. Agg = aggregated to the mean; CWC = centered within cluster (group mean centered)
***p<0.001 ** p<0.01 * p<0.05

Table 4

Attainment model specification

	Model 1 Level 1 Predictors	Model 2 Random Slopes	Model 3 Level 1 and 2 Predictors
Fixed Effects			
Intercept	4.50(0.04)***	4.50(0.04)***	4.22(0.06)***
Disadvantage$_{cwc}$	-0.02(0.03)	-0.02(0.03)	-0.05(0.03)
SES$_{cwc}$	0.33(0.03)***	0.33(0.03)***	0.35(0.03)***
HS GPA$_{cwc}$[a]	1.12(0.02)***	1.12(0.02)***	1.13(0.02)***
Gender$_{girl}$	0.03(0.03)	0.03(0.03)	0.04(0.03)
Race$_{Native}$	-0.16(0.20)	-0.15(0.20)	-0.09(0.20)
Race$_{Asian}$	0.09(0.06)	0.08(0.06)	0.27(0.06)***
Race$_{Black}$	-0.02(0.06)	-0.02(0.06)	0.22(0.05)***
Race$_{Hispanic}$	-0.25(0.05)***	-0.25(0.05)***	0.02(0.05)
Race$_{Multiracial}$	-0.15(0.07)*	-0.15(0.07)*	-0.09(0.07)
Disadvantage$_{agg}$			-0.13(0.04)**
SES$_{agg}$			0.65(0.07)***
HS GPA$_{agg}$[a]			0.91(0.06)***
Urbanicity$_{Rural}$			-0.16(0.06)**
Urbanicity$_{Suburb}$			-0.08(0.04)
Region$_{Midwest}$			0.14(0.06)*
Region$_{Northeast}$			0.43(0.06)***
Region$_{South}$			0.07(0.05)
School Type$_{Choice}$			0.03(0.04)
School Type$_{Private}$			0.33(0.06)***
Random Effects			
Intercept	0.59(0.04)***	0.59(0.04)***	0.08(0.01)***
Disadvantage		0.00(0.00)	
Covariance		-0.02(0.02)	
Residual	2.20(0.03)***	2.20(0.03)***	2.20(0.03)***

Note. Agg = aggregated to the mean; CWC = centered within cluster (group mean centered)

[a]Overall HS GPA

*$p<0.05$ **$p<0.01$ ***$p<0.001$

Results

11th grade GPA

Linear and quadratic effects

The linear relationship between neighborhood disadvantage and 11th grade GPA was examined at level one and level two (see Table 5). There was a significant negative main effect at level one indicating that GPA was lower for students living in neighborhoods with greater levels of neighborhood disadvantage. The main effect at level two was not significant indicating that there was not a contextual effect for neighborhood disadvantage at the school level.

Although the linear effect for neighborhood disadvantage at level two was not significant, the quadratic effect was examined for neighborhood disadvantage at level one and level two to test the study hypothesis that the negative relationship between neighborhood disadvantage and achievement would level out at higher levels of disadvantage. Therefore, quadratic terms were added to neighborhood disadvantage at both the student and school level to test whether there was a curvilinear relationship between neighborhood disadvantage in grade 10 and GPA in 11th grade. The quadratic term failed to reach significance at both the individual and school level indicating that a linear relationship best explained the relationship between neighborhood disadvantage at the individual level and achievement.

All covariates except school type were significant in both the linear and quadratic models. At level one, SES and 10th grade GPA were associated with greater 11th grade GPA. Being a girl was associated with higher GPA compared with boys, while being Black or Latino was associated with lower GPA compared to White students.

Table 5.

Linear and quadratic models

11th grade GPA	Linear Model	Quadratic Model
Fixed Effects		
Intercept	2.71(0.01)***	2.71(0.01)
$Disadvantage_{Linear}$	-0.02(0.01)*	-0.02(0.01)
$Disadvantage_{Quad}$	-	-0.00(0.01)
SES	0.05(0.01)***	0.05(0.01)***
$Gender_{girl}$	0.08(0.01)***	0.08(0.01)***
$Race_{Native}$	-0.13(0.08)	-0.13(0.08)
$Race_{Asian}$	0.01(0.02)	0.01(0.02)
$Race_{Black}$	-0.05(0.02)*	-0.05(0.02)*
$Race_{Hispanic}$	-0.05(0.02)**	-0.05(0.02)**
$Race_{Multiracial}$	-0.04(0.02)	-0.04(0.02)
10th Grade GPA_{cwc}	0.77(0.01)***	0.77(0.01)***
$Disadvantage_{Linear}$	-0.01(0.01)	-0.01(0.01)
$Disadvantage_{Quad}$		0.00(0.01)
School $Type_{Choice}$	0.02(0.01)	0.02(0.01)
School $Type_{Private}$	0.03(0.02)	0.03(0.02)
GPA_{agg}	0.87(0.02)***	0.87(0.02)***
Random Effects		
Intercept	0.01(0.00)***	0.01(0.00)***
$Disadvantage_{cwc}$	0.01(0.00)*	0.01(0.00)*
Covariance	0.00(0.00)*	0.00(0.00)*
Residual	0.22(0.00)***	0.22(0.00)***

*p<0.05, **p<0.01, ***p<0.001

Mediation

It was hypothesized that the school climate (school order, academic climate, and condition of school facilities) would explain the relationship between neighborhood disadvantage and student outcomes. School climate represents characteristics of the school that were measured at level two and, within the context of multilevel modeling, can only mediate the relationship between another level two predictor and level one outcome (Krull & MacKinnon, 2001). Such a model is referred to as 2-2-1 mediation, as the independent and mediator variables are at level two predicting a level one outcome (Bauer, Preacher, & Gill, 2006; Zhang, Zyphur, & Preacher, 2009).

Although the main effect of neighborhood disadvantage at level two in the linear model was not a significant predictor of 11^{th} grade GPA, it is still possible that neighborhood disadvantage has an indirect effect on GPA through school climate. Hayes (2013) argues that a significant association between a predictor (e.g., neighborhood disadvantage) and an outcome (e.g., GPA) is not a necessary condition to conducting mediation analysis. Therefore, the indirect effect of neighborhood disadvantage was examined by estimating the effect of neighborhood disadvantage on school climate and the effect of the school climate on 11^{th} grade GPA.

Investigation of the relationship between neighborhood disadvantage and the school climate indicates that neighborhood disadvantage is a significant predictor of school order [$F(1, 600) = 17.36$, $p<0.001$], academic climate [$F(1, 600) = 70.21$, $p<0.001$], and the condition of school facilities [$F(1, 720) = 31.60$, $p<0.001$] (see Figure 2). Specifically, results indicate that greater levels of neighborhood disadvantage were associated with less school order (or greater disorder) and poorer academic climate. There was a positive relationship between neighborhood disadvantage and the condition of school facilities indicating that greater levels of neighborhood disadvantage was associated with greater levels of disrepair. However, school order [$F(1, 7110) = 3.12$, p=0.08)], academic climate [$F(1, 7110) = 0.14$, p=0.71)], and condition of school facilities [$F(1, 7110) = 0.02$, p=0.88)] were not significant predictors of 11th grade GPA.

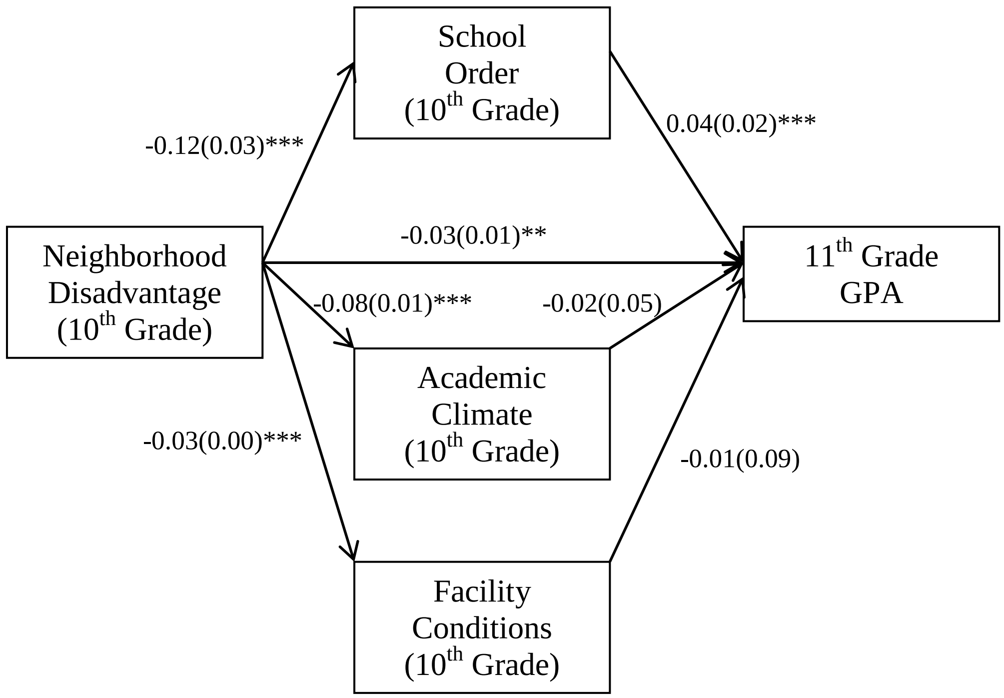

Figure 2. Mediation model: Neighborhood disadvantage predicting GPA through school climate mediators (all variables at 10th grade, except for 11th grade outcome).

Moderation

The significant random effect for neighborhood disadvantage at level one indicated that the relationship between neighborhood disadvantage and 11th grade GPA varied between schools. Therefore, the cross level interaction between neighborhood disadvantage and school type was entered into the equation to test whether school type helped explained this between group variance. The interaction between neighborhood disadvantage and school type was significant

[$F(2, 8520) = 3.54$, p=0.03], suggesting that school type moderates the relationship between student level neighborhood disadvantage and student GPA. Specifically, the relationship between neighborhood disadvantage and 11th grade GPA differed between students attending comprehensive public schools and students attending public schools of choice (β=-0.05, SE=0.03, p=0.04). While there was a negative relationship between neighborhood disadvantage and 11th grade GPA, the negative relationship was more pronounced for students attending public schools of choice (magnet, charter, and public schools of choice) than for students attending comprehensive public schools (see Figure 3). Students attending public schools of choice performed better academically than students attending comprehensive public schools at low and moderate levels of neighborhood disadvantage. However, at high levels of neighborhood disadvantage, students attending public schools of choice performed less well.

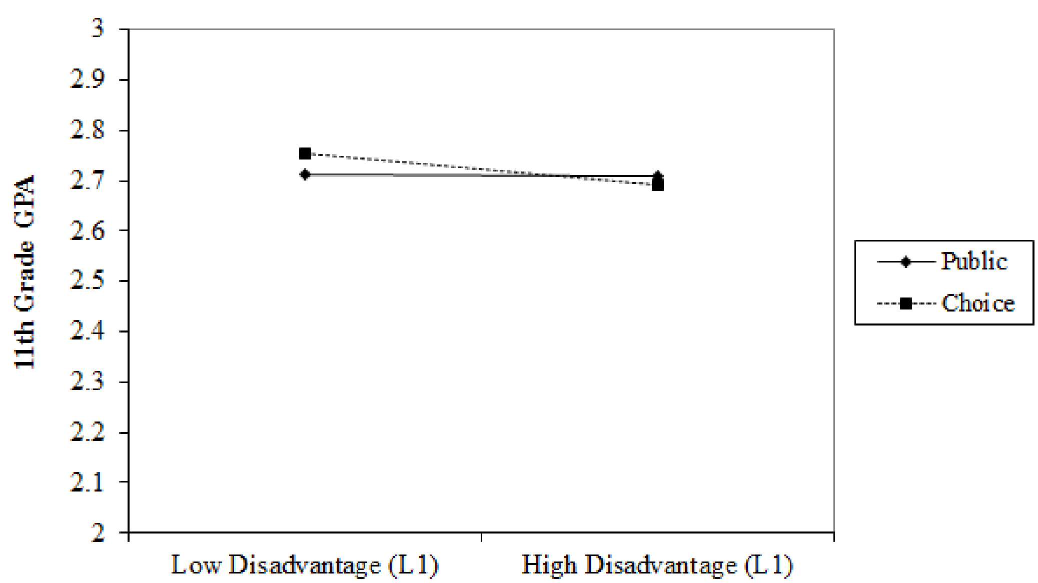

Figure 3. Interaction between level 1 neighborhood disadvantage and school type on 11th grade GPA

Moderated mediation. Although, school climate did not predict student outcomes, it is possible that the relationship between the proposed mediators and study constructs vary based on some other factor, such as a school type. Therefore, in order to test the hypothesis that the indirect effect of neighborhood disadvantage varies as a function of school type, the interaction between 1) school type and neighborhood disadvantage and 2) school type and each component of school climate were examined. Thus, the paths from neighborhood disadvantage to each mediator was examined as well as the paths from the mediators to GPA.

The relationship between neighborhood disadvantage and school climate was not moderated by school type. The interactions between school type and neighborhood disadvantage were not significant for school order [$F(2, 600)=0.16$, $p=0.85$] and conditions of school facilities [$F(2, 720)=0.86$, $p=0.43$]. While the interaction between school type and neighborhood disadvantage failed to reach significance for academic climate [$F(2, 600)=2.62$, $p=0.07$], the relationship between neighborhood disadvantage and academic climate differed between comprehensive public schools and public schools of choice ($\beta=0.04$, SE=0.02, $p=0.02$) (see Table 6). Specifically, academic climate was higher for comprehensive public schools than public schools of choice at low levels of disadvantage (see Figure 4). This was reversed at higher levels of disadvantage, indicating that public schools of choice attenuated the negative effects of neighborhood disadvantage on academic climate.

Table 6.

Moderation of the relationship between predictor (disadvantage) and mediator (school climate)

	Outcome		
	School Order	Academic Climate	Condition of Facilities
Intercept	3.57(0.02)***	-0.02(0.01)	0.05(0.01)***
Disadvantage	-0.03(0.03)	-0.08(0.01)***	0.02(0.01)**
School $Type_{Choice}$	-0.02(0.03)	-0.01(0.01)	-0.00(0.01)
School $Type_{Private}$	0.51(0.04)***	0.11(0.02)***	-0.03(0.01)**
Disadvantage*School $Type_{Choice}$	-0.03(0.05)	0.04(0.02)*	0.00(0.01)
Disadvantage*School $Type_{Private}$	-0.01(0.07)	0.01(0.03)	-0.02(0.01)

*$p<0.05$, **$p<0.01$, ***$p<0.001$

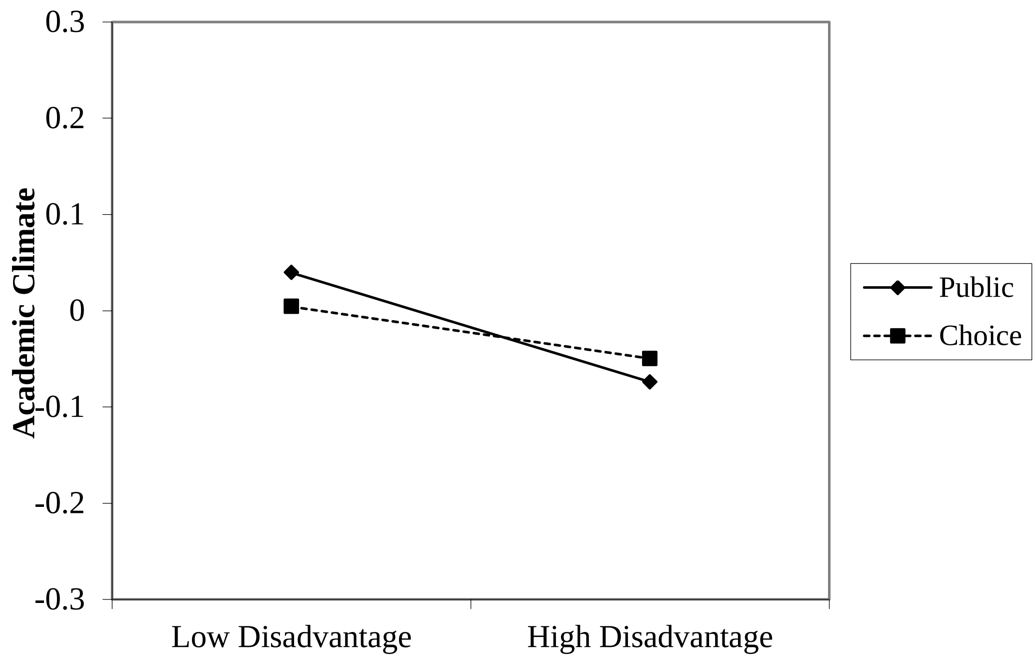

Figure 4. Interaction between level 2 neighborhood disadvantage and school type on academic climate

The relationship between the school climate and GPA was not moderated by school type (see Table 7). The interactions between school type and school order [F(2, 7110)=1.02, p=0.36], school type and academic climate [F(2, 7110)=0.67, p=0.51], and school type and condition of school facilities [(F(2, 7110)=0.28, p=0.76] were not significant.

Table 7.

Moderation of the relationship between mediators (school climate) and outcome (GPA)

11^{th} grade GPA	Model Parameters
Fixed Effects	
Intercept	2.66(0.14)*
$Disadvantage_{cwc(Linear)}$	-0.03(0.01)**
SES_{cwc}	0.05(0.01)***
$Gender_{girl}$	0.07(0.01)***
$Race_{Native}$	-0.15(0.09)
$Race_{Asian}$	0.00(0.02)
$Race_{Black}$	-0.03(0.02)
$Race_{Hispanic}$	-0.06(0.02)**
$Race_{Multiracial}$	-0.02(0.03)
10^{th} Grade GPA_{cwc}	0.77(0.01)***
$Disadvantage_{agg(Linear)}$	-0.01(0.01)
School $Type_{Choice}$	-0.05(0.17)
School $Type_{Private}$	-0.31(0.23)
10^{th} Grade GPA_{agg}	0.85(0.02)***
School order	0.02(0.04)
Academic climate	0.05(0.08)
Facilities	0.07(0.14)
School order*School $Type_{Choice}$	0.02(0.05)
School order*School $Type_{Private}$	0.08(0.06)
Academic climate*School $Type_{Choice}$	-0.12(0.12)
Academic climate*School $Type_{Private}$	-0.09(0.14)
Facilities*School $Type_{Choice}$	-0.16(0.21)
Facilities* School $Type_{Private}$	-0.10(0.34)
Random Effects	
Intercept	0.01(0.01)***
$Disadvantage_{cwc}$	0.00(0.00)
Covariance	0.00(0.00)
Residual	0.22(0.00)

*p<0.05, **p<0.01, ***p<0.001

Attainment

Linear and quadratic effects

The relationship between neighborhood disadvantage and educational attainment ten years after the study base year (eight years after high school) was examined by exploring linear and curvilinear relationships (see Table 8). The linear relationship between neighborhood disadvantage at level one and students' (level one) educational attainment was not significant indicating that students' residence in tenth grade does not significantly predict educational attainment after high school. However, the contextual effect for neighborhood disadvantage at the school level was significant. Specifically, greater neighborhood disadvantage at the school level was associated with lower levels of students' (level one) educational attainment.

All controls were significant except for gender. At level one there was a significant effect for SES such that greater SES in high school was associated with greater levels of attainment after high school. At level two, greater school level SES and GPA was associated with greater student attainment after high school. There were significant effects for urbanicity, region, and school type such that rural high schools were associated with less attainment compared to urban high schools. Compared to schools in the West, Midwest and Northeast high schools predicted greater educational attainment. Finally, private schools were associated with greater educational attainment compared to comprehensive public schools.

Table 8.

Linear and quadratic models predicting educational attainment

Attainment	Linear Model	Quadratic Model
Fixed Effects		
Intercept	4.22(0.06)***	4.16(0.06)***
$\text{Disadvantage}_{\text{Linear}}$	-0.05(0.03)	-0.05(0.03)*
$\text{Disadvantage}_{\text{quadratic}}$		0.03(0.02)
SES	0.35(0.03)***	0.35(0.03)***
GPA	1.13(0.02)***	1.13(0.02)***
$\text{Gender}_{\text{girl}}$	0.04(0.03)	0.04(0.03)
$\text{Race}_{\text{Native}}$	-0.09(0.20)	-0.09(0.20)
$\text{Race}_{\text{Asian}}$	0.27(0.06)***	0.27(0.06)***
$\text{Race}_{\text{Black}}$	0.22(0.05)***	0.21(0.05)***
$\text{Race}_{\text{Hispanic}}$	0.02(0.05)	0.012(0.05)
$\text{Race}_{\text{Multiracial}}$	-0.09(0.07)	-0.09(0.07)
$\text{Disadvantage}_{\text{Linear}}$	-0.13(0.04)**	-0.25(0.06)***
$\text{Disadvantage}_{\text{Quadratic}}$	-	0.12(0.03)***
SES	0.65(0.07)***	0.57(0.07)***
GPA	0.91(0.06)***	0.91(0.06)***
$\text{Urbanicity}_{\text{Rural}}$	-0.16(0.06)**	-0.07(0.06)**
$\text{Urbanicity}_{\text{Suburban}}$	-0.08(0.04)	-0.08(0.04)
$\text{Region}_{\text{Midwest}}$	0.14(0.06)*	0.12(0.06)*
$\text{Region}_{\text{Northeast}}$	0.43(0.06)***	0.42(0.06)***
$\text{Region}_{\text{South}}$	0.07(0.05)	0.09(0.05)
$\text{School Type}_{\text{Choice}}$	0.03(0.04)	0.04(0.04)
$\text{School Type}_{\text{Private}}$	0.33(0.06)***	0.37(0.06)***
Random Effects		
Intercept	0.08(0.01)***	0.07(0.01)***
Residual	2.20(0.3)***	2.20(0.03)***

*$p<0.05$, **$p<0.01$, ***$p<0.001$

Curvilinear effects were examined at level one and level two in order to test hypothesis that the relationship between neighborhood disadvantage and student attainment after high school was not constant across levels of neighborhood disadvantage. There was a significant quadratic effect for neighborhood disadvantage at level two (see Table 8). The negative linear effect indicates that greater neighborhood disadvantage at the school level is associated with lower levels of attainment 10 years following high school. However, the positive quadratic effect suggests that the negative relationship between neighborhood disadvantage and educational attainment is not constant, but rather levels off at higher levels of disadvantage (see Figure 5).

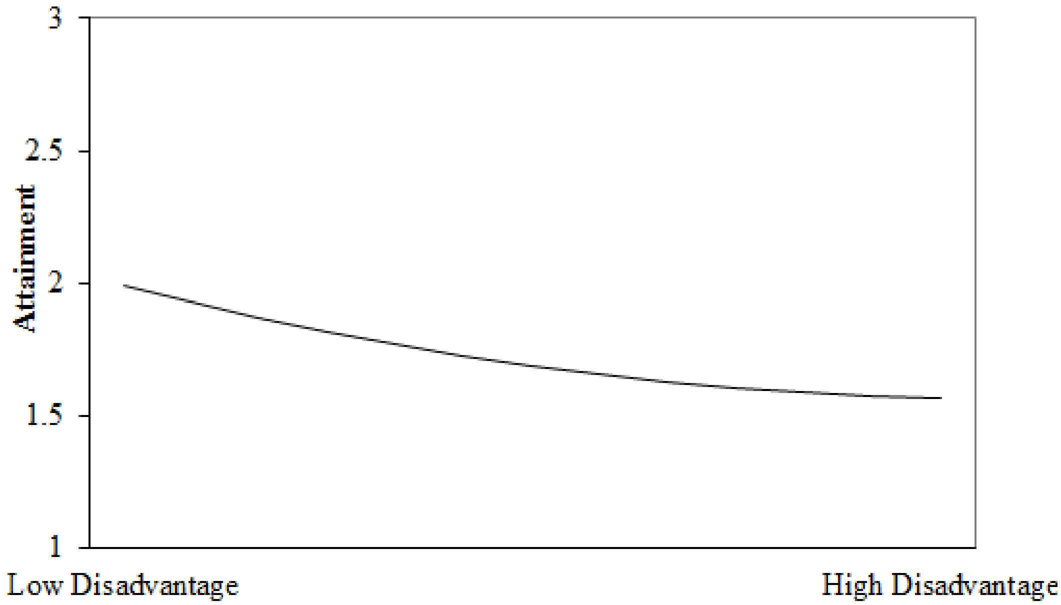

Figure 5. Quadratic effect of neighborhood disadvantage and educational attainment.

Mediation

In order to examine whether the relationship between neighborhood disadvantage and educational attainment could be explained by school climate, school order, academic climate, and condition of school facilities were added to the model. As previously discussed, neighborhood disadvantage significantly predicted the school climate (see GPA). However, the school climate was not a significant predictor of educational attainment (see Figure 6).

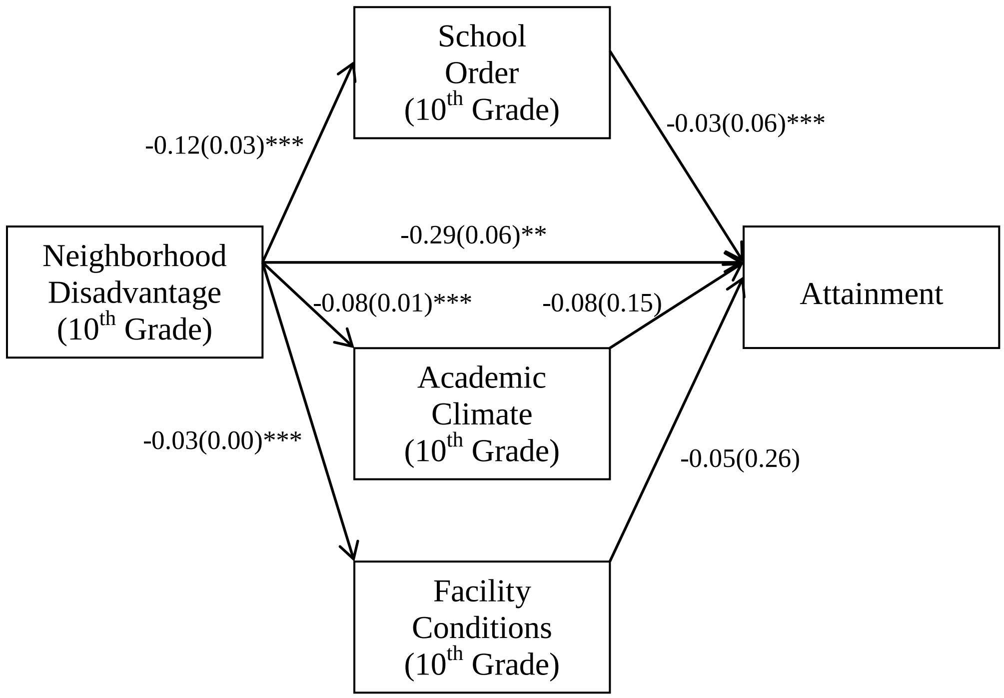

Figure 6. Mediation model: Neighborhood disadvantage predicting academic attainment through school climate mediators (all variables at 10th grade, except for attainment).

Moderated Mediation

Although school climate did not mediate the relationship between neighborhood disadvantage and educational attainment, the relationship between neighborhood disadvantage through school climate may differ based on other characteristics of the school. Therefore school type was examined as a potential moderator of the indirect effects. Moderation effects for the paths from neighborhood disadvantage to each mediator were examined as well as the paths from the mediators to GPA. As previously discussed, the relationship between neighborhood disadvantage at level two and academic climate (level 2) differed between comprehensive public schools and public schools of choice (see GPA).

However, school type did not moderate the relationship between neighborhood disadvantage and school order or condition of school facilities.

The path from school climate to educational attainment was not moderated by school type. The interaction between school type and school order [$F(2, 560)=0.85$, $p=0.43$], school type and academic climate [$F(2,520)=1.13$, $p=0.32$] and school type and condition of school facilities [$F(2,630)=0.84$, $p=0.43$] failed to reach significance. Table 9 shows the parameters for the model examining moderation of the path between school climate and educational attainment.

Table 9.

Moderation of the relationship between mediators (school climate) and outcome (attainment)

Educational Attainment	Model Parameters
Fixed Effects	
Intercept	2.17(0.39)***
$Disadvantage_{Linear}$	-0.06(0.03)*
SES	0.35(0.03)***
GPA	1.14(0.02)***
$Gender_{girl}$	0.03(0.03)
$Race_{Native}$	0.04(0.22)
$Race_{Asian}$	0.28(0.06)***
$Race_{Black}$	0.24(0.06)**
$Race_{Hispanic}$	-0.01(0.06)
$Race_{Multiracial}$	-0.14(0.08)
$Disadvantage_{Linear}$	-0.29(0.06)***
$Disadvantage_{Quadratic}$	0.12(0.04)**
SES	0.56(0.09)***
GPA	0.85(0.06)***
$Urbanicity_{Rural}$	-0.18(0.07)**
$Urbanicity_{Suburban}$	-0.10(0.05)*
$Region_{Midwest}$	0.10(0.06)
$Region_{Northeast}$	0.38(0.07)***
$Region_{South}$	0.08(0.06)
School $Type_{Choice}$	-0.02(0.48)
School $Type_{Private}$	-0.38(0.66)
School order	-0.09(0.10)

Educational Attainment	Model Parameters
Academic climate	0.28(0.37)
Facilities	-0.15(0.22)
School order* School $Type_{Choice}$	0.03(0.13)
School order* School $Type_{Private}$	0.21(0.17)
Academic climate* School $Type_{Choice}$	0.33(0.31)
Academic climate* School $Type_{Private}$	-0.22(0.39)
Facilities* School $Type_{Choice}$	-0.67(0.52)
Facilities* School $Type_{Private}$	-0.14(1.06)
Random Effects	
Intercept	0.07(0.01)***
Residual	2.20(0.03)***

*p<0.05, **p<0.01, ***p<0.001

Discussion

This study examined three hypotheses for two student outcomes, 11^{th} grade GPA and educational attainment eight years after high school (ten years after the study base year). In addition, the effects of neighborhood disadvantage on these outcomes were examined at level one (the student level) and level two (the school level). Results showed that both student and school level neighborhood disadvantage have important implications for student outcomes.

The first hypothesis was that the relationship between student outcomes and neighborhood disadvantage would be curvilinear, such that the negative effects of neighborhood disadvantage would not be observed until disadvantage reached moderate to high levels. There was a curvilinear trend found for the effect of school level neighborhood disadvantage on educational attainment. However, this was not true for student level neighborhood disadvantage, as the curvilinear effect was not significant. This finding indicates that the effect of school-level neighborhood disadvantage levels out at higher levels of disadvantage; whereas, at the student level, greater disadvantage is associated with worse outcomes. This is one of the first studies to examine neighborhood disadvantage in this way and results suggest that this type of distinction may useful given the difference in findings at level one and level two.

This study also sought to understand how neighborhood disadvantage affects student outcomes by identifying possible explanatory mechanisms of this relationship. It was hypothesized that school climate, as measured by school order, academic climate, and the condition of school facilities, would mediate the relationship between neighborhood disadvantage and educational outcomes. Results showed that neighborhood disadvantage significantly predicted school climate, but the indicators of school climate were not significant predictors of GPA or educational attainment. Therefore, school climate did not mediate the relation between neighborhood disadvantage and student outcomes.

Finally, the third hypothesis predicted that the indirect effect of neighborhood disadvantage on student outcomes through school climate would be moderated by school type. More specifically, it was proposed that attending a choice school (public school of choice or private school), as opposed to a neighborhood school (comprehensive public school), would buffer the negative effects of neighborhood disadvantage by providing students access to better schools. Contrary to this hypothesis, school type did not buffer the negative relationship between neighborhood disadvantage and student outcomes. However, the relationship between neighborhood disadvantage and aspects of school climate differed between public schools of choice and comprehensive public schools. More specifically, results indicated that school type moderated the relationship between neighborhood disadvantage and academic climate such that neighborhood disadvantage had a greater deleterious effect on academic climate for public schools of choice than comprehensive public schools.

These findings indicate that student and school neighborhood disadvantage may have implications during high school in terms of achievement, as well as influence long-term educational attainment. However, student and school neighborhoods may influence different types of outcomes in different ways.

Neighborhood Disadvantage and Student Outcomes

Linear and quadratic effects for neighborhood disadvantage at level one and level two were examined for each outcome – 11^{th} grade GPA and educational attainment – and indicated that both student and school level neighborhood disadvantage affect educational outcomes. Particularly interesting was the different way in which student and school level neighborhood disadvantage related to study outcomes. Most of the research on neighborhood effects has focused on where students reside. Therefore, this study provides a more refined understand of neighborhood effects.

By aggregating student neighborhood data to the school level, this study was able to compare the effects of student and school level neighborhood disadvantage on student achievement and attainment. While many students attend their neighborhood school and school composition may mirror neighborhood composition (A. Owens, 2010), increasing school choice means that more students are attending schools outside of their neighborhood or in qualitatively different neighborhoods from their home neighborhood (*Improving the Measurement of Socioeconomic Status for the National Assessment of Educational Progress*, 2012). Indeed, Steinberg, Allensworth, and Johnson (2011) found that the school neighborhood differed from students' home neighborhoods, in terms of crime and safety, among students in Chicago. Further, schools are unique contexts that foster interactions between students that differ from those in the neighborhood (A. Owens, 2010). Thus, school neighborhood disadvantage is a meaningful construct that should be used in describing the characteristics of schools (National Center for Education Statistics, 2012; National Forum on Education Statistics, 2015).

The National Center for Education Statistics (NCES) has argued the importance of examining neighborhood SES as an expanded measure of traditional indicators of SES, as not all resources available to the student come from the family (National Center for Education Statistics, 2012; National Forum on Education Statistics, 2015). However, little research has compared the effects of neighborhood disadvantage at the student level and as a characteristic of schools (A. Owens, 2010). Examining neighborhood effects in this way can provide a more nuanced understanding of the relationship between neighborhoods, schools, and students outcomes.

Academic Achievement (Eleventh grade GPA). Results showed a significant effect for neighborhood disadvantage at level one, but not level two, suggesting that living in a disadvantaged neighborhood is associated with poorer achievement in school; however, attending a school with a greater proportion of students from disadvantaged neighborhoods may not be as important to academic performance. The hypothesis that the relationship between neighborhood disadvantage and GPA would be nonlinear was not supported, as the quadratic term was not significant at either level. Thus, student neighborhood disadvantage has a constant negative effect on student achievement.

The negative effect for student neighborhood disadvantage is in line with previous research suggesting that neighborhood socioeconomic disadvantage undermines student achievement. Reviews of the literature on neighborhood effects have shown that the socio-economic conditions of the neighborhoods where students live are associated with a range of indicators of academic achievement, such as GPA and test scores (Leventhal & Brooks-Gunn, 2000; McBride Murry, Berkel, Gaylord-Harden, Copeland-Linder, & Nation, 2011). This study supports this notion and adds to the literature by suggesting that, when looking at student neighborhoods and school characteristics together, student neighborhoods may be more critical than school neighborhood disadvantage, when it comes to academic performance.

It is interesting that neighborhood disadvantage was significant at the student level but not at the school level. While schools serving poor communities are associated with numerous challenges, living in a poor neighborhood may reflect significant barriers that are more directly associated with student achievement than school characteristics. Individuals often select into neighborhoods, and higher SES families may choose a neighborhood based on its schools and/or characteristics of its neighbors (Grady & Bielick, 2010; Lareau & Goyette, 2014; Owens, 2010). Thus, the effect of neighborhood disadvantage at the individual level may reflect characteristics about parents, such as their expectations and values regarding education. Attitudes toward education in the home may shape student's attitudes and behaviors about school as well access to academic support or resources outside of school (Usher & Kober, 2012). Research suggests that student disposition towards school is critical to academic success (Boesel, 2001; Wang & Eccles, 2012). Thus, school characteristics may be less important if education is not a priority for students or in the home. However, Elliott et al. (1996) argue that conventional values and norms may not be rejected by low-income individuals, but are less salient when an individual or family is focused on surviving or meeting basic needs.

Low income families may have limited housing options and the cost of housing can present challenges to meeting basic needs. A history of exclusionary zoning laws, landlord refusal of housing vouchers, and information gaps are some of the barriers that limit low-income families access to better neighborhoods and resources (Kneebone & Holmes, 2014). Further, low-income families are more likely to face housing insecurity and instability (Enterprise Community Partners, 2014). The burden of housing costs can limit families ability to afford healthy food or meet other important needs of their family (Enterprise Community Partners, 2014). These types of challenges may limit families ability to support higher level needs such as education.

Living in a disadvantaged neighborhood may also affect student ability to perform in school due to effects on psychological functioning (DeSocio & Hootman, 2004; McLeod, Uemura, & Rohrman, 2012). Youth growing up in low SES neighborhoods are more likely to perceive their environment as dangerous, suffer from symptoms of depression and anxiety, and exhibit delinquent behavior (Aneshensel & Sucoff, 1996; Leventhal, Dupéré, & Brooks-Gunn, 2009). Psychological symptoms such as depression and anxiety have been shown to undermine student academic performance (M. Owens, Stevenson, Hadwin, & Norgate, 2012).

Educational attainment. In contrast to findings for GPA, it was found that neighborhood disadvantage at level two, not level one, was a significant predictor of educational attainment suggesting that there was a contextual effect for neighborhood disadvantage. In other words, attending a school with greater concentrations of students from disadvantaged neighborhoods was predictive of lower levels of educational attainment ten years later. However, greater neighborhood disadvantage at the student level was not predictive of educational attainment, suggesting that school characteristics may be more critical in preparing students for postsecondary education than neighborhoods. In one of the few studies examining neighborhood and school effects, Owens (2010) found similar results, as neighborhood SES of school peers was associated with educational attainment. In another study examining school and neighborhood characteristics, Goldsmith (2009) found that school racial composition, but not the racial composition of the neighborhoods where students lived, predicted educational attainment.

One of the primary purposes of high school is to prepare students for college or postsecondary schooling (Balfanz, 2009). Coursework offerings (e.g., advanced placement and international baccalaureate courses, foreign language courses, higher level math courses) and a rigorous curriculum are key ways that schools prepare students for postsecondary education (Balfanz, 2009). However, schools serving poor communities are less likely than schools serving more advantaged students to offer college preparatory coursework or a challenging curriculum that encourages critical thinking (Bryant, 2015; Hudley, 2013). In addition, underfunding and a lack of resources, such as adequate textbooks and access to college counselors, may further influence students' ability to advance their education (Bryant, 2015; Hamrick & Stage, 2004). Bryant (2015) argues that poor students may have the strongest need for college counselors as their families and community networks may be less familiar with postsecondary opportunities. Indeed, in their research on postsecondary outcomes among students in Chicago, the University of Chicago Consortium on School Research found that low-income students were not academically prepared for higher education and struggled to navigate the college enrollment process (Nagaoka, Roderick, & Coca, 2009). Thus, when students want to further their education, lack of opportunities and preparation in high school may limit student options after high school.

Further, poor schools or schools in disadvantaged neighborhoods are more likely to be associated with outdated, dilapidated, facilities (Bryant, 2015; Darling-Hammond, 2010; Kozol, 2012) and low expectations or a deficit-based culture (Valencia, 2012). Therefore, not only are these students not afforded the same academically rich opportunities as their more advantaged counterparts, the environment in which they must learn may undermine their educational attitudes or aspirations. Indeed, Ogbu (1991) and Gibson and Ogbu (1991) suggest that negative experiences with the education system, such as inadequate learning opportunities and discrimination, produce skepticism about educational success.

The hypothesis that there would be a nonlinear effect for neighborhood disadvantage was supported in that there was a significant quadratic effect for neighborhood disadvantage at level two. However, while it was proposed that the effects of neighborhood disadvantage would be strongest at higher levels of disadvantage, results showed that the negative effects of neighborhood disadvantage leveled out as disadvantage increased. While there has been evidence for a stronger effect of neighborhood disadvantage in the most disadvantaged neighborhoods (Crane, 1991), several studies have found results consistent with this study (Krivo & Peterson, 2000; McNulty, 2001; Nicholson & Browning, 2012). Nicholson and Browning (2012) proposed a “leveling off” hypothesis, which they tested on a national sample of adolescents. In line with the leveling off hypothesis, they found a curvilinear relationship between neighborhood disadvantage and obesity. Both Krivo and Peterson (2000) and McNulty (2001) found that concentrated disadvantage had a curvilinear relationship with homicide rates. The results of the current study provide further evidence of a curvilinear effect of neighborhood disadvantage and extends this research to the examination of educational attainment beyond high school.

In their study of obesity, Nicholson and Browning (2012) suggest that beyond a certain threshold, additional socioeconomic decline may have no further impact on obesity because the primary mechanisms (e.g., sedentary behavior) have already been maximally affected. Similarly, in examining crime, Krivo and Peterson (2000) posit that further increases in disadvantage have diminishing impacts on crime because the conditions that bring about increased violence are already in place after a certain level of disadvantage. In line with these hypotheses, the observed curvilinear effect of neighborhood disadvantage on educational attainment in the current study may reflect the fact that the mechanisms, such as poor school climate or lack of academic rigor, that influence educational attainment are already in place at moderate levels of disadvantage, therefore, increasing neighborhood disadvantage has a diminishing effect on attainment. In other words, schools are already poor at moderate levels of disadvantage; thus, greater levels of neighborhood disadvantage do not continue to have an additive effect beyond this point.

Mediating effects of schools. In order to understand potential mechanisms explaining the relationship between neighborhood disadvantage and students outcomes, the indirect effect of neighborhood disadvantage at level two was explored by examining school climate as a mediator of neighborhood disadvantage and student outcomes (GPA and educational attainment). School level neighborhood disadvantage was a significant predictor of all three indicators of school climate, controlling for the other two (all three mediators were examined in the same model). Specifically, neighborhood disadvantage was associated with less school order, poorer academic climate, and facilities with greater levels of disrepair. However, school climate did not predict 11th grade GPA or educational attainment after high school indicating that the school environment does not mediate the relation between neighborhood disadvantage and student outcomes. These findings suggest that neighborhood disadvantage affects school climate in multiple ways, but these indicators of school climate may not be influential in terms of academic performance in high school and educational attainment.

This study supports previous work suggesting that neighborhood disadvantage is associated with poor school facilities, academic climate, and greater disorder. However, the lack of significance between the school climate indicators and student outcomes was somewhat surprising, particularly regarding academic climate and school order, given previous research connecting these variables to student outcomes. While several studies have found that the condition of school facilities is predictive of student achievement in school (Durán-Narucki, 2008; Edwards, 2006; Evans, Yoo, & Sipple, 2010), the research is mixed. One reason for this discrepancy may be differences in measures and methods.

Using data from the New York City Building Condition Survey, an inspection of school buildings conducted by architects and construction engineers to assess architectural, mechanical, and electrical conditions of schools; both Durán-Narucki (2008) and Evans, et al., 2010) found that building quality was predictive of standardized test scores in elementary school. Using qualitative data, Edwards (2006) also examined the relationship between school facilities and student outcomes in an urban context, and found that students perceived there to be a connection between the condition of school and their level of motivation and achievement. In contrast, using state level data, Picus, Marion, Calvo, and Glenn (2005) drew on a survey of building quality completed jointly by a school representative and an assessor and found no relationship between the condition of school facilities and student performance on standardized tests among fourth, eighth, and eleventh grade students in Wyoming. Similarly, using ELS:2002 data and multilevel modeling, Bowers and Urick (2011) found no direct relationship between school facilities and math test scores. We build on this work at the national level by examining two additional outcomes, GPA in high school and educational attainment after high school.

Examining facility effects across localities may aid in better understanding the relationship between facilities and student outcomes. It is interesting that at the local level, an effect for facilities has been found, but not at the state or national level. There may be important contextual differences (e.g., local policies) that complicate the relationship between facilities and student outcomes or mask the effects of facilities at the national level. For example, the roles and responsibilities of states in supporting facility adequacy and equity varies from state to state (Filardo, 2016). In states, such as Wyoming, where the state contributes significantly towards facilities, there may be more equitable access to quality facilities whereas greater reliance on local communities may lead to more variability in facility quality.

Another reason for the lack of mediation findings may be due to the fact that the current study drew on researcher report of facilities and administrator report of academic climate and school order as objective measures of the school climate. It may be that student perceptions of the school climate may be a more robust predictor of student level outcomes. Indeed, Edwards (2006) found that students perceived there to be a connection between the condition of schools and their motivation and academic performance. Interestingly, using ELS:2002 data, Urick & Bowers (2014) found that both administrator and student report of academic climate in grade 10 were significant predictors of 10^{th} grade achievement, as measured by math test scores; however, they did not control for previous levels of achievement as in the current study. Research should explore the relationship between multiple reports of indicators of school climate and student outcomes. Additionally, use of administrative data, such as suspensions and expulsions, may provide further information about the school climate and supplement multiple reporters.

Although this study found that school climate did not predict student outcomes, it is possible that there is an indirect effect of school climate on achievement and attainment through factors such as student attitudes, beliefs and/or behaviors. For example, facilities in disrepair may undermine students' motivation or school attendance, which in turn may adversely affect student achievement and attainment. Indeed, Durán-Narucki (2008) found that students attended fewer days of school in "run-down" school facilities which explained the relationship between school facilities and standardized test scores, while also controlling for ethnicity, SES, school size, and teacher characteristics. Similarly, a poor academic climate may undermine student confidence or self-efficacy which may impact students' academic performance (Dobbie & Fryer Jr, 2011). Thus, it is possible that an indirect effect of neighborhood disadvantage on student outcomes is explained by a complex process in which school climate influences student attitudes and beliefs, which in turn influences student outcomes. In other words, neighborhood disadvantage may lead to poor school climates, which leads to lower self-efficacy or confidence, which then effects student achievement and attainment. Such serial multiple mediator models, where one mediator causes another mediator, has been discussed by Hayes (2013).

School choice

School type (comprehensive public school, public school of choice, and private school) was used to explore the effects of choice on student outcomes. Specifically, this study examined whether attending a choice school, as measured by attending a public school of choice or private school, attenuated the direct and indirect relationship between neighborhood disadvantage and student outcomes. Results suggested that school choice moderated the relationship between neighborhood disadvantage at level one, but not level two.

Moderation. School choice was examined as a possible moderator of the random effect for neighborhood disadvantage at level one, which indicated that the relationship between neighborhood disadvantage and GPA varied between groups. Further, analysis revealed that the relationship between neighborhood disadvantage and 11th grade GPA differed between comprehensive public schools and public schools of choice such that the negative relationship between neighborhood disadvantage and 11th grade GPA was stronger for students attending public schools of choice than for students attending comprehensive public schools. More specifically, GPA was higher for choice schools than comprehensive public schools at low levels of disadvantage, but not at higher levels of neighborhood disadvantage. This is contrary to the hypothesis that choice would buffer the negative effects of neighborhood disadvantage on student outcomes. However, these findings are not entirely surprising given the evidence that choice does not necessarily translate into better outcomes (Ozek, 2009; Rotberg, 2014). This study sheds light on the mixed findings in the choice literature by suggesting that choice can be beneficial, but not necessarily for the most disadvantaged.

Similar to these findings, Lauen (2009) found that school choice was more beneficial for students from low poverty neighborhoods than high poverty neighborhoods. This may be due to the lack of schooling options in more disadvantaged neighborhoods (Nathanson et al., 2013); thus, even when parents make choices regarding their children's' schools, the choice may lead to a substandard school. It is also possible that parents lack sufficient knowledge to make informed decisions about their children's education (Hastings & Weinstein, 2008). However, even when parents have knowledge about the academic performance of schools, parents from poor communities may use different criteria for choosing schools than parents from more advantaged communities. For example, Harris and Larsen (2015) found that the poorest families were more likely to choose schools that were closest to home and that offered extracurricular activities, such as football and band, rather than focusing on academic quality.

Moderated mediation. This study examined moderation of the indirect effects of neighborhood disadvantage on student outcomes and found that school choice buffered the negative effect of neighborhood disadvantage on the school climate, but not the effect of the school climate on student outcomes. More specifically, choice buffered the negative effects of neighborhood disadvantage on school academic climate such that the negative relationship between neighborhood disadvantage and academic climate was stronger for comprehensive public schools than public schools of choice. Although there was no effect on other indicators of the environment, this finding provides some support for the hypothesis that choice buffers the negative effects of neighborhood disadvantage on school climate.

By definition, students generally self-select into choice schools for the educational opportunities they offer. Thus, choice schools may draw students that are more academically oriented, particularly in high poverty contexts where students may be opting out of failing schools in search of better opportunities (Cullen, Jacob, & Levitt, 2005). This may translate into an environment where teachers and staff have higher expectations for students, fostering a more academically rich atmosphere, even in schools with a high proportion of students living in concentrated poverty. To date, the choice literature has focused on the relationship between choice policies and student outcomes (Berends, Goldring, Stein, & Cravens, 2010). However, understanding how choice leads to particular outcomes for different types of students can aid in creating educational contexts that support the success of all students.

Limitations and Strengths

One of the main limitations of the study was the small number of magnet and charter schools, which limited the ability to examine differences between magnet, charter, and public schools of choice. Further, due to the fact that administrators were able to choose multiple school types, there was significant overlap between these types of schools. The small numbers and the overlap across school types contributed to the decision to collapse these schools into a single public school of choice variable; however, these schools may differ in terms of their policies and practices as well as in the types of students who chose to enroll.

Additionally, although this study examined neighborhood and school effects, other experiences outside of school, such as early childhood experiences and exposure to violence, which may significantly influence students' likelihood of educational success, were not accounted for. There are many factors that influence youth education and it is not feasible to control for all of them. Further, given the nature of the ELS:2002 study, limited data was available related to student experiences prior to high school and outside of school settings.

Despite these limitations, this study has several strengths. This study drew on sophisticated statistical models with a large sample to capture the complex relationships between neighborhoods, schools, and students. Multiple mediator models, moderated mediation, and conditional indirect effects are less frequently examined in the literature. Simple mediation models can be overly simplistic and do not allow for the examination of the multiple pathways that a variable may exert its effect on an outcome (Preacher, Rucker, & Hayes, 2007). Use of these methods within multilevel modeling is even more limited (Preacher & Hayes, 2008). Therefore, this study was able to add to the literature on neighborhood disadvantage by examining why neighborhoods affect student outcomes, while also taking into consideration the nested structure of the data.

This study is also strengthened by the use of neighborhood data at the census tract. Previous research has largely drawn on zip code data, yet zip codes may be poor proxies for neighborhoods as they are generally larger than most neighborhoods and are not designed to be socioeconomically or ethnically homogenous (Crane, 1991). Further, census tracts may align with perceptions of one's neighborhood.

Finally, less research has examined school choice at the national level (Walberg, 2007). Although school choice policies and practices may vary by state and locality, the push for choice at the national level makes it important to understand how such policies may effect education nationally. Education policy makers have expressed concerns over the performance of U.S. students, particularly in light of poor performances on international assessments, such as the Program for International Student Assessment (PISA) (Carnoy & Rothstein, 2013). However, further analysis of PISA indicates that this poor performance is largely driven by a disproportionately greater proportion of students from disadvantaged backgrounds in the U.S, and when adjustments are made for disadvantage, the U.S. performs better than many other countries (Carnoy & Rothstein, 2013). Darling-Hammond (2010) argues that disadvantaged students in the U.S. are provided differential access to knowledge and are not prepared for success in an international arena. Therefore, assessment of policies such as school choice, which aim to address issues of disadvantage and educational access, may inform translation of national educational outcomes.

Implications for Theory, Policy, Practice, and Research

This study drew on ecological and social isolation theories, which posit that context shapes development and that poverty concentration undermines youth outcomes due to lack of access to quality institutions that support mainstream values. At the most basic level, these results showed that context matters. Specifically, students are embedded in multiple contexts, such as neighborhoods and schools, and disadvantage in each of these contexts has implications for student outcomes. Social isolation theory adds specificity to the broader ecological theory by explaining how multiple contextual factors relate to one another. In other words, it proposes a causal pathway which can be empirically tested. However, this study did not find support for the notion that school characteristics, explained the relation between neighborhood disadvantage and students outcomes. Neighborhood disadvantage was associated with poorer school climate, but school climate was not predictive of student outcomes. This finding suggests that concentrated disadvantaged may negatively impact multiple dimensions of the institutional climate, but these characteristics of schools may be less critical to academic success. There is a need for theory to better define and understand the aspects of schools that matter. Theoretical models that provide a framework for understanding the characteristics of institutions that lead to specific outcomes may help further advance research in this area. Further, social isolation theory focuses on macro-level causes of social issues with little attention paid to micro-level factors such as psychological processes. Theory should consider the relationship between institutional factors and psychological processes on student outcomes.

From a policy standpoint, this study suggests that both neighborhoods and schools matter when it comes to student outcomes, but these contexts may have differing relationships with various types of student outcomes. Nonetheless, policies aiming to support the well-being and educational advancement of the most disadvantaged youth, those living in concentrated poverty, should address both contexts. Given the link between education and concentrated poverty, researchers have argued that education and housing policies need to be addressed jointly in order to support educational outcomes (Tegeler, 2015). This study provides further evidence for this argument by showing that both individual and school level neighborhood disadvantage shape educational outcomes.

In terms of practice, at high levels of disadvantage, students attending public schools of choice had poorer achievement than students attending comprehensive public schools. These findings suggest there may be a need to educate parents, particularly those from disadvantaged communities, to make informed decisions about their students’ schooling. Hastings and Weinstein

(2008) found that when low-income parents were given information on school test scores, they were more likely to send their children to higher performing schools. Therefore, schools and districts should seek to provide parents with more information on schools (e.g., school achievement) that will help them make better decisions about their children's education.

Additionally, although school climate did not have a significant effect on achievement or attainment students should have access to safe and supportive environments. The fact that neighborhood disadvantage was associated with greater facility disrepair, less order, and poorer academic climate indicates that much more could be done to provide disadvantaged students with quality school climates in which to learn. School districts and schools should work together to ensure that school buildings are maintained and that property is kept clean and in order. Additionally, discipline policies should be explored in schools with behavior problems. Alternatives to traditional discipline policies may be considered, such as restorative justice. Finally, the academic culture of schools could be regularly assessed to promote a climate of academic success where teachers and students believe they can succeed. For example, the state of Connecticut recently implemented an anti-bullying law which requires schools to create a school climate plan and conduct a biennial assessment of school climate (Public Act 11-323, 2011).

Finally, this study adds to the research on neighborhood disadvantage by examining the processes by which neighborhood disadvantage leads to poor student outcomes. The neighborhood effects research has largely focused on the association between neighborhood disadvantage and youth outcomes and less research has tested the mechanisms by which neighborhoods lead to certain outcomes (Ainsworth, 2002). By examining mediators of this association, we are able to gain insight into why neighborhood disadvantage undermines education. Multiple mediator models allow for the examination of a mediator while controlling for other potentially important mechanisms that may also be at play. More research is needed that utilizes multiple mediator models, as it may provide a better reflection of real world processes.

In addition to examining school level mediators, student attitudes, beliefs, and behaviors should be examined as mediators of neighborhood disadvantage and educational outcomes. Statistical models such as serial mediation could be used to examine both school characteristics and students' psychological processes as mediators of neighborhood effects on student outcomes. Such a model could help examine the complex interplay between neighborhood and school contexts, student psychological processes, and student outcomes.

Additionally, more consistent measurement of constructs may aid in understanding how factors such as neighborhood disadvantage and school characteristics relate to student outcomes. In terms of the neighborhood effects literature, disadvantage has been operationalized in different ways (Leventhal & Brooks-Gunn, 2000) and a common operationalization may further shed light on the extent to which neighborhood level disadvantage effects student outcomes. Similarly, in regards to the climate of schools, the mixed literature on school facilities and lack of research in this area suggests that there is a need to better understand aspects of the physical environment that are predictive of student outcomes (e.g., maintenance, structural) in order to inform the development of measures that advance research in this area. Currently, research on the physical environment has relied on principal report, which has brought into question impartiality and their level of expertise to compare the condition of their schools to other schools (Bowers & Urick, 2011). Other studies have relied on building age or engineering checklists (Bowers & Urick, 2011). These more objective measures primarily reflect on a buildings infrastructure, which may not directly influence teacher instruction and student learning outcomes (Roberts, 2009). Validated and reliable measures that assess different aspects of the physical environment would allow for better comparison of physical effects across studies.

Conclusion

In conclusion, neighborhood disadvantage may have deleterious effects on student outcomes in high school, and these effects may extend into young adulthood. This study provides some insight into why neighborhood disadvantage may influence student outcomes, as neighborhood disadvantage was shown to impact aspects of the school climate. However, these aspects of the school climate were not predictive of student outcomes. Thus, more research is needed to explain the relationship between neighborhood disadvantage and student outcomes in order to improve educational outcomes. Additionally, this study suggests that while school choice policies aim to alleviate disparities in access to schools that support learning and success, school choice does not necessarily improve access or educational outcomes, particularly among the most disadvantaged. This research is one of the first explorations into the complex relationship between concentrated poverty, school choice, and student outcomes. Research should continue to draw on techniques that allow for the exploration of these complex relationships in order to better understand how to support all students.

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