School Effectiveness and School Improvement: An International Journal of Research, Policy and Practice
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/nses20

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Published online: 07 Oct 2014.

To cite this article: Gregory J. Palardy (2014): High school socioeconomic composition and college choice: multilevel mediation via organizational habitus, school practices, peer and staff attitudes, School Effectiveness and School Improvement: An International Journal of Research, Policy and Practice, DOI: 10.1080/09243453.2014.965182

To link to this article: http://dx.doi.org/10.1080/09243453.2014.965182

School Effectiveness and School Improvement, 2014
http://dx.doi.org/10.1080/09243453.2014.965182

High school socioeconomic composition and college choice: multilevel mediation via organizational habitus, school practices, peer and staff attitudes

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(*Received 20 November 2013; final version received 1 September 2014*)

Qualitative research has identified college choice organizational habitus (CCOH) as an important mediating mechanism through which high school socioeconomic composition influences students' college choice, perpetuating social reproduction and educational inequity. This study examines the mediation effects of 2 general forms of CCOH: normative structures (i.e., school practices directed towards preparing students for college studies) and the collective postsecondary attitudes of school peers, family, and school staff. The results indicate that socioeconomic composition has a substantial effect on college choice and that slightly more than half of the total effect is mediated by CCOH. Collective attitudes had the largest mediation effect of the 2 general forms of CCOH with peer attitudes being by far the most potent single measure followed by staff attitudes. These findings suggest that socioeconomic segregation of adolescents in schools perpetuates social reproduction and addressing that inequity may require greater socioeconomic integration of schools to alter peer composition.

Keywords: socioeconomic composition; organizational habitus; college choice; peer influences; multilevel mediation

Introduction

Nearly a half century ago, American sociologist James Coleman and his associates found that the most important school factor influencing student achievement is the socioeconomic composition of the student body (Coleman et al., 1966). Socioeconomic composition (SEC) also plays an important role in educational opportunity because students from low socioeconomic status (SES) and underrepresented minority families are far more likely to attend a low-SEC school (Palardy, 2013). Indeed, Coleman et al. estimated that low-SES Black sixth graders attending middle- or high-SES schools were, on average, nearly two years ahead of low-SES Black sixth graders attending low-income schools. They found comparable effects for SEC across grade levels and ethnic groups and noted that the association between SEC and achievement is similar in magnitude to the effect of family SES. Over the past 45 years, a significant body of research has accumulated that largely confirms Coleman et al.'s findings (Borman & Dowling, 2010; Borman & Rachuba, 2001; Chubb & Moe, 1990; Harker & Tymms, 2004; Jencks & Mayer, 1990; Mickelson & Bottia, 2010; Opdenakker & Van Damme, 2006; Rumberger & Palardy, 2005). While most of these studies are based on data from American secondary schools, Strand (2010) noted a similar effect in a large sample of English schools. Furthermore, the results of a recent meta-analysis indicate that the effects of school

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SEC are somewhat consistent across achievement outcomes (e.g., language and math) and across nations (Van Ewijk & Sleegers, 2010). In addition, low-SEC schools face a substantial number of challenges that make them resistant to improvement efforts (Muijs, Harris, Chapman, Stoll, & Russ, 2004). Together, this body of research suggests that SEC has one of the most robust school effects on student achievement.

One aspect of high school socioeconomic composition that has seen limited attention in the research literature is its effects on students' educational trajectories once they leave high school (Pustjens, Van de gaer, Van Damme, & Onghena, 2004). The longer term consequences of school SEC are arguably more important than their near-term effects on achievement because of the greater implications for life-long health, participation in society, and economic prosperity (College Board, 2004; Wells & Crain, 1994). The most critical educational outcome after high school is arguably college choice – whether the student enrolls in college and, if so, the selectivity of the college. Linking college choice with high school SEC is quite natural given that the college choice process typically begins when students are in high school. In fact, a few recent studies have documented a positive association between SEC and college enrollment (Engberg & Wolniak, 2010; Hill, 2008; Perna & Titus, 2005), although none of these studies focuses on the effect of SEC per se, which limits the depth and breadth of the analysis of the effects of SEC. However, some focused studies have been conducted. In perhaps the earliest such investigation, Alexander and Eckland (1977) found that high school SEC was associated with the selectivity of the college one attends, but only for males.[1] Another early study showed that SEC has a positive association with college attendance and subsequent educational and occupational aspirations (Marsh, 1991). In perhaps the most extensive study on this topic, McDonough found that school SEC strongly influenced college choice (McDonough, 1997). More recently, Palardy (2013) found that even after controlling for an array of student and school factors, students who attend high socio-economic composition (SEC) schools are 68% more likely to enroll at a 4-year college than are students who attend low-SEC schools. Hence, evidence has emerged suggesting that SEC influences students' postsecondary decisions and trajectories, including college choice.

Another gap in the research literature is that surprisingly few studies have investigated the mechanisms through which SEC exerts its effect on educational outcomes. This issue was noted in an early review of the literature in which Jencks and Mayer (1990) state, "Almost all of it relies on a 'black box' model of neighborhood and school effects that makes no assumptions about how social composition influences individual behavior" (p. 115). This conclusion is still applicable today, albeit to a lesser degree.

The present study uses large-scale survey data to begin addressing these gaps in the research literature using multilevel mediation to explicitly test mechanisms through which SEC exerts its effects on college choice. The mechanism of primary focus is school *college choice organization habitus*, which includes overlapping constructs such as school practices related to preparing students for college studies, teacher and counselor attitudes, and school-based peer influences that specifically pertain to college choice. Multilevel mediation is a newer statistical model that is highly suitable for testing the mediating effects of these mechanisms, yet it has not been applied to this problem and has rarely been utilized in school effectiveness research more generally (Bauer, Preacher, & Gil, 2006; Krull & MacKinnon, 2001; Preacher & Selig, 2012). Hence, this study also serves as an empirical example of an application of this model in school effectiveness research. The following research questions are addressed:

(1) Is high school socioeconomic composition predictive of students' college choice? This is the total effect of SEC on college choice.
(2) Does SEC have a direct effect on college choice and indirect effects mediated by college choice organizational habitus related school practices and peer, family, and staff attitudes?
(3) To what degree do direct and indirect effects of SEC depend on student and school input characteristics? Because student and school inputs tend to vary widely across schools and to be strongly associated with SEC and college choice, it is necessary to control for those factors when estimating the effects of SEC.

Background

Mediation mechanisms of socioeconomic composition

Two theories on the mechanisms through which SEC exerts its effects on student outcomes have received considerable attention in the research literature – peer influences and school practices. A third theory, known as *college choice organizational habitus* (CCOH), has emerged in recent years (McDonough, 1997). This section reviews the literature on these three theories of SEC mediation mechanisms. Greater elaboration is provided in the review of CCOH because it is by far the lesser known of the three and is the primary focus of this study.

Peer influences

A substantial amount of research evidence has linked school outcomes with peer influences. For example, peers have been shown to influence students' achievement, attainment, and educational aspirations (Hallinan & Williams, 1990). Moreover, students' academic competencies, educational attitudes, and school behaviors each tend to be bounded to some degree by family SES (Kahlenberg, 2001; Palardy, 2013). One explanation for the association between SEC and educational outcomes is that peer influences serve as a mediator. That is, the socioeconomic composition of the school partially defines the characteristics of the peers students will be associated with and potentially influenced by at school. School peers may influence one another's educational motivations and values, as well as behaviors, through interactions, which can have long-term consequences on cognitive development and attainment (Coleman et al., 1966; Dreeben & Bar, 1988; Engberg & Wolniak, 2010; Jencks & Mayer, 1990; Kahlenberg, 2001). Importantly, socioeconomic-based peer influences tend to undermine educational performance, attitudes, and values in low-SEC schools, where peers tend to have lower levels of the educational and cultural attributes that enhance those outcomes.

School practices

A second theory on how socioeconomic composition influences student outcomes is that schools tend to adapt their instructional practices, curriculum, and academic orientation to what they perceive to be appropriate for the student body of the school (Coleman, 1966; McDonough, 1997; Thrupp, 1999). As a result, low-SEC high schools tend to have less academically demanding curricula, and students tend to be less academically engaged and spend less time on homework (Lippman, Burns, & McArthur, 1996). Similarly, the academic mission at low-SEC schools, which measures the school's emphasis on

academics, tends to be substantially lower compared with high-SEC schools (Lee & Smith, 1999; Palardy, 2008). Together, these rather systematic differences in school practices related to academic orientation at low- and high-SEC schools can impact students' college choice in a variety of ways. This includes whether students have acquired the necessary coursework and academic skills for admissions to a selective college and whether students have been socialized to believe that attending college is a desirable postsecondary choice (Adelman, 1999; McDonough, 1997; Perna, 2004).

College choice organizational habitus

The theory of habitus was developed by Bourdieu (1977) and pertains to individuals rather than organizations. Habitus is an architecture of the mind whereby preferences, dispositions and sensibilities, and ways of knowing regulate what is perceived as desirable and feasible (Bourdieu, 1977, 1986; Bourdieu & Wacquant, 1992). Bourdieu (1977) believed that habitus is largely circumscribed by one's social class and cultural background. McDonough (1997) extended the theory of habitus to organizations such as schools, defining organizational habitus (OH) as "the impact of a cultural group or social class on an individual's behavior through an intermediate organization" (p. 107). Both habitus and OH are theories of social reproduction.

The notion that OH mediates the effect of college choice was first proposed by McDonough (1997) in her influential qualitative study conducted on a sample of four high schools in southern California. She referred to this dimension of OH as *college choice organizational habitus* (CCOH), which can be described as the collective sensibilities, preferences, and values of the school regarding postsecondary education. She found that CCOH influences college choice broadly, including whether students choose to attend college and, if so, the type (i.e., 2-year or 4-year) and selectivity of the college. She concluded that CCOH influences students' "view of the opportunity structure of American higher education" (McDonough, 1997, p. 106). That is, a school's CCOH influences students' perceptions of the appropriateness and feasibility of various postsecondary options, which serves to limit a student's universe of college choices (McDonough, 1997). McDonough concluded that CCOH is manifested through various school processes, such as the resources allocated to college preparation (e.g., the timing, availability, and support for guidance counseling), the school's normative structures (e.g., the school's mission and academic orientation), and the collective attitudes of students and the school's staff about postsecondary education. To be clear, CCOH is not something that teachers and administrators unilaterally impose, but rather something that evolves over time through interactions between parents, students, and staff. It is akin to culture in that it is interwoven with the values and preferences that tend to distinguish people from low- and high-socioeconomic backgrounds and is resistant to change (McDonough, 1997). Indeed, the socioeconomic composition of the school is defined by the students' family background. Hence, one would expect school CCOH to reflect student and family perception and attitudes as well as the perceptions and attitudes of staff.

Importantly, CCOH has been conceptualized as being largely circumscribed by the socioeconomic composition of the school (McDonough, 1997; Reay, 1998). For example, the CCOH of a low-SEC school may influence an exceptional student's decision to attend the local community college rather than accepting a scholarship offer to a selective private college in another state. In that way, CCOH can be considered a mediator of the school's "collective social class conscience in regards to the processes and outcomes of college choice" (McDonough, 1997, p. 10). The collective conscience includes the perceptions

and values of all actors involved with the school and not just the staff. Because CCOH is SEC based and influences educational decisions, it is hypothesized to perpetuate social reproduction when students are segregated in schools by social class, as is commonly the case in American high schools.

Since McDonough (1997) introduced OH and its impact on college choice, there have been few studies attempting to validate her theory and replicate her empirical findings. Reay's (1998) qualitative piece, based on 10 British students making the transition out of secondary school, examined the impact of habitus on college choice and touched on the role of organizational habitus (which she referred to as institutional habitus). She concluded that while organizational habitus influences college choice, within-school biases based on social class may result in differential effects on students attending the same school. This finding is consistent with a body of research on within-school inequity (see Oakes, 2005) and is particularly applicable to large and diverse high schools that practice academic tracking.

A gap in the research literature on CCOH is that very few quantitative studies have attempted to validate McDonough's theory using large-scale survey data, which has greater external validity (i.e., generalizability). A recent paper by Grodsky and Riegle-Crumb (2010) appears to be the first quantitative study to attempt to replicate aspects of McDonough's findings. Their study uses a sample of 2004 high school seniors from the state of Texas to examine if CCOH is predictive of whether students apply to at least one 4-year college by the spring of their senior year of high school (90% did). They used multiple measures of two forms of CCOH including what they refer to as [school] preparatory commitment and actual college attendance decisions. The results indicate that while most of the measures of CCOH tested were not predictive of applying to a 4-year college, the percentage of students who enroll in Advanced Placement (AP) courses had a significant positive association. This measure of college prep curriculum emphasis is consistent with what McDonough (1997) refers to as CCOH related to the school's normative structures. Grodsky and Riegle-Crumb (2010) note a number of limitations with their data that compromise their ability to test the theory of CCOH.

The measurement of CCOH. Despite the rich descriptions of CCOH provided by McDonough (1997), its abstract and theoretical nature poses measurement challenges in quantitative research. That is because, like other abstract and theoretical constructs, there are no unique or direct measures of CCOH. Instead, it must be measured using proximal and latent variables, which can be argued to be redescriptions of other phenomena that appear in the school effectiveness literature. For example, CCOH school normative structures – school practices directed towards preparing students for college studies – overlap with measures of school practice that have previously been identified in the school effectiveness literature. Similarly, CCOH collective peer attitudes overlaps with the literature on peer influences. The theory of CCOH suggests that normative structures and collective attitudes regarding college choice are at least partially born out of the socioeconomic-based school culture related to the value of a college degree and the feasibility of earning one. Yet, with large-scale survey data it is very difficult to determine whether CCOH was the impetus of the school normative structures and collective attitudes. It is important to acknowledge this limitation of measuring abstract and theoretical constructs using quantitative methods and to carefully evaluate alternative explanations for the phenomena. This topic is revisited in the discussion section.

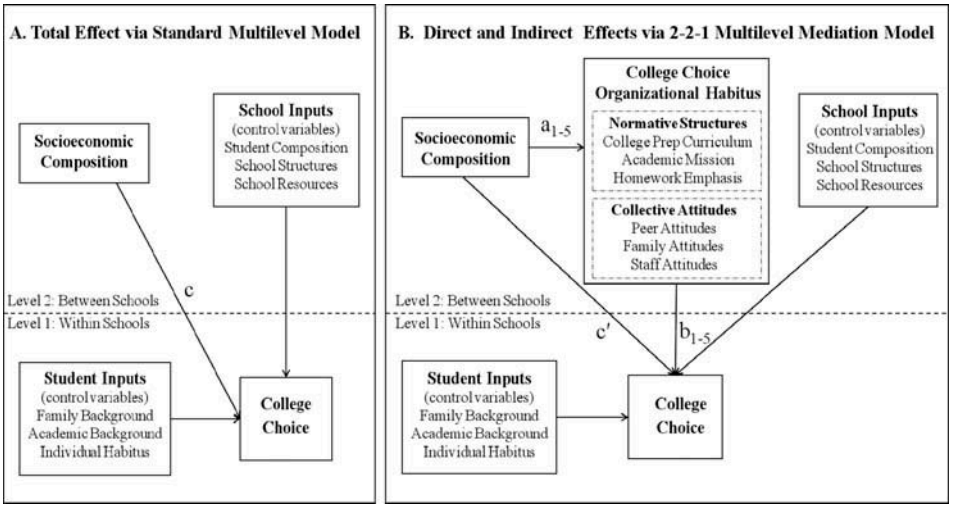
Conceptual framework

Figure 1b shows the conceptual framework guiding this study. The figure depicts a path diagram of a multilevel mediation model with students (Level 1) nested within schools (Level 2). The diagram shows that SEC, which is a school-level variable, impacts college choice both directly (path c′) and through mediation by various forms of college choice organizational habitus (path a*b). The figure also shows that student inputs, such as a student's family and academic background, are correlated with SEC and the mediators and are predictive of college choice. This is a significant aspect of the framework for modeling the effects of SEC because it is conceptualized as a compositional effect that impacts students' outcomes above and beyond their own backgrounds. Hence, it is important to control for student inputs when estimating the effects of SEC on college choice. Similarly, the framework also shows that school inputs – measures of student body composition other than SEC and the level of resources and the structural characteristics of schools – are correlated with SEC and that the mediators are predictive of college choice. Therefore, it is important to control for school inputs as well.

Methods

Data source

The *Education Longitudinal Study of 2002* (ELS:2002), a survey of high school sophomores in America in 2002 conducted by the National Center for Education Statistics (NCES), was used in this research.[2] Students were initially surveyed in 2002 during the spring of their 10th grade year. Two follow-up surveys were conducted at 2-year intervals, the first in the spring of 2004, when students were expected to be in 12th grade, and the second 2 years after their expected high school graduation. In addition, high school transcripts were collected in 2005, one year after the expected high school graduation date. This longitudinal sampling design is suitable for modeling college enrollment patterns directly after high school. The survey provides an extensive number of student



Figures 1a and 1b. Theoretical framework for the total, direct, and indirect effects of school socioeconomic composition on student college choice.

variables measuring aspects of the students' family and academic background, attitudes, and behaviors, as well as measures of school factors, such as resources and practices. The large and nationally representative sample of schools provides sufficient statistical power for studying school effects and for making inferences applicable to American high schools. Note that the dataset is fairly new – the second follow-up was released in October of 2007 – which will make the results more relevant for addressing current policy issues.

The ELS:2002 full base-year sample consists of 15,325 tenth graders attending 752 public and private schools. Students who attended a public high school and were a member of the base year to second follow-up panel (2002-2006) were retained.[3] This panel includes students who completed all three waves of the survey (i.e., 2002, 2004, and 2006). NCES provides a sample weight for this panel that yields an approximately nationally representative sample of 2002 10th graders.[4] The final sample used for this study included 10,151 students nested in 580 public schools.

Dependent variable

College choice is a 4-point ordinal outcome based primarily on the selectivity of the postsecondary institution the student enrolls in directly after high school. It is coded as follows, with the percentage in each category in parenthesis: 0 = did not enroll in college (31%), 1 = enrolled in non-selective 2-year college (26%), 2 = enrolled in less-than-selective 4-year college (31%), 3 = enrolled in selective 4-year college (12%).

Independent variables

Variable selection was guided by the conceptual framework outlined in Figure 1b and by previous research that identified student and school factors associated with college enrollment decisions (Choy, 2002; Palardy, 2013). Appendix 1 provides a list of the independent variables used in this study and descriptive statistics broken down by low-, middle-, and high-SEC groupings. The variables in the table are organized into four classes: student background controls, student postsecondary controls, school inputs, and college choice organizational habitus. Student background controls is subdivided into measures of demographic and academic background, whereas school inputs is subdivided into student body composition, school resources, and school structures. Student postsecondary controls are included because the research literature indicates that college expenses and the availability of financial aid play important roles in college choice, particularly among low-SES students (Bowen, Chingos, & McPherson, 2009; Paulsen & St. John, 2002). School inputs are conceptualized as aspects of the school that may be associated with student outcomes, including college choice, but are largely outside of the influence of school personnel. While student and school inputs are not the focus of this study, they are critical statistical controls because American high schools vary considerably in terms of these factors, which tend to influence student outcomes. Hence, failing to statistically control for these factors may bias estimates of the direct and indirect effects of SEC on college choice (Ballou, Sanders, & Wright, 2004).

Socioeconomic composition and six measures of college choice organizational habitus are the central independent variables of this study. Socioeconomic composition (SEC) is the school mean of students' SES, which was measured in both 2002 and 2004, when students were in 10th and 12th grades.[5] The average of the 2002 and 2004 measures was used to provide an estimate of SEC during the period of this study.[6]

The six measures of CCOH are organized into two classes based on the work of McDonough (1997) – normative structures and collective attitudes about college choice. Normative structures are essentially school practices and processes that imbue the organizational perception of the values and feasibility of various postsecondary options. The specific normative structures used in this study are college prep curriculum, homework emphasis, and academic mission. College prep curriculum is an ordinal measure on an 8-point scale indicating the highest level math course a student took during high school. It was developed by NCES using student transcripts collected a year after the expected graduation date. It is coded in the following way: 1 = no math, 2 = non-academic course, 3 = low academic course, 4 = middle academic course, 5 = middle academic II course, 6 = advanced I course, 7 = advanced II/pre-calculus, 8 = advanced III/calculus. Because college preparatory math is generally not required by states in America for high school graduation, but 2 to 4 years is required for admission to many 4-year colleges and almost all selective colleges, this variable is considered a proxy measure for a school-wide curriculum focusing on college prep course taking.[7] Academic mission is a factor score of principal-reported items on the degree to which teachers, counselors, and students focus on academics. Homework emphasis is the mean number of hours students report spending on homework per week.

Three measures of collective attitudes were used in this study – peer, family, and staff attitudes. Peer attitudes is also a factor score estimated from three student-reported variables – the student's own educational attainment expectations, which is on an 8-point scale ranging from less than high school diploma to a doctorate degree; whether a close friend desires the student to attend college directly after high school; and whether the student has a close friend who dropped out of high school. Family attitudes is a factor score derived from three student-reported variables that indicate whether the father, mother, and close relative desire the student to attend college directly after high school. Staff attitudes is a factor score derived from three student-reported variables that indicate whether the favorite teacher, school counselor, and favorite coach desire the student to attend college directly after high school. Note that collective attitudes may be modeled as a single-factor score combining the three measures described here. However, by unconflating these measures, the results of the present study can differentiate the relative effects of peer, family, or staff attitudes on college choice.

Recall that CCOH is theorized to be circumscribed by SEC and that both CCOH and SEC are school measures. Yet, the effects of the six CCOH measures described above are due in part to students' academic and social backgrounds, as well as aspects of the school inputs. Hence, the effects of the five measures can only be considered CCOH effects when student background and school inputs are statistically controlled. For example, how far a student progresses in the mathematics course sequence is partially due to her academic and social background, as well as school inputs. Therefore, only after controlling for those factors can one reasonably consider the effects of college prep curricular emphasis to be a proximal measure for CCOH normative structures. The model-building sequence used in this study, which is described in detail below, is designed to address this issue.

Details on the measurement properties of the academic mission and collective attitudes factor scores are provided in Appendix 2. Note that the items used for academic mission are measured at the school level, so that variable is a "true" school-level variable. However, all other measures of CCOH are based on student items. In the case of collective attitudes, those factor scores are estimated at the student level, and the mean for each school is used in the statistical analysis. Academic mission and homework emphasis are single-item student measures that were aggregated to school means.

Statistical modeling

The data used in this study are hierarchical in structure in that students are nested in high schools. When analyzed using traditional methods, nested data violate the assumption of statistical independence, produce biased estimates of parameters and their standard errors, and thus often result in inflated levels of statistical significance. The present study employs multilevel models (MLMs), which were designed to address these issues with nested data. Level 1 is the within-school level for modeling the effects of individual differences among students on college choice, and Level 2 is the between-school level for modeling the effects of school factors on college choice.

As can be seen in Figure 1b, the conceptual framework guiding this study is not only multilevel but also involves indirect effects, which are estimated via statistical mediation. Furthermore, the key antecedent (SEC) and the mediators (i.e., six measures of CCOH) are measured at Level 2, whereas the outcome (college choice) is measured at Level 1. This combination of hierarchical data, indirect effects, and key variables measured within and between schools necessitates a specialized form of MLM that is referred to as the 2–2–1 multilevel mediation model (Krull & MacKinnon, 2001), where the numbers denote the level of measurement of the respective variable type (antecedent-mediator-outcome). Multilevel mediation analysis has important applications in school effectiveness research, but it has rarely, if ever, been used. Moreover, the outcome of the present study, college choice, is an ordinal scale measure. Ordinal outcomes are also underutilized in school effectiveness research. For these reasons, a detailed overview of the statistical model and methods are provided.

The multilevel mediation model can provide estimates of the total, direct, and indirect effects of SEC on college choice, as depicted in Figures 1a and 1b. Figure 1a shows the total effect of SEC on college choice, which is denoted by path c. Note that there are no statistical mediators in the model, but there may be control variables for student and school inputs. Figure 1b shows the direct effect of SEC on college choice and indirect effects mediated by each of the measures of CCOH. The direct effect of SEC is represented by path c′, while the indirect effects or mediation effects are the products of paths a_1–a_5 and paths b_1–b_5 (e.g., a_1*b_1). When the effects of multiple intercorrelated mediators are estimated in a single model, as is the case in this study, each represents the unique or independent effect of the antecedent through the respective mediator. The total or joint effect of this set of mediators can be computed by subtracting the direct effect of the antecedent from the total effect (c–c′). Note that the statistical significance of the total mediation effect can be estimated using an adaptation of the equation provided by Freedman and Schatzkin (1992).

While the figures provide a lucid conceptualization of the of 2–2–1 multilevel mediation model used in this study, additional details can be reaped from formal multilevel equations representing the model.

Level 1 Model:

$$\eta_{mij} = \log\left(\frac{\varphi^*_m}{1-\varphi^*_m}\right) = \beta_{0j} + \sum_{q=1}^{12}\beta_{qj}(\text{Student Inputs})_{qij} + \sum_{m=2}^{3} D_{mij}\delta_m,$$

At Level 1, η_{mij} is the college choice outcome that was described previously. The subscripts denote the m ordinal levels ($M = 4$) of the outcome and that i students are nested in j schools. Because the college choice outcome is ordinal in scale, and therefore its association with predictors is nonlinear, a linear transformation is applied via the

cumulative logit ("log-odds") link function ($\log\frac{\varphi^*_m}{1-\varphi^*_m}$), where φ^*_m is the cumulative probability of enrolling in a college of m level or less. Note that this transformation facilitates the conceptualization of the college choice outcome as a continuous latent construct that has been sampled at discrete points. β_{0j} represents the random intercepts for each of the j schools, which are estimates of the cumulative log-odds of enrolling in a college of m level or less for students attending the respective high school, controlling for the predictors in the model. $\sum_{q=1}^{12}\beta_{qj}$ represents the set of 12 slope estimates, one for each of the q student-input control variables in the model (i.e., SES, ethnicity, etc.). The interpretation of each slope coefficient is the expected change in the cumulative log-odds of falling in category m or less per unit change in the respective predictor. Of course, the parameter estimates in the cumulative log-odds metric can be transformed back to the odds or the probability metrics, if desirable, for the purpose of interpretation. δ_{mj} represents the thresholds, which are the intercepts of the ordinal categories. Note that there are M–1 (3) thresholds estimated by the model. The threshold for Category 4 is not estimated because the cumulative probability of all of the categories combined is always 1.0. Also, given that β_{0j} may be considered the threshold for the reference category, only two additional threshold estimates are needed. $\sum_{m=2}^{3}D_{mij}$ is a set of two dummy variables that indicate Categories 2 and 3 for the thresholds (e.g., if D_{2ij} = 1, m = 2).

At Level 2, the school level of analysis, there is a set of equations for the direct effects of SEC on college choice and a set of simultaneous equations for the indirect effects of SEC mediated by each of the three forms of CCOH.

Level 2 Models:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\text{SEC}_j + \sum_{s=2}^{7}\gamma_{0s}\text{Mediators}_{sj} + \sum_{s=8}^{16}\gamma_{0s}\text{School Inputs}_{sj} + u_{0j},\ u_{0j} \sim N(0, \tau_{00}),$$

$$\begin{aligned}\beta_{1j} &= \gamma_{10}\\ \vdots &\ \ \vdots \quad\ \vdots\\ \beta_{12j} &= \gamma_{120},\end{aligned}$$

$$\delta_{2j} = \delta_2$$

$$\delta_{3j} = \delta_3$$

$$\text{College Prep Curriculum}_{13j} = \gamma_{130} + \gamma_{131}\text{SEC}_j + u_{13j},$$

$$\text{Academic Mission}_{14j} = \gamma_{140} + \gamma_{141}\text{SEC}_j + u_{14j},$$

$$\text{Homework Emphasis}_{15j} = \gamma_{150} + \gamma_{151}\text{SEC}_j + u_{15j}, \qquad \boldsymbol{U}_{tj} \sim N(\boldsymbol{0}, \boldsymbol{T}_{tt})$$

$$\text{Peer Attitudes}_{16j} = \gamma_{160} + \gamma_{161}\text{SEC}_j + u_{16j},$$

$$\text{Family Attitudes}_{17j} = \gamma_{170} + \gamma_{171}\text{SEC}_j + u_{17j},$$

$$\text{Staff Attitudes}_{18j} = \gamma_{180} + \gamma_{181}\text{SEC}_j + u_{18j},$$

γ_{00} is the mean of the intercepts of the j schools. γ_{01} and $\gamma_{02} - \gamma_{06}$ represent the expected change in the cumulative log-odds of falling in a category, m, or less per unit change in SEC or the respective mediators. The model also includes control variables for school inputs and a random effect, u_{0j}, which is assumed to be approximately normal in distribution with a mean of zero and a variance of τ_{00}. Next are the equations for the fixed Level 1 predictors (i.e., $\gamma_{10} - \gamma_{120}$) and the thresholds ($\delta_2$ and δ_3). Finally, the equations for the indirect effects show each of the five measures of CCOH as outcomes, with SEC as the predictor. There is also a random effect, u_{tj}, for each mediator. Note that the mediation effect for each form of CCOH is the product of the effect of SEC on the mediator and the effect of the mediator on college choice. For example, the mediation effect of Peer Attitudes is $\gamma_{161} * \gamma_{05}$. The mediation effects are interpreted as the expected change in the cumulative log-odds of falling in college choice category m or less, per unit change in SEC, through its association with the respective CCOH mediator. For additional discussion of the multilevel ordinal outcome model, see Raudenbush and Bryk (2002, pp. 317–325) and Snijders and Bosker (2012, pp. 210–213). For elaboration on multilevel mediation, see Krull and MacKinnon (2001) and MacKinnon (2008, pp. 237–275).

Mplus software, which was used to estimate model parameters in the present study, only provides maximum likelihood estimates (ML) of coefficients and their standard errors. This is potentially problematic because recent research suggests that ML estimates of the standard errors on mediation effects tend to be biased (Bauer et al., 2006; Preacher & Selig, 2012). To obtain unbiased estimates, these authors have recommended using Monte Carlo resampling methods. To comply with this recommendation, the mediation effects in the present study were re-estimated using Monte Carlo resampling methods via an online calculator developed by Selig and Preacher (2008).[8]

Model assumptions, collinearity, and missing values

The validity of inferences derived from the statistical models used in this study depends in part on whether model assumptions are met. These assumptions are that the model residuals are approximately normal in distribution and homogeneous across predicted values, that observations are independent, and that the associations between the dependent variable and predictors are approximately linear. In addition to these standard assumptions for linear models, the ordinal regression assumes that the association between each predictor and the outcome are consistent across ordinal categories. The residuals from each model were examined to test whether the standard assumptions were met. To test for consistency of effects across four ordinal college choice categories, the final model was re-estimated using logistic regression three times – Category 0 vs. Categories 1–3, Categories 0–1 vs. 2–3, and Categories 0–2 vs. 3 – and the coefficients were examined for consistency. Two variables had minor violations for the base model, but none had violations after the student control variables were added. Given that the primary focus of our results is the school inputs model that controls for student background, the ordinal regression model was retained despite the minor violations for the base model.[9]

A potential issue with large correlational models is collinearity between variables, which can bias coefficient estimates such as the direct and indirect effects of CCOH. The variance inflation factor (VIF) was computed for each variable used in this study to test for collinearity. All values were far below the conventionally suggested level for concern of 10.

The level of missingness in the variables used in the present study was between 0% and 21%. These missing values were imputed using the expectation-maximization (EM)

methods (Little & Rubin, 1987). This method assumes a distribution for missing observations and imputes values based on the likelihood under that distribution, given all intercorrelations between the variables in the data set. Missing values on student variables were imputed using the full sample of 10,151 students, whereas missing values on school variables were imputed using the full sample of 580 high schools.

Model-building strategy

A sequential model-building strategy was used whereby model complexity was increased in steps by adding theoretically cohesive sets of variables that are potential confounders of the direct and indirect effects of SEC on college choice. The sequence begins with the baseline mediation model, which does not include any student or school input control variables. The results of this model provide estimates of the total direct effects of SEC on college choice and the total mediation effects of each form of CCOH. Note that these effects are confounded and likely inflated due to the fact that schools serve students from different academic and social backgrounds and also have different school inputs, both of which are correlated with college choice and SEC. The second step, the student-input model, is designed to address the confounding due to differences in students' backgrounds across schools. The student model includes a set of 12 student predictors of college choice that measure aspects of students' family and academic background and the degree to which financial aid is needed and was offered. Failing to statistically control for these factors may result in biased estimates of the direct, indirect, and mediation effects (Ballou et al., 2004; Judd & Kenny, 1981). The purpose of this model is to gain insight into the degree to which the direct and indirect effects of SEC on college choice are artifacts of differences in student inputs across schools. The third and final step is the school input model. This model includes student inputs from Step 2 plus school inputs measuring contextual aspects of the school. The results of this model provide insight into the degree to which the effect of SEC on college choice is due to contextual aspects of schools such as the composition of the student body, the level of resources, and the structural characteristics of the school. Moreover, the school input model provides the best estimate of the true direct effect of SEC on college choice and the true indirect effects of SEC mediated by each form of CCOH.

Steps for testing mediation effects

For each model described above, three steps recommended by Baron and Kenny (1986) for testing mediation were carried out. The first step was to estimate the total effect of SEC on college choice. Note that the mediator variables were not included in this step and that a statistically significant total effect is neither a necessary or sufficient condition for mediation (Hayes, 2009). The second step was to estimate the effects of SEC on each mediator. The third step was to estimate the effects of SEC and each form of CCOH on college choice simultaneously, which provides estimates of the direct effects of SEC and the effects of each form of CCOH on college choice. Note that many statistical software packages will estimate Steps 2 and 3 simultaneously.

Results

This section begins with descriptive results on the extensive contextual differences between high- and low-SEC high schools. This is followed by the results of the three sequential mediation models.

Descriptive results

Appendix 1 shows the descriptive statistics for each variable used in this study, which are broken down into low-, medium-, and high-SEC schools (low-SEC school = greater than 1.0 *SD* below mean SEC; high-SEC school = greater than 1.0 *SD* above mean SEC). Students attending high- and low-SEC high schools differ substantially in their rates of college enrollment, and when they do enroll, they also differ in terms of the selectivity of the colleges they choose. Eighty-five percent of the 2002 10th graders who attended a high-SEC high school were enrolled in college in the fall of 2004, which is directly after their expected high school graduation date, compared with 53% who attended a low-SEC school. Moreover, students from high-SEC schools enrolled in selective colleges at approximately 4 times the rate of their low-SEC counterparts. These differences in college-going behaviors are to some degree predictable given the consistent differences in students' academic and social backgrounds at low- and high- SEC schools. For example, on average, students who attended a low-SEC school had grade point averages (GPAs) 0.54 points lower and achievement test scores 1 standard deviation lower than students who attended high-SEC schools. Similarly, students who attended a low-SEC school had family and demographic backgrounds suggestive of educational disadvantage. For instance, on average, students at low-SEC schools had SESs 1.4 standard deviations lower than students at high-SEC schools and were more than 3 times more likely to be Black or Hispanic.

School inputs also differ substantially in high- and low-SEC schools. The compositional characteristics of the student body reflect the disparity in student inputs. The compositional characteristics matter because, to some degree, they circumscribe the peer influences students are exposed to at school. They may also influence school practices. The average student SEC at low-SEC schools is nearly 3 standard deviations lower than at high-SEC schools, and more than double the proportion of the students are from underrepresented racial/ethnic groups. The structural characteristics and level of resource also differ at high- and low-SEC schools. For example, low-SEC schools are over 3 times more likely to be located in rural areas, over 5 times more likely to be small sized (enrollment under 600), and have 18% lower teacher salaries. These extensive differences in student and school inputs across the SEC settings likely play a role in the schools' CCOH; therefore, it is important to statistically control for these factors.

The levels of the three measures of CCOH also vary considerably across SEC settings, differing from 0.35 to 1.72 standard deviations at low- and high-SEC schools. These differences were particularly pronounced – well over a standard deviation – for college prep curricular and peer and family attitudes about college choice.

Table 1 shows the correlation matrix for the six measures of CCOH. Note that the three measures of collective attitudes are moderately intercorrelated (r = 0.47–0.66). This

Table 1. Correlation matrix of college choice organizational habitus measures.

	1	2	3	4	5	6
1. Collective Peer Attitudes	1.00	—	—	—	—	—
2. Collective Family Attitudes	0.62	1.00	—	—	—	—
3. Collective Staff Attitudes	0.47	0.66	1.00	—	—	—
4. College Prep Curricular Emphasis	0.58	0.52	0.42	1.00	—	—
5. Academic Mission	0.28	0.25	0.18	0.35	1.00	—
6. Homework Emphasis	0.13	0.16	0.20	0.18	0.07	1.00

shows that the three sources of collective attitudes coincide to a large degree about the importance of attending college directly after high school. College preparatory curricular emphasis was also moderately correlated with the three measures of collective attitudes. However, academic mission and particularly homework emphasis had much weaker associations with the other four measures.

Mediation analysis

According to Baron and Kenny (1986), the first step of mediation analysis is to estimate the total effect of the antecedent (SEC) on the outcome (college choice), which is Research question 1 in the present study. The total effect of SEC on college choice was estimated for the baseline model, which does not control for student or school inputs. Table 2 shows the results in odds ratios and Cohen's *d* effect size; SEC has a statistically significant total effect on college choice (ES = 0.34, $p < 0.01$).[10]

The second step of mediation analysis is to estimate the effect of the antecedent on each of the mediators (CCOH), which is also provided in Table 2. The third step of mediation analysis is to estimate the direct and indirect effects of the antecedent on the

Table 2. Direct, indirect, and total effects of socioeconomic composition on college choice.

	Baseline		Student Input		School Input	
Variables	OR	ES	OR	ES	OR	ES
SEC Total Effect on College Choice (c)	1.85**	0.34	1.39**	0.18	1.35**	0.17
SEC Direct Effect on College Choice (c′)	1.34**	0.16	1.16**	0.08	1.14**	0.07
SEC Indirect Effects on College Choice						
Normative Structures						
College prep curricular emphasis (a_1*b_1)	1.10**	0.05	1.02	0.01	1.02	0.01
Academic mission (a_2*b_2)	1.02*	0.01	1.01	0.00	1.00	0.00
Homework emphasis (a_3*b_3)	1.03**	0.01	1.00	0.00	1.00	0.00
Collectives Attitudes						
Peer attitudes (a_4*b_4)	1.15**	0.08	1.14**	0.07	1.15**	0.08
Family attitudes (a_5*b_5)	1.00	0.00	1.00	0.00	1.00	0.00
Staff attitudes (a_6*b_6)	1.05**	0.03	1.03*	0.02	1.02*	0.01
Cumulative Indirect Effect (c – c′)	1.39**	0.18	1.20**	0.10	1.20**	0.10
Effects of CCOH Mediators						
Normative Structures						
College prep curriculum (b_1)	1.19**	0.10	1.03	0.02	1.03	0.02
Academic mission (b_2)	1.08*	0.04	1.03	0.02	1.01	0.01
Homework emphasis (b_3)	1.12**	0.06	1.00	0.00	1.00	0.00
Collective Attitudes						
Peer attitudes (b_4)	1.34**	0.16	1.38**	0.18	1.37**	0.17
Family attitudes (b_5)	1.07	0.04	1.01	0.01	1.00	0.00
Staff attitudes (b_6)	1.11**	0.06	1.13**	0.07	1.13**	0.07
Student Inputs and Financial Aid Controls	no		yes		yes	
School Input Controls	no		no		yes	

Notes: OR = odds ratio; ES = Cohen's *d* effect size; *$p < 0.05$; **$p < 0.01$. The odds ratio is the change in the odds of falling into a category or below per unit increase in the predictor. Values greater than 1 indicate an increase in the odds of success. Effect size estimates are based on Chinn's (2000) method for converting odds ratios to Cohen's *d*. In nonlinear models, the total effect in the log-odds or effect size metrics is approximately, but not precisely, equal to the sum of the direct and indirect effects (Pearl, 2005). In the odds ratio metric, the total effect is approximately the product of the direct and indirect effects.

outcome. Research question 2 is addressed in part by the base model results, which indicate about 47% the total effect of SEC flows directly to CCOH (ES = 0.16, $p < 0.01$), and the other 53% is mediated by CCOH (total indirect effect, ES = 0.18, $p < 0.01$). The individual indirect (mediation) effects for five of the six forms of CCOH were statistically significant: college prep curricular emphasis (ES = 0.05, $p < 0.01$), academic mission (ES = 0.01, $p < 0.05$), homework emphasis (ES = 0.01, $p < 0.01$), peer attitudes (ES = 0.08, $p < 0.01$), and staff attitudes (ES = 0.03, $p < 0.01$). Only the mediation effect of family attitudes was not statistically significant.

Note that the cumulative indirect effect of the three measures of normative structures (curriculum, mission, and homework) is similar in magnitude to the cumulative indirect effect of the three measures of collective attitudes (ES = 0.11 vs. 0.07). Also note that cumulative direct effects of those two types of CCOH are also similar in magnitude (see bottom panel of Table 2: ES = 0.20 vs. 0.26). As we will see, controlling for student inputs reduces the magnitude of the effects for normative structures to a far greater degree than for collective attitudes.

The results of the student-input and school-input models address Research question 3. The student-input model controls for students' family and academic background and whether they had a need for and access to college financial aid – factors that impact college choice but are not school effects. Because student-input characteristics vary across schools, it is important to statistically control for their influence when estimating school composition effects, including SEC and CCOH. Otherwise, the compositional effects subsume the individual effects and are biased upwards. However, the estimated effects of individual student inputs are not of substantive relevance to the present study, and therefore are not provided. The student-input model results in Table 2 show that SEC continues to have a significant total effect on college choice after controlling for student inputs (ES = 0.18, $p < 0.01$), albeit reduced by approximately 47% compared with the base model. About 44% of the total effect is direct (ES = 0.08, $p < 0.01$), while 56% is indirect and mediated by CCOH (ES = 0.10, $p < 0.01$). After controlling for student inputs, only the two CCOH measures of collective attitudes remained statistically significant mediators of the SEC effect (peer attitudes ES = 0.07, $p < 0.01$; staff attitudes ES = 0.02, $p < 0.05$).

The school-input model results differ only slightly from those of the student-input model (see Table 2). The total effect of SEC was reduced by 6% and continues to have a highly significant association with college choice (ES = 0.17, $p < 0.01$). Of that total effect, approximately 41% is direct (ES = 0.07, $p < 0.01$) and 59% is indirect, mediated by CCOH (ES = 0.10, $p < 0.01$). The incremental reductions in the direct and total indirect effects of SEC were 13% and 0%, respectively, and each remained statistically significant. As was the case with the student-input model results, of the six measures of CCOH, only the peer and staff collective attitudes were significant mediators of SEC (peer attitudes ES = 0.07, $p < 0.01$; staff attitudes ES = 0.02, $p < 0.05$). Controlling for school inputs did not alter the magnitude of their effects.

Discussion

The results of the present study provide some support for McDonough's (1997) theory that CCOH is a mediating mechanism through which SEC influences college choice and that may contribute to social reproduction. That is, students attending low-SEC schools will typically encounter a CCOH that is less conducive to attending college – particularly a selective 4-year college –than students attending high-SEC schools (see Appendix 1),

which tends to suppress their postsecondary education trajectories (see Table 2, indirect effects). However, results suggest that only one form of CCOH that McDonough identified of two forms tested in this study mediates the effect of SEC. Only the collective attitudes of peers and staff were significant mediators of SEC after controlling for students' background, and the effects of peer attitudes were approximately 8 times the magnitude of the staff attitudes. While all three forms of school normative structures were significant mediators of SEC in the base model, none were significant after controlling for student inputs. An explanation of these differential findings for collective attitudes compared with normative structures is that normative structures are artifacts of student inputs other than SEC. That is, schools tend to tailor curricular emphasis and instructional practices based on their perceptions of students' academic and social background, which are correlated with SEC and college choice and therefore normative structures mediate the effect of SEC on college choice when the model does not control for students' academic and social background. This explanation is consistent with previous research findings that schools tend to match curricular and instructional rigor with their perceptions of students' ability, backgrounds, and aspirations (Coleman, 1966; Thrupp, 1999). The results of this study, however, suggest that the matching is not based solely on SES, but rather on academic background, ethnicity, and family structure.

A second explanation for the differential results is that student and staff collective attitudes are more direct measures of CCOH, given McDonough's conceptualization of CCOH as "the collective social class conscience in regards to the processes and outcomes of college choice" (1997, p. 10). Normative structures, on the other hand, are conceptualized as school practices that reflect the school's underlining CCOH. That normative structures are less direct measures of CCOH compared with collective postsecondary expectations suggests that their construct validity as measures of CCOH may be compromised to some degree. The additional degree of separation of the measure from the construct weakens both the conceptual and statistical links between the measures of normative structure with college choice. This explanation seems less viable than the first, however, because the cumulative direct effects and the cumulative mediating effects of normative structures and collective attitudes are very similar in magnitude before controlling for student inputs, but controlling for student inputs nullifies the effects of normative structures.

Implications for policy and practice

The results of this study have implications for policy and practice pertaining to educational equity. The results suggest that the segregation of adolescents in schools by SES perpetuates social reproduction through both the direct effects of SEC on college choice and the indirect effects through peer and staff attitudes about college attendance. Because CCOH is conceptualized as being largely a product of the school's SEC, policy and practices designed to minimize the negative consequences of attending a school with a "low" CCOH should focus on SEC. However, the present study provides scant support for the notion that schools can minimize these consequences by altering practices. For example, the three measures of CCOH normative structures used in this study can also be considered school practices designed to prepare students for admissions to college and success in college, and none were significantly associated with college choice. These findings suggest that emphasizing college preparatory coursework, homework, and academics will have a limited impact on college choice as long as students are segregated in schools by SES. On the other hand, collective attitudes – particularly peer attitudes – did

matter to college choice. However, altering peer attitudes about college choice is likely more difficult than altering staff attitudes or school practices. Hence, the main implication of this study to educational policy and practices is that, to the degree that equality of educational opportunity and social mobility (rather than social reproduction) are objectives of public education, policies and practices should be implemented to reduce concentrated poverty in schools and to promote balance across schools in terms of social composition.

By far the greatest obstacles to reducing concentrated poverty in schools, particularly in the United States, are structural barriers such as neighborhood segregation and district boundaries. That is, low-SES families tend to be segregated in neighborhoods that feed into neighborhood schools. To some degree, those boundaries are artificial and can be redrawn to alleviate socioeconomic segregation in schools. A number of specific and feasible recommendations for reducing school and neighborhood socioeconomic segregation have been discussed in recent papers (see, e.g., Kahlenberg, 2001; Mantil, Perkins, & Aberger, 2012; Palardy, 2013; Rothwell, 2012).

Limitations

This study has a few noteworthy limitations. While ELS is an outstanding data source for addressing the research questions, as with other large-scale observational datasets, causal inferences should be considered tentative. This is primarily because student selection into schools is non-random and student inputs differ substantially across the sample schools. Although a careful effort was made to minimize these selection biases by controlling for a range of student inputs and by limiting the sample to public high schools (which intake students based on geographic catchments rather than some form of self-selection and therefore are likely less prone to selection biases), some level of selection bias may still be present.

While most of the effects noted in this study, particularly the mediation effects, are small based on Cohen's *d* effect size classification scheme (Cohen, 1988), small school effects may still have practical significance (Mosteller, 1995). Indeed, research indicates that comprehensive school reform tends to have a small effect on student outcomes (Borman, Hewes, Overman, & Brown, 2003). Moreover, the magnitudes of school effects in this study are similar to those for class-size reduction on student achievement (0.06 per year), which some observers consider to be a successful school reform (Finn & Achilles, 1999). These comparisons suggest that the small effects found in this study can be considered of practice significance.

As described in the background section of this paper, CCOH is an abstract and theoretic construct; as such, it is difficult, if not impossible, to measure directly. To investigate such constructs using quantitative methods, one must rely on proxy measures and latent variables, which arguably measure something more concrete than CCOH. In this study, we conceptualized three school practices as measures of normative structures related to CCOH. Similarly, measures of peer, family, and staff attitudes related to attending college right after high school were conceptualized as collective postsecondary attitudes related to CCOH. Of the two types of CCOH, the measures of normative structures are open to the greatest criticism regarding what they actually measure. The three variables were selected because they are practices that emphasize the development of skills, behaviors, and attitudes conducive to college attendance and are consistent with McDonough's (1997) descriptions of the construct. Yet, whether they capture CCOH or just practices that were promoted by schools without regards to COOH is difficult to

ascertain. Collective peer influences suffer from the same quandary, as peer influences have been widely documented on an array of student outcomes and behaviors. The ultimate usefulness of CCOH to educational effectiveness is in whether it provides a viable explanation for how SEC exerts its effects on college choice. The present study was designed to explore that, and does provide evidence of the mediating effects of CCOH, but as one of the first quantitative studies to address this topic, additional quantitative research is needed to validate these findings.

Summary and conclusions

Starting with the Coleman report (Coleman et al., 1966), a substantial body of research has accumulated on the effect of SEC on student achievement (Borman & Rachuba, 2001; Chubb & Moe, 1990; Harker & Tymms, 2004; Jencks & Mayer, 1990; Mickelson & Bottia, 2010; Muijs et al., 2004; Opdenakker & Van Damme, 2006; Rumberger & Palardy, 2005; Strand, 2010; Van Ewijk & Sleegers, 2010). However, few studies have focused on its effect on college-going behaviors. Indeed, few studies have linked any form of high school composition with any postsecondary outcome. This is an area of school effectiveness research that deserves greater attention, given its implications for educational equity and for long-term wellbeing in terms of health, economic prosperity, and even participation in society (College Board, 2004; Wells & Crain, 1994). Another gap in the literature on SEC is that few studies have examined the mechanisms through which SEC influences outcomes.

The present study begins addressing these shortcomings in the research literature by examining the mediating effects of a set of school practices and peer, family, and staff attitudes that are consistent with McDonough's (1997) conceptualization of CCOH. The results indicate that SEC has a substantial direct effect on college choice. In addition, the effect of SEC is mediated by the collective postsecondary attitudes of school peers and staff, even after controlling for students' academic and social background and their need for and access to financial aid to attend college. Of the two, peer attitudes has the strongest mediation effect on college choice – approximately 8 times that of staff attitudes. However, school normative structures, which are essentially school practices and processes that imbue the organizational perception of the values and feasibility of various postsecondary options, did not mediate the effects of SEC on college choice. The reason for the differential effects of the two forms of CCOH is likely that school personnel adopt curricula and instructional practices that they feel best match the students' academic and social backgrounds. Hence, after having statistically controlled for students' academic and social backgrounds, these school practices are not associated with college choice and thus do not mediate the effects of SEC on college choice.

The results indicate that socioeconomic segregation of adolescents in schools perpetuates social reproduction in that attending a low-SEC school reduces the likelihood of attending college. Students at low-SEC high schools are exposed to peer and staff college choice attitudes that introduce or reinforce educational values and sensibilities that reduce the likelihood they will view attending college – and particularly attending a selective 4-year college – as a feasible or even a desirable option. The results also suggest that concentrated poverty in schools will likely need to be reduced to address the negative consequences of attending a low-SEC school on college choice, as school practices do not mediate the effects of SEC on college choice after controlling for students' background.

Funding

This study was supported by the Association for Institutional Research [RG-08-228], which received funding from the National Science Foundation and the National Center for Education Statistics. The opinions, findings, conclusions, and recommendations do not necessarily reflect those of the funding agencies.

Notes

1. The study was based on data from American high school sophomores in 1955. Hence, the gender effect is likely an artifact of that era when fewer women attended college and some elite universities did not admit women (e.g., Princeton and Yale).
2. See http://nces.ed.gov/surveys/els2002
3. This study focuses on public schools, omitting private schools because public school funding, policies, and practices are largely public domain and because private schools are more prone to selectivity biases that can confound the modeling of school effects. The concerns of selectivity biases are because students attending private schools typically must apply, be admitted, and pay fees, whereas public school attendance is typically free, has no admissions requirements, and is based on geographically defined catchments. Therefore, students who attend private schools and their parents may have various characteristics, motivations, and values that are difficult to measure and are associated with college choice and thus can create selection biases in the statistical modeling of school effects on college choice.
4. NCES employed a stratified two-stage sampling design. From the population of American schools that enroll 10th graders, 752 schools were selected with probabilities proportional to the enrollment of the school. Next, individual students were sampled within the schools. Asian, Pacific Islander, and Hispanic students were oversampled. As a result, neither the student nor the school sample can be considered representative of the population of 2002 10th graders or schools that enroll 2002 10th graders. To correct this, NCES provides student and school sample weights. The present study uses the ELS:2002 second follow-up, base-year panel weight (F2BYWT). This weight was designed for students who completed both the base-year and second follow-up surveys to produce a representative sample of 2002 10th graders. The base-year school sample weight (BYSCHWT) was also used, which is designed to create a representative sample of 2002 American schools that enroll 10th graders.
5. ELS:2002 provides SES variables that are equally weighted composites of 5 measures – mother's and father's education levels and occupational statuses, as well as family income. SES was measured in 2002, when students were 10th graders, and again in 2004. The 2002 variable is used in this study to control for family background.
6. Note that the correlation between the 2002 and 2004 SEC variables is 0.94, suggesting SEC was fairly stable in most schools during that period.
7. The rationale for why the mean level of math course taking can be considered a proxy for college preparatory curriculum may benefit from additional explanation. Note that almost all high schools in our sample offer college preparatory math at Level 6 or higher and 91% and 73% offer Levels 7 or 8, respectively. Hence, there is little variation among the schools in terms of highest level of math course offered, which makes that a poor measure of curricular emphasis. The school mean for highest math course taken is also flawed as a proxy for college prep curricular emphasis in that it is strongly associated with student math achievement upon entering high school. Hence, it can only be considered a proxy for college preparatory curricular emphasis after controlling for prior math achievement, which is a student control variable used in this study.
8. Selig and Preacher's Monte Carlo resampling calculator can be found at http://quantpsy.org/. Interestingly, in the present study, the estimates derived from Monte Carlo resampling differed from ML estimates only to a minute degree, and in no case did the 95% or 99% confidence intervals differ in their inclusion of the null effect.
9. Homework emphasis and college prep curricular emphasis are the two variables that violate this assumption in the base model. In both cases, the coefficients were highly similar and statistically significant for Categories 0 vs. 1–3 and for 0–1 vs. 2–3, but different and nonsignificant for Categories 0–2 vs. 3 (Category 3 is selective 4-year college). One way of addressing the violation is to use a multinomial outcome, which does not assume consistence

effects across categories. However, doing so will increase the number of coefficients to interpret by threefold with only minor differences in the results and only for a base (i.e., preliminary) model. Hence, using a multinomial outcome would add complexity and considerable volume to the results with very little benefits. Therefore, we opted to retain the ordinal model.

10. Note that in the odds ratio metric, the total effect is approximately the product of the direct and indirect effects.

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Appendix 1. Descriptive statistics for total, low-, medium-, and high-SEC school samples[a]

Variable Name	Total Mean (*SD*)	Low Mean (*SD*)	Medium Mean (*SD*)	High Mean (*SD*)	Descriptions and (ELS:02 NAME and coding)
			Student-level Variables (N = 10,151)		
Outcome					
College choice**	1.23	0.81	1.16	1.80	Ordinal measure of the selectivity of the college attended
0 = No college**	0.32	0.47	0.33	0.15	Did not attend college (Choice = 0)
1 = Non-selective 2-year**	0.26	0.29	0.27	0.20	Attended non-selective 2-year (Choice = 1)
2 = Less than selective 4-year**	0.30	0.21	0.31	0.37	Attended less than highly selective 4-year college (Choice = 2)
3 = Selective 4-year**	0.12	0.04	0.09	0.29	Attended selective 4-year college (Choice = 3)
Student Background Controls					
Demographics and Family Background					
SES**	0.00 (1.00)	−0.63 (0.74)	−0.08 (0.92)	0.77 (1.03)	Socioeconomic status composite (BYSES2)[P]
Traditional family structure**	0.53	0.46	0.52	0.65	Live with both birth parents (BYFCOMP = 1)[P]
Asian/Pacific Islander**	0.04	0.02	0.04	0.06	(BYRACE = 2)
Black**	0.14	0.20	0.14	0.07	(BYRACE = 3)
Hispanic**	0.15	0.24	0.15	0.05	(BYRACE = 4, 5)
American Indian	0.01	0.01	0.01	0.01	(BYRACE = 1)
Academics and Transfer					
Cumulative academic GPA (10th grade)**	2.50 (0.91)	2.27 (0.95)	2.46 (0.94)	2.81 (0.83)	10th grade GPA for academic coursework (F1RAGP10)[T]
Math/reading achievement (10th grade)**	0.00 (1.00)	–0.46 (0.94)	–0.05 (0.97)	0.54 (0.93)	Reading and math test composite (BYTXCSTD)[N]
Transfer**	0.19	0.24	0.20	0.13	Transferred schools during H.S. (SCH_ID – F1SCHID ≠ 0)
Student Postsecondary Controls					
Financial aid offered**	0.62	0.70	0.63	0.55	(1 on F2IGRANT, F2ILOAN, F2IWKSTY, or F2WAIVR)
College expenses high importance**	0.35	0.42	0.36	0.27	(F1S52A = 3)

(*continued*)

Appendix 1. (*Continued*)

Variable Name	Total Mean (*SD*)	Low Mean (*SD*)	Medium Mean (*SD*)	High Mean (*SD*)	Descriptions and (ELS:02 NAME and coding)
		School-level Variables (N = 580)			
School Inputs					
Student Body Composition					
Mean SES (SEC)**	0.00 (1.00)	–1.24 (0.33)	–0.14 (0.58)	1.68(0.59)	Standardized mean (BYSES + F1SES2),10th & 12th grade SES[P]
Percent minority**	27.68 (31.39)	40.87 (37.45)	24.11 (29.37)	20.43 (16.18)	(CPO2PMIN)[CC]
School Resources					
Student/teacher ratio**	15.55 (5.10)	16.68 (7.09)	15.00 (4.34)	16.67 (3.23)	Student/teacher ratio (CP02STRO)[CC]
Learning hindered by facilities	0.00 (1.00)	0.15 (0.92)	–0.05 (1.01)	–0.03 (1.09)	Factor score (BYA50A, B, C, D, E, F)[P]
Learning hindered by equipment**	0.00 (1.00)	0.29 (0.74)	–0.06 (1.06)	–0.30 (0.99)	Factor score (BYA50G, H, I, K)[P]
Percent full teacher certification	90.59 (15.72)	89.61 (15.58)	90.55 (16.33)	93.28 (10.42)	(F1A34A)[P]
Teacher salary**	40123 (7638)	37174 (7536)	40390 (7225)	45488 (7414)	Mean teacher salary (BYA26A + BYA26B)/2[P]
School Structures					
Urban†	0.15	0.15	0.14	0.26	School located in urban setting (BYURBAN = 1)[CC]
Rural**	0.44	0.49	0.46	0.13	School located in rural setting (BYURBAN = 3)[CC]
Small school**	0.56	0.73	0.56	0.14	Total school enrollment 2001/02 (CP02STEN = 1–600)[CC]
Large school**	0.13	0.05	0.13	0.27	(CP02STEN = 1201–1800)[CC]
Extra large school**	0.09	0.03	0.09	0.24	(CP02STEN = 1801+)[CC]
College Choice Organizational Habitus					
Normative Structures					
College prep curricular emphasis**	0.00 (1.00)	–0.81 (0.72)	–0.06 (0.76)	0.96 (0.76)	Mean level of mathematics coursework completed (F1RMAPIP)[TR]
Homework emphasis**	0.00 (1.00)	–0.38 (1.06)	–0.01 (0.98)	0.37 (0.91)	Mean hours of homework per week (BYS34A 1 BYS34B)
Academic mission**	0.00 (1.00)	–0.16 (1.10)	–0.06 (0.93)	0.80 (0.84)	Factor score[P]
Collectives College Choice Attitudes					
Peer attitudes**	0.00 (1.00)	–0.71 (0.91)	–0.09 (0.86)	1.07 (0.85)	Factor score
Family attitudes**	0.00 (1.00)	–0.69 (1.01)	0.08 (0.81)	0.96 (0.82)	Factor score
Staff attitudes*	0.00 (1.00)	–0.10 (0.96)	0.04 (0.93)	0.25 (1.13)	Factor score

Notes: † = 0.10; * = 0.05; ** = 0.01. Student variables are weighted by F2BYWT (normalized) and school variables are weighted by BYSCHWT (normalized). [a] = Low- and high-SEC samples include high schools at least ±1.0 *SD* from mean SEC, respectively. All variables are based on student survey responses unless otherwise noted. [CC] = Common Core data; [I] = Integrated Postsecondary Education Data System (IPEDS); [N] = NCES-administered achievement test score; [P] = principal report; [T] = teacher report; [TR] = H.S. transcripts).

Appendix 2. Factors score measurement models

Academic mission		
F1A38B	Teachers press students to achieve	.80
F1A38D	Learning is high priority for students	.72
F1A38E	Students expected to do homework	.70
F1A38K	Students are encouraged to compete for grades	.40
F1A38L	Counselors/teachers encourage students to enroll in academic classes	.68
Percent of Variance Explained		50.3
Peer college choice collective attitudes		
F1S44D	Friend desires student to attend college after high school (HS)	.76
F1S42	How far in school respondent thinks will get	.78
Friend drop	Have friend who dropped out of high school (F1S65A = 2-5)	–.74
Percent of Variance Explained		57.8
Staff college choice collective attitudes		
F1S44E	School counselor desires student to attend college after HS	.94
F1S44F	Favorite teacher desires student to attend college after HS	.97
F1S44G	Favorite coach desires student to attend college after HS	.88
Percent of Variance Explained		91.0
Family college choice collective attitudes		
F1S44A	School counselor desires student to attend college after HS	.92
F1S44B	Favorite teacher desires student to attend college after HS	.91
F1S44C	Favorite coach desires student to attend college after HS	.89
Percent of Variance Explained		83.3

Note: A weighted least squares (WLS) estimator was employed to compute the factor scores, as recommended for ordinal outcomes (Finney & DiStefano, 2006). Unlike maximum likelihood estimators, WLS estimators do not assume multivariate normality, which may be untenable for ordinal items. Academic mission is a "true" school variable in that all items are principal responses for the school. The other 3 factors are compositional measures. The factors scores were estimated from student items, then aggregated (meaned) to the school level.