Don't Expect Too Much: The Limited Usefulness of Common SES Measures and a Prescription for Change

Michael Harwell
University of Minnesota

January 2018

National Education Policy Center

School of Education, University of Colorado Boulder
Boulder, CO 80309-0249
(802) 383-0058
nepc.colorado.edu

Publication Type: NEPC Policy Briefs synthesize existing research knowledge on a policy or practice issue of importance. NEPC Policy Briefs are blind peer-reviewed.

Peer Review: This NEPC Policy Brief was blind peer-reviewed by members of the Editorial Board. Find NEPC publications at: http://nepc.colorado.edu/publications/all. Find the NEPC editorial board at: http://nepc.colorado.edu/editorial-board.

Funding: This brief is made possible in part by funding from the Great Lakes Center for Education Research and Practice.

Suggested Citation: Harwell, M. (2018). *Don't Expect Too Much: The Limited Usefulness of Common SES Measures and a Prescription for Change*. Boulder, CO: National Education Policy Center. Retrieved [date] from http://nepc.colorado.edu/publication/SES.

NEPC
NATIONAL EDUCATION POLICY CENTER

Don't Expect Too Much: The Limited Usefulness of Common SES Measures and a Prescription for Change

Michael Harwell
University of Minnesota

January 2018

Executive Summary

Measures of socioeconomic status (SES) are widely used in educational research and policy applications, in large part due to overwhelming evidence linking SES to student achievement. SES is usually conceptualized as an unobservable factor—a construct—measured using variables such as parental education, occupation, income/wealth, and home possessions to take into account disparities between students, classrooms, and schools. For example, assessing the efficacy of an intervention designed to improve students' understanding of math, by comparing students who did not receive the intervention, would require adjusting for SES differences between the two groups of students. SES is taken into account statistically to ensure that the program's effectiveness is evaluated independent of student SES. This is because a failure to take SES disparities into account can result in concluding that an intervention is effective when much of its apparent effectiveness is related to the SES differences between students receiving and not receiving the intervention.

A common way of controlling for SES uses students' eligibility for a free- or reduced-price lunch (FRL). Yet researchers generally agree that FRL is a poor SES measure, since it fails to validly reflect access to financial resources, shows reduced levels of participation as students age, and misclassifies, on average, approximately 20% of students.

Beyond problems with the continued use of the profoundly flawed student FRL variable, we face two additional problems with SES measures. First, the usefulness of common SES measures, used at the student level, is undermined by the modest correlations that exist between those measures and outcome variables. This limits the effectiveness of SES measures as control variables in statistical analyses. Second, common SES measures conceptualize SES in ways that are not guided by theory, thereby creating uncertainty about what SES represents (e.g., access to financial or social resources). Such atheoretical approaches to SES have a long history. But models grounded in thoughtful theory should be employed that define SES in ways consistent with the purpose of the research or policy, that guide the selection of SES

measures, and that help ensure that new SES measures do in fact measure what they are intended to (i.e., show evidence of construct validity).

These problems speak to an important gap between the usefulness of common SES measures and the perception among researchers and policymakers of the great impact of SES in educational settings. The problems, however, also provide a prescription for change, to promote a deeper understanding and more effective use of SES in research and policy.

Recommendations include the following:

- A theory-grounded model of SES should be adopted to define this construct in ways consistent with the purpose of the research or policy application.
- Correlations between SES measures and outcomes should be examined to assess the usefulness of these measures as control variables in statistical analyses.
- Researchers and policymakers wishing to employ existing SES measures should consider a composite index of SES, perhaps in conjunction with common measures, or turn to alternative measures such as (a) students' perception of their SES or (b) poverty estimates at the district level. Those interested in developing new measures should use a theory-grounded SES model as a guide to help ensure new SES measures do in fact measure what they are intended to (i.e., show evidence of construct validity).
- The development of new SES measures guided by a theory-grounded model of SES requires assembling a multidisciplinary team with expertise in a substantive area of education (e.g., mathematics education) as well as expertise in psychometrics, statistics, and the SES literature.
- Eligibility for a free- or reduced-price lunch should not be used as a student-level SES measure, but aggregating this variable to reflect the percentage of students receiving subsidized meals produces a crude but useful index to compare the economic need of a school or district with other schools or districts.

NEPC
NATIONAL EDUCATION POLICY CENTER

Don't Expect Too Much: The Limited Usefulness of Common SES Measures and a Prescription for Change

Michael Harwell
University of Minnesota

January 2018

Introduction

Socioeconomic status (SES) has a major presence in educational research. SES measures are used to increase statistical power and enhance causality arguments, and as control variables in statistical models to take into account disparities among students, classrooms, and schools.[1] Socioeconomic measures also play a key role in allocating resources to schools through state and local education agencies.[2] The terms social class, social stratification, and SES are sometimes used interchangeably, and while there are some differences, they will be treated here as synonymous. SES also differs from poverty with the latter more narrowly defined because it is typically linked to the federal government's poverty levels, which are defined using income.

Multiple definitions of SES exist but most overlap with that appearing in a U.S. Department of Education (2012)[3] report: "SES is defined as one's access to financial, social, cultural, and human capital resources." (p. 14) The widespread use of SES in education is in large part due to a belief that SES has a strong impact on many educational outcomes. Evidence of this belief is provided by the Coleman et al. (1966)[4] report which included measures of SES such as the presence of reading materials in the home and parental education, the practice of reporting National Assessment of Educational Progress (NAEP) scores by student participation in the free/reduced price lunch (FRL) program,[5] and the use of SES in theories of factors impacting educational attainment.[6,7]

Other evidence of the perceived importance of SES is provided by a review of all papers published in two prominent educational research journals, *American Educational Research Journal* and *Sociology of Education*.[8] Approximately 25% of the articles used achievement data as outcomes, and of these approximately 70% statistically controlled for the effects of SES measures. Repeating the survey for the same journals for 2000-2015 showed 29% of the articles used achievement data and approximately 62% controlled for measures of SES. Similarly, more than 50% of the articles in *Educational Researcher* from 2000-2015 modeling

educational outcomes employed SES measures in some capacity. In short, SES is a core facet of much educational research and policy because of the perceived importance of taking into account disparities in SES among students, classrooms, and schools to help ensure accurate inferences about student learning and achievement. For example, assessing the efficacy of an intervention designed to improve students' understanding of math may require taking SES into account to evaluate whether its effectiveness is related to a student's SES.

To take disparities in SES into account, the U.S. Department of Education[9] recommends using parental education, occupation, income or wealth, and home possessions (e.g., number of books, electronic tablets, and computers in a household) as SES measures, either individually or as a composite, because these variables are believed to reflect access to financial or social resources that many researchers and policymakers link to SES, and may have less measurement error than competing measures. The long history of these variables as SES measures in education and the consistent way variables like parental education have been measured (i.e., highest degree earned, total years of formal education) also contributes to recommendations to use these variables as SES measures. Another recommendation in the U.S. Department of Education (2012)[10] report is to conceptualize SES as a construct (unobservable variable or latent factor) that represents access to different kinds of resources, such as financial or social resources.

It is important to distinguish between income and wealth, with the latter including accumulated economic assets such as property, housing, retirement balances, etc., and to recognize that changes in the distribution of wealth in the U.S. have been greater than changes in income in the past few decades.[11] SES measures are assumed to provide similar information about access to similar resources, and correlations between measures and educational outcomes are assumed to be non-negligible. If those correlations are modest, the ability of SES measures to take disparities in SES into account in statistical analyses is limited.

An important point of agreement in the SES literature is that a student's FRL status (1 = eligible, 0 = no), which generally involves students or parents returning an application, while relatively non-intrusive and cheap to obtain, is a poor measure of SES because it (a) fails to accurately reflect access to financial resources,[12] (b) shows reduced levels of participation as students age, and (c) misclassifies approximately 20% of students on average. Student FRL is often aggregated to a school or district level to produce the percentage of students eligible for a FRL, which is used in statistical analyses as well as to allocate resources in policy applications primarily through Title I funds. School FRL values 40% or greater means a school is eligible for Title I funds which are used to help students from lower SES backgrounds meet academic standards by, for example, adding teachers, paraprofessionals, or instructional materials to a curriculum focused on these students.

These difficulties produce an important gap between the perceived impact of SES in educational settings and the usefulness of common SES measures that can bias research- and policy-based conclusions. However, responding to these difficulties also provides a prescription for change that depends on defining this construct and selecting measures that are consistent with that definition and are correlated with important educational outcomes. The result should promote a deeper understanding and more effective use of SES in educational research and policy.

Review of the Literature: SES and its Impact on Educational Outcomes

Theory-grounded versus atheoretical approaches to SES

Research places a premium on theory because theory defines phenomena of interest and their relationships, guides methodological decisions, and provides a framework for interpreting empirical findings.[13] Theory often motivates the selection of outcome variables in research studies but this practice is rarely followed for SES measures. Several authors have pointed out that atheoretical approaches to SES have a long history in multiple fields including education, psychology, and public health.[14] Lack of agreement on what SES represents and how it should be measured have exacerbated difficulties created by an atheoretical approach.[15]

Educational studies often provide theoretical arguments justifying the selection of outcome variables but rarely do so for SES measures. An atheoretical approach to SES in educational research is reflected in the undesirable practice of defining SES in research and policy applications by whatever measures of SES are used.[16] For example, Morgan et al. (2015)[17] used a composite of parents' education level, occupation, and income, along with student FRL status, in their study of the relationship between mathematics instructional practices and mathematics achievement. Similarly, Bachman et al. (2015)[18] used parental income and mother's education as SES measures in their analyses of mathematics achievement data. Both studies provided theoretical arguments for outcome variables but neither defined SES (e.g., access to financial resources, access to social resources) or explained why particular measures were selected, creating uncertainty about what SES is and whether the selected SES measures are effective control variables for taking disparities in SES among students, classrooms, and schools into account.

Atheoretical approaches can also create challenges in interpreting findings when SES is used to take disparities into account statistically (i.e., its effect is removed from other variables). Implicit in controlling for SES is understanding what is being controlled (removed); otherwise the findings may be difficult to correctly interpret, increasing the likelihood of biased conclusions. For example, statistically removing the effects of a pre-test of comprehension of science diagrams from a post-test whose construction was guided by a theoretical model clarifies what was removed (prior proficiency in comprehending diagrams) and enhances interpretations of findings.[19] On the other hand, statistically removing the effects of SES measures like student FRL status from an outcome reflecting mathematics achievement without ever defining SES or providing a rationale for utilizing FRL status makes it unclear what the removed variation represents.

An atheoretical approach can also produce uncertainty about whether SES is unidimensional (one factor such as access to financial resources) or multidimensional (two or more factors such as access to financial and social resources). This distinction also impacts the measurement of SES. The U.S. Department of Education (2012)[20] report distinguished between SES components -- variables that should be part of the measurement of SES -- and correlates,

-- variables that correlate with SES but are not part of SES and may not be suitable measures because what they are measuring may be unclear. For example, in an atheoretical approach it may be unclear whether a measure of a student's access to individuals with advanced educational degrees is a component or correlate of SES.

Concerns about atheoretical approaches to SES have been widely recognized: "All too often SES and class are ambiguous terms that serve as a shorthand expression to refer to social and economic characteristics that are thought to be important, but whose rationale or meaning is not always made clear" (Bollen et al., 2001, p. 4)[21] , and "One of the most glaring gaps we discovered is between the theoretical literature on class or SES and the manner in which these concepts appear in empirical work." (Bollen et al., 2001, p. 42)[22] Unfortunately there is little evidence that this issue has received much attention from educational researchers and policymakers.

Problems created by an atheoretical approach can be remedied by employing a theoretical model that conceptualizes SES in ways consistent with the definition and purpose of the particular research or policy application, guides the selection of SES measures, and places a premium on construct validity in the construction of new measures (i.e., ensuring a new measure measures what it is intended to). Theoretical models and methodologies for measuring SES are available in several disciplines but all have roots in the social class literature.[23] Prominent theoretical approaches to SES in this literature include those derived from Marx,[24] Weber,[25] Durkheim,[26] and Coleman.[27] These theories are complex, often linked to different methodologies for measuring SES, and are not tied to substantive research areas like education. There are also a large number of competing theories.

Coleman's (1988)[28] theory of social capital is among the most widely studied in education and is characterized by the critical role played by non-economic factors. Central to Coleman's theory is a convergence between economics and sociology combined in a model characterized by the actions of individual agents based on other actors and resources that are related through common interests and control.[29] Social inequality results from differences in interests and control over scarce resources. The idea of resources is developed through material capital, human capital, and social capital, with SES representing access to these resources deriving from (a) material endowments such as income and wealth, (b) skills, abilities and knowledge reflected in educational level, and (c) an individual's social network and the status, power, trustworthiness, and abilities of its members. For example, Coleman's theory might posit families with different income and wealth levels (material capital) that become close through the friendship of their children (social capital), leads one set of parents to emphasize to their children the value of doing well in school based on their relationship with parents holding these values.

Several authors have argued that a strength of Coleman's theory is its ability to incorporate societal evolution through the impact of material, human, and social capital on the definition and identification of social classes.[30] These changes may also mediate the effect of SES on educational outcomes. For example, the continuing shift of income and wealth to the highest SES levels, the increasing numbers of women and ethnic-minority executives, newly minted high-tech millionaires and billionaires, the decline of manufacturing jobs, and the increased numbers of part-time employees may have an important impact on definitions of

SES and how this construct is measured.

Adoption of a theoretical model of SES begins by conceptualizing SES as access to desired resources. For example, choosing Coleman's theory to guide construction of a composite index of SES using multiple measures might involve providing evidence of the impact of material, human, and social capital factors on outcomes like students' math and verbal achievement. The choice between a composite index of SES, which implies SES is unidimensional, and multiple (multidimensional) factors not part of a composite, has been long debated.[31] Assuming SES is unidimensional offers simpler explanations but may be unrealistic in some contexts because each factor making up SES (e.g., access to material resources, access to social resources) exerts an influence similar to other factors. Multidimensional SES may be more realistic but assumes that each factor can have an effect independent of others; this can lead to complicated explanations. There is agreement, however, that this decision should be informed by theory and the existing literature.

Researchers should select SES measures based on their conceptual fidelity with SES factors as well as empirical evidence of construct validity.[32] Other criteria that may figure in the selection of SES measures include measurement error, intrusiveness, cost, and the likelihood of missing data. These criteria have particularly important implications in practice. The popularity of FRL status as an SES measure is related to the fact it is relatively non-intrusive, can be collected directly from a school, and is generally inexpensive to obtain. Other SES measures such as parental income, wealth, and educational level must typically be collected from parents, which may be perceived as intrusive and lead to missing data that bias findings. For example, higher-income households are less likely to provide income information. Gathering SES data on parental income, wealth, and educational level may also require greater resources than those needed to obtain student FRL status for several reasons.

Researchers should select SES measures based on their conceptual fidelity with SES factors as well as empirical evidence of construct validity

A researcher wishing to take disparities in SES among students, classrooms, or schools into account may argue that parental education and home possessions show conceptual fidelity if SES is defined as access to material capital, and choose one or both of these measures, guided by evidence of construct validity, anticipated measurement error, likelihood of missing data, and cost. Evidence of the relationship between SES measures of a construct and educational outcomes may also contribute to this choice because stronger relationships should result in more effective efforts to take disparities in SES into account in statistical analyses.

A particularly helpful way to proceed is to employ a (structural equation) diagram to illustrate the SES model and its measures, and to use a regression-based statistical procedure (structural equation modeling) to provide empirical evidence that a variable is measuring the underlying SES factor (construct validity) or that SES has an impact on educational outcomes. Similar diagrams and analyses have been used in research.[33] In the Oakes and Rossi (2003)[34] SES model, material capital, human capital, and social capital served as factors that were treated as unidimensional and posited to have a direct impact on a comprehensive factor labeled SES (access to desired resources). Oakes and Rossi assumed SES factors were

correlated. The diagram neatly defined SES and its measures, including parental income (material capital), parental education (human capital), and the number of clubs a household's adults participated in (social capital). These authors used data obtained from the National Survey of Families and Parents to form a composite index and estimate an SES score for each case based on their model. The resulting model provided evidence of construct validity: higher SES scores reflected greater access to desired material, human, and social resources (e.g., respectively, home possessions such as access to a computer and the internet, occupations whose flexibility facilitates parental access to their child's teachers and school activities, and access to individuals with advanced degrees who provide tutoring), and lower scores reflected less access.

Consider a hypothetical example in educational research of adopting a theoretical model of SES similar to that of Oakes and Rossi (2003).[35] A researcher plans to assess the impact of student race on math achievement after an extensive effort to control for SES. The findings are expected to have important implications for efforts to eliminate the achievement gap: if the gap shrinks or disappears once disparities in SES are taken into account the inference is that Black-White achievement differences are partly or wholly attributable to differences in SES, whereas if the gap doesn't change the inference is that Black-White achievement differences exist independent of SES. If Title I schools participated in the study either finding could impact the way Title I funds might be used to help students from lower SES backgrounds meet academic standards.

Based on a literature review, the researcher defines SES as access to desired resources and turns to Coleman's theory of social capital to define access as involving access to material, human, and social capital. The literature also prompts the researcher to treat these factors as multidimensional and to posit that access to material capital will have a direct impact on access to social capital, which in turn is expected to have a direct impact on math achievement.

Figure 1: Hypothetical Model of the Impact of Multidimensional SES on Math Achievement

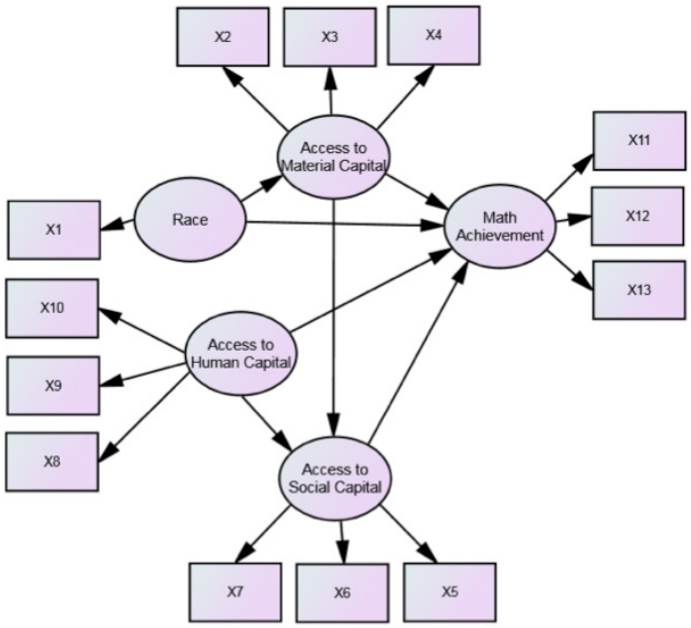

Figure 1 provides a (structural equation) diagram of the above model for students. Race and access to material capital and human capital are constructs (unobserved factors, latent variables) serving as independent variables which are assumed to impact the dependent variable math achievement, access to social capital is both a latent independent and dependent variable, math achievement is a latent dependent variable, and X1-X13 are observed SES measures (error terms have been omitted). Student race is assumed to be measured with no error and is measured with a single observed variable X1. The remaining variables are treated as components and represent observed measures of a construct. For example X2-X4 could be parental income, wealth, and home possessions, X5-X7 could be the number of clubs a parent participated in, access to individuals with advanced degrees, and size of peer group, and X8-X10 could be parental education, occupation, and years in current job.

Single-headed arrows in Figure 1 represent the direct impact (effect) of one variable on another and are consistent with traditional methods for estimating the impact of SES (e.g., effect of access to material capital on math achievement estimated using a correlation coefficient, regression slope, or path coefficient). Figure 1 also contains indirect (mediated) effects in which a variable serves as both an independent and dependent variable. Examples of mediators characterizing the impact of SES on educational outcomes are not new[36] and Figure 1 posits that the impact of access to material capital on math achievement is mediated by access to social capital (i.e., the impact of access to material capital on math achievement is transmitted through access to social capital). Perhaps the impact of greater income on math achievement is amplified in families with greater access to individuals with advanced degrees. As with direct effects, theory and previous literature should inform the use of mediated effects like those in Figure 1.

Representing the impact of SES through both direct and indirect effects, and the total effect which is the sum of direct and indirect effects, offers a potentially useful complement to traditional approaches in providing a comprehensive picture of the impact of SES.

Modest correlations between SES measures and outcome variables limit the effectiveness of SES as a control variable in statistical analyses

If SES has a strong impact on educational outcomes, non-negligible correlations reflecting this impact should appear in the literature. Available evidence involving correlations suggests these correlations are on average moderately weak (.20 ≤ r ≤ .30) to weak (≤ .20) for student-level data but show a wide range of values. Moderately weak to weak correlations limit the effectiveness of SES measures as control variables in statistical analyses because a modest amount of variance in an outcome variable is removed. For example, a correlation of r = .22 between parental education and math achievement means $(.22)^2$ or about 5% of the variance in the latter has been removed (taken into account, controlled). In other words, removing the variation in math achievement attributable to parental education makes it possible to make inferences about students' math achievement without worrying that these are distorted by parental education. Note that a correlation of r = 1.0 means all variation in math achievement is attributable to parental education and a correlation of r = 0 that SES has no effect on math achievement and there is no variation in achievement attributable to

SES.

White's (1982)[37] meta-analysis is probably the most widely cited source of the SES- achievement relationship, with 386 citations between 1983 and 2016 found using a Web of Science search. White's meta-analysis was based on correlations between SES and achievement measures obtained from 101 published and unpublished studies appearing between 1918 and 1975. White (1982) reported an unweighted mean correlation of $\bar{r}$ = .24 based on averaging K = 489 correlation coefficients for student-level data. Sirin (2005)[38] updated the results of White by coding the SES-achievement relationship in 58 journal articles appearing between 1990 and 2000 and performing a meta-analysis. For K = 207 student-level correlation between SES and achievement, and a statistical model that assumed studies producing these correlations were sampled from a population of studies with varying SES-achievement correlations, $\bar{r}$ =.27 ($\bar{r}$ = .28 for a statistical model assuming the population of studies shared a common SES-achievement correlation).

Harwell, Maeda, Lee, and Xie (2017)[39] performed a meta-analysis of the relationship between SES and achievement based on sampling 143 studies in which the most important findings were (a) $\bar{r}$ = .18 for K = 2,610 for student-level data when sample sizes in studies were ignored, (b) $\bar{r}$ = .22 for K = 297 independent correlations when sample sizes used in the 143 studies were taken into account and correlations were assumed to be sampled from a population of studies with varying SES-achievement correlations, and (c) $\bar{r}$ = .09 (K = 297) assuming the sampled population of studies shared a common SES-achievement correlation). The pattern of modest correlations persisted across several variables believed to be related to SES-achievement correlations including type of SES measure (e.g., parental education, home possessions, FRL status), whether a school was public or private, and percentage of Black, Hispanic, Asian, and White students in a study.

Analyses of the relationship between SES measures and achievement show a wide range of correlations but generally agree that average correlations are frequently less than .30

In sum, analyses of the relationship between SES measures and achievement show a wide range of correlations but generally agree that average correlations are frequently less than .30, which is consistent with other empirical summaries of this relationship[40,41] but probably weaker than many educational researchers and policymakers expect. Modest SES-achievement correlations are consistent with reports in the social sciences that relationships among variables of all kinds are generally weak to moderately weak.[42]

Explanations of SES-achievement correlation patterns begin with ensuring that a broad distribution of SES measures and their values have been sampled along with a range of student samples. Otherwise the distribution of SES measures and student samples may not reflect the U.S. as a whole and SES-achievement correlations may be biased. A review of coded variables and findings in the above meta-analyses suggest a broad distribution of SES measures (parental education, occupation, income, home possessions, neighborhood SES, FRL status, composite measures) and values were sampled. The studies synthesized in the meta-analyses also represented a wide range of settings and conditions including school location (urban,

suburban, rural), type of achievement assessment (mathematics, literacy, science, GPA), source of SES information (parent, student, school), and student race, gender, and grade.

Meta-analyses ideally reproduce results obtained from analyses of raw data,[43] but various issues such as coding shortcomings can mask important patterns. An examination of the Coleman et al. (1966)[44] study (used in two of the above meta-analyses) provides evidence that meta-analytic inferences about the SES-achievement relationship can be made about a broad range of SES measures and student samples. Coleman et al.[45] examined the relationship between SES and achievement by sampling more than 600,000 students representing all 50 U.S. states. This study collected data in rural, suburban, and urban schools. Variables serving as SES measures included home possessions, mother's and father's education, and whether the father was working. Information on students' verbal skill, reading comprehension, and math achievement was also obtained. The resulting 936 correlations between SES and achievement measures produced values corresponding to the first, second, and third quartiles of the distribution of unweighted correlations of .06, .13, and .21, respectively. In other words, 25% of the 936 correlations were less than .06, one-half of the 936 correlations were less than .13, and 75% were less than .21, suggesting that SES and achievement were generally weakly related. Thus the results of Coleman et al. (1966)[46] are consistent with meta-analytic evidence and suggest that inferences about the SES-achievement relationship can be made to a broad range of SES measures and student samples.

One explanation for modest SES-achievement correlations is this pattern reflects the true SES-achievement relationship, implying that the impact of SES on achievement is not as strong as many educational researchers and policymakers assume. Alternatively this pattern of modest correlations may underestimate the true SES-achievement relationship, raising the question of what accounts for this pattern. Modest SES-achievement correlations cannot be solely attributed to an atheoretical approach to SES since the latter impacts definitions, interpretations, and selection of SES measures but would not be responsible by itself for a pattern of moderately weak to weak correlations. Nor is a pattern of modest correlations due to a failure to statistically capture the broader impact of SES by removing the effects of other variables influencing the SES-achievement relationship because these would be expected to be smaller than the original SES-achievement correlations.

Measurement error in SES measures attenuates this relationship (lack of validity can also contribute to measurement error) but is unlikely to account for a pattern of modest correlations because the reliability of common SES measures like parental education is generally high.[47] Characteristics of achievement assessments may play a role in the pattern of modest correlations but the necessary information to study their impact has not been reported. None of the above meta-analyses reported information about assessments which could provide evidence that these correlations were attenuated due to the nature of the assessment (standardized tests, district- or teacher-constructed tests), number of items, and how items were scored (dichotomous, open-ended).

Modest correlations between SES and educational outcomes are sometimes attributed to bias resulting from missing data because the nature of SES information makes nonresponse likely. As noted earlier, missing SES data can bias findings. For example, higher-income households show much higher rates of missing data than lower SES households, producing a

homogeneous sample of income values that reduces the resulting SES-achievement correlation. Similarly, middle school and high school students eligible for a FRL may not return application forms because of social stigma, which may have a homogenizing effect in that a disproportionate number of students who do not return forms are incorrectly classified as eligible for a FRL or not eligible for a FRL. This homogenization may reduce correlations. Smaller correlations may also be related to the reliance on the linearity of this relationship, which can produce a downward bias if the relationship differs at different values of SES (e.g., in the center of a distribution of SES values versus the tails). It is also likely SES measures moderate other effects in statistical models but these are not typically reported.

There are fewer empirical summaries of the SES-achievement relationship for aggregated units like schools, although aggregated units are relatively common in educational research. White (1982)[48] reported $\bar{r} = .68$ for K = 81 aggregated units (classrooms, schools, school districts) whereas Harwell et al. (2017)[49] found $\bar{r} = .20$ for schools (K = 102). Individual studies of the relationship between school SES and achievement also show a wide range of correlations, for example .19 to .72.[50]

The effect of bias on measures can play an important role in these correlations.[51] One source of bias arises when a school-level SES variable aggregated using student-level data such as FRL status is imperfectly correlated with the corresponding student-level FRL variable.[52] Another occurs when a school-level variable like percentage of FRL students is used as a predictor in statistical analyses along with student-level FRL in which case the former can be correlated with the residuals of the latter, biasing findings.[53] The size of aggregated units, for example schools versus districts, can also play a role, with smaller units showing less bias than larger units. The latter results can provide guidance when choosing among types of aggregated unit.[54]

The continued use of the profoundly flawed student FRL variable

A third factor undermining the usefulness of common SES measures in educational research and policy applications is the continued practice of using student FRL to take disparities into account in statistical analyses. Students are certified as eligible for a reduced-price lunch if parental income is less than 185% of federal poverty guidelines or a free lunch if parental income is less than 130%. Available data for the 2013–2014 school year show that 22 million students, approximately 44% of all K–12 students in the U.S., received a FRL.[55] The Community Eligibility Provision is an extension of the FRL program that provides free breakfasts and lunches without a household application to all students in schools in low-income areas in which 40% or more of students are certified eligible for free school meals.

The frequency with which student FRL is used as a measure of SES is non-negligible: the meta-analysis of Harwell et al. (2017)[56] found 26% of the studies sampled from1980-2010 used FRL (FRL was rarely used prior to 1980), and Sirin (2005)[57] reported that 29% of sampled studies used FRL. FRL also appears regularly in studies using regional and national datasets, in large part because it is available for every student, usually accessible, and cheap to obtain.

Despite its frequent use, FRL is a profoundly flawed measure of SES whose deficiencies have been well-documented[58] and include (a) its failure to accurately reflect financial resources, (b) reduced levels of participation in the FRL program in middle school and high school, especially 12th grade for reasons that remain unclear, although a social stigma may be partly responsible, and (c) an average misclassification rate of 20%.[59] Issues with (a) and (b) are exacerbated when students who do not submit a FRL application have one submitted on their behalf by school officials (every student must have an FRL status), but the extent to which this occurs across school districts and states is unclear. Issues with (c) are exacerbated by uncertainty of the nature of the misclassification. A 20% misclassification rate in a school could mean one-half of the students eligible for FRL under federal guidelines are classified as ineligible and one-half who are ineligible are classified as eligible, or all 20% are misclassified as ineligible or eligible, or something in between. A misclassification rate of 20% could also be distributed equally or unequally across key student subgroups. There is no consistent evidence of the nature of misclassification in the FRL literature but misclassification of any kind undermines the validity of FRL status as an SES measure.

Aggregating student FRL to the school level produces a variable frequently used as a predictor in statistical analyses. Perhaps more importantly, school FRL is widely used as an SES measure in policy applications where it is typically treated as a surrogate for school poverty. As noted earlier, eligibility for Title I funds depends on school FRL and schools with FRL rates equal to or greater than 40% are automatically eligible.[60] Unsurprisingly the flaws of student FRL are transmitted to school FRL. If 20% of students in a school are misclassified, a school FRL rate of 40% would be distorted, although the precise nature of the distortion or its distribution across student subgroups would typically be unclear. In the absence of such distortion a school might or might not be eligible for Title I funding. Nor should school FRL be used to infer the FRL status of individual students because of the risk of biased inferences.[61] On the other hand, school or district FRL can provide a crude but useful index of economic need relative to other schools or districts.

Recent Developments

Fortunately, alternatives to commonly used SES measures have received attention. A U.S. Department of Education (2012)[62] report advocated the use of composite SES indices when these are consistent with research or policy applications. Meta-analytic results show 38% of SES measures used in the sampled studies involved a composite measure, but the U.S. Department of Education report suggests greater consideration be given to composites. Other SES measures have appeared, including a student's subjective SES, which has been shown to be a useful predictor of various outcomes,[63] and a measure capturing how long a student has been economically disadvantaged as reflected in FRL eligibility.[64]

The U.S. Department of Education (2012)[65] report also recommended aggregating student variables such as the percentage of English Language Learners and average parental education level to the school level and using these as SES measures. Other authors have studied the use of census-based (aggregate) indicators of SES. Kurki et al. (2005)[66] examined four aggregate measures of poverty which they argued quantify neighborhood disadvantage (dis-

similarity index, isolation index, poverty level of the school, and percentage of single parents in a school neighborhood), all of which require census data (e.g., block groups located within a one-kilometer radius around a school). A U.S. Department of Education (2015a)[67] report described alternative measures of SES including the Census Bureau's Small Area Income and Poverty Estimates (SAIPE), which provide school district poverty estimates to support the administration and allocation of Title I funding under the No Child Left Behind Act of 2002. Still, school FRL remains a standard indicator of school poverty in law and in educational practice, bolstered by the relative ease of access and low cost.

Discussion and Analysis

The prominent role of SES in educational research and policy is indisputable, as is a deeply rooted belief that SES has a pronounced impact on educational outcomes. However three factors can undermine the usefulness of common SES measures in ways that can bias research- and policy-based conclusions: (a) an atheoretical approach to conceptualizing SES and selecting measures which creates uncertainty about what SES represents; (b) modest correlations between SES measures and outcome variables that limit the ability of SES to take disparities between students, classrooms, and schools into account in statistical analyses, and (c) the continued use of the profoundly flawed student FRL variable as a measure of SES. These factors can produce biased conclusions but also provide a prescription for change centered on conceptualizing this construct and selecting measures in ways that clarify its interpretation and promote a deeper understanding and more effective use of SES.

Uncertainty about what SES represents can be remedied by adopting a theoretical model that conceptualizes SES in ways consistent with the definition and purpose of the research or policy application and clarifies its interpretation. These models also provide guidance in selecting appropriate SES measures. For example, adopting a theoretical SES model focused on access to material capital and access to human capital would point to the use of parental income as a measure of material capital and parental education as a measure of human capital.

Unfortunately, selecting a theoretical model is challenging given the number of models in the social class literature, their complexity, and the range of available methodologies for measuring SES. What is needed is research unpacking these theories in ways that embed specific practices and measurement strategies in educational contexts, and in the process, adapts them to support research and policy applications. Work in health research[68,69] provides examples of how to proceed, which are characterized by a multidisciplinary approach involving expertise in a substantive area of education such as mathematics education, as well as psychometrics and statistical analysis, and social class. A multidisciplinary approach is also needed to develop new SES measures guided by theoretical SES models.

The use of structural equation diagrams and regression-based (structural equation) modeling can assist in this process. In some instances the focus will be on providing evidence of construct validity for SES measures, but in others it will be on specifying and testing the impact of SES on educational outcomes. Figure 1 is an example of the latter and allows direct

effects, indirect effects, and the total effect of SES on an outcome to be estimated and tested. Central to constructing and testing an SES model is recognizing that SES-achievement correlations are modest on average but show a wide range of values, which makes it important to select SES measures with non-negligible correlations with educational outcomes to enhance their effectiveness as control variables used to take into account disparities among students, classrooms, and schools in statistical analyses.

Attention to theoretical SES models should also inform thinking about the mechanisms of influence linked to a wide range of SES values, about the limitations of SES measures in specific contexts, and about the importance of differentiating the impact of SES on educational outcomes. Theoretical models may also prompt educational researchers and policymakers to consider alternative measures such as a student's subjective SES. If an aggregate measure of SES is desired, student-level measures can be aggregated (e.g., percentage of English Language Learners in a school), or an aggregate measure like the Census Bureau's Small Area Income and Poverty Estimate (SAIPE) may be appropriate. The net effect may be greater use of composite measures or aggregate measures like school-level percentage of English Language Learners and average parental education, and the development of new SES measures. In none of these scenarios is there a role for FRL status as a measure of SES at the student level, although school and district FRL will continue to be a crude but useful way to compare the economic need of different schools.

Recommendations

- A theory-grounded model of SES should be adopted to define this construct in ways consistent with the purpose of the research or policy application.
- Correlations between SES measures and outcomes should be examined to assess the usefulness of these measures as control variables in statistical analyses.
- Researchers and policymakers wishing to employ existing SES measures should consider a composite index of SES, perhaps in conjunction with common measures, or turn to alternative measures such as (a) students' perception of their SES or (b) poverty estimates at the district level. Those interested in developing new measures should use a theory-grounded SES model as a guide to help ensure new SES measures do in fact measure what they are intended to (i.e., show evidence of construct validity).
- The development of new SES measures guided by a theory-grounded model of SES requires assembling a multidisciplinary team with expertise in a substantive area of education (e.g., mathematics education) as well as expertise in psychometrics, statistics, and the SES literature.
- Eligibility for a free- or reduced-price lunch should not be used as a student-level SES measure, but aggregating this variable to reflect the percentage of students receiving subsidized meals produces a crude but useful index to compare the economic need of a school or district with other schools or districts.

Notes and References

1 White, K.R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin, 91*, 461–481.

2 U.S. Department of Education (2015a). *Forum guide to alternative measures of socioeconomic status in education data systems* (NCES 2015-158). Washington. DC: Author. Retrieved October 1, 2017, from https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2015158

3 U.S. Department of Education. (2012). I*mproving the measurement of socioeconomic status for the National Assessment of Educational Progress: A theoretical foundation* (NCES 2013-009). Washington, DC: Author. Retrieved October 1, 2017, from http://nces.ed.gov/nationsreportcard/pdf/researchcenter/Socioeconomic_Factors.pdf

4 Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfield, F.D., et al. (1966). *Equality of educational opportunity (2 vols.)*. Washington, DC: U.S. Government Printing Office.

5 U.S. Department of Education (2015b). *Digest of education statistics*. Retrieved October 1, 2017, from https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2016014

6 Lopez-Turley, R.N. (2002). Is relative deprivation beneficial? The effects of richer and poorer neighbors on children's outcomes. *Journal of Community Psychology, 30*, 671-686.

7 Sewell, W.H., Haller, A., & Portes, A. **(**1969). The educational and early occupational attainment process. *American Sociological Review, 34,* 82–92.

8 Bryant, E.C., Glazer, E., Hansen, M.A., & Kirsch, A. (1974). *Associations between educational outcomes and background variables* [Monograph]. Denver, CO: National Assessment of Educational Progress.

9 U.S. Department of Education. (2012). I*mproving the measurement of socioeconomic status for the National Assessment of Educational Progress: A theoretical foundation* (NCES 2013-009). Washington, DC: Author. Retrieved October 1, 2017, from http://nces.ed.gov/nationsreportcard/pdf/researchcenter/Socioeconomic_Factors.pdf

10 U.S. Department of Education. (2012). I*mproving the measurement of socioeconomic status for the National Assessment of Educational Progress: A theoretical foundation* (NCES 2013-009). Washington, DC: Author. Retrieved October 1, 2017, from http://nces.ed.gov/nationsreportcard/pdf/researchcenter/Socioeconomic_Factors.pdf

11 American Psychological Association. (2007). *Report of the APA task force on socioeconomic status*. Washington, DC: Author. Retrieved April 8, 2017, from http://www2.apa.org/pi/SES_task_force_report.pdf

12 Hauser, R.M. (1994). Measuring socioeconomic status in studies of child development. *Child Development, 65*, 1541–1545.

13 National Research Council (2002). *Scientific research in education*. Washington, DC: National Academy Press.

14 Bradley, R.H., & Corwyn, R.F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*, 371-399. doi: pdf/10.1146/annurev.psych.53.100901.135233

15 Krieger, N., Williams, D.R., & Moss, N.E. (1997). Measuring social class in US public health research. *Annual Review of Public Health, 18*, 341–78.

16 Payne, K.J., & Biddle, B. . (1999). Poor school funding, child poverty, and mathematics achievement. *Educational Researcher, 28*(6), 4–13. doi: 10.3102/0013189X028006004

17 Morgan, P.L., Farkas, G., & Maczuga, S. (2015). Which instructional practices most help first-grade students with and without mathematics difficulties? *Educational Evaluation and Policy Analysis, 37*(2), pp. 184–205.

18 Bachman, H.J., Votruba-Drzal, E., Nokali, N.E.E., & Heatly, M.C. (2015). Opportunities for learning math in elementary school: Implications for SES disparities in procedural and conceptual math skills. *American Educational Research Journal, 52*(5), 894–923.

19 Cromley, J.G., Perez, T.C., Fitzhugh, S.L., Newcombe, N.S., Wills, T.W., & Tanaka, J.C. (2013). Improving students' diagram comprehension with classroom instruction. *Journal of Experimental Education, 81*(4), 511-537.

20 U.S. Department of Education. (2012). I*mproving the measurement of socioeconomic status for the National Assessment of Educational Progress: A theoretical foundation* (NCES 2013-009). Washington, DC: Author. Retrieved October 1, 2017, from http://nces.ed.gov/nationsreportcard/pdf/researchcenter/Socioeconomic_Factors.pdf

21 Bollen, K.A., Glanville, J.L., & Stecklov, G. (2001). Socioeconomic status and class in studies of fertility and health in developing countries. *Annual Review of Sociology, 27*, 153–185.

22 Bollen, K.A., Glanville, J.L., & Stecklov, G. (2001). Socioeconomic status and class in studies of fertility and health in developing countries. *Annual Review of Sociology, 27*, 153–185.

23 Wright, E.O. (2002). Foundations of class analysis in the Marxist tradition. In E.O. Wright (Ed.), *Alternative foundations of class analysis* (pp. 6–50). Cambridge, UK: Cambridge University Press.

24 Wright, E.O. (2002). Foundations of class analysis in the Marxist tradition. In E.O. Wright (Ed.), *Alternative foundations of class analysis* (pp. 6–50). Cambridge, UK: Cambridge University Press.

25 Breen, R. (2002). Foundations of class analysis in the Weberian tradition. In E.O. Wright (Ed.), *Alternative foundations of class analysis* (pp. 41–69). Cambridge, UK: Cambridge University Press.

26 Grusky, D. (2002). Foundations of Durkheimian analysis. In E. O. Wright (Ed.), *Alternative foundations of class analysis* (pp. 70–118). Cambridge, UK: Cambridge University Press.

27 Coleman, J.S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*, 95-120.

28 Coleman, J.S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*, 95-120.

29 Grossman, E.R.B. (2013). *An examination of Putnam's, Coleman's, and Bourdieu's conceptualizations of social capital and the structural differences across class, race, and gender groups*. Unpublished doctoral dissertation, University of Akron.

30 Hwan, K.D. (2005). Coping through social capital in educational stratification: Relational alignment and complementary ties. *Development and Society, 34*(1), 147-167.

31 Oakes, J.M., & Rossi, P.H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science and Medicine, 56*, 769–784.

32 Oakes, J.M., & Rossi, P.H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science and Medicine, 56*, 769–784.

33 McLoyd, V.C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53*(2),

185-204.

34 Oakes, J.M., & Rossi, P.H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science and Medicine, 56*, 769–784.

35 Oakes, J.M., & Rossi, P.H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science and Medicine, 56*, 769–784.

36 Hauser, R.M., & Andrews, M. (2007). *Reliability of student and parent reports of socioeconomic status in NELS-88*. Retrieved April 8, 2017, from https://nces.ed.gov/pubs97/97052.pdf

37 White, K.R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin, 91*, 461–481.

38 Sirin, S.R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*, 417–453.

39 Harwell, M.R., Maeda, Y., Lee, K., & Xie, A. (2017). The surprisingly modest relationship between SES and achievement. *Journal of Experimental Education, 85*(2), 197-214. doi: 10.1080/00220973.2015.1123668

40 Alexander, K.L., Eckland, B.K., & Griffin, L.J. (1975). The Wisconsin model of socioeconomic acheivement: A replication. *American Journal of Sociology, 81*(2), 324-342.

41 Brooks-Gunn, J., & Duncan, G. (1997). The effects of poverty on children. *Future of Children, 7*, 55–71.

42 Rosnow, R., & Rosenthal, R. (2003). Effect sizes for experimenting psychologists. *Canadian Journal of Experimental Psychology, 57*, 221–237. doi: 10.1037/h0087427

43 Olkin, I., & Sampson, A. (1998). Comparison of meta-analysis versus analysis of variance of individual patient data. *Biometrics 54*, 317–322.

44 Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfield, F.D., et al. (1966). *Equality of educational opportunity (2 vols.)*. Washington, DC: U.S. Government Printing Office.

45 Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfield, F.D., et al. (1966). *Equality of educational opportunity (2 vols.)*. Washington, DC: U.S. Government Printing Office.

46 Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfield, F.D., et al. (1966). *Equality of educational opportunity (2 vols.)*. Washington, DC: U.S. Government Printing Office.

47 Hauser, R.M., & Warren, J.R. (1997). Sociological indexes for occupations: A review, update, and critique. *Sociological Methodology, 27*, 177–298.

48 White, K.R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin, 91*, 461–481.

49 Harwell, M.R., Maeda, Y., Lee, K., & Xie, A. (2017). The surprisingly modest relationship between SES and achievement. *Journal of Experimental Education, 85*(2), 197-214. doi: 10.1080/00220973.2015.1123668

50 Harwell, M.R., Maeda, Y., Lee, K., & Xie, A. (2017). The surprisingly modest relationship between SES and achievement. *Journal of Experimental Education, 85*(2), 197-214. doi: 10.1080/00220973.2015.1123668

51 Goddard, R.D., Salloum, S.J., & Berebitsky, S. (2009). Relationships between poverty, racial composition, and academic achievement: Evidence from Michigan's Public Elementary Schools. *Educational Administration Quarterly, 45*(2), 292-311.

52 Firebaugh, G. (1978). A rule for inferring individual-level relationships from aggregate data. *American Sociological Review, 43*, 557-572.

53 Geronimus, A.T., & Bound, J. (1998). Use of census-based aggregate variables to proxy for socioeconomic

group: Evidence from national samples. *American Journal of Epidemiology, 148*(5), 475-486.

54 Soobader, M., LeClere, F.B., Hadden, W., & Maury, B. (2001). Using aggregate geographic data to proxy individual socioeconomic status: Does size matter? American *Journal of Public Health,91*(4), 632-363.

55 U.S. Department of Agriculture (2015). *Eligibility manual for school meals: Determining and verifying eligibility*. Alexandria, VA. Retrieved April, from http://www.fns.usda.gov/sites/default/files/cn/SP40_CACFP18_SFSP20-2015a.pdf

56 Harwell, M.R., Maeda, Y., Lee, K., & Xie, A. (2017). The surprisingly modest relationship between SES and achievement. *Journal of Experimental Education, 85*(2), 197-214. doi: 10.1080/00220973.2015.1123668

57 Sirin, S.R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*, 417–453.

58 Hauser, R.M. (1994). Measuring socioeconomic status in studies of child development. *Child Development, 65*, 1541–1545.

59 Harwell, M.R., & LeBeau, B. (2010). Student eligibility for a free lunch as an SES measure in educational research. *Educational Researcher, 39*, 120-131.

60 U. S. Department of Education (2015c). *Data and research*. Washington, DC: Author. Retrieved September 26, 2017, from http://www2.ed.gov/programs/titleiparta/index.html

61 Robinson, W.S. (1950). Ecological correlations and the behavior of individuals. *American Sociological Review, 15*, 351-357.

62 U.S. Department of Education. (2012). I*mproving the measurement of socioeconomic status for the National Assessment of Educational Progress: A theoretical foundation* (NCES 2013-009). Washington, DC: Author. Retrieved April 8, 2017, from http://nces.ed.gov/nationsreportcard/pdf/researchcenter/Socioeconomic_Factors.pdf

63 Demakakos, P., Nazroo, J., Breeze, E., & Marmot, M. (*2008*) Socioeconomic status and health: The role of subjective social status. *Social Science & Medicine, 67*(2), 330-340.

64 Michlemore, K., and Dynarski, S. (2017). The gap within the gap: Using longitudinal data to understand income differences in educational outcomes. *AERA Open, 3*(1), 1–18. doi: 10.1177/2332858417692958

65 U.S. Department of Education (2012). I*mproving the measurement of socioeconomic status for the National Assessment of Educational Progress: A theoretical foundation* (NCES 2013-009). Washington, DC: Author. Retrieved April 8, 2017, from http://nces.ed.gov/nationsreportcard/pdf/researchcenter/Socioeconomic_Factors.pdf

66 Kurki, A., Boyle, A., & Aladjem, D.K. (2005, April). *Beyond free lunch: Alternative poverty measures in educational research and program evaluation*. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.

67 U.S. Department of Education (2015c). *Data and research*. Washington, DC: Author. Retrieved September 26, 2017, from http://www2.ed.gov/programs/titleiparta/index.html

68 Bollen, K.A., Glanville, J.L., & Stecklov, G. (2001). Socioeconomic status and class in studies of fertility and health in developing countries. *Annual Review of Sociology, 27*, 153–185.

69 Oakes, J.M., & Rossi, P.H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science and Medicine, 56*, 769–784.