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Examining the bricks and mortar of socioeconomic status: An empirical comparison of measurement methods

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Examining the Bricks and Mortar of Socioeconomic Status: An Empirical

Comparison of Measurement Methods

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Abstract

The impact of socioeconomic status (SES) on educational outcomes has been widely demonstrated in the fields of sociology, psychology, and educational research. Across these fields however, measurement models of SES vary, including single indicators (parental income, education, and occupation), multiple indicators, hierarchical models, and most often, an SES composite provided by the National Center for Educational Statistics. This study first reviewed the impact of SES on outcomes in higher education, followed by the various ways in which SES has been operationalized. In addition, research highlighting measurement issues in SES research was discussed. Next, several methods of measuring SES were used to predict first-year GPA at an institution of higher education. Findings and implications were reviewed with the hope of promoting more careful considerations of SES measurement.

CHAPTER I

Introduction

In recent decades, the relationship between socioeconomic status (SES) and educational achievement has been proclaimed by many as a "self-evident fact" (White, 1982). Specifically, research findings have shown a relationship between SES and several outcomes in higher education. In *Swimming Against the Tide: The Poor in American Higher Education*, Terenzini, Cabrera and Bernal (2001) reviewed a great deal of research, concluding that students from low-SES backgrounds enroll, persist, engage, and graduate less than their high-SES peers. Walpole (2003) came to similar conclusions, citing differences in the experiences, study habits, GPA's, and educational attainment. What's more, these differences are of great consequence. Terenzini et al. noted that the difference in career earnings between those who have earned a degree and those who have not is much greater for low-SES students.

These findings support the forecast provided in *America's Perfect Storm* (Educational Testing Service, 2007), which painted a bleak picture for the future of the United States. Its authors concluded that racial and socioeconomic gaps in education, combined with a changing population and economic market, place the nation on the precipice of a socioeconomic divide that could force some into a permanent underclass.

Based on this potential impact, continued research into SES and educational attainment is imperative. However, in order to conduct quality studies that can impact educational practice, researchers and practitioners need a thorough understanding of SES. What exactly does SES represent? The nature of the term implies that there are at least two facets – the social and the economic – to SES, yet it is often represented by a single

variable. The nature of SES aside, what reasonably obtainable indicators can provide reliable and valid inferences about socioeconomic status? From and about whom should these data be collected? Some of these questions have been explored in fields such as sociology, health, psychology and even education, but these studies tend to focus on specific methodological flaws and rarely provide guidance for better practices in educational research.

As an example of the complexity of SES, consider two students, Dena and Sara, who are about to graduate from a typical American high school. Both students come from what might be considered traditional, two-parent households. Dena's mother, a successful real estate agent, and father, the owner of a construction company, earn salaries among the top 20% of all Americans. Given that Dena's mother started working right out of high school and her father inherited the family business, neither attended college.

Both of Sara's parents work at the local university: her father holds a doctoral degree and teaches in the psychology department, while her mother, an alumna of the institution, works in the financial aid office. Sara's parents earn what would be considered a modest income. Although they are certainly not near the poverty level, they are not affluent, nor does their income level approach that of Dena's parents.

As students like Dena and Sara prepare to graduate from high school and attend college, how might socioeconomic statuses (SES) affect their success in higher education? Between Dena and Sara, who would be better poised to stay in school, do well in her classes, and receive a degree? There are several pieces of information that might be used to answer these questions. First, an examination of their parents' income would suggest Dena, given that her mother and father earn sizably more than Sara's parents.

Dena is able to afford a better education, and receives financial support from her parents that facilitates her transition to college and persistence toward a degree.

However, to consider only the effects of parental income would emphasize the *economic* component of socioeconomic status, leaving out the very relevant *social* aspects SES. For example, when encountering difficulties in school, Dena always has the option of working for her father's company, and considers that a plausible choice. Conversely, Sara, based on the atmosphere of her home life, believes that a college education is a fundamental and critical step in her personal and professional development. Also, Sara has learned from her parents how to apply for financial aid, how to engage in activities on campus, and what services are available should she need assistance. Dena has none of this "college knowledge" and usually must learn what to do simply from observing her friends' behavior.

Additionally, while Dena might be able to afford a better education, Sara has (under the guidance of her parents) been in contact with other faculty and staff from the university. They have not only served to inform her about potential educational and career choices, but they served as references on her college applications. Dena's parents have an entirely different social circle. Many of the professional and academic role models that she views are in similar lines of work as her mother and father. Though most of their occupations did not require a college education, all of them earn more than enough to provide for their families, which is the primary means by which Dena evaluates a career.

Sara and Dena serve as two hypothetical examples how socioeconomic status might affect students' success in higher education. Specifically, they demonstrate how

different aspects of SES, namely the social and economic components, can have different effects. Particularly in higher education, where attendance is not compulsory as it often is in primary and secondary school, students' resources, attitudes, and beliefs about education play an important part in determining outcomes such as attendance, persistence, and graduation.

If researchers attempted to study the impact of SES on Sara and Dena's educational success, they would be faced with several significant measurement questions, some of which have already been mentioned. For one, would this study represent SES as a single effect? Thus far, SES has been referred to as such, though this is an assumption that can be tested. How should SES be scored? However it is structured, SES appears to be a continuous variable, though it might be appealing to make comparisons between the fabled "upper" and "lower class." At what level should SES be measured? Although Sara and Dena's individual SES appears most immediately relevant, perhaps the resources available to those around them, either in their school or their neighborhood, might influence their academic performance. Certainly, other questions could be posed as well.

However, researchers often avoid these questions altogether. For example, the National Center for Educational Statistics (NCES) typically provides a SES variable along with its data. Many authors merely cite this index as their measure of SES, without considering the implications of the methods used to measure and calculate it. The core premise of this paper is that such an action is unacceptable: researchers should carefully consider how and why a given method of measuring SES is used. As Adelman (1999) put it:

Before one accepts a variable simply because it has been used for decades or

because a federal agency paid for it, one must examine the bricks and mortar of

that variable very carefully. Where architecture is faulty, the data must be fixed or

the variable discarded – or one will never tell a true story. (p. xi).

Indeed, some researchers have explored the "bricks and mortar" of socioeconomic status.

Some have done so theoretically, others empirically.

The current study seeks to further the practice of careful and thorough SES

measurement, specifically in the area of higher educational research. A review of the

literature will explore several areas in SES research and measurement, establishing the

basis for the research questions that were ultimately be investigated. First, I will review

myriad research demonstrating the impact of SES on a variety of outcomes in higher

education. Second, I will generally classify the methods by which SES has been

measured. Third, I will synthesize the extant research, coming from several fields of

study, which has directly explored measurement practice. However, I would first like to

generally introduce the issues that have served as the impetus for the present research

questions.

Issue 1: The Structure of SES

In the 20th Century, William H. Sewell was likely the most prominent sociological

researcher of socioeconomic factors that relate to educational an occupational attainment.

In his 1942 article, "The Development of a Sociometric Scale," (which is possibly his

first publication in this area), he noted that literature is rife with references to the term

"socioeconomic status," but surprisingly void of a suitable definition.

For a large part of the 20th century, Sewell and other researchers made reasonable efforts at remedying this issue. Chapman and Sims (1925), Chapin (1928; who Sewell cited as providing at least an observable definition of SES[1]), and a host of others researched SES in an exploratory way. Behaviors or attitudes were proposed and measured, then correlated with external criteria, and compared to hypotheses about SES in an attempt to provide theoretical structure to the field. Their efforts, just as those of Sewell in 1942, were aimed at developing a scale of SES that could accurately and reliably measure the social and economic characteristics critically related to other social phenomena (e.g., education, occupation, etc.).

Their research never clearly reached its goal, as no scale was widely accepted as standard practice, particularly in educational research. However, Duncan, Featherman, and Duncan (1972) concluded, without clear specification, that this line of research had identified five key characteristics that were sufficient to represent SES in educational studies. These were parental education, parental occupation, number of siblings, participant's occupation, and participant's income. In that study, Duncan et al. elected to create a composite variable to represent SES, equally weighting each of these five factors. However, it does not appear that the assumption of unidimensionality that is conveyed by such a composite was ever tested in their research.

Rather inexplicably, Duncan et al.'s methodology appears to have set a standard, and this composite-style measurement of SES is still the most popular method today. Specifically, the composite provided by the NCES is most often used, given the wide array, availability and usage of their data. The NCES composite is calculated by standardizing parental education, occupation, income, and several items regarding

household possessions, then adding these variables together, giving equal weight to each (NCES, 2006).

However, some educational researchers have continued to research the definition of SES, particularly as it relates to educational outcomes. The student college choice model (Hossler & Gallagher, 1987), status attainment theory (Blau & Duncan, 1967), and the blocked opportunities model (Kao & Tienda, 2006) are some examples of theoretically-based frameworks that, either directly or indirectly, attempt to model and frame the effects of SES in higher education. The most widely accepted model of socioeconomic factors, however, has been social capital theory (Bourdieu, 1985; Coleman, 1988).

According to social capital theory, individuals "inherit" things other than economic resources from their parents. These three components of socioeconomic background are economic capital, social capital, and cultural capital. Economic capital represents the financial resources available to an individual, the impact of which on education is rather apparent. Social capital refers to the network of people and relationships available to someone. Social capital might impact education through the ability to access personal connections or resources when accessing or persisting in higher education. Finally, cultural capital refers to the knowledge and expectations of education. This is often embodied by the fact that lower SES individuals have less of an expectation to attend college, and their parents have less knowledge about procedures such as financial aid, support systems, etc.

Here, educational research appears conflicted. The most popular theoretical model clearly represents a multi-faceted view of SES, yet the prominent measurement practice

is to use only one variable to represent SES. Bollen, Glanville and Steklov (2001) thoroughly explored synthesis of theory and measurement in SES, albeit in studies of fertility and child health. They noted that theory and practice often disagree, which has serious implications on the selection and usability of various statistical models, as well as the inferences one can make based on a model's findings.

Issue 2: The Scoring of SES

Regardless of the method of measurement, SES is almost always a continuous variable. Even when variables such as education and occupation are obtained using ordinal responses, the number of responses is sufficient to represent a continuous distribution. Such is the case with research that uses the NCES composite, which is again the dominant means of representing SES. However, researchers often elect to simplify SES into groups, making comparisons among high-SES and low-SES students.

MacCallum et al. (2002) explained that researchers might have several reasons for restricting continuous variables. Most commonly, it is believed that this will simplify the analyses or their interpretations. Also, researchers might believe that distinct groups exist within the continuous distribution. In the case of SES, both of these might serve as reasonable explanations. Comparisons of high-SES and low-SES groups might serve as a simpler interpretation to readers. Also, SES has long been discussed alongside race and ethnicity (e.g., Labovitz, 1975), and a sizable amount of research has compared and contrasted the two (e.g., Williams, 1996).

Regardless of the reasoning, SES categorization occurs rather frequently in educational research. Sirin (2005) found that roughly 25% of studies investigating SES and achievement used simplified measures of SES. It appears that this practice is even

more common in higher education, as the rate of SES simplification was much higher than 25% in the studies that will be discussed here.

What's more, this practice has been shown to impact findings. White (1982) and Sirin (2005), examining the relationship between SES and achievement, both showed that studies using simplified measures of SES had consistently lower coefficients than those using continuous measures. Indeed, MacCallum et al. (2002) strongly recommend against simplifying continuous variables, noting a loss of information and statistical power.

Issue 3: The Level of SES

In the example above, another socioeconomic factor that might be related to Dena and Sara's educational success, or lack thereof, is the amount of resources available to their peers. Regardless of their individual levels of SES, Sara and Dena might be more or less likely to succeed if their friends, peers, and neighbors possess or lack certain resources. To use examples from social capital theory, Sara might expect to attend college because all her classmates' parents expect them that of them. The quality of Dena's schools might be higher because she lives in an affluent neighborhood. In both of these cases, although it is possible that individual-level SES is related to these factors – Dena might live in that neighborhood because her family is well off, or Sara might be friends with those students because they share similar backgrounds – the individual and group-level effects could contribute to their educational success in different ways.

For these reasons, a considerable number of studies have examined the effect of SES at the school or neighborhood level. White (1982) and Sirin (2005) both reviewed studies using aggregate measures of SES as related to academic achievement, focusing on primary and secondary education. Primarily, they noted the strength of the relationship

between SES and academic achievement. Additionally, each took time to note particular issues in research. For example, Sirin compared the appropriate inferences for student versus aggregate data. He pointed out that it is inappropriate to make student-level inferences based on aggregate data, and vice versa. White insisted that student-level relationship between SES and achievement was at best small, and that the aggregate relationship was of far greater magnitude.

Yet higher education research has largely failed to examine aggregate measures of SES as predictors of collegiate performance. In fact, no studies were found that included aggregate measures of SES to predict any outcome in higher education. Given the ample evidence pointing toward the importance of SES, a lack of measurement at the aggregate level appears to be a significant oversight requiring attention in the literature.

Purpose of the Current Study

The issues discussed above – the structure, scoring, and level of SES – do not represent all of the issues plaguing SES measurement. However, in looking at these and other areas in which researchers differ in SES measurement, one overall question surfaces: to what extent does variance in SES matter? Given the breadth of research demonstrating the relationship between SES and college outcomes, one way to answer this question is to model SES in several different ways within a given data set, and examine the differences in those models. Thus, the current study will use competing SES models to predict first-year GPA in an effort to answer three more specific research questions. These questions will all be explored by manipulating the three variables popularized by the Duncan et al. and the NCES composite: parental education, parental occupation, and parental income.

First, how do unitary (one effect) and component (multiple effect) models differ in their ability to predict collegiate performance, as defined by first-year grade point average (FGPA)? Second, how does dichotomizing SES affect the ability to predict collegiate performance? Third, can aggregate SES information significantly predict collegiate performance, specifically in comparison to student-level indicators of SES?

Research question 1: Unitary vs. component models of SES. Bollen et al. (2001) outlined several methods for component and unitary models of SES. Unitary models, given that they only represent one effect of SES, may include only one variable to represent SES. Thus, three single indicator models (parental income, parental education, and parental occupation) were used to represent this style of unitary, single indicator model. However, just as with the SES composite, multiple variables can be combined to represent one SES-effect. Thus, a fourth unitary model combined income, education and occupation in the same manner as the SES composite to represent yet another unitary model. These four models were compared to a component model which includes income, education and occupation as three individual effects of SES. By comparing this fifth model to the previous four, the following research question was explored: *Do component models of socioeconomic status predict first year GPA better than unitary models?*

Research question 2: Simplification of SES. Similar to Research Question 1, Research Question 2 directly compared competing methods to measure the impact of a measurement method on results. The five models used in Research Question 1, all of which use continuous data, were simplified using a median split. This created two groups: low-SES and high-SES. Five additional models resulted, each of which were

compared to the respective continuous model. Comparing their ability to predict first-year GPA informed Research Question 2: *Does the use of categorical SES variables, as opposed to continuous SES variables, decrease our ability to predict first-year GPA?*

Research questions 3a and 3b: Aggregate measures of SES. In order to represent the higher-order resources that might be available to students, information will was gathered about the neighborhood in which students lived prior to enrolling in college. Mirroring parental income, education and occupation, median income, percentage of the neighborhood with a bachelor's degree, and percentage of the neighborhood in the labor force were matched to the zip code for each student.

These neighborhood-level indicators were used to predict first-year GPA using hierarchical linear modeling (HLM), a procedure designed to model higher-order effects by accounting for the between group variance that occurs when participants are nested in groups such as neighborhoods. Ultimately, two comparisons will provide information about the ability of aggregate SES.

A model using only student-level indicators was compared to a model using only neighborhood-level indicators in order to answer Research Question 3a: *Does a model using only aggregate measures of socioeconomic status predict first-year GPA significantly better than a model using only student-level measures of SES?* Then, a model using student-level and neighborhood-level indicators was compared to several other models, mainly one using student-level indicators of SES to answer Research Question 3b: *Does the use of aggregate measures of socioeconomic status significantly predict first-year GPA after controlling for student-level predictors of SES?*

Ultimately, the primary issue of concern is that educational research of socioeconomic status has used varying means of measuring and defining SES. In some cases, researchers may, as Adelman put it, "blindly" accept a measurement method. In others, these models may be determined using an existing theoretical model. To be sure, the latter of these two scenarios is preferred if methodological decisions will have significant impacts upon the inferences researchers make about socioeconomic status. The goal of research such as this is to use empirical operationalizations of SES to the underlying theoretical assumptions. Through better understanding the way SES interacts with educational outcomes, educational researchers and practitioners can be better suited to help students overcome the obstacles SES presents.

CHAPTER II

Review of the Literature

In asking, "Does socioeconomic status affect students in higher education?" one soon finds out that this inquiry, as most research questions are, is not nearly as simple as it seems. Obviously, there is the difficulty in qualifying this relationship: is there an effect or not? Indeed, a vast array of research has attempted to answer this question, an exhaustive review of which is beyond the scope of this, or perhaps any single study. Nevertheless, the first part of this chapter reviews a portion of this literature, namely, that dealing with SES and aspects of higher education. Through this, I hope to demonstrate the significance of SES in higher educational research.

Despite this significance, a review of these studies shows substantial variation in the way socioeconomic status is defined and measured. What's more, there is often little or no justification as to why one measurement method is used over another. This operational definition of SES is yet another difficulty that researchers encounter in answering the SES-College question. Thus, the second part of this chapter outlines the methods of measurement that various researchers, across the wide range of sociological, psychological and educational research, have used as their operational definitions of SES.

The ambiguity in SES measurement has not gone unnoticed in educational and psychological research. In fact, this issue has been independently discussed in other fields as well. Thus, the third section of this chapter reviews literature that not only points out glaring issues in SES measurement – such as the unreliability of students' reports of parental education– but provides some suggestions and guidelines toward more effective measurement of SES. However, even when researchers have justified their operational

definitions of SES, support often comes in the form of a single citation or methodological guideline. Rarely do researchers thoroughly consider the theoretical nature of SES, and its implications for measurement. Thus, this section concludes with a discussion of considerations and implications of SES measurement.

The Role of Socioeconomic Status in Higher Education

A further complication of the SES-College question is selecting where to look to determine impact. There are certainly several obvious points where students of varying SES backgrounds might differ in higher education: enrollment, persistence, engagement, degree attainment, etc. However, there are other areas that might not be so apparent, such as aspirations to attend college. To be sure, amidst the vast body of research that has studied the impact of SES on higher education, there have been many definitions of the dependent variable. In reviewing these potential outcomes sequentially from the point of view of the student, the first variable that is commonly studied is aspirations toward higher education. Although there might be considerations relevant to higher education that affect students before this point in their lives, such as access to quality high schools or primary school resources, for the sake of time and scope, college aspirations will be the launch point for this presentation of evidence. Subsequent areas of study will follow in order of students' experience.

College aspirations and expectations. It would not be difficult to make the case that the first step in college success is the inclination to attend, let alone succeed in college. After all, a student cannot graduate from, persist at, enroll to, or select an institution of higher education until that student aspires to do so. Some (e.g., Adelman, 2006) have argued that aspirations, as they have been studied, along with any variable

that is not degree attainment, are an insufficient dependent variable, since they are not the goal of equity in higher education. However, the sheer volume of research dedicated to educational aspirations alone warrants its mention here.

However, defining the nature of students' desire to go to college has not been without debate. Mickelson (1990) is largely credited as the first to formally distinguish between "aspirations" and "expectations." In what Mickelson refers to as the "attitude-achievement paradox," students from minority backgrounds demonstrated high aspirations, while not attaining educational success. Mickelson postulated that this is because *aspirations* refer to "abstract…idealistic preferences for the future," (Bohon, Johnson, & Gorman, 2006; p. 208) whereas *expectations* refer to an evaluation of the likelihood of an educational outcome. Interestingly, Mickelson's definition for "expectations" has previously been used by others to describe educational "aspirations" (Alexander & Cook, 1979; Jencks, Crouse, & Mueser, 1983). Nevertheless, early research in this area failed to mention this distinction at all, and some researchers still do not.

In any case, this study is not designed to analyze the relative merits of either definition, nor is it intended to pursue the empirical and theoretical worth of distinguishing the two. This point of definition is mentioned here for two reasons. First, so that the reader may understand that the term "educational aspirations" is generally used here simply to define intent to attend college, since such an extensive amount of the literature reviewed defined it as such. Secondly, this illustrates that the issue of defining this variable is (much like socioeconomic status) rarely addressed and even more rarely justified in the literature.

That being said, the relationship between SES and college aspirations has been studied extensively and for quite some time. In fact, as early as 1968, William Sewell and Vimal Shah, were already willing to dub it a "sociological truism… that children of higher social class origins are more likely to aspire to high educational and occupational goals than are children of lower social class origins" (Sewell & Shah, 1968; p. 559). However, this statement was based solely on the empirical observation of this relationship, i.e. researchers knew that these variables were correlated. Several theoretical explanations have been provided in order to explain *why* this relationship exists, and moreover, what the implications are of this finding. Four theories from a variety of fields (i.e. sociology, psychology, and education), are presented here: status attainment theory, the student college choice model, the blocked opportunities framework, and social capital theory.

*Status attainment theory***.** Status attainment theory, one the most widely studied in the field of sociology, attempts to explain social mobility: the causes and impediments of mobility from one social class to another. Blau and Duncan (1967), who are often credited as the first to posit the theory, showed the effect of parental factors on social mobility by demonstrating the similarities between the occupations of fathers and sons. It was William Sewell, however, who emphasized the importance of education on social mobility. Because of his position at the University of Wisconsin, as well as his reliance on data sets from Wisconsin residents, his work is often referred to as the "Wisconsin Model," as well as being identified with status attainment theory. In any case, it was in this context that Sewell was interested in the relationship between SES (or as he often referred to it, "social class") and education.

Sewell and Shah's (1968) aforementioned proclamation about the positive relationship between SES and educational aspirations was based on findings from several studies using varying samples: 1947-48 private school students in Wisconsin (Sewell, Haller, & Straus, 1957), a sample of sons of Wisconsin farmers (Sewell, Haller, & Portes, 1969), and a survey of all 1957 graduating seniors in Wisconsin (Sewell & Orenstein, 1965; Sewell & Shah, 1967), including a focus on Milwaukee metropolitan students (Sewell & Armer, 1966). What's more, this effect of SES on aspirations was repeatedly found even after controlling for individual factors such as intelligence and gender. This empirical relationship was not only noted by Sewell and his colleagues, but a host of other studies as well (e.g., Christensen, Melder & Weisbrod, 1975; Labovitz, 1975; Levine, 1970;).

Several studies (e.g., Otto & Haller, 1979; Sewell, Haller, & Ohlendorf, 1970; Sewell & Hauser, 1972), as well as those by others (e.g., Labovitz, 1975) repeatedly provided evidence for the status attainment model, with minimal variation. Sewell and Hauser (1972) found a sizable relationship between SES and educational aspirations, as well as educational attainment, accounting for roughly 54% of the variance in the latter. However, when including aspirations in the model, the relationship between SES and attainment was almost zero: the SES-attainment relationship was mediated by aspirations.

Labovitz (1975) found this relationship as well in a sample of 1966 high school graduates from the San Diego, California area. He referred to this relationship as a "causal chain sequence," in which social variables, such as SES and race, influence personal variables (e.g., IQ, GPA, and aspirations), which in turn influence college behavior (application, enrollment, attainment, etc.).

***Social capital theory*.** Following Sewell's status attainment theory, researchers sought to more precisely explain *how* SES affected these educational experiences and outcomes. An extremely popular theoretical explanation has been that of *social capital*[2].

Generally, social capital is the benefit, both actual and potential, that one receives from relationships with others (Bourdieu, 1985; Coleman, 1988). From the perspective of parental influence, one can see how this can be compared to economic capital in that children from varying classes might "inherit" vastly different social networks (with vastly different benefits). Furthermore, it is a small intuitive leap to understand how this conceptualization of social capital might explain additional variance in educational outcomes beyond economic resources.

I should note that this explanation of social capital is a simplistic one. There are issues such as the term "cultural capital," which Coleman and Bordeiu define and classify differently. Additionally, the function of social capital differs in the eyes of Bordeiu and Coleman. Whereas Bordeiu focuses on the means by which social and cultural capital can be converted into economic capital, Coleman focuses on the sociological implications of social capital, such as the expectations and opportunities that arise from varying social networks (Portes, 1998). However, the present focus is not on a thorough theoretical review of social capital, but merely to demonstrate its role in explaining the relationship between SES and educational aspirations.

Although Bordeiu and Coleman provided the theoretical framework for social capital, empirical support for this theory, as it relates to educational aspirations, has been provided in a host of other studies. For example, Wilson and Wilson (1992) examined the role of home environment, represented by parental education and parental educational

expectations on the aspirations of high school seniors from two-parent families in the NCES 1985 High School and Beyond (HS&B) study. They found that home environment (social capital) and SES (economic capital) both influenced student aspirations. Moreover, parental education had a greater effect than parental expectations.

   Student college choice model. SES also plays an integral role in Hossler and Gallagher's (1987) student college choice model. In reviewing the literature, this theory is one of the most often cited when explaining the processes by which students aspire to, consider, and ultimately decide upon their college education. Hossler and Gallagher (based on several other, similar frameworks) outline three stages of college choice. First, students are *predisposed* to post-secondary education, displaying a general interest to attend college. Once students have decided they want to attend college, they enter the *search* phase, during which they determine their potential options. Finally, in the *choice* stage, students evaluate which school they will pursue. At any point, students may elect to no longer pursue an educational path.

   Hossler and Gallagher cite a litany of previous research (similar to that provided here) showing the relationship between SES and aspirations, thus affecting the dispositional stage of the model. In addition, Somers, Cofer, and VanderPutten (2002) examined the effect of SES on second and third stages of student college choice. The authors used data from the National Education Longitudinal Study of 1988 (NELS:88), a nationally representative survey of students who were in 8th grade in 1988. Follow-up surveys were then conducted two years (roughly 10th grade), four years (roughly 12th grade) and six years later. The authors found that SES played a role in the type of school students attended, with more students from low SES backgrounds attending 2-year, as

opposed to 4-year schools. Moreover, SES, along with aspirations, was found to significantly predict the choice to ultimately attend college.

The most comprehensive study on the effect of SES on higher education is *Swimming Against the Tide* (Terenzini, Cabrera, & Bernal, 2001). Amidst a rather comprehensive view of the SES-college relationship, they looked at the impact of SES on student aspirations using the student college choice model. The authors accessed data from a number of nationally sampled longitudinal studies, and found several impacts of SES on the college experience. Student aspirations, as well as parental knowledge about financial aid and the college application process, were significantly related to SES. Moreover, the authors note that these differences in aspirations "manifest themselves in differences in college-going, persistence, and degree attainment rates, all of them unfavorable to low-SES students in comparison with their more affluent counterparts" (p. v).

Blocked 0pportunities. Kao and Tienda (1998) provided yet another theoretical explanation to explain the SES-aspirations relationship. Their model claims that family background and resources not only directly influence educational aspirations, but also indirectly influence aspirations by affecting the everyday experiences which students undergo. By creating "blocked opportunities," which are perceived or actual limitations that arise due to socioeconomic circumstances, SES negatively impacts educational aspirations by causing low-SES students to devalue educational success as a means to transcend their lower class status. This indirect affect goes beyond the mere economic effects hypothesized by Sewell and Shah (1968)[3].

Kao and Tienda also used data from the NELS:88. The authors used separate logistic regression models for each racial group, attempting to predict whether or not students aspired toward a college degree at the 8th and 10th grade surveys. Although significant differences were found among racial groups, once parental education and family resources were included in the model, the groups did not differ. In other words, racial differences in college aspirations could be explained by differences in SES. Though their empirical analysis provided evidence of SES-based differences in aspirations, the authors used qualitative methods to provide support for the theory-based explanations of those differences.

By interviewing focus groups, Kao and Tienda were also able to find ways in which SES differences might actually increase aspirations. Some minority students held high aspirations, thinking that their status as minorities or as athletes would increase their chances of receiving a scholarship. Thus, the authors concluded that some expectations might arise because of, not in spite of, a lack of knowledge and experience of the educational and financial aid system. This type of aspiration was described as "less concrete," typically occurring during the 8th grade survey, and was not stable over time. Moreover, these findings substantiated hypotheses by Sewell and Shah (1968) and Labovitz (1975).

In conclusion, myriad studies have provided a link between socioeconomic status and college aspirations. Although many studies have done so empirically, a variety of schemas from education, psychology, and sociology have provided theoretical links as well. (Moving forward, none of the other outcomes reviewed here have received such theoretical attention.) Moreover, the importance of aspirations, as they relate to

enrollment and degree attainment, has been demonstrated by showing their role as a mediator between SES and other college outcomes.

Access to higher education. Once students have made the decision to pursue post-secondary education, they must be admitted to an institution of higher education. Several researchers, though much fewer in number than those who have studied aspirations, have examined discrepancies in access to higher education amongst varying levels of socioeconomic status. Interestingly, Adelman (2007) not only asks (in his article's title), "Do We Really Have a College Access Problem?" but points out that, just as with "aspirations" and "expectations," a standard definition of "access" has not yet been settled in the literature.

Although Adelman uses what he dubs a "threshold" definition of access, meaning that access refers to admission and enrollment regardless of student, institution, or attendance characteristics, he also outlines several other definitions of access (2007). "Recurrent access" refers to the ability to continually pursue a single degree or advanced degrees, regardless of stopping out. "Convenient access" refers to a somewhat open-door policy, meaning that anyone at any time can decide to pursue higher education, and be granted that opportunity. Finally, "distributional access" means that individuals, regardless of credential, can attend schools of all levels of quality.

Here, I will agree with Adelman upon a broader definition of access, simply to mean the opportunity for any individual to receive a post-secondary education, if for no other reason than to facilitate the inclusion of any relevant research. The issue of SES and access is not a new one. Studies have demonstrated a lack of socioeconomic diversity during the 1960's-1980's (Karen, 1991) and even as early as the late 1800's and early

1900's (Young, 1971). However, only recently has the question been given more widespread attention and study.

Mortenson (2000) explains the SES-access relationship in the title of his article, "Poverty, Race, and the Failure of Public Policy: The Crisis of Access in Higher Education." He points out that government investments, particularly those of states, which facilitated the flourish of higher education in the 1980's and 1990's, saw cutbacks in the late 1990's. Ultimately, a lesser investment from states requires families to play a greater role in funding students' college expenses. Obviously, such a shift has a disparate impact on low-SES families. Ultimately, he concludes that public policy needs to refocus on access across all classes in order to prevent a polarization of social classes and qualities of living. Here, Mortenson emphasized the economic aspect of SES.

Although Mortenson views this issue using macro-level policy information, Carnevale and Rose (2004) approached the question with student-level data. Using data from the NELS:88 and the High School & Beyond (HS&B) surveys, they looked beyond access to higher education alone and focused on access to top-tier institutions (as defined by selectivity and average student GPA and SAT/ACT scores). The authors did find differences in access, both to top-tier institutions and to higher education in general, by social class. What's more, they noted that efforts by schools to increase diversity rarely focus on SES. This differential access is critical because, as the authors point out, top tier schools spend more per student and produce graduates with higher rates of acceptance to graduate schools and career salaries, particularly for those in low SES groups. Moreover, adjusting for test scores, students at top-tier schools are more likely to graduate.

As with aspirations, several authors have gone beyond mere empirical observations of disparate access across social classes and attempted to provide some evidence explaining this occurrence. For example, Smith (2008) conducted a qualitative study of three low-SES African American families in an effort to understand differences in post-secondary enrollment. Using the framework of the student college choice model, he concluded that SES was an integral factor in developing student predispositions. Moreover, though the parents in his study thoroughly encouraged students toward academic goals, their focus was often on completion of a high school diploma, and that information and knowledge about the college process was often lacking or inaccurate. Thus, according to Smith, the quality of parental influence, not the lack thereof, explained differences among SES classes.

McDonough (1994), also using the student college choice model as a guide, cites changes in the admissions process as the reason for socioeconomic disparities in access. According to her, enrollment occurs as a result of two interacting systems: the student and family desiring to enroll, and the institution that markets to, recruits, and ultimately selects students. From the outset, low-SES students are disadvantaged by a lack of knowledge about the procedures and requirements for college. Moreover, colleges have made the recruiting and selection processes even more complex in effort to make decisions amongst a highly competitive talent pool.

In her article, however, McDonough focuses on private admissions counselors, designed to provide "college knowledge," or strategies that may help an applicant better market themselves to institutions. She argues that these services, which might help students who are unaware about the college application process, only further advantage

those who can afford them: middle or upper-class students who are already advantaged by the application process. These factors – parent knowledge about the application process, highly competitive admissions standards, and private admissions counselors – all have a compounding negative effect on low-SES students' access to higher education.

Finally, Adelman (2007) used data from the NELS:88 survey to support the claim that we do not actually have an access problem, answering the question posed by the aforementioned title of his article. Given that low-income respondents, when asked at age 26 why they did not continue their education after high school, more often cited academic reasons (71%) or negative attitudes toward school (57%) than financial reasons (37%), he claims that we have a "participation" problem. Low SES students would be granted access if primary and secondary schools did a better job of preparing them for and educating them on the importance of college.

In conclusion, research has repeatedly found differences in access to higher education across social classes. Certainly, this relationship is complex. Not only has Adelman (2007) questioned the existence of the problem, but he demonstrated that researchers often fail to concretely define how students might "access" higher education. Furthermore, personal, political, and cultural factors all serve as potential sources of variance in this relationship. Nevertheless, access has shown to be yet another area in which socioeconomic status has an impact on higher education.

College experience: Engagement and learning. Once students have entered higher education, they encounter an array of important experiences both inside and outside the classroom. As Terenzini et al. (2001) state, these experiences "help shape students' future circumstances in a range of areas, including the personal, financial,

educational, intellectual, social, cultural, and civic areas" (p. 18). According to their

model, these experiences play an integral and causal role in degree completion,

occupational attainment, learning and satisfaction. Their research, along with that of

Walpole (2003), not only demonstrated differences in college experiences according to

SES, but highlighted their importance in the framework of higher educational outcomes.

Terenzini and his fellow authors also pointed out that "the research literature is

virtually silent about how the experiences of college students might vary by

socioeconomic status" (p. 24). The National Study of Student Learning (NSSL;

Pascarella, Whitt, Nora, Edison, Hagedorn, & Terenzini, 1996) surveyed roughly 4,000

students from 23 universities annually from 1992-1996. Terenzini et al. analyzed first-

year data from the NSSL's College Student Experience Questionnaire (CSEQ; Pace,

1984), which surveyed students' engagement in several areas.

The first area which they addressed was academic engagement, comprised of four

subscales: course learning activities, writing experiences, experiences with faculty, and

library experiences. Interestingly, the only subscale that showed any relationship with

SES was course learning activities, which was defined as "note-taking, participating in

class discussions, working on a paper that requires the integration of ideas from various

sources, summarizing major points and information in readings, explaining the material

to another student or friend, and doing additional readings on course topics" (p. 24). Even

this difference, favoring higher SES students, was described as modest, at best. For

example, students from the lowest SES quartile reported studying about 25 hours per

week, compared to 30 hours per week for highest quartile students. Terenzini et al. found

similar modest differences (at most) among the lowest and highest SES-quartile students

using the 1990 Beginning Postsecondary Students Survey's (BPS:90) "Index of

Academic Integration," which includes "attending career related lectures, joining a study

group, talking with faculty members about academically related matters, and meeting

with advisors for academic planning" (p. 25). Once again, high-SES students reported

engaging in these activities more frequently than low-SES students.

Next, Terenzini et al. examined several areas of engagement outside of the

classroom. Socioeconomic status was related to each of the five areas of engagement

outlined by the scale - personal experiences, student acquaintances, clubs and

organizations, student union use, and athletic/recreation facilities – with low SES

students reporting less engagement in all five areas. Involvement in clubs and

organizations and use of athletic/recreation facilities showed sizable differences among

SES groups, whereas differences in the other three areas were modest. Once again, these

findings agreed with data from the BPS:90's "Index of Social Integration," (analyzed by

the same authors) which showed sizable differences between low and high SES students.

Following Terenzini et al., Walpole (2003) studied the experiences and outcomes

for a broad range of low and high-SES students[4]. Interestingly, she makes the claim that,

if the higher educational system is meritocratic, then low and high SES students should

have the same experiences and outcomes, once controlling for ability and institutional

quality. The broad implication, from her point of view, is that education is a means for

advancing one's social class, and a system biased against low SES students hinders that

progress. This claim echoes statements made much earlier by authors such as Sewell.

Furthermore, she also incorporates her hypotheses into social capital theory.

Using Cooperative Institutional Research Program (CIRP) longitudinal data, Walpole sampled almost 12,400 respondents from over 200 four-year institutions. Students were initially surveyed upon enrollment in college in 1985, then followed up four and nine years later. Data were collected regarding college experiences, educational attainment, income, and educational aspirations over an extended period of time. In comparing the lowest and highest SES quintiles, she found that "students from low SES backgrounds who attend four-year colleges and universities work more, study less, [and] are less involved… than their high SES peers" (p. 63).

She went on to state that these differences arise from differences in "*habiti*," a term from social capital theory that refers to the collection of an individual's views and relative value of various forms of capital (i.e. social, cultural, and economic). According to Walpole, low-SES students place greater value on economic capital and a lesser value on social and cultural capital, thus leading them to disproportionately seek those activities that yield economic capital.

Although research in this area is less extensive than others presented here, college experiences may serve as yet another means by which students from low-SES backgrounds are hindered in higher education. Whether as an outcome in and of themselves or as a mediator between SES and educational and occupational attainment, the importance of these experiences is a promising new area of educational research.

College experience: Retention. In stark contrast to the scarcity of research regarding SES and student engagement, there are myriad studies examining student retention. This is most likely because this phenomenon is a complex one, with several terms used to describe it (i.e. "retention," "attrition" or "dropping out," and "persistence

to degree"). As Tinto (1993) points out, departure from the higher educational system is not always permanent and is too often associated with failure (i.e. "dropping out"). Once again, however, the focus of this review is not to thoroughly and exhaustively discuss how and why students stay or leave higher education, but to provide evidence of socioeconomic SES' importance in that area. Accordingly, it is not important to focus on one definition, viewpoint, or even term by which we examine students' decisions to remain in or depart from higher education.

In compiling a litany of research from the 1970's and 1980's, Tinto (1993) outlines three areas that challenge students of low SES. First, students face pressing academic challenges. In addition to the being ill-prepared for college, low-SES students may lack certain non-cognitive skills (e.g., positive academic self-concept, preparation for the academic requirements of post-secondary education) that are critical for academic integration. Second, low-SES students face social barriers, such as differences between themselves and their classmates and faculty, which may prevent them from successfully integrating into college life. Finally, and perhaps most obviously, there are financial issues that may prevent persistence in low-SES students. Interestingly, but not surprisingly, these three obstacles link directly to the three primary reasons low-SES students gave for not continuing on to higher education in Adelman's (2007) study.

Tinto does note that much of this research has studied SES in combination with issues of race. However, he points out that these issues are just as likely to affect low-SES students who are white, as they also come from differing backgrounds than most students, and are thus just as likely to feel "isolated" and "marginalized."

Several studies have provided empirical evidence for a negative relationship between persistence and SES. One interesting example was provided by Choy and Premo (1996), who in studying the BPS:90, found that family income did not account for a significant amount of unique variance in persistence. However, parental education and expected family financial contributions (EFC) toward education, along with gender and having taken out a loan, were positively related, whereas being African American, non-Hispanic (compared to white, non-Hispanic), enrolling initially as part-time, and borrowing from parents were negatively related[5].

Though some might infer that the non-significance of income indicates that SES is not a factor in persistence, parental education and family contribution are clear representations of more expanded conceptualizations of social class.

In *Swimming Against the Tide,* Terenzini et al. (2001) did not focus on persistence as defined by other authors, even though they employed the term. Instead, they qualified persistence using attendance patterns, or the frequency with which students deviated from full-time, continual enrollment. Moreover, the authors did not conduct any unique data analysis, but instead sited two older reports that addressed the role of SES in attendance.

The first report framed the importance of non-traditional attendance patterns. Carol (1989), examining data from the 1980 HS&B survey, found that less than one tenth of non-traditional attendees attained bachelor's degrees by 1986 (six years after graduation). Socioeconomic status was "highly related" to attendance pattern, with high SES students being one third less likely to have "off-track" starts (attending two-year institutions, enrolling part-time or in non-degree programs).

In contrast to off-track starts, Carol's main hypothesis is that the "persistence track" – i.e. enrolling immediately following high school graduation into a 4-year institution and continually enrolling for four years until graduation – is the key to degree attainment. Only 15% of low SES students followed such a path, compared to 53% of students in the upper-most SES quartile.

The second report cited in *Swimming Against the Tide* was produced by Hearn (1992), who also studied the HS&B:80. He determined that social class played an integral role in the way students persisted, and supported three hypotheses that explained this relationship. Interestingly, but perhaps not surprisingly, his three hypotheses dealt with social/cultural, financial, and academic pressures, respectively, to enter non-traditional paths toward a degree (Terenzini et al., 2001).

Paulsen and St. John (2002), who also based their study on the Student College Choice model, conducted one of the more complex studies of socioeconomic status and higher education that one encounters in reviewing the literature. In modeling several interactions, they were able to determine that the relationship was not a simple, linear one as most researchers hypothesize (or at least model). Though they assuredly noticed a relationship between SES and persistence, it was not always the direct relationship that most would hypothesize.

For example, they found that women from low-income families were less likely to persist than men - a relationship moderated by differing gender goals. Given that low-income families are more likely to be single-parent families, women are often motivated to leave school in order to seek employment opportunities. Paulsen and St. John also found that low-SES students with "non-traditional precollege experiences" (i.e. those

with GED's or lacking high school diplomas) actually persisted *more* than their

traditional counterparts. They hypothesized that this was due to knowledge about

employment and employability: those who had left high school or failed to graduate were

more aware of the importance of post-secondary education in obtaining better wages.

Ultimately, the authors concluded that these complex patterns of student choice

had several implications. Notably, they stated that much of the research into

socioeconomic status treats this variable, let alone it's relationships with educational

outcomes, far too simply. That is, economic, social, and cultural factors may play

separate or even differential roles in determining students choice and persistence patterns.

Moreover, institutions need to be more adept at identifying and monitoring "diverse

patterns of student choice" and how changes in financial policy (e.g., means of funding,

such as recent shifts from grants to loans) might affect incoming students differentially

according to their social class.

Paulsen and St. John's research highlights an interesting point: even when there is

a negative relationship between SES and higher educational experiences, there is a

relationship. That is, they observed fundamentally and qualitatively differences in the

way different social classes experience higher education. Whether these experiences are

institutional (such as the case with retention) or individual (as is with engagement), they

are yet another example of the impact of SES.

Degree attainment. Degree attainment or completion is likely the most

emphasized educational area of any of those listed here. Sewell's status attainment theory

cites education, particularly degree attainment, as the key to transcending one's social

class (Sewell & Hauser, 1972). Others (e.g., Bowles & Gintis, 1976; Jencks & Riesman,

1968; Terenzini et al., 2001) have referred to the college degree as the passport to America's middle class. Adelman (1999) refers to degree completion as the "Dow Jones Industrial Average of U.S. Higher Education" (p. 3). Moreover, others have found that post-secondary attainment, even of a two-year degree, is a key to increased earnings, particularly for low-income individuals (Jacobsen & Mohker, 2009).

The discrepancy among social classes in degree attainment has been noted for quite some time. In fact, some of the research presented here (i.e. that by Sewell and Labovitz) has viewed degree completion as the ultimate dependent variable, with factors such as aspirations mediating the relationship between SES and attainment (yet another testament to the importance of attainment). More recent research, particularly in the field of education, has approached such discrepancies as empirical observations, rather than seeking theoretical explanations.

Another previously mentioned study (Carol, 1989), examined social class discrepancies in degree attainment. According to his analysis, 50% of low quartile SES students from the HS&B:80 survey did not attain a degree by 1986, whereas 11% of those in the high quartile reached the same outcome. Tuma and Geis (1995), examining the same data found what Terenzini et al. called "a longer perspective but no prettier picture" (p. 32). Examining students who were sophomores in the HS&B:80 twelve years later, they found that only 6.4% of the lowest SES quartile had received a bachelor's degree by 1992, compared to 19% of the middle two quartiles and over 41% of the highest quartile.

Clifford Adelman has published two of the more widely disseminated studies on degree completion: *Answers in the Toolbox* (1999) and *The Toolbox Revisited* (2006). In

the former of these two studies, he focused on students attending four-year institutions, studying transcripts, test scores, and the HS&B:80. Notably, he tracked attendance and retention from a student, rather than institutional perspective, allowing for a more accurate picture of students who received degrees and those who did not. Although he noted a relationship between SES and degree attainment, he claimed that "academic resources," comprised of high school curriculum, test scores, and high school G.P.A., is actually a stronger predictor of completion. However, SES and academic resources were not unrelated ($r = .368$). Thus, these resources may simply have been another indicator of SES.

In his 2006, *Toolbox Revisited*, Adelman revisited several of his 1999 hypotheses using more recent data (HS&B:88). In this study, he found a unique effect of SES, even above and beyond academic resources, educational aspirations, and a host of other variables. Consistently, moving upward from one SES quintile to another produced, on average, over a 6% increase in the likelihood of receiving a college degree. Ultimately, he concluded that SES was the only demographic variable significantly related to degree attainment.

Methods of Measuring Socioeconomic Status

One of the recurring themes that should be apparent by this point is that the definition of even the most elementary terms is not always agreed upon. Just as with "aspirations," "access," "persistence," "engagement," and "degree attainment," the term "socioeconomic status" has been defined in a plethora of ways. Among the 23 studies presented thus far that have conducted their own analyses, at least 11 different methods of calculating SES have been employed, not to mention the six studies that failed to

clearly define how SES was measured. Even when the method of SES is presented, it is rare to encounter a justification of why a particular method is used over another (Sirin, 2005). Even the most common method among these studies – the NCES' SES composite, comprised of parental income, occupation, education, and at times an index of household possessions – is often used without considering the relative importance, empirical structure, or even the existence of its components.

Later, I shall review the current body of research that has examined the implications of various methods of SES measurement. First, however, I would like to review the potential means by which one might measure SES. Although a more thorough means of classifying measurement will be discussed later, methods in the literature generally fall into three groups: single indicator methods, multiple indicator methods, and aggregate methods.

Single indicators of SES. Given the lengthy theoretical discussion of socioeconomic status and social class that has been presented here (which is an extremely brief glimpse, relatively speaking), one might find it hard to believe that any one variable might be used to represent SES. Yet, in White's (1982) meta-analysis of SES and academic achievement in K-12 settings, he reviewed well over 200 analyses that used only one indicator of SES. Among the studies presented here, only two (Moretenson, 1990; Sewell, Haller & Strauss, 1957) used a single indicator for SES. Additionally, Choy and Premo (1996) studied the separate relationships of several individual variables.

There are quite a few variables that could serve as reasonable indicators of SES. Several commonly used options are parental income, parental education, family atmosphere (e.g., attitudes toward education, parental expectations for education), school

resources, and occupational prestige (Braveman et al., 2005; White, 1982). In discussing SES measurement in medical research, Bravemen et al. noted that American studies tended to favor parental education over occupational prestige when using a single indicator, largely because American occupational classifications are not as related to SES as their European counterparts.

One of the most popular means of classifying students as low-SES (using single indicators or otherwise) is their enrollment in free or reduced lunch programs. This variable is commonly used because these data are held by the school, and need not be collected from students. This is advantageous because income data can be sensitive to gather, and student reports can be rife with error (Entwisel & Astone, 1994). However, free/reduced lunch participation is not a relevant variable for studies of higher education. For one, participation in such programs tends to wane as students get older, and is thus often unavailable to higher educational researchers (Ensminger et al., 2000). Furthermore, several authors have sided against using this variable as a proxy for SES, citing such lack of participation, variable means of determining participation, and "crude" methods for calculating families' eligibility (Entwisel & Astone, 1994; Hauser, 1994).

However, enrollment in free/reduced lunch is not the only variable that has been discouraged as a single indicator of SES. Fetters, Stowe, and Owings (1984) provide empirical evidence to indicate that single indicators, particularly provided by students, should not be used. They conducted follow-up surveys to the 1980 High School and Beyond (HS&B) study, gathering questionnaires from the parents of over 3,300 sophomores and 3,100 seniors in order to corroborate the responses of their children. Using parents' responses as a reference, they found that student responses to many SES-

related variables were inaccurate. I shall return to this issue and this particular study in greater depth later in this review.

Adelman (1999) further indicates that students often omit data altogether. He stated that roughly 29% of HS&B students "found various ways to indicate that they did not know their father's highest level of education; though for mothers, the rate was a mere 19 percent" (p. 35). Furthermore, among data from the National Educational Longitudinal Study of 1988 (NELS:88), roughly 16 percent of students provided no responses to inquiries about parental education. Based on these findings of, at best, less than desirable levels of accuracy in these data, Fetters et al. and Adelman recommended against the use of any single indicator of SES or family background.

Multiple indicator methods: Scale based. In their conclusions, Fetters et al. (1984) ultimately recommend the use of multiple indicators of SES over single indicators. Indeed, most studies across sociology, education, and psychology employ multiple methods for measuring SES. However, researchers may differ in deciding whether to combine these indicators, and if so, how. In this section I will first present some examples of scales that were developed in the early to mid-1900's. Then, I will present studies using the more recent advent of non-scale methods.

Ironically, decades before Fetters et al. and Adelman, Chapman and Sims (1925) claimed that using one variable to represent SES was inadequate:

> Experimenters within this field have been satisfied with isolated factors such as education of parents, occupation of parents, income, rentals, magazines and newspapers, libraries, clubs and organizations to which the parents belong…we

must measure different aspects of the total complex, decide in some manner the

validity and intercorrelation of these aspects, and weight accordingly. (p. 380)

Additionally, he claimed that measures of SES should be required to present evidence of

reliability and validity, just as any scale or method of measurement would. Accordingly,

studies of the measurement of SES would be dominated by a "scale" mentality for the

next fifty years.

   Early scales of social class. Early research took what could be referred to as a

construct approach to studying socioeconomic status. That is, several authors approached

the issue as if SES were some latent, unobservable characteristic for which researchers

should find the most suitable manifest representations. For example, Chapin (1928)

created what he referred to as the "living room" scale. Using 58 items, he proposed that

various possessions were representative of the four dimensions of SES: "cultural

possessions, effective income, material possessions, and participation in group activity of

the community" (p. 99).

   As validity evidence for his living room scale, Chapin provided correlations with

the Chapman and Sims (1925) scale. This 16-item scale also focused heavily on

possessions, but included some questions pertaining to parental income and educational

factors as well. Although their study contained several self-noted methodological flaws,

their main point was simple: education/ income/ occupation classifications of SES were

far too simple, and a nuanced and complex picture was required to accurately model

differences in social class.

   The question of SES was not exclusive to American culture. Pareek and Trivedi

(1961, 1964) attempted to examine the socioeconomic status of farmers in India. They

used several items that addressed the following issues: amount of land owned, level of

education, type of home owned, occupation, caste, number of farm animals, family type,

and social participation. They then administered these items to 512 families in rural India

and conducted exploratory factor analyses to determine potential underlying latent

factors. Ultimately, their solution produced three dimensions: social influence (education,

house, family, and social participation), caste (land, occupation, caste, and farm power),

and economic status (land, farm power, and material possessions). Although one could

find fault with the frequent cross-loadings and means by which the factors were

interpreted, it is nevertheless interesting *how* these results were obtained. Rarely have

researchers taken such an empirical approach to socioeconomic status, allowing the data

to suggest how participants' responses should be scored and classified.

The Duncan Socioeconomic Index (SEI; Duncan, 1961) is also commonly listed

as a "scale" of SES. Given Duncan's pioneering research involving SES and social

mobility (i.e. Blau & Duncan, 1967), the SEI has been one of the most widely used tools

in sociological research. However, several authors have noted that the SEI merely used

census data to determine the relative income and average educational level of an

occupational class. Thus, even though Mueller and Parcell (1981) deemed it a reasonable

indicator of SES, it is not technically a "scale" along with the others provided here. It is

actually the income and average educational attainment of a given occupation, meaning

that it is a combination of other indicators of potential resources.

The work of those mentioned here are just several examples of the early "scale"

mentality of SES measurement. Certainly, there were other scales constructed in the mid-

1900's, so much so that Gordon (1952) wrote a piece outlining the process for developing

such a measure. In reviewing the literature, it is not terribly apparent why this method of SES measurement fell out of favor.

What is apparent is the popularity of the non-scale method popularized by Duncan, Featherman, and Duncan (1972). They, based on the findings of these SES scales, concluded that five separate variables were sufficient to represent SES: parental education, parental occupation, number of siblings, participant's occupation, and participant's income. According to Sirin (2005), who conducted a replication of White's (1982) meta-analysis, it was their definition that became the agreed upon standard method of measurement. Thus, in their apparent effort to simplify SES measurement, Duncan and his colleagues might be the reason for the abandonment of such scales and their inherent methodology.

Again, this shift away from a scale mentality, in which SES is treated as a latent construct, has serious theoretical and empirical implications. In assuming SES is a latent variable, questions about validity and reliability are continually at the forefront of measurement. As an example, prior to Duncan et al., several studies used factor analysis and external correlations to answer Chapman and Sims' call for validity evidence. No such studies were found since 1972.

Multiple indicator methods: Not scale based. Actually, it was a three variable method - parental education, parental occupation, and parental income - which Sirin attributed to Duncan, Featherman and Duncan. From an educational perspective, this is most likely an accurate attribution since the occupation and income of the student is often trivial, if not non-existent. Even Mueller and Parcel (1981), in noting the viability of

occupational prestige measures such as the SEI, also stated that some measure of income and education should be included.

Duncan, Featherman, and Duncan explained why these indicators are important to include when understanding how an individual's socioeconomic background can affect educational (as well as occupational) attainment and mobility. Income represents the economic resources available to an individual, which can certainly determine the educational opportunities that someone is able or decides to pursue. Parental education and occupation can both account for a great deal of the variance in the social connections and cultural (i.e. educational) expectations that influence a person's attainment and mobility. Interestingly, these ideas of economic resources, social connections and cultural expectations are direct parallels to Bordeiu's social capital theory.

Indeed, of the 16 studies included thus far that used multiple variables to measure socioeconomic status, 15 used at least these three variables. Recently, studies using any of the many surveys conducted by the National Center for Educational Statistics (e.g., HS&B, NELS) commonly used a variable that is provided by the NCES. Authors will often, quite simply, state as such without little explanation or justification. For example, Carnevale and Rose (2004) stated: "In determining family background, both HS&B and NELS:88 computed a measure of the socioeconomic status of the family on the basis of reported income and parental education and occupations" (p. 105).

In fact, the composite variable provided by the NCES includes other indicators as well. According to the 2002 Educational Longitudinal Study summary report (NCES, 2006), this SES composite, across several HS&B and NELS surveys, has typically contained maternal education, paternal education, maternal occupation, paternal

occupation, family income, and several items pertaining to household possessions. The report also noted that this list of possessions has changed over the past several decades, as various appliances and pieces of technology have become obsolete or popular. Possession variables were omitted altogether from the ELS:2002 survey (though none of the studies presented here used that data). Generally, authors not only fail to consider the meaning or variation in these components, but they fail to mention them altogether.

All of the NCES reports that I reviewed (e.g., NCES, 2002; 2008) claimed that the composite had been computed in the same way: the variables that are included are standardized and equally weighted. Parental income (more than 10 response options) and education (more than 7 points) use ordinal response scales, but (based on the description above) are treated as continuous. Occupation is gathered either by open-ended response or a nominal scale with a multitude of response options. According tothe NELS:2002 report, occupation is then quantified using an occupational prestige scale, such as the Duncan Socioeconomic Index (SEI) or the Seigel Prestige Scale. Once again, these scores merely represent the average income and education level for a given occupational classification. It is not clear how household possession information is incorporated into this standardized composite.

Interestingly, these SES variables are not always obtained from the same source (NCES, 2002). Although parental sources of data are usually considered the most accurate (similar to Fetters, 1984), student data were imputed in the absence of parent data. Although the report claims that for more recent surveys, in the absence of student data, missing data were imputed, it does not explicitly state what imputation method was used, or if imputation was prevalent in previous surveys. The issue of data source,

particularly the relative reliability of data provided by students and parents, is one that will be addressed in a later section.

Sirin (2005) noted the increasing popularity of using household possessions, though the practice is still not as prevalent as that of using income, education, and occupation. Entwisle and Astone (1994), noting some of the missing data and inaccuracy that plague students' reports, suggested that household possessions may be a more reliable indicator of economic capital. This perspective is intuitively appealing: students are more likely to know the size of their parents' television and the make of their car, for example, than their annual income. Ironically, the inclusion of possessions harkens to Chapin's "living room" scale, which was presented over 80 years ago, though never used extensively in research.

Household possessions, along with variables such as home atmosphere (White, 1982), bring up a point of theoretical and methodological distinction. Early in this line of literature, under the research of Sewell and others, attitudes about education, possessions, and other variables, were often treated as products of SES. However, social capital theory posited that parental expectations and encouragement toward educational outcomes, as well as potentially beneficial relationships with others, were a component of SES. A thorough discussion of the implications of this theoretical distinction will be provided later.

Aggregate indicators. Socioeconomic status might not only affect students at the individual level, but at the aggregate (i.e. school, neighborhood) level as well. In areas where many low SES families live, schools are likely to have fewer economic resources, and students are less likely to encounter expectations or knowledge about college

attendance. In fact, White (1982) and Sirin (2005) actually concluded that SES had a stronger effect at the aggregate level than at the student level. Sirin found that the correlation coefficient between SES and achievement was twice as high when the school was the unit of analysis than when the student was. Both authors noted, however, that this relative relationship is somewhat of a statistical artifact, as it is generally easier to predict the mean for a sample than the score for an individual. That being said, both authors concluded that the use of aggregate measures should be explored further in educational research.

Sirin (2005) cautioned that the use of aggregate measures of SES may lead to the "ecological fallacy," where researchers make inferences about individual differences based on group data (although the fallacy can also occur by making group-level inferences from student data). Consider a hypothetical example: a researcher finds that schools with higher levels of SES tend to have higher levels of engagement. To assume that this same positive relationships holds between student-level SES and student-level engagement is a case of the ecological fallacy. Although the existence of a higher-order relationship may makes the presence of a student-level relationship seem more likely, it does not ensure it.

White (1982) concluded that the student-level relationship between SES and academic achievement is quite small. The oft-cited large effect of SES on academic achievement, he found, occurred only in aggregate studies of SES.

Perhaps the best way to explore the effects of aggregated indicators is to use them in combination with student-level indicators of SES. This approach permits researchers to explore the effects of both kinds of indicators simultaneously. An example of how both

student-level and aggregated indicators of SES can be used in educational research is

provided by Cadas and Bankston (1997). Studying Louisiana 10th graders' state test

scores, the authors considered student-level SES, measured by parental education and

occupation. Additionally, they wanted to consider the overall effect of school SES on

children. In other words, were students from high SES schools likely to score better

simply as a function of their school, after controlling for individual-level factors? Posed

differently, do students with the same individual SES, but from schools with different

SES levels, score differently on the state test?

Cadas and Bankston illustrated two ways in which aggregate indicators can be

acquired. As one measure of school level SES, they simply averaged the individual-level

data for all students within a given school in their sample. This embodies one of the two

methods of collecting aggregate indicators. The second method involves directly

collecting data about a given school. They took the overall percentage of students

involved in free and reduced lunch programs at each school. These data were obtained

from the schools themselves, not from the students in the sample. This is the second

means of gathering aggregate indicators. In contrast to White and Sirin, Cadas and

Bankston found the effect of aggregate SES on test scores to be significant, but slightly

smaller than student-level SES.

Cadas and Bankston also describe very well the nature of these student and

aggregate level effects. The disadvantages of decreased economic, social and cultural

capital have hopefully already been conveyed. However, students of equal SES levels

might be affected differently if located in contrasting SES schools or neighborhoods. For

example, the shared beliefs and habits (both good and bad) of students' peers can directly

affect achievement. Indirectly, teachers in low-SES settings may have lower expectations of their students, simply because of their socioeconomic background.

Hierarchical linear modeling (HLM) is the most appropriate statistical method for examining both student-level and aggregated effects of SES on an outcome (Raudenbush & Bryk, 2005). As in typical regression, the relationships between student-level SES predictors and an outcome can be estimated. HLM goes beyond typical regression in three ways that are advantageous for the study of SES. First, the coefficients that capture the relationship between student-level SES predictors and outcomes for each "nested" group (e.g.,, school, neighborhood) can be allowed to vary. Second, researchers can relate characteristics of schools (such as school-level SES, public/private status, school size) or neighborhoods to the slopes and intercepts of the individual regression equations to determine what factors are related to differences in the student-level relationships. Different kinds of centering of the student-level predictors in this model can be used to explore the effects of both student-level and aggregated indicators on the outcome (Enders & Tofighi, 2007). Third, different forms of centering can also be used to explore whether there are contextual or compositional effects for predictors. A contextual or compositional effect is one in which a predictor at the aggregate level has an effect above and beyond its effect at the student level.

Interestingly, I was unable to find any studies in higher education that used aggregate indicators of SES. Titus (2004, 2006) used characteristics of colleges and universities as predictors of retention, but did not include institutional SES or a higher-order effect of high school or community SES. Yet White, Sirin and Cadas and Bankston

all agreed that the consideration of aggregate indicators of SES was important in thoroughly understanding how SES affects academic achievement.

Summary of SES measurement. To summarize, researchers in higher education employ varying methods when choosing how to define socioeconomic status. Single indicator methods, although still used occasionally, have generally fallen out of favor in recent decades. This is due, in large part, to the increasing awareness of data inaccuracy and the prevalence of the three-part measurement of SES championed by Duncan, Featherman, and Duncan (1972). Other methods of measurement include measuring possessions or the use of aggregate indicators, such as neighborhood or school-level SES.

Although the three common indicators of SES are somewhat representative of the popular social capital theory, this justification is rarely, if ever provided or considered when researchers measure SES. Moving forward, I shall present literature that examines the implications and repercussions of varying methods of SES measurement.

Issues in SES Measurement

In examining the methods of SES measurement presented thus far, one would most likely assume there are implications for choosing one over another. For example, if researcher A were to use parental income while researcher B were to use a composite of income, education, and occupation, most would expect at least slightly different results for the two studies, regardless of the dependent variable.

This section presents research that has examined, either theoretically or empirically, issues of SES measurement. These studies have come from educational research as well as other fields. Across the studies presented here, there are four issues

that repeatedly arise and thus outline this review of the literature: measurement accuracy, the definition of SES, categorization, and the use of aggregate measures.

Measurement accuracy. Prior to any discussion about whether or not a given variable is a reasonable representation of socioeconomic status, researchers of SES should inquire as to the quality of the data they use. For example, how accurate are students' reports of their parents' income, education, occupation, etc.? Given certain circumstances, it is not unreasonable to think that students might lack this knowledge, have a certain amount of random error in their responses, or even consistently under or over-report such information. Some researchers have made an effort to measure the extent to which this occurs.

The most oft cited study in this area is most likely the research of Fetters, Stowe, and Owings (1984) on the 1980 HS&B survey. This survey is particular suited for studying the validity and reliability of students' responses for three reasons. First, of the roughly 58,000 high school students who were surveyed in 1980 (approximately 30,000 sophomores and 28,000 seniors), roughly 6,500 parent surveys were surveyed as well. Second, transcript information was collected for over half of the 1980 sophomores surveyed in the study. Third, responses for over 500 sets of twins were captured. These three sources of information provided a unique opportunity for Fetters, Stowe and Owings to corroborate the responses of the sophomores and seniors surveyed in 1980.

In their analysis, the authors used several terms that may not be entirely transparent. They first considered the "validity" of student data as their correlation with parent responses. The next considered potential "bias" in student responses, which they defined as the tendency for students to consistently over or under-report levels of a

variable, when compared to their parents. Finally, they defined the "reliability" as the correlation between twins' responses.

According to their data, students' responses to a wide array of SES variables were frequently invalid when using parents' responses as a reference. Father's education level, mother's education level, and race/ethnicity demonstrated the highest validity coefficients by far, and none of those exceeded .87. Among the variables exhibiting "moderate" validity coefficients (.50 to .70) were several possession-related indicators of SES, such as having a typewriter in the home or owning more than 2 vehicles. However, most notable amongst this group was the family income variable, which only saw a .50 correlation between parents and children. Surprisingly, aside from mother's occupation, all of the variables in the low validity coefficient group were related to study materials: presence of a pocket calculator at home, ownership of an encyclopedia, more than 50 books in the home, and whether a student had a place to study in the home.

Examining the bias in student responses also raised concerns about the quality of the HS&B data. Students generally tended to under-estimate their parents' level of education, more frequently reporting that they only had a high school education, even though their parent(s) reported having at least some college education. Though the direction of bias was consistent, there were slight variations in magnitude both according to age of the student (sophomores had greater bias than seniors) and which parent they were reporting on (less bias for fathers). Students also tended to frequently under-report whether their parents generated very high or very low amounts of income. In other words, students tended to over-report a middle-range of parental income.

Finally, Fetters et al. were able to take advantage of 276 sophomore and 235 senior sets of twins, describing the correlations among twins' responses as the "reliability" of background variables. Once again, these findings suggested a sizable amount of error in the data, with coefficients distributed rather evenly across a range of .50 to 1.00. Notably, though reliability coefficients for parental education responses ranged from .85 to .94, occupation response ranged from .51 to .65 and income responses ranged from .66 to .75.

Ensminger et al. (2000) conducted a similar study, comparing adolescents' (ages 10-19) responses to several SES items to those of their parents. Interestingly, they directly based their measures of SES on social capital theory. As indicators of financial capital, they used maternal and paternal employment status (unemployed, working part-time, or working full-time) and participation in need-based social programs (i.e. welfare, food stamps, free/reduced lunch). Cultural capital was measured with two items, one for the mother and one for the father, relating to parental education, with the options of "less than high school graduate," "high school graduate," or "college graduate." Finally, social capital was measured by one item about family structure: "single parent," "parent and step-parent/other adult," or "mother and father."

As with Fetters et al., Esminger et al. found less than perfect agreement between students' and parents' responses. Given that many households were absent of a father, the mothers' responses were used as references. Among all the items, the percentage agreement ranged roughly from 60-90%. Moreover, they used logistic regression to identify predictors of agreement. They concluded that older adolescents and those less involved in risk behaviors were more likely to agree with their mother's responses. Also,

not surprisingly, adolescents living in households in which the father was not present less accurately reported paternal education and employment.

One of the more powerful demonstrations of measurement accuracy occurred in White's (1982) meta-analysis of SES and academic achievement. He coded studies using a "SES reporting error" variable, which considered parent reports the most accurate, followed by students, teachers and "someone from the central office." This four-point scale of reporting error, ranging from low (parents) to high (central office) correlated significantly ($r = -.266$) with the magnitude of the SES-achievement relationship. He thus concluded that findings from studies using non-parental reports were attenuated due to reporting error. Similar results were found in Sirin's (2005) meta-analysis, though comparisons were only made between student and parent reports.

Ultimately, these studies raise concerns about the quality of responses to SES-related variables, which have several implications. First, if individual variables intended to measure a given construct contain measurement error, researchers would be better suited to gather data on multiple variables in order to increase the amount of reliable variance (Lord & Novick, 1968). As such, as more indicators of SES are included in a research study (e.g., using multiple indicators over a single indicator, or using a school-level information in addition to student-level information), estimates of SES become more reliable, thus improving the stability of that study's findings. Moreover, Esminger et al., White, and Sirin provide evidence that some respondents are providing more accurate (i.e. reliable and valid) responses to SES items than others, thus intimating that our measures of SES are biased or inaccurate. From a measurement perspective, the significance of these implications cannot be understated.

Finally, this evidence suggests that, when possible, researchers should take strides to factor error in their statistical models. Methods such as factor analysis provide the means for modeling such error. The importance of this consideration will become apparent later in this discussion.

Definition/structure of SES. Even if all indicators were gathered with perfect accuracy, researchers would still need to determine which variables should represent SES. These decisions might be based on theoretical considerations. For example, one might elect to use variables to represent each of the factors of social capital theory. Researchers might also endorse or decline the use of a given variable for empirical reasons, such as inaccuracy or biased reporting. This section shall review research that has considered the theoretical and empirical factors that might influence such decisions.

Mueller and Parcell (1981) argued that, among several competing theories, sociology has at least provided sufficient evidence to conclude that SES is a multidimensional construct, regardless of which dimensions an individual researcher may endorse. They also point out that appropriate measurement of these dimensions and their relative importance in various areas of psychological research has yet to be determined. Although they support the three-faceted model of SES that includes income, education, and occupation, they state that measures of occupational prestige, particularly the Duncan Socioeconomic Index (SEI) and the Seigel Prestige Scale, are the best indicators of SES, due to a lack of research determining the relationship of income and education indicators to various outcomes.

Hauser (1994) used three criteria for measures of SES: "it is important to focus on characteristics that will be relatively easy to measure, that can be measured for every

child in the survey, and that will probably not vary greatly over the short term" (p. 1541).

For these reasons, he encouraged the use of occupation over income. First, students often

lack accurate knowledge of parental income, which could lead to inaccurate reports or

missing data. Thus, to gather quality income data would require significant effort (i.e. not

easy to measure). Second, income may not be equally representative across all students.

For example, the income levels for two-parent households are not equally representative

of economic resources as those from one-parent homes. Finally, Hauser claims that

income is just too volatile: occupation is more likely to stay constant over a given period

of time.

Hauser also makes several other suggestions about SES measurement. In addition

to occupation, items about housing, such as tenure and ownership, also have high

response rates, thus lessening efforts to collect data and potential biases in responses. He

also discourages the use of free or reduced lunch and poverty level.

Entwisle and Astone (1994) also provided guidelines for measuring SES. Citing

issues of unreliability, missing data, and varying household structure, they suggested that

social capital theory provides a strong framework for understanding the various factors

(i.e. lack of resources) that might influence a child's development. As such, any

measurement of SES should include indicators of financial, cultural and social capital. In

addition to income, Entwisle and Astone recommended using participation in various

social services, such as welfare, public housing, or unemployment compensation, as

additional indicators of financial capital beyond income, free/reduced lunch participation,

etc. Level of education is the only variable they provided as an indicator of human

capital. For social capital, they recommended three variables: number of birth parents in the home, the presence of step-parents, and the presence of grandparents in the home.

Finally, as opposed to Mueller and Parcell (1981), Entwisle and Astone recommended *against* using occupational indices as representations of SES. This is due in large part to gender bias in both occupational preference and pay scale. As they stated, "Women are concentrated in occupations that have relatively high prestige but that pay rather poorly (e.g.,, schoolteacher, librarian, social worker)" (p. 1525). Additionally, women may not be a part of the work force in order to support their family, which creates issues of missing data.

Thus far, studies discussing the structure and definition of SES have taken a more theoretical perspective. However, several studies have empirically compared various means of defining SES. For example, Grundy and Holt (2001) studied the viability of a relatively wide array of SES indicators to predict health status in older adults (a dichotomy of good vs. fair/poor health). In addition to education, occupation, and income, they considered several household possessions, access to a car, housing tenure (rent vs. own), and a deprivation index (items relating to basic possessions and needs, such as a winter coat, designed to identify those from the lowest SES classes). Each of their models started with one of the three common SES indicators, then progressively added one of the four other indicators (none of the models included education, occupation, and income). In general, all of these variables significantly contributed to the model.

Aside from their empirical contributions, Grundy and Holt argued that it was important to include all of these variables in measuring SES because any single variable

has limitations. For example, they noted that older populations report a lack of occupation at a rather high level due to retirement. Although this precise issue might not be as relevant for educational research, the more important take-away is that individual indicators often have undesirable characteristics, such as the inaccuracy of student reports of parental income, demonstrated by Fetters et al. (1984). Ultimately, Grundy and Holt conclude that any measure of SES meet two requirements: it must be grounded in theory and it must use readily available and reliable data.

Braveman et al. (2005) examined the implications of varying SES measurement methods in several national health databases. They used five longitudinal health databases that studied varying populations and health outcomes. Their primary focus was to demonstrate how results would vary if different definitions of SES were used. Ultimately, they outlined four key findings regarding the structure and measurement of SES.

First, they found that education and income are not interchangeable indicators of SES - one cannot be used in lieu of the other. Researchers may chose to only include one of these two variables in order to avoid issues of collinearity, and in fact a significant correlation exists. However, they found that each variable explained enough unique variance in health outcomes to warrant the inclusion of both.

Second, they stated that income and wealth are not interchangeable. Non-income indicators of wealth, such as home ownership, car ownership, or liquid assets, accounted for unique variance in health outcomes. This concept is paralleled in educational settings, with some noting that indicators such as study resources can provide valuable information about a student's socioeconomic background (e.g., Sirin, 2005). Bravemen et

al. also cited the potential direct effect of these indicators on certain outcomes, a notion also mirrored in education. Certain resources (e.g., internet access, a quiet place to study) may not only indicate SES, but may also directly determine one's academic success.

Bravemen et al.'s third point does not appear to directly relate to educational research. They mentioned that occupational classifications frequently used in American research may not be relevant for studies of health. The authors recommended including potentially causal factors, such as the possibility for physical labor, in classifying jobs, which is seemingly less relevant in educational research. Their fourth point is one that is not often mentioned in the educational literature, but may still be relevant. They discussed the potential for SES to differentially impact health outcomes depending on when in the participant's life it was measured. They found that childhood SES was more impactful than SES later in life. This also speaks to Hauser's (1994) point about the volatility of SES - that it may significantly change over time.

Once again, however, White's (1982) meta-analysis provides a powerful means of comparing studies that differ in their definition of SES. Using studies that generally examined SES and academic achievement, White outlined nine different categories of SES measurement. These groups increased in complexity from single indicator methods to multiple indicators, all of which contained one of the four traditional SES variables: education, occupation, income, and home atmosphere/resources. Not surprisingly, among these methods, there was sizable variance in the mean SES-achievement correlation. Studies using only education as an SES indicator had the lowest mean correlation (.185), while studies using measures of home atmosphere had the highest (.577). There were also slight variance among the average correlation for those methods using multiple

indicators: income and education (.230); income and occupation (.332); education and occupation (.325); income, education and occupation (.328), income, education, and occupation, "plus something else major" (.365). Again, Sirin (2005) found similar results, with studies using neighborhood characteristics producing an average SES-achievement correlation of .25, and those using home atmosphere producing an average correlation of .47.

Overall, it is important to note that these studies have emphasized different aspects of SES. They not only bring into question the validity and reliability of inferences that are made from any individual variable, but they suggest that each of these variables provide unique information about socioeconomic background. Most of all, they suggest that all means of measuring SES are not equivalent.

Alignment and divergence of theoretical and measurement models. To this point, I have presented the means by which authors in higher education research have chosen to measure SES. In a similar effort to this study, Bollen, Glanville and Steklov (2001) reviewed SES measurement practices in fertility and child health research. They found that "there are nearly as many concepts of socioeconomic status and class as there are authors writing on them" (p. 157). Indeed, in reviewing their findings, it is apparent that there are even more conceptualizations and measurement models of SES when looking outside of educational research. However, Bollen et al. provide four basic questions that, using theoretical and measurement distinctions, categorize many models of socioeconomic status. Figure 1 outlines these questions and the possible models that ultimately result from each decision (represented by elipses).

First, researchers must decide whether SES is a unitary or component concept. If SES is unitary, then it is conceptualized as being unidimensional and has only one effect on any given dependent variable. In a component view, however, SES has separate, distinct elements that can have quanitatively or qualitatively different effects. To clarify the distinction between the two views, consider the measurement of SES implied by each. A component conceptualization implies the use of multiple variables, whereas a unitary conceptualization implies the use of a single variable, which can be literally one variable or an index based on multiple variables. In looking at the educational research, the NCES composite would represent a unitary view of SES, since that one variable represents the effect of SES on educational outcomes. However, this theoretical stance is often only inferred - authors who use the NCES composite typically do not discuss their theorized view of SES' effect. On the other hand, social capital theory represents a component view of SES, given that economic, social, and cultural capital are hypothesized to differentially affect educational success.

Bollen et al.'s primary finding was a gap between the theorized effect of SES on fertility and child health and the measurement methods that researchers employed. In their case, theory predominantly pointed to a unitary conceptualization of SES, yet measurement practice typically used a component approach. Ironically, research in higher education appears to have the same issue, but in the opposite direction. The most prevalent theory on SES appears to be social capital theory (a component theory), yet the NCES composite is the most popular measure of SES (a unitary approach).

The second decision that researchers must make about SES involves the number of SES variables. A component view of SES dictates the use of multiple variables,

whereas a unitary view of SES implies the use of either a single variable or an index based on multiple variables. As mentioned, studies that use only a single variable have not been common in more recent educational literature. Most studies include multiple variables, citing issues pointed out by Adelman (1997), Fetters et al. (1984), etc. However, these variables are often not used in a way that aligns with a component view of SES. Instead, a composite variable is used as a single indicator of SES (e.g.,, NCES) thus implying a unitary view (Bollen et al., 2001).

The third decision about SES measurement involves the treatment of measurement error in the model. One has to decide how measurement error is handled in the model regardless of whether a unitary or component view is adopted, or whether one or many variables are used to measures SES. As an example, consider a single SES indicator used as a predictor in a regression model. One assumption of this regression model is that the predictors are measured without error. Bollen et al. and Kline (2006) flatly state that this assumption is likely implausible with SES. In fact, several studies already cited here have provided empirical evidence that there are, at the very least, non-negligible amounts of measurement error in the traditional SES indicators, particularly when they are provided by students.

The use of a latent variable allows researchers to incorporate error into their models, which leads to the fourth decision to be made by researchers: how to model the relationships between latent SES and its observed indicators. The researcher could assume an *effect* model if they believe that the observed indicators are caused by (or effects of) latent SES. Alternatively, the researcher could assume a *causal* model if they believe instead that the observed indicators cause the latent SES variable. To further

convey the distinction between causal and effect indicators, consider the use of education as an indicator of SES. If education is an effect indicator of SES, education is a *result o*f SES; if education is a causal indicator of SES, education *contributes to* SES. Based on current conceputalizations of SES, one might argue that education is a causal indicator by considering its relationship with SES. As education increases, it is likely that SES will as well. However, as SES increases, it is not necessarily true that education will change.

From these four questions, 9 possible measurement models emerge. These models fall into three general groups: unitary models with one indicator (Figure 2), unitary models with multiple indicators (Figure 3), and component models with multiple indicators (Figure 4). Within each of these groups, three models are possible: the case in which a researcher assumes no measurement error, (referred to here as an "error-free model"), an effect model (indicators are effects of latent SES), and a causal model (indicators are causes of latent SES).

Each of these options are discussed in the section that follows (following the outline used by Bollen et al.), along with examples from the educational literature, when available. In an ideal situation, a researcher would establish a theoretical model of SES and use that to guide measurement practice. Thus, the following section will discuss what measurement methods should follow various theoretical models, as well as the implications of incongruent theory and measurement.

Unitary models with one indicator. In discussing models that use single indicators of SES, Bollen et al. noted that this includes single variable studies, as well as those that combine several variables to create an index or composite, such as the NCES method. Model 2a depicts a model in which a researcher has elected a unitary model of

measurement with one assumedly error-free indicator. However, several previously mentioned authors have argued against error-free models such as 2a, providing both theoretical and empirical evidence that these indicators likely contain measurement error.

Two alternative models that formally acknowledge and model measurement error in SES are shown in Figure 2 as Models 2b and 2c. These models are similar in that they treat SES as a latent variable. Model 1b is a one-indicator unitary model that assumes the observed variable to be an effect indicator of latent SES, while Model 2c assumes the observed variable to be a cause indicator. In Model 2b, measurement error is captured in the disturbance term associated with the indicator, whereas in Model 2c, measurement error is captured in the disturbance term associated with the latent SES variable.

Although Models 2b and 2c are desirable in that measurement error is formally recognized, the models are problematic because neither is identified. In either case, there are not sufficient degrees of freedom to estimate the model parameters. For Model 2b, if the error variance was fixed based on a plausible estimate, that parameter would not need to be estimated and the model would be identified. However, information about the error variance is often not available (Bollen et al., 2001).

Bollen et al. also discuss the repercussions of using Model 2a if Models 2b or 2c are true, which they note is common practice. If the observed variable is truly an effect indicator of SES, they state that any estimate of the relationship between SES and Y is biased. However, if in truth a causal relationship exists between the indicator and SES, the estimate of the SES-Y relationship will be consistent, as long as it is the only indicator of SES.

Ultimately, providing examples of these models in the higher educational literature is difficult. One study cited thus far (Sewell, Haller, & Straus, 1957) used a model similar to Model 2a. There were no studies that I found discussing measurement error with only one SES indicator. Although composite variables might be considered here because they are techincally single indicators, I will instead consider them in the discussion of multiple indicator methods.

Regardless, the point of emphasis about single indicator models is that any one has concerns. Those models that do include measurement error cannot be statistically identified. The model which does not assume measurement error is only appropriate if the causal view of latent SES is adopted and if the single indicator utilized is the *only* causal indicator of SES. Moreover, several authors have shown that measurement error is often present and sizable, and any one indicator will thus poorly represent socioeconomic status.

Unitary models with multiple indicators. Model 3a represents a unitary model that does not assume measurement error. In this case the researcher has used several indicators of SES, and estimated a relationship between each indicator and the dependent variable. According to Bollen et al., this is a popular, albeit contradictory approach. If SES has only one effect and is measured with relatively no error, then only one indicator of SES is necessary. This model is presented here to demonstrate an example of conflicting theory and measurement, but to also serve as a point of comparison for other unitary models with multiple indicators.

The distinction between effect or causal models of SES is best understood by considering a unitary view of SES and the use of multiple indicators. In this situation a

single latent SES variable exists and the question is whether the multiple indicators are effect indicators or causal indicators. If the indicators are considered effect indicators, the arrows in the path diagram point from the latent SES variable to the indicators as in Model 3b. If the indicators are instead considered causal indicators, the arrows point from the indicators to the latent SES variable as in Model 3c. In the effect model, the latent SES variable is a factor, whereas in the causal model, the latent SES variable is more like a principal component from a principal components analysis (PCA)[6].

Bollen and Ting (2000) provided an exercise that can be used to decide between a causal and effect model in this context. They proposed conducting "mental experiments," where one considers what would result from changes in the latent variable. For example, if a change in the latent SES variable meant that all observed indicators would change, then an effect model is appropriate. As another example, consider self-efficacy. If five items were used to represent latent self-efficacy, and an individual's level of the construct increased, one would expect some increase in all five observed variables. This is because responses to these items are caused by the latent construct.

Conversely, Bollen and Ting point out that if a change in one indicator would result in a change in the latent variable, but not necessarily a change in the other indicators, then a causal model is appropriate. Kline (2006) uses this process to conlcude that SES, as it has traditionally been considered, should in fact be modeled causally. For instance, consider the indicators of education, income and occupation. If one's income increases, one's level of SES surely increases, but one's levels of education or occupation may not change (e.g.,, consider a change in income due to an inheritance).

Model 3b depicts a unitary view of SES where multiple indicators are assumed to be caused by a single SES effect. The error terms for each independent variable represent the portion of a given indicator that is not caused by SES. This model has two primary advantages. First, because multiple indicators are used, Model 3b can be estimated where Model 2b could not. Second, because of the inclusion of multiple indicators and the modeling of measurement error, the SES-Y coefficient is not biased as it was in Model 2a.

Similarly, Model 3c represents a multiple-indicator model assuming measurement error, except here a causal model is assumed. In this case, the error term (the disturbance in latent SES) represents the variance in latent SES that is not accounted for by the given indicators. Just as with Model 2c, however, this model cannot be identified.

In the cases of Models 3b and 3c, the question again arises: What if the error-free model is used in lieu of the effect models? In fact, the results are similar to those found with single indicator models. If Model 2a is used, where X is a either a single indicator or a composite such as the NCES method, and Model 3b is the true model, the estimate capturing the relationship between SES and Y will once again be biased.

As SES has traditionally been viewed, it is hard to argue that the indicators are indeed effect indicators. Because a stronger argument can be made for the treatment of indicators as causal indicators, Model 3c is more appealing. In Model 3c, however, which displays causal indicators, the model can again not be identified. However, if Model 3c is the true model and Model 2a is estimated, estimates of SES' effect on Y will be consistent. Given that most researchers chose to use regression based methods that do not include considerations for measurement error (that is, use Model 2a), this is of extreme

importance. This signifies that, as long as a causal model is true, these methods can obtain a reasonable estimate of the relationship between SES and Y. Thus, in choosing between two models that include measurement error or hypothesizing about the true model, it is imperative to consider the relationship between the latent and observed variables (Edwards & Bagozzi, 2000).

Once again, I will withold a discussion of applied studies in higher education using the Model 3a until the following section, since this is actually a component model[7]. In looking for studies similar to Models 3b and 3c, it is difficult to identify any examples in the research. Any study that has used a composite variable might fall under these classifications, but none of the studies reviewed here provided a theoretical discussion of measurement error, even when they acknowledged its existence. Even the studies published by Sewell and his colleagues that used a "factor-weighted combination" of several SES indicators did not provide a description of their methodology sufficient to infer their hypotheses about the direciton of causality.

Component models with multiple indicators. If Figure 3a is considered under a component perspective of SES, it depicts a model in which each variable represents, without measurement-error, one effect of SES on Y. Figure 4b similarly assumes that there are multiple effects of SES, but that the variables elected used to represent these effects contain measurement error, and that levels of those variables are caused by these SES components (an effect model). The measurement model used in Figure 4c is similar to that in 4b, but assumes the opposite direction of causality: the SES variables cause latent SES.

Although Models 4b and 4c are desirable in that they both adopt a component view and take into account measurement error, neither model is identified. As with Model 3b, error variances in Model 4b could be fixed if the values are known, but this a rarely the case in practice. The only model that can be estimated of those models that adopt a component view is therefore Model 3a. Again, it is worthwhile to understand the implications of fitting Model 4a if Models 4b or 4c are true. If a researcher were to measure SES in accordance with a component view, but fail to include the likely existence of measurement error, the repercussions again depend on the nature of causality. If an effect model is the true model, then (as with Model 3b) the estimates will be inconsistent. However, if Model 4c is the true model, then the estimates found by using Model 4a are consistent, a finding which Bollen et al. refer to as "remarkable."

Perna and Titus (2005) used a measurement model similar to Model 4a. Using a social capital framework, they used family income and perceived costs as indicators of social capital, parents education and expectations as indicators of cultural capital, and several parental involvement variables as indicators of social capital. They did not, however, consider measurement error in their model. Even so, this is one of the more thorough considerations of SES measurement that is available in literature, particularly that focusing on higher education. No studies were available that employed a measurement model similar to Models 4b or 4c (but since Model 4c cannot be estimated, this is not surprising).

Conclusions about theoretical and measurement models. Bollen et al. provided a thorough discussion of the interplay between SES theory and measurement. Although their work took place in the framework of fertility and child health research, and others

have taken place in other fields (e.g., Bravemen et al. in medicine), such a thorough review of practice and implications has not occured in educational research. Nevertheless, a great deal stands to be learned from such analyses.

The overall lesson is broad but critical: researchers need to thoroughly consider the theoretical nature of SES and the implications for measurement practice. It appears that this is not standard procedure in higher education research. If it is, it is not clearly conveyed or discussed in the literature.

Specifically, researchers should always address four issues when designing studies of involving socioeconomic status. First and foremost, they must determine if SES has one effect (a unitary view) or several unique component effects (a component view). They must also determine how many variables they will use to represent SES, regardless of its hypothesized structure. Based on the extant literature, measurement error is likely an issue and researchers should consider that when measuring and modeling SES. Furthermore, researchers should explain how ignoring measurement error can impact their results. Along with considerations of measurement error, researchers must give thought to the nature of causality between latent SES and its manifest indicators. If the indicators are caused by latent SES (an effect model), then estimates found using regression analyses that do not include measurement error will be inconsistent. This is not the case if the indicators are considered to cause SES.

In synthesising the research presented here, suggestions for answers to Bollen et al.'s four questions become apparent. First, social capital theory suggests that a component perspective seems a more likely structure for SES, given the potential for differential impacts of social, cultural, and economic capital. Accordingly, multiple

variables would be necessary in order to capture these components. Because such strong

theoretical and empirical evidence has been presented to demonstrate the existence of

measurement error, it is also important that researchers strive to model error in their

studies.

Finally, when using social capital theory as a guide for structuring SES

measurement, I would conclude that the indicators often used to represent SES are likely

effects of latent SES. For example, Perna and Titus (2005) included multiple indicators

for each of the aspects of social capital theory. Economic capital was represented by

family income, perceived importance of costs and aid, and perceived importance of living

expenses. Cultural capital was represented by parents' education and parents' educational

expectations. In both of these cases, a change in all of the indicators accompanying a

change in the latent variable is quite plausible.

Although an effect model opposes the viewpoints of Kline (2006) and Bollen et

al. (2005), their recommendations were based upon a traditional, unitary view of SES. If

SES was considered a unitary effect comprised of education, occupation, and income,

then a causal model has intuitive appeal. One would not expect an increase in education

to be accompanied by an increase in occupation and/or income. However, this is not

because a causal model is true, but rather because these are distinct components. Instead,

education, occupation, and income, under social capital theory, must be viewed as

indicators of different kinds of capital.

Certainly, this is an empirical debate that can be researched in further study.

Regardless of which is the "true" model, researchers should at least attempt to posit their

own justificaitons for a method of measurement when conducting research. Conversely,

they should understand that different measurement methods imply different perspectives and functions of SES. At present, the most popular empirical method (the NCES composite) and theoretical stance (social capital theory) find themselves at odds. Other relevant issues, namely the existence and prevalence of measurement error and the relationship between manifest indicators and their latent variables, are rarely considered. In an ideal situation, studies of SES and education would address these issues as well.

Categorization of SES. Another issue in SES measurement deals with how information is *scored*, rather than how the variable is measured or defined. Instead of treating SES as a continuous variable, many authors chose to categorize SES into quartiles or quintiles, comparing the highest and lowest groups. MacCallum, Zhang, Preacher, and Rucker (2002) demonstrated how such transformations of continuous variables typically have negative consequences, such as inaccurate effect sizes, loss of power or spurious statistical significance, and the loss of measurement reliability.

White (1982) and Sirin (2005) both looked at the implications of restricting SES, primarily by creating a dichotomy or groups (such has "low SES" vs. "high SES") from a continuous variable. White coded each study according to the number of SES groups (using 9 for continuous studies) and correlated that value with the SES-achievement correlation. He found a rather small relationship when student-level measures of SES were used ($r=.013$), but a larger effect when aggregate (i.e. school or community-level) measures of SES ($r=.127$).

Sirin (2005) grouped studies into three groups. In the first group, he reviewed 102 studies which dichotomized SES into high and low groups. In the second group, 15 studies coded SES into between three and seven groups. In the third group, the remaining

78 studies used continuous SES variables. He found significant variance in the average SES with achievement relationship among the three groups, with means of .24, .28, and .35, respectively. Unlike White, Sirin only compared studies using student-level measures of SES.

Aggregate measures of SES. Once again, White (1982) and Sirin (2005) provided the best empirical evidence of the importance of aggregate (school or neighborhood) measures of SES, and their emphasis on the importance of this issue has already been presented here. Specifically, White found that the average correlation between SES and achievement at the student level was .245, yet the average correlation at the aggregate level was .680. As in other cases, Sirin (2005) found similar results, claiming that the effect size for aggregated studies was double that of student-level. The importance of aggregate measures was also emphasized by Bravemen et al.'s (2005) research in health outcomes.

Moreover, White stated that this difference in measurement moderated some of the effects of measurement method. For example, the correlation between the number of variables used to measure SES and the SES-achievement relationship was .308 in studies using student-level data, but -.287 in all studies (those studies using aggregate measures, student-level measures, as well as those in which the measurement was confounded). In other words, these findings demonstrate that not only does it matter how you measure SES, but it matters *differently* (almost the opposite effect) if one were to use the student as the unit of measurement as opposed to the school or neighborhood.

Conclusion of literature review. Thus far, three important issues have been demonstrated by reviewing the existing literature. First, socioeconomic status has been

shown to relate to several outcomes in higher education. Using a variety of populations, theoretical frameworks, and methods of analysis over the better part of a century, researchers in education, psychology and sociology have shown a relationship between SES and educational aspirations, access to higher education, college experiences, persistence, and degree attainment.

Second, researchers have used varying methods to define and measure SES in these studies. Studies have occasionally used a single indicator, such as parental income, to indicate a student's socioeconomic background. Most commonly, educational researchers will use a composite of SES variables, typically parental income, occupation, and education. Despite empirical evidence that supports the use of aggregate measures of SES, research in higher education has largely failed to use aggregate data to explain the effect of SES on achievement in college.

Third, a litany of studies has uncovered some common issues in measuring SES. Much of the data gathered in SES research, particularly those taken from students, are rife with missing and possibly inaccurate data. Also, not only have studies varied in their definition of SES, but this variance has shown systematic differences in findings based on the operationalization of SES. Furthermore, a thorough review of possible measurement models shows that researchers often do not give careful consideration to the measurement and structure of SES in educational research. Another methodological issue, the categorization of SES, has been shown to attenuate the relationship between SES and academic achievement. In addition, including school or neighborhood-level information has the potential to drastically change the magnitude and possibly the direction of the relationship between SES and educational outcomes.

These findings have not come without recommendations and directions for future research. When gathering SES data, reliability should be a primary concern. Thus, one should consider the source of the data (e.g., parents vs. students) as well as the use of multiple indicators in order to increase measurement consistency and accuracy. Other issues focus on the validity of the inferences made from SES data. Researchers need to carefully consider both the structure of SES and, given that data likely contain measurement error, the relationship between latent SES and any observed indicators. Also, the influence of schools or geographic area should be included in SES models through the use aggregate SES measures.

The current study sought to explore several of these issues. Using parental education, occupation, and income, unitary and component models were tested and compared to determine the difference of these two models in predicting higher educational outcomes (Research Question 1). Second, the models used to test Research Question 1 were compared to those using dichotomized measures of SES to determine the effect of grouping SES information (Research Question 2). Third, aggregate measures of income, education, and occupation were used to explore the predictive utility of higher-order information (Research Question 3).

CHAPTER THREE

Methods

Regression, both non-hierarchical and hierarchical, was used along with data from 876 college freshman at a single institution in 2002 and 2006 to address the following four research questions (RQs):

1) Do component models of socioeconomic status predict first year GPA better than unitary models?

2) Does the use of categorical SES variables, as opposed to continuous SES variables, decrease our ability to predict first-year GPA?

3a) Does a model using only aggregate measures of socioeconomic status predict first-year GPA significantly better than a model using only student-level measures of SES?

3b) Does the use of aggregate measures of socioeconomic status significantly predict first-year GPA after controlling for student-level predictors of SES?

To explore these questions, the outcome variable of first-year grade-point average (FGPA) was examined and various indicators of SES were utilized. The first and second RQs utilized parental occupation, parental income and parental education as student-level indicators of SES. To address the first RQ, the fit and predictive utility of unitary models, which consisted of either a single predictor or a single composite created from many predictors, were compared to a component model, which included all three student-level indicators as predictors of FGPA. To address the second RQ, the models utilized for the first RQ were reanalyzed, but with the predictors categorized using median-split

techniques. The fit and predictive utility of the models with categorical predictors were compared against those with continuous predictors.

Because it was hypothesized that the component model including continuous predictors would yield the best fit to the data, only continuous predictors and component models were utilized to address research questions 3a and 3b. To explore the effects of aggregate measures of SES in the third research question, hierarchical linear models (HLM) were used, allowing the similarities and differences among students associated with the neighborhood from which they matriculated to be explicitly modeled. Aggregate measures of SES at the neighborhood level, which were selected to mirror the education, occupation and income variables at the student level, included the percent of the population having their bachelor's degree, the percentage of the population in the labor force, and the median income of the neighborhood. The fit of the model including these three aggregated predictors was compared to a component model, similar to that used to address the first RQ, which included only student-level indicators of SES.

Finally, the extent to which the fit of the models is improved when using both student-level and aggregated indicators of SES was explored using HLM. If this model fit substantially better than that of the other models, then it is plausible that neighborhood-level SES has an effect on FGPA above and beyond the effect of individual SES.

To compare the fit and predictive utility of all models - both non-hierarchical and hierarchical - with one another, full maximum likelihood estimation using the MIXED procedure in SAS was used for the analyses. Model deviance (-2LL), percentage of variance in FGPA accounted for, and information criteria (AIC, BIC) were used as indices of model fit and predictive ability. In the discussion to follow, all models are

presented using HLM notation in order to illustrate for the reader the similarities among the models.

Participants and Procedures

Data were taken from 876 first-year students from the 2002 and 2006 incoming classes at a mid-sized, public university in the southern United States. All of these students were full-time, degree seeking students who first enrolled in the Fall semester. Although this excludes part-time and transfer students, it does include those students who received college credit during high school or took college courses in the summer preceding enrollment. Initial survey data were collected during the Summer Orientation Program, which is attended by over 95% of incoming students annually. (Because part-time and transfer students did not participate in this orientation, data were unavailable and they were excluded from this study.)

Along with student-level SES variables, social security number (SSN) and reported home zip code were the only variables in the data set provided. However, demographic characteristics of the total 2002 and 2006 samples were provided with the data, and are available in Table 2. Both populations were predominantly female (57.8% in 2002 and 58.3% in 2006). As would be expected with a population enrolling for the first time, a majority of the sample was 18 years of age (57.2% in 2002 and 64.2% in 2006). In regards to race/ethnicity, White/Caucasian comprised the largest group by far (90.5% in 2002 and 91.9% in 2006).

Although the total available sample size was 2,308, missing and incorrect data reduced the usable sample size to 876. Cases were eliminated for several reasons. First, since students were not required to provide any responses, missing SSN or home zip code

data eliminated students from the analyses because they could not be matched to FGPA or aggregate measures of SES, respectively. In addition, some SSNs and zip codes were provided, but incorrect, and thus could not be matched. Finally, to ensure that the same sample was used across models, only students with complete data on all student-level SES variables were retained.

FGPA data were provided by the university's Office of Institutional Research. In order to prevent the release of individual student grades, the Office was provided with a data set containing all independent variables, SSNs, and home zip codes. FGPAs were then queried and attached to the data set. However, SSNs were removed before the data were returned, preventing individual identification.

Measures

Cooperative Institutional Research Program (CIRP) Freshman Survey. Survey data for this study were taken from the 2002 and 2006 administration of the Cooperative Institutional Research Program (CIRP) Freshman Survey. This survey, administered annually to over 400,000 incoming students at over 700 institutions of higher education, is generally designed to "gather information on the characteristics of incoming freshmen," using questions about "a broad array of student issues including secondary school experiences, reasons for college attendance, college expectations, degree aspirations, values, attitudes, and personal goals" (Higher Education Research Institute, 2009). The current study used three variables from this survey as indicators of SES: parental education, parental occupation, and parental income.

Student-level SES indicators. Parental income was represented by students' responses to the following question: "What is your best estimate of your parents' total

income last year? Consider income from all sources before taxes." Students responded on a 14-point ordinal scale, ranging from "Less than $10,000" to "More than $250,000." This question and the potential responses were identical in the 2002 and 2006 administrations of the survey.

Parental education was measured by students' responses to two questions, one for each parent. The question stem was posed, "What is the highest level of formal education obtained by your parents?" with responses ranging from 1, "Grammar School or Less," to 8, "Graduate degree." Per the recommendations by authors such as Entwistle and Astone (1994), the higher of these two variables was used to represent the highest level of education in the student's household. Once again, the question and the response options were identical in 2002 and 2006.

To indicate parental occupation, students were given a list of 43 options, as well as "Other" and "Unemployed," all of which had a response option to indicate mother's occupation and/or father's occupation. As with education, the higher of the two values was used to represent the highest level available in the household. In order to quantify parental occupation, occupational prestige scores, most recently updated by Nakao and Treas (1994), were used. The NCES uses the Nakao and Treas scores in their methodology, though using only 16 categories as response options (NCES, 2002).

The procedure of transforming these 43 job responses into occupational prestige scores was a difficult one. Nakao and Treas list well over 400 occupational classes, many with several specific job titles contained within. The occupational prestige scores, overall, range from 22 (private household cleaners, cooks, and staff) to 97 (physicians). However, one of the CIRP responses, "College teacher," has no direct parallel. In fact, there are 31

professorial job titles (varying by the subject taught) that range in occupational prestige from 71 to 94. Similar situations were encountered with the following responses: Clerk, Business Sales, Engineer, Law Enforcement, Scientist, Skilled Trades, and Therapist. In these cases, the mean of the occupational prestige scores for relevant job classes was used. Although this is not the perfect resolution to this issue, it certainly exemplifies some of the difficulties with occupational prestige that have been mentioned already.

In addition, several occupational responses provided no occupational prestige score. For example, those listed as unemployed or homemaker, under Nakao and Trace's framework, have an occupational prestige score of 0, since they have no occupation. Furthermore, Nakao and Treas intentionally omit any military classifications. In many cases, this issue was avoided because only one parent fell into a one of these categories, and the occupational prestige score of the other parent served as the maximum value. However, if, for example, a student had one parent who was a homemaker and one who was in the military, she would have a parental occupational value of zero. Ultimately, this highlights some of the measurement issues with occupational prestige.

Table 3 contains a list of the occupational response options for the CIRP survey, the Nakao and Treas job classification that was used here, and the corresponding occupational prestige score. See Appendix A for the items and response options for the parental education, occupation, and income items.

Neighborhood and neighborhood-level SES indicators. Rather than aggregate student responses, all neighborhood-level indicators of SES were obtained through the American FactFinder, provided by the United States Census Bureau (United States Census Bureau, 2009). Three higher-level indicators were used: median family income,

percentage of the population with a bachelor's degree or higher, and percentage of the population in the labor force. These indicators are designed to mirror the income, education, and occupation information obtained at the student-level.

"Family income" is defined by the total annual earnings by all members of a family, which in turn is defined as all those living in one household who are related. The "percentage of the population with a bachelor's degree or higher specifically" refers to the percentage of the population over the age of 25 that possesses a bachelor's, master's, professional, or doctoral degree. "The percentage of the population in the labor force" refers to the percentage of those over the age of 16 who are either employed or unemployed, which includes those either actively looking or available for work.

First-year GPA. First-year grade-point average (FGPA) was used as a general indicator of student success. Given the present study's lengthy discussion of measurement issues in SES, it would be negligent to omit a discussion of similar issues that have been demonstrated with grades. Many authors have noted the subjectivity, unreliability, and varying purposes and interpretations of grades (e.g., Allen, 2005; Brookhart, 1993; Burke, 2006). Nevertheless, GPA has been prevalently used as a general indicator of student success in a variety of research (e.g., Bridgeman et al., 2000; Coyle & Pillow, 2008; Ting, 2008), which is how it shall be employed here. Indeed, first-year GPA has been the dependent variable of choice in studies designed to provide validity evidence for the SAT and other predictors of college success (e.g., Kobrin et al., 2008, Mattern et al., 2008). In order to support the use of FGPA in the current study, a comparison was made, using data from the institution of interest, between students who returned from Fall 2008 to Fall 2009 and those who did not. On a four-point scale, non-

returning students had an average FGPA of 1.40, while returning students had an average FGPA of 2.84 ($d = 1.65$).

FGPA values were provided by the university's Office of Institutional Research. Potential values range from 0 to 4.0, and were calculated by averaging the grade points received in each class over each student's first year of courses (weighted for the number of credits per course).

Data Analysis

Before analyzing any hypotheses, several steps were taken to ensure data quality and the satisfaction of the assumptions held by the statistical methods used here. First, the data were screened for univariate and multivariate outliers, as they can have sizable and unpredictable influences on results. Per the recommendations of Tabachnick and Fidell (2001), univariate outliers were sought using z-scores and box plots. Multivariate outliers were examined using Mahalanobis distance and Cook's distance.

The distribution of each variable was explored using descriptive statistics and histograms. In addition to examining the descriptive statistics and distributions of each variable, the bivariate correlations among the variables were estimated. Correlations between each predictor and FYGPA provided insight into the regression results and scatter plots of these relationships indicated the appropriateness of assuming linear relationships in the regression models.

The final step before interpreting any analyses was to ensure that certain regression assumptions had not been violated. Plots of observed residuals were inspected to determine if the regression variate was linearly related to FGPA. The homogeneity of variance assumption was checked by reviewing Lowess curves to ensure that residuals

were evenly distributed across all levels of the regression variate. Regression procedures also assume that the residuals are normally distributed, which was examined by looking at histograms and QQ plots of the residuals.

Research question 1 (RQ1). The statistical models for all research questions are contained in Table 1. RQ1 explored whether component models of SES predicted FGPA better than unitary models. In order to test this, five models using student-level data were used, with four of the models capturing the unitary conceptualization and one model representing the component conceptualization. In each of the four unitary models (Models 1-4), Y_{ij} represents the FGPA. The single student-level indicator of SES – Inc_{ij} for income, $Occup_{ij}$ for occupation, $Educ_{ij}$ for education, and $Comp_{ij}$ for the equally weighted composite of those three variables – represents the level of that indicator for student i from neighborhood j.

Although this model is written as a HLM in Model 1, the intercepts and slope coefficients were not allowed to vary at Level 2, meaning that the same intercept and slope coefficients (γ_{00} and γ_{01}, respectively) capture the relationship between the variables for all students. In other words, the nesting of students in neighborhoods was not taken into account in this model since both the coefficients are fixed at Level 2.

These single predictor models represent unitary conceptualizations of SES, as shown in Figure 2*a*. The unitary models consisting of parental income, parental education, and parental occupation are referred to as Models 1, 2, 3, respectively. Model 4 represents a composite method of SES calculation, somewhat similar to that employed by the NCES. Parental education, occupation, and income were standardized and equally

weighted to form a composite. This composite, however, still represents only one effect of SES on FGPA.

The performance of these four models was compared to one another and to that of Model 5, a component perspective of SES, which included parental education, occupation, and income as three separate predictors of FGPA. In essence, multiple regression, similar to Model 4, makes a composite of these variables as well (the variate). However, the weights used to determine the variate are empirically determined by the unique variance accounted for by each predictor. It is because of this empirically determined weighting (rather than assuming an equal relationship between each SES variable and FGPA) that Model 5 was hypothesized to fit better than Model 4.

Research question 2 (RQ2). RQ2 investigated the impact of categorizing SES indicators. Thus, all of the models used in RQ1 were re-run, using simplified measures of SES. Instead of using the existing continuous (or in some cases ordinal) measurements, each of these variables was dichotomized using a median split. In the case of Model 4, in which the equally-weighted composite was used, the composite was first calculated and the composite scores were dichotomized.

This created two groups, "high-SES" students and "low-SES" students. After inspecting plots of the residuals for assumption violations, these results were contrasted with those from models using continuous variables. Unitary models with the categorical predictors of parental income, parental education, parental occupation and the SES composite are referred to as Models 6, 7, 8 and 9, respectively. The component model consisting of categorical indicators is referred to as Model 10 (see Table 1).

Research questions 3a and 3b (RQ3a and RQ3b). One of the assumptions of
MR models is that the residuals are independent, which is commonly violated when the
data are naturally grouped, or nested. In educational research, data are often nested in
classrooms, schools, or other existing frameworks. Hierarchical linear modeling (HLM)
is one method that is well suited to account for this assumption violation. HLM explicitly
models the nesting of students in higher-level units (such as neighborhoods) and in doing
so, is an incredibly useful tool for examining the effects of predictor variables collected at
different levels of the hierarchy. For this reason HLM was used to address RQ3a, which
examines the ability of higher-order SES indicators to predict FGPA, and RQ3b, which
explores whether the common variance among students from similar areas (represented
by zip code) contributed to the prediction of FGPA above and beyond information at the
student-level.

To determine the within-neighborhood similarities among students, several
models were compared. First, an intercept-only model (Model 11 in Table 1) was fit to
the data. Again, Y_{ij} represents FGPA for student i from neighborhood j. Because there are
no predictors in the model, the Level 1 intercept, β_{0j}, represents the average FGPA for
students in neighborhood j. At Level 2, the β_{0j}s are modeled as a function of an overall
intercept, γ_{00}, which is the average predicted FGPA across all neighborhoods, and u_{0j},
which is an error term representing the difference between the average predicted FGPA
for a given neighborhood, j, and γ_{00}. The variance of u_{0j} is considered Level 2 (between
group) error, or the amount that neighborhoods differ in their average predicted FGPA.
Finally, r_{ij} represents the difference in student i's predicted FGPA from his or her
neighborhood's average predicted FGPA. The variance of r_{ij} is considered Level 1

(within group) error, or the amount that students differ from their neighborhood's average predicted FGPA.

To the extent that the variance of u_{0j} is high, HLM methods are more appropriate because students from the same neighborhood have more similar FGPAs than students from different neighborhoods. In order to quantify this, the intraclass coefficient (ICC) is used. This is the proportion of total variance in FGPA that is accounted for by neighborhood membership. If the ICC indicates a dependency among students from the same neighborhood, the second HLM (Model 12; see Table 1), using the three previously used student-level indicators of SES, is appropriate.

The only difference between Model 12 and Model 5 is that the former incorporates the neighborhood effect into the model by allowing the intercepts to vary across neighborhoods. Thus, Model 12 differs in that it effectively accommodates the possible independent observation assumption violation due to the nesting of students in neighborhoods.

The third HLM (Model 13 Table 1) fit to the data was used to explore the effects of only aggregate or neighborhood-level indicators of SES, and thus answer RQ3a. These indicators enter the model at Level 2 since they are characteristics of the neighborhood (Level 2) not the individual (Level 1). To answer RQ3a, the fit and explanatory power of the Model 12 (which includes only individual-level indicators of SES) was compared to Model 13 (which includes only neighborhood-level indicators SES).

Finally, the fourth HLM (Model 14 in Table 1) is referred to as a contextual model. Since Level 1 and Level 2 indicators may represent different factors, contextual models determine if the relationship between SES and FGPA is the same at the individual

and neighborhood levels (Enders & Tofighi, 2007). For example, Level 1 SES may represent the family resources a student could access in attending, persisting and succeeding in college. Level 2 SES, however, may indicate the quality of schools that a student attended. As such, these two types of indicators may have quantitatively or qualitatively different relationships with FGPA.

Model 14 demonstrates how contextual models include both individual and aggregate indicators of SES as predictors of FGPA. This allows the ability to assess if Level-2 predictors contribute to the prediction of FGPA beyond Level-1 predictors. Ultimately, RQ3b was answered by evaluating the relative performance of the Model 14. In other words, does a model using student and neighborhood-level SES predict FGPA *significantly better* than a model using only student-level data or only aggregate-level data?

Indicators of Model Performance

Considering all models, both hierarchical and non-hierarchical, in an HLM framework not only facilitates their explanation, but provides a common set of criteria by which they may be judged. These measures are deviance, information criteria, and variance accounted for statistics.

Likelihood ratio test (LRT). Deviance is a measure of model misfit, represented by the -2 log likelihood (-2LL) of a model. There are no established criteria or cutoffs for deviance. In addition, as variables are added to a model, the amount of deviance will always decrease. Therefore, using the -2LL as an indicator of model performance is of little value. Instead, the value of deviance is in its ability to compare two nested models. Differences in -2LL follow a chi-square distribution, and can thus be tested using the

likelihood ratio test (LRT). The likelihood ratio test determines if the increase in fit of a more complex model is statistically significant.

In order to compare -2LL's using the likelihood ratio test, two models must be nested, meaning that the restricted model can be obtained from the full model by placing constraints on some of the full model's parameters. In the current study, this is applicable for RQ1 when comparing Models 1, 2, and 3 (student-level, unitary, single indicator models) to Model 5 (student-level component model), since the unitary models are formed by constraining parameters in the component model to zero. This is also applicable for the same reason in RQ2 when comparing Models 6, 7, and 8 (student-level, unitary, single indicator models) to Model 10 (student-level component model). The LRT was also used to compare the fit of Models 12 and 13 with Model 14 as the former two models are both nested within the latter.

Information criteria. In order to fully answer the research questions in this study and to compare the relative fit of all models with one another, information criteria indices were utilized. Information criteria, such as the AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion), can be used to compare the fit of both nested and non-nested models. Both of these are a function of the deviance that favors more parsimonious models. Specifically, both indices apply a penalty to the deviance statistic for the number of parameters being estimated. The BIC's penalty differs from the AIC in that its penalty depends on sample size with the penalty per parameter increasing as sample size increases. Smaller values of the AIC and BIC indicate better model fit. The AIC and BIC have the additional advantage that they are less influenced by sample size

than the likelihood ratio test (which is, as are most significance tests, heavily influenced by sample size).

Proportion of variance explained. R^2 is an easily interpreted, commonly used, and standardized effect size for multiple regression models, used to quantify the predictive utility of a model. Formally known as the squared multiple correlation, R^2 is the proportion of variance in the dependent variable accounted for by the best linear composite of the independent variables in a given model. In non-hierarchical models, calculating R^2 is relatively straightforward and the statistic can be acquired by utilizing the error variance of the model of interest (σ_f^2 = error variance of the fitted model) and the error variance of a baseline model (σ_b^2 = error variance of the baseline model), which is typically a model without any predictors:

$$R^2 = (\sigma_b^2 - \sigma_f^2)/\sigma_b^2 \tag{1}$$

A non-hierarchical model without any predictors (referred to as Model 0) served as the baseline model in calculating the R^2 for all non-hierarchical models (Models 1-10). In this baseline model, the error variance, σ_b^2, is equal to the variance of FGPA. Thus, the numerator in Equation 1 represents the variance explained by the predictors in the full model and denominator represents the variance of the dependent variable. This results in the R^2 value being equal to the proportion of total variance in the dependent variable explained by the predictors in the full model. Another interpretation of the statistic is that it represents the proportion reduction in error variance attributable to the addition of the predictors in the full model.

The predictive utility of hierarchical models is not quantified as simply. As McCoach and Black (2008) pointed out, because there are Level 1 and Level 2 error variances (σ^2 and τ_{00} respectively), R^2 must be calculated for each level. Thus, for each hierarchical model in the current study two R^2s were computed: a Level 1 R^2 capturing the reduction in within-neighborhood variance attributable to the predictors, and a Level 2 R^2, capturing the reduction in between-neighborhood variance attributable to the predictors. As with non-hierarchical models, the error variances of a baseline model and a fitted model are needed to calculate the R^2 statistics. The baseline model typically consists of no predictors or a subset of the predictors being used in the fitted model. The Level 1 R^2 is calculated as:

$$\text{Level 1 } R^2 = \frac{\sigma_b^2 - \sigma_f^2}{\sigma_b^2} \tag{2}$$

and the Level 2 R^2 as

$$\text{Level 2 } R^2 = \frac{\tau_{00b} - \tau_{00f}}{\tau_{00b}} \tag{3}$$

where the b and f subscripts for the variance components refer to the baseline and fitted models, respectively.

In the current study, Model 11 served as the baseline model when calculating the Level 1 R^2 for Model 12, which represents the proportion reduction in within-neighborhood variance when using student-level indicators of SES to predict FGPA.

Because Raudenbush and Bryk (2002) recommend against the comparison of τ_{00} between models with different level-1 specifications, the estimates of τ_{00} from Models 11 and 12 were not compared and the Level 2 R^2 for Model 12 was not calculated.

Model 11 also served as the baseline model when calculating the Level 2 R^2 for Model 13, which represents the proportion reduction in between-neighborhood variance when using neighborhood-level indicators of SES to predict FGPA. Because indicators of SES in Model 13 are all neighborhood-level indicators, the estimates of σ^2 from Models 11 and 13 should not differ. Therefore, the Level 1 R^2 for Model 13 was not calculated.

Model 11 served as the baseline model when calculating both the Level 1 and Level 2 R^2s for Model 14. Because both student-level and neighborhood-level indicators of SES are included in this model, both σ^2 and τ_{00} should be reduced in this model compared to the baseline model.

CHAPTER FOUR

Results

Data Screening

As mentioned, the sample used for the present analyses consisted of 876 students. However, these data were available after considering an initial sample of 2,314 from the 2002 and 2006 administrations of the CIRP. Table 4 outlines how missing data resulted in the elimination of 1438 (62.1%) of the cases. Most of the variables under consideration had reasonable response rates, ranging from 88% to almost 99%. However, student social security numbers were only provided by 67.5% of students in 2002 and 35.4% in 2006. Since, students could not be matched to FGPA without SSNs, a large portion of the original sample was removed from consideration. After considering the missing data in other variables, the final sample of 876 represented 38% of the original sample.

Using box plots and z-scores, none of the data represented univariate outliers. Moreover, Mahalanobis distance and Cook's distance were used to screen for multivariate outliers, where again none were present. Variables were then examined for non-normality. Using Kline's (2005) benchmarks of 3 and 7 for skewness and kurtosis, respectively, none of the variables appeared to be univariate non-normal. Examination of the Mardia's coefficient showed that multivariate normality was also not a concern.

All assumptions, with the exception of the normality of residuals, appeared to be satisfied for these models. The normality assumption was violated because of the large number of zero values for FGPA, which are over-predicted by each model. Since violating this assumption typically leads to increased standard errors only when small sample sizes are used, it was believed that the large sample size used here made the effect

of this violation inconsequential. In addition, ancillary analyses were conducted, removing cases with zero values for FGPA and parental occupation, and similar results were found.

Descriptive Statistics

Distributional characteristics of FGPA and predictors. Table 5 outlines the descriptive statistics for FGPA and all independent variables. For FGPA, a mean of 2.51 indicates that most students had an average grade of a B or C. Also, the standard deviation of 1.14 indicates a sizable amount of variance in the dependent variable, given the 0 to 4 range that was available.

Inspection of the frequency distributions revealed a large number of cases with a value of zero for FGPA as well as parental occupation. Figures 5 and 6 present the frequency distributions for FGPA and parental occupation, respectively. For FGPA, zero values were used when students either failed-out or drop-out of school. For occupational prestige, zero is used to represent anyone who is unemployed or a stay-at-home parent. In both of these cases, a zero may accurately represent an individual's level for that variable. However, given the frequency with which withdrawing from college courses, unemployment, and being a stay-at-home parent occur, each of these variables can easily become non-normal and disrupt the results of regression analyses. [8]

As was the case with FGPA, there was also substantial variance in all of the independent variables. Students' average reported parental income was roughly 8, which represented $50,000-$59,999 per year on the CIRP scale. The average for parental education was roughly 5, equal to "some college" on the CIRP response scale. Finally, the average parental occupation score was equal to 52.56, slightly above sales and law

enforcement positions and slightly below dietitian and musician on the Nakao and Trace (1994) occupational prestige scale.

For all three student-level variables, the median values were included in Table 5 to indicate where these variables would be split for models related to Research Question 2. The medians and means for parental income and education were relatively similar. For parental occupation, however, the median was slightly higher (64.00), equal to Nakao and Trace's job classification of "Managers and Administrators." The difference between the median and mean for parental occupation reflects the negative skewness of the variable caused by the large number of zero values.

Table 5 also displays descriptive statistics for neighborhood-level indicators of SES. The average median income of $51217.40 corresponds with the average parental income of $50,000-59,999. However, there was a large amount of variance in median income, ranging from roughly $16,000 to over $100,000. Neighborhood indicators of education and occupation saw similar variance. The percentage of the population with a bachelor's degree or higher averaged 19.8%, but ranged from less than 2% to over 60%. The percentage of the population in the labor force averaged 65.5%, but ranged from less than 40% to almost 80%.

Correlations. Table 6 contains the bivariate correlations among student-level variables, neighborhood-level variables, and FGPA. As one would hypothesize, all inter-correlations are positive. The student-level variables are all moderately related to one another, with Pearson's r values ranging from .304 to .441. This level of covariance signifies that these variables are moderately related, but not to the extent that would create concerns about multicollinearity. In addition, the phi coefficients for the

dichotomized versions of each student-level variable are presented in parentheses in Table 6, and follow a pattern similar to their continuous counterparts. As would be expected, the correlations among the dichotomized predictors are lower than the correlations among their continuous counterparts.

The aggregate predictors, however, were somewhat more strongly related to one another. Although the relationship between the percentage of the population with a bachelor's degree and the percentage of the population in the labor force is moderate ($r =$ .431), the high magnitude of the other two correlations may cause issues of multicollinearity, which will be discussed later.

Interestingly, the student and neighborhood-level predictors were relatively unrelated. Among the nine correlations, the highest relationship existed between parental education and percentage of the population with a bachelor's degree ($r = 0.219$), while the weakest relationship was between parental occupation and the percentage of the population in the labor force ($r = 0.009$), which were almost wholly unrelated. The other two matched variables, parental income and median income, saw a small relationship as well ($r = 0.154$). Overall, these results suggest that the student and neighborhood-level measures of SES represent rather different things.

The bivariate correlations between the predictors and FGPA provide some insight into the overall relationship between SES and FGPA. The relationships between FGPA and parental income ($r = .087$), parental education ($r = .086$), parental occupation ($r = .076$), and the SES composite ($r = .110$) were all positive but very small. Again, the phi coefficients for the dichotomous versions of each student-level variable mirrored the results of the continuous variables. As expected, the correlations between FGPA and the

dichotomous versions of each student-level variable were lower than their continuous

counterparts.

Similar results were found with the neighborhood level variables, where FGPA

was only slightly correlated with median family income ($r = .077$), percentage of the

population with a bachelor's degree ($r = .050$), and percentage of the population in the

labor force ($r = .030$). Interestingly, the correlations for neighborhood level variables are

somewhat weaker than their student-level counterparts.

Neighborhood size. The 876 students who composed the final sample

represented 177 neighborhoods. Table 7 displays the frequency of neighborhood size, and

indicates that a large number of neighborhoods contain 1 ($k = 85$) or 2 ($k = 28$) students.

In fact, 89% of the neighborhoods have fewer than 10 students. Although this may appear

as an issue of concern, two sources state otherwise. First, because information was

gathered at the zip code level, and not merely aggregates of sample data, within-group

estimates of neighborhood-level SES variables would not become more stable as within-

group sample sizes increase. Morevoer, Maas and Hox (2007) noted that only the number

of level-2 groups (in this case, neighborhoods) influences accurate parameter estimation,

and not the sample size per group.

Research Question 1 (RQ1): Unitary vs. Component Models

Research Question 1 explored the relative predictive ability of unitary (Models 1-

4) and component models (Model 5) of socioeconomic status. Although it was

hypothesized that component models of SES would predict FGPA better than unitary

models, none of the models used here predicted FGPA with any sort of practical

significance. Thus, even though the model fit and variance accounted for will be

reviewed for each model, it is critically important for the reader to understand that *no meaningful relationship was found between SES and FGPA, regardless of how SES was conceptualized*.

Table 8 provides fit information (-2 log likelihood, AIC, BIC), the error variance, and the variance accounted for by each of the models used to test RQ1. Table 9 displays the likelihood ratio tests for all models, comparing their fit to the intercept only model (Model 0). Also, Table 10 displays the regression coefficients and standard errors for the models in RQ1. The intercept-only model represents the accuracy with which one could predict FGPA using no predictors, only the mean FGPA (the intercept). Two pieces of information can be taken from this model. First, it provides a baseline for model fit and second, it provides the baseline error variance used in calculating R^2 (Equation 1) for the remaining non-hierarchical models.

Model 1 through 3 each added a student-level indicator of SES to the model. Although each of these models fit significantly better than Model 0, the model without any predictors, the percentage of variance each explained in FGPA was incredibly small. In looking across Models 1, 2 and 3, parental education and income accounted for similar amounts of variance in FGPA - 0.75% and 0.74%, respectively. These SES indicators explained only slightly more variance than parental occupation (0.58%). However, given the small differences among these R^2 and their low value, it can be concluded that these three variables predicted FGPA with relative similarity. Overall, it is clear that none of these single indicators predicted FGPA with any practical significance.

Model 4 attempted to mirror the composite method of measuring SES used in NCES databases. Parental income, occupation, and education were standardized and

added (equally weighted) to form this composite. As with the other unitary models, the increase in fit over Model 0 was statistically significant, but not practically significant, accounting for only 1.21% in FGPA. Although this is an increase compared to Models 1-3, absolutely speaking, this is still a small portion of the total variance.

It was hypothesized that Model 5, using parental income, occupation, and education, would perform the best of these 5 models. In fact, the model did fit significantly better than Model 0 (see Table 9) and accounted for more variance than Models 1-4. Once more, however, Model 5 did not predict FGPA with any practical significance. The 1.23% of the variance in FGPA for which it accounted is still a very low amount, and is hardly more than the 1.21% accounted for by Model 4. Table 10 contains the regression coefficients for Models 1-5. Since Models 1-4 are all single indicator models, the tests of their coefficients are equivalent to the likelihood ratio tests, which were all significant. In looking at the coefficients for Model 5, however, the inclusion of all three coefficients allows for direct tests of each predictor, controlling for the other two. Interestingly, neither parental income ($\beta_1 = 0.024$, $t\,(1) = 1.65$, $p = 0.098$), parental occupation ($\beta_1 = 0.001$, $t\,(1) = 0.93$, $p = 0.355$), nor parental education ($\beta_1 = 0.033$, $t\,(1) = 1.34$, $p = 0.182$) was significant when controlling for all other predictors. Rather, only the combination of all three predictors was statistically significant. Once again, these results should be interpreted with caution. Since percentage of variance accounted for by each model was so low, these models have no practical significance in predicting FGPA. Any statistical significance found here is likely due to the large sample that was used.

Ultimately, RQ1 sought to directly compare unitary and component models, hypothesizing that the component model would better predict FGPA. There are several pieces of information that were used to answer this question. Likelihood ratio tests were consulted to assess whether the fit of Model 5 was significantly better than Model 1, 2, and 3. This was not the case. Model 5 did not fit significantly better than Model 1 ($X^2(2)$ = 4.2, p = 0.122), Model 2 ($X^2(2)$ = 5.8, p = 0.055), or Model 3 ($X^2(2)$ = 4.3, p = 0.116). Because Models 4 and 5 were not nested, a likelihood ratio test could not be conducted. However, information criteria could be used to assess the fit of all models relative to one another. AIC and BIC values favored Model 4. Although the deviances (-2LLs) of Models 4 and 5 were quite similar, the information criteria were far lower for Model 4, because it is more parsimonious than Model 5 (using only 1 predictor, compared to three in Model 5).

Upon a closer review, Models 4 and 5 are similar because of the individual relationships between the student-level indicators of SES and FGPA. The reader will recall that, in actuality, both of these methods form a composite. The NCES method standardizes each variable and adds them together, which weights each indicator equally. In Model 5, the weights for each variable are determined empirically by multiple regression. The advantage here is that if one variable is more strongly related to FGPA than another, it would be weighted more heavily.

However, an analysis of the standardized regression coefficients showed that income (b=0.068, se=0.041), occupation (b=0.040, se=0.043), and education (b=0.058, se=0.044) had very similar unique relationships with FGPA. Thus, the linear composite formed by Model 5 was rather similar to the SES composite used in Model 4.

Although the component model did not fit significantly better than the unitary models, it did explain the largest amount of variance in FGPA. However, Model 5's increase in R^2, particularly when compared to Model 4 (0.02%), could easily be considered negligible. In conclusion, these results indicate that there is not overwhelming evidence that a component model should be adopted over a unitary model. Most importantly, however, none of these models predicted FGPA with any practical significance.

Research Question 2: Continuous vs. Dichotomous Measurement

RQ2 explored the impact of simplifying the continuous measures of SES used in Models 1-5. As Table 8 shows, Models 6-10 follow the same progression in adding predictors as Models 1-5. That is, Models 6-8 use dichotomized versions of parental income, occupation, and education, respectively, Model 9 uses a dichotomized version of the SES composite, and Model 10 uses dichotomized versions of income, education and occupation. Again, all of these dichotomies were created using a median split technique.

As one would expect, the overall results of these models' ability to predict FGPA were somewhat similar to their continuous counterparts. Model 6, 7, and 9 (see Table 9) all fit the data significantly better than the intercept-only model. Model 8, which included dichotomized parental education, and Model 10, which included all three dichotomized student-level indicators of SES, did not fit significantly better than Model 0. The variance accounted for by each model suggested no relationship between SES and FGPA, regardless of how it was conceptualized. Model 6 (0.49%), Model 7 (0.48%), Model 8 (0.18%), Model 9 (0.75%), and Model 10 (0.82%) all demonstrated relatively no practical significance.

Table 11 contains the regression coefficients for Models 6-10. It should be restated that these coefficients should be interpreted with caution, given then extremely low practical significance of these models' predictive ability. As with Models 1-4, the significance for Models 6-9 mirror the likelihood ratio tests of the entire model since only one predictor was used. Accordingly, Models 6, 7, and 9 were all statistically significant, but Models 8 and 10 were not. Although Model 9 does not explain as much variance as Model 10, it is favored over Model 10 by the information criteria due to its parsimony.

However, RQ2 focused on comparing Models 6-10 to Models 1-5. Overall, this comparison is relatively moot, since none of these models accounted for any sizable amount of variance in FGPA. As expected, however, the percentage of variance explained by each dichotomous model was lower than its continuous counterpart. Nevertheless, if any inference can be drawn from findings of such little practical significance, it does not appear that dichotomizing most continuous measures of SES substantially decreases the prediction of FGPA.

Research Questions 3a and 3b: Including Aggregate Predictors

Research Questions 3a and 3b explored the relative ability of individual and aggregate measures of SES to predict FGPA. RQ3a directly compared student-level and neighborhood level indicators of SES, while RQ3b looked at the incremental predictive validity of neighborhood measures over student-level predictors. In sum, there was essentially no relationship between neighborhood-level SES indicators and FGPA. Thus, before the results from Models 11-14 are presented, the reader should understand that (as was the case with student-level indicators), *there was no meaningful relationship between neighborhood SES and FGPA.*

Not only was there no meaningful relationship between neighborhood SES and FGPA, there was no effect of neighborhood on FGPA as indicated by the results of Model 11. Model 11 is also an intercept-only model, as was Model 0, except that it uses a neighborhood effect to predict FGPA in addition to the grand mean. If neighborhoods significantly vary in FGPA, meaning that there is a neighborhood effect, than the level-2 error variance would be high, Model 11 would fit significantly better than Model 0, the intraclass correlation (ICC) would be sizable, and the use of HLM would be justified. However, this was not the case. Since Model 11 did not fit better than Model 0 (X^2 (1) = 0.0003, p=1.00; see Table 9) and the ICC was only 0.0002, neighborhoods did not vary significantly in FGPA, essentially meaning that τ_{00}=0.

Since there was no dependency among FGPA for students coming from the same neighborhood, there was no threat of violating the independence assumption of multiple regression. Since it is the risk of this violation that justifies the use of HLM, modeling the dependencies among students from the same neighborhood was not necessary. Thus, the neighborhood effects (u_{0j}'s) were dropped from Models 12-14, making these models non-hierarchical models. This caused several changes in the models that were used. Model 11 became equivalent to Model 0 and thus, Models 12-14 were compared to Model 0, not to Model 11. Also, Model 12 became equivalent to Model 5. For Models 13 and 14, The neighborhood-level effects were entered as level-1 variables. Finally, since the random effects for neighborhood were constrained to zero, one less parameter was estimated for Models 12-14.

The reader is again referred to Table 8 for the model fit and variance accounted for by Models 12-14. Again, since Model 12 (using parental income, occupation, and

education as predictors) is equivalent to Model 5, this model's performance has already been reviewed. Although the fit of this model is significantly better than the intercept-only model, practically speaking, it accounts for little variability in FGPA.

Unlike Model 12, Model 13 (which consists of only neighborhood-level predictors of SES) did not significantly increase fit over Model 0 (X^2 (3) = 7.4, p = 0.060). Moreover, it accounted for a very small portion of the variance in FGPA (0.84%). Finally, the contextual model (Model 14, using all student-level and neighborhood level indicators) fit the data significantly better than the intercept-only model and accounted for more variance than any other model (1.84%). However, none of these models accounted for any sizable amount of variance in FGPA, again indicating that, regardless of conceptualization, there was no relationship between SES and FGPA.

Table 12 contains the regression coefficients for Models 12-14. Note that median income in Models 13 (t (1) = 2.26, p = 0.024) and 14 (t (1) = 2.13, p = 0.033) is the only significant predictor in any of the three models. The reader may note that the regression coefficients for the other two aggregate indicators are negative (although non-significant) in Models 13 and 14, this is a result of the high multicollinearity of the neighborhood-level predictors noted at the beginning of the chapter. Nevertheless, even the contextual model, which contains the most predictors, does not account for a practically significant amount of the variance in FGPA. Thus, the relationship between median income and FGPA should not be overstated.

To explore RQ3a, Model 12 and Model 13 must be compared in terms of model fit and variance accounted for, though they cannot be directly tested against each other because they are not nested. The AIC and BIC indicate that the model (Model 12)

including only student-level predictors of SES fits better than the model (Model 13)

including only neighborhood-level predictors. As well, Model 12 fit significantly better

than Model 0 whereas Model 13 did not. Similarly, Model 12 accounted for more

variance (1.23%) than Model 13 (0.84%), although this difference was not substantial.

Thus, to answer RQ3a, it actually appears that student-level variables predicted FGPA

slightly better than neighborhood-level variables, though neither represented a practically

significant relationship with FGPA.

RQ3b, however, looked at the incremental validity of neighborhood-level SES

over student-level SES. Here, Models 12 and 14 must be compared. In fact, Model 14 did

fit significantly better than Model 12 ($X^2(3) = 5.3$, $p = 0.034$) and accounted for more

variance (1.82% in Model 14, compared to 1.23% in Model 12). Again, however, neither

of these models accounted for a practically significant amount of variance in FGPA.

Moreover, AIC and BIC values indicate that the increase in fit associated with Model 14

did not outweigh its lack of parsimony. Thus, although there was an increase in

prediction of FGPA when neighborhood-level SES was added to student-level SES, this

difference was not substantial enough to conclude that neighborhood level predictors add

anything above and beyond student level predictors in predicting FGPA.

CHAPTER V

Discussion

Based upon the abundance of existing literature that was reviewed here, this study operated under the assumption that SES had a sizable impact on outcomes in higher education. Additional research suggested that the way in which SES is conceptualized and measured would impact the results of a study that investigated the SES-education relationship. Accordingly, the purpose of the current research was to empirically contrast various SES conceptualizations and measurement methods.

However, the ultimate goal of the current study could not be met once the initial supposition – that a relationship existed between SES and higher educational outcomes – failed to be true. Across all of the measurement models, theoretical conceptualizations, and methodological differences, the ability of SES to predict first-year grade point average was, even at its strongest moments, extremely weak.

Nevertheless, this chapter will seek to summarize the results of this study within the framework of the present research questions. In addition, limitations that may have quantitatively or qualitatively impacted the present results will be discussed. Finally, implications of the current findings will be discussed, and suggestions will be made for future directions that might shed light on the questions posed and findings established here.

Review of Results

Research question 1. RQ1 explored unitary and component models of SES. Generally, neither unitary nor component models accounted for any sizable variance in

first-year GPA. Thus, it did not appear that there were significant differences in the measurement methods that were considered.

Moreover, although Fetters et al. (1984) and Adelman (1997) have argued for the use of multiple measures of SES, the current results did not see large differences between single and multiple variable methods. In situations where resources are limited, these findings suggest that researchers may not need to expend the effort or resources necessary to gather parental education, occupation and income.

However, among these variables, it appeared that parental occupation predicted FGPA slightly less than education or income. This may be due to some of the measurement issues that exist with occupational prestige, such as the generality of occupational classifications, or the zero values that are used for parents who are home-makers, unemployed, or members of the military. In addition, the reporting error that has been demonstrated with parental income (e.g., Fetters et al., 1994) may make this variable an undesirable option as well. Thus, if a researcher were to use only one SES measure, parental education appears the best choice.

In comparing the SES composite to a multiple indicator method, the models performed rather equally. In the current study, this was due to the similarities in the unique relationships between each of the independent variables (income, education, occupation) and FGPA. Because their standardized regression coefficients were similar, the regression composite that was used in Model 5 was very similar to the SES composite used in Model 4, which equally weighted each component. Ultimately, this yielded similar results for these two models. In fact, AIC and BIC favored Model 4, because it was technically more parsimonious (the actual model only includes one variable, even

though three were used to create it). Thus, the current findings do not provide any evidence that the assumption made by the NCES (i.e. equal relationships between income, education, and occupation) is untenable.

However, although FGPA was somewhat equally related to each of the predictors here, this may not always be the case. Forming a composite forfeits the ability to understand the individual relationships between SES components and a given outcome. Assuming the relationships are equal when they are not can hinder the ability to predict a given outcome, as well as the ability to understand how various SES factors might individually, or perhaps even differentially relate to that outcome. To those ends, forming a composite without theoretical justification is still an undesirable practice.

Research question 2. RQ2 explored the effects of dichotomizing SES using a median split. In all cases, the models using dichotomous versions of income, education, occupation, and the SES composite accounted for less variance than those using continuous measures. However, given that none of the models predicted FGPA with any practical significance, one cannot make conclusive statements about the impact of dichotomization.

Nevertheless, despite the ease of interpretation that may be facilitated by such a method - making the comparison between "high SES students" and "low SES students" – simplifying continuous measurement is still considered an unsound measurement practice. When a median split is used, all individuals below (or above) the median are represented by the same score, regardless of differences on the continuous scale. Conversely, two individuals, one slightly above the median and one slightly below, are

represented by different scores, despite their relative similarity on the continuous scale (MacCallum, Zhang, Preacher & Rucker, 2002).

In other words, the dichotomization of continuous data results in a loss of information about participants. A continuous representation of a variable allows one to distinguish among cases along all points of a scale, but a dichotomization of that variable only allows one to distinguish among people at one point – wherever the split occurs. This loss in information can cause underestimation of the relationship between two variables, as demonstrated by the differences between Models 1-5 and Models 6-10. For this reason, dichotomous splits or any reduction of continuous data should be avoided..

Research questions 3a and 3b. The third research questions explored the use of aggregate measures of SES to predict FGPA. It is important to note that there was almost no variance in FGPA between neighborhoods. The intraclass correlation coefficient was 0.0002, indicating no similarity among the FGPAs of students coming from the same neighborhood. Given that students' FGPAs were not related to their neighborhood, it is no surprise that neighborhood characteristics did not predict FGPA. Nevertheless, the finding that students are not more or less likely to receive a certain FGPA based on their neighborhood of origin is, in and of itself, noteworthy.

In his meta-analysis of the relationship between SES and achievement, White (1982) concluded that the higher-order impact of SES was far stronger than that at the individual level, and that popular conceptions about the role of SES in education were misplaced. However, the current study found no relationship between SES and FGPA at the neighborhood level, using median income, percentage of the population with a bachelor's degree, and percentage of the population in the labor force as SES indicators.

In fact, neighborhood-level SES indicators accounted for even less variance (0.84%) than student-level indicators (1.23%). Furthermore, the addition of aggregate indicators to a model using student-level indicators did not contribute to the model in any statistically or practically significant way. The model including both student-level and neighborhood-level indicators explained 1.82% of the variance in FGPA, indicating that the variance explained by neighborhood-level indicators above and beyond that already explained by the student-level indicators was less than 1%.

One explanation for these results could be the source of information. In many HLM studies, it is common to obtain higher-order variables by aggregating the sample data. To use the current study as an example, the average parental income for students from the sample within a given zip code would be used as the neighborhood-level indicator of SES. However, the variables used here were independently gathered. That is, they were taken from an external source (the United States Census Bureau's American FactFinder) that provided information about the neighborhoods independent of the sample. As a follow up, ancillary analyses examined the correlations between FGPA and aggregated parental income, education, and occupation. In other words, I examined whether the neighborhood means of the student-level indicators were significant predictors of FGPA.

Indeed, it appeared that the sample-based estimates of neighborhood-level indicators predicted FGPA better than independently collected indicators. In comparing average parental income ($r =0.099$) to median income ($r =0.077$), average parental education ($r =0.068$) to percentage of the population with a bachelor's degree or higher ($r =0.037$), and average parental occupation ($r =0.058$) to percentage of the population in

the labor force ($r = 0.030$), the sample-based correlation coefficient exceeds those for the

zip code-based variable in all three cases. Given the prevalence of aggregating individual

data to estimate higher-order values, this difference in results may suggest that the

findings of White (1982) and Sirin (2005) are a product of the method used to calculate

aggregate SES. This would have significant ramifications on the field's current

understanding of the impact of SES.

One explanation for this finding might be the sampling bias of students who

attend college. These students may be significantly different from the population, and

thus the value for their neighborhood is not indicative of the overall higher-order effect of

SES. This possibility is clearly demonstrated by looking at the correlations between

sample-based and independently gathered indicators. The neighborhood level ($k = 177$)

correlations between average parental income and median income ($r = 0.187$) and

parental education and percentage of the population with a bachelor's degree or higher (r

$= 0.262$) were slightly less than moderate, but parental occupation and percentage of the

population in the workforce were almost entirely unrelated ($r = 0.047$). These findings

show that, although both methods are designed to measure the higher-order effect of SES,

they in fact measure different things. This creates the possibility of very different findings

depending on the method that is selected.

Implications

SES as a covariate. Researchers often use SES as a covariate (White, 1982; Sirin

2005), perhaps even more so than studying its direct effect on educational outcomes. In

this case, a researcher studies the effect of some variable, *X*, on a given outcome

controlling for SES. Thus, one might be interested in the impact of the current findings when SES is used for such a purpose

Even if SES is unrelated to the dependent variable (DV), it can still have relevance as a covariate, depending on its relationship with *X*. If SES is related to *X*, then SES may have a "suppressor" effect, in which it "suppresses variance that is irrelevant to the DV" (Tabachnick & Fidell, 2001). By including SES, a researcher can gain a better understanding of the impact of *X* on the DV. Thus, sound, theoretically based measurement of SES remains important.

If however, SES is unrelated to the *X* and the DV, it has no relevance to the study. Inclusion of SES (or any irrelevant covariate) would actually be harmful to the study, as power is lost through the expense of an additional degree of freedom (Tabachnick & Fidell, 2001).

SES and higher education. The lack of a relationship between SES and FGPA, although hindering the present research questions, certainly has implications in the larger field of educational research. Indeed, this challenges the large body of extant literature that demonstrates SES's impact on outcomes in higher education. For example, Terenzini, Cabrera, and Bernal's (2001) noted report, *Swimming Against the Tide*, outlines a host of issues that face low income students, ranging from aspirations to access, graduation rates, and occupational outcomes.

However, some research might explain these findings. Adelman (2007) pointed out that many students are affected by SES before they have the opportunity to even attend college. He found that the academic, economic and social issues they faced prevented them from even considering a continuation of their education beyond high

school. Thus, there may be no effect of SES in the current study because this sample has experienced a type of selection bias. That is, those students who attend college are able to navigate or overcome the SES-related issues that would hinder the collegiate success of those students who did not enroll.

Regardless, any time findings refute such a sizable body of literature, questions arise. Is there something about the institution from which this sample came that affected the results? Were the variables used here – both independent and dependent – simply unable to capture the constructs they were intended to measure (socioeconomic status and college success, respectively)?

Limitations

Characteristics of the sample. Several aspects of this study may have limited the ability to answer the research questions at hand. Foremost among these issues are matters related to the sample that was selected. Obviously, any study that focuses on an existing sample (i.e. one institution) risks that its findings will not fully generalize to other samples or the entire population. However, there are a few specific concerns in the current study.

First, there was a sizable amount of missing data. Again, only 37.9% of the original sample was able to be used in the full analysis, primarily due to missing social security numbers. Because there were so many missing social security numbers, it is likely that these data were not missing at random. Thus, it is likely that those students who elected to provide SSN's were in some way different than those who did not. This could have a significant impact the observed relationship between SES and FGPA, as well as the extent to which that relationship generalizes to the rest of the population.

Second, characteristics of the institution may have impacted the results. Low-income, first generation college students are a historically significant population at the university that was used for this study. Thus, institutional actions specifically designed to mediate factors affecting low-SES students, such as specific academic or social programming or financial aid measures, may have impacted the results.

Measurement issues. Unfortunately, despite this study's emphasis on measurement quality, several of the issues that have been demonstrated by previous research may have impacted the current findings. For example, Fetters et al. (1984) demonstrated the unreliability of student reports of parental SES information. In their study, students frequently were unaware of the amount of money their parents' earned, their educational attainment, or even their occupation. In several cases, twins would actually provide conflicting answers about their parents. Hence, the intuitive appeal of "possession" indicators of SES (e.g., the number of cars a family owns, the size of the family's television) becomes apparent, since it is more likely that students would be able to accurately report such information.

Measurement error may have played a key role in the current findings. If income, education, and occupation are rife with error, as has been the case in previous studies, this unreliability will directly decrease the statistical power of the study. In other words, as measurement error increases, so does error variance in the model, and the ability to detect a relationship between SES and FGPA is significantly hindered (Humphreys & Drasgow, 1989).

Certain measurement issues were also present with neighborhood-level SES variables as well. Perhaps most importantly, neighborhood may have been an

inappropriate unit of analysis. Students within a given zip code may still vary significantly in the way that community resources (most notably schools) impact their education. Many educational studies use schools rather than neighborhoods as the unit of analysis. Such a method may have yielded different results in the current study. Moreover, it is logical to use an educational unit of analysis (schools) in educational research.

Percentage of the population with a bachelor's degree and the percentage of the population in the labor force also have an undesirable measurement characteristic that has been discussed at length here – they are essentially dichotomous splits of a continuous variable. Certainly whether or not someone has a bachelor's degree is a simplified indicator of their educational attainment, a variable that would be better represented continuously. The same could be said for the occupational relevance of being in the labor force.

Just as income, education, and occupation may not have fully represented SES, FGPA may not have been the optimum indicator of college success. As mentioned, a host of research has found fault with the measurement properties of grades. In addition, GPA is only one indicator of college success, and in this case, was only captured at one time point.

One piece of research that was a significant part of this study's foundation was Bollen et al.'s (2001) analysis of varying SES measurement models. One of the key points made by the authors is that a primary driver in SES measurement is the information that is available. Often, researchers are limited to the data at hand, and the measurement scenario in practice is removed from the ideal. Certainly to some extent,

this was the case in the current study. Various design aspects created the limitations mentioned here. However, these limitations, in combination with the results that have been presented, point to directions that future research may take to advance the field's understanding of socioeconomic factors in higher education.

Future Directions

In accordance with the limitations that have already been identified, the first direction future research should take is to examine the current research questions with a larger, more heterogeneous sample. Given that the current sample was taken from two years of data at one institution, including a wider array of students and institutions over a longer period of time would provide a better picture of SES's effect on higher educational outcomes. Moreover, the role SES plays in higher education may evolve as populations grow and change, and as institutions listen to reports such as *Swimming Against the Tide* and *America's Perfect Storm*, making efforts to adapt to diverse, low-income populations. As Adelman (2007) noted, perhaps the effect of SES is not on outcomes in higher education, but on the expectation and pursuit thereof.

Second, research still needs to pursue a more thorough means of measuring the socioeconomic factors that influence educational outcomes. Social capital theory has provided a thorough theoretical framework that explains the economic, social, and cultural factors that affect students' educational success. Such a framework is ill-represented by the three manifest, self-reported variables used here, which have been shown to contain sizable amounts of measurement error.

The key recommendation for future research would be to measure social, economic, and cultural factors using a scale development approach. Such an effort should

hearken back to the scale methods of the early 1900's described earlier (Chapin, 1928, 1933; Chapman & Sims, 1925). In this way, the importance of establishing reliability evidence is reemphasized. Authors of the scale movement also recommended following a traditional plan of establishing construct validity, later outlined by Benson (1996): using theory to identify behaviors that represent the construct, evaluating how those variables relate to each other, and establishing appropriate relationships with external variables.

For example, in identifying how various aspects of social capital might influence educational success, researchers might consider that social capital represents the network of individuals who can provide contacts and information to students. Thus, it would be logical to ask students the number of people they know who have college degrees. Since cultural capital refers to the "college knowledge" necessary to navigate the system of higher education, the assessment of students' knowledge (and even awareness) of financial aid, scheduling, and other services with which they need to be familiar might better represent the relationship between SES and higher educational outcomes.

In viewing SES as a construct, researchers should strive to minimize the distance between the theoretical and the operational definitions. If various forms of capital hinder educational attainment, one should directly measure the ways in which that impact takes place (such as the knowledge about higher educational processes and support) and not a proxy for those impacts (parental education).

In addition to the independent variables, future research would also be well served to examine the dependent variable of this study. GPA serves as only one indicator of college success – one that has been criticized for its ambiguity, unreliability, and inability to represent learning (Allen, 2005; Brookhart, 1993; Burke, 2006). Other indicators, such

as direct assessments of student learning and development, persistence to degree, engagement, and degree attainment may help to paint a more complete picture of student success in higher education.

Finally, because White (1982) and Sirin (2005) so heavily emphasized the importance of higher-order SES effects, future research should consider effective means of representing these effects. For one, using schools as the units of measurement might better detect the aggregate effects of SES on students' educational success. For example, based on Adelman's (1997) conclusion that curricular rigor was a significant predictor of collegiate success, studies might examine the average teacher experience or average state test scores within high schools to predict students' achievement.

Ultimately, whether referring to student or higher-order measures of SES or the broad concept of student success, one must return to the quote by Clifford Adelman (1997) that provided the foundation for this study:

> "Before one accepts a variable simply because it has been used for decades or because a federal agency paid for it, one must examine the bricks and mortar of that variable very carefully. Where architecture is faulty, the data must be fixed or the variable discarded – or one will never tell a true story" (p. xi).

Researchers must continue to explore the "bricks and mortar" of socioeconomic status and student success in the constant pursuit of that true story.

Footnotes

[1]"Socioeconomic status is the position that an individual or family occupies with reference to the prevailing standards of cultural possessions, effective income, material possessions, and participation in the group activities of the community." (Chapin, 1933; p. 3)

[2]This notion was originally coined by French sociologist Pierre Bourdieu (1985), though it is often attributed to James Coleman (1988) as well. Portes (1998) explains that this is due to two facts. First, Bourdieu's (1979) original work was published in French and it, as well as its first English translation, were not widely disseminated or discussed amongst English-speaking researchers. Second, Coleman does not cite Bourdieu in his 1988 work, despite striking parallels between the two works.

[3]Kao and Tienda note that racial and ethnic differences in educational aspirations arose as a result of this effect of SES. Specifically, African American and Hispanic students, coming from less privileged backgrounds, were less likely to perceive a college degree as a likely outcome.

[4]Walpole (2008) conducted an almost identical study focusing on low-SES African American students, which yielded very similar results and conclusions.

[5]EFC was related to retention, while income was not, even though the two variables were highly related to one another. Choy and Premo note that EFC captures income, family size, and dependency status. Thus, the fact that EFC captures more information than just income might explain this differential relationship.

[6]If the disturbance term for the latent SES variable in Model 2c is omitted, SES is simply a principal component, or weighted linear composite of the indicators.

[7]A good example to include here would be a model assuming a unitary effect of SES, but modeling it as a component model. However, since so few studies consider the theoretical structure of SES, such an example was difficult to find.

[8]In order to examine the impact of these zero values, analyses were also conducted, removing any cases that had a zero value for either parental occupation or FGPA. The results mirrored those found using the full sample, indicating that these zero values had little or no impact on the ultimate findings.

Table 1.
Statistical Models and Relevant Research Questions

#	Statistical Model	Research Question			
		1	**2**	**3a**	**3b**
1	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{Inc}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$	X	X		
2	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{Occup}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$	X	X		
3	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{Educ}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$	X	X		
4	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{Comp}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$	X	X		
5	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{Inc}_{ij} + \beta_{2j}\text{Educ}_{ij} + \beta_{3j}\text{Occup}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$ $\beta_{2j} = \gamma_{02}$ $\beta_{3j} = \gamma_{03}$	X	X	X	X
6	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{IncD}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$		X		
7	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{OccuD}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$		X		
8	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{EducD}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$		X		
9	$Y_{ij} = \beta_{0j} + \beta_{1j}\text{CompD}_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$		X		

Table 1 (cont.).
Statistical Models and Relevant Research Questions

#	Model		
10	$Y_{ij} = \beta_{0j} + \beta_{1j}IncD_{ij} + \beta_{2j}EduD_{ij} + \beta_{3j}OccupD_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$ $\beta_{2j} = \gamma_{02}$ $\beta_{3j} = \gamma_{03}$	X	X
11	$Y_{ij} = \beta_{0j} + r_{ij}$ $\beta_{0j} = \gamma_{00} + u_{0j}$	X	X
12	$Y_{ij} = \beta_{0j} + \beta_{1j}Inc_{ij} + \beta_{2j}Educ_{ij} + \beta_{3j}Occup_{ij} + r_{ij}$ $\beta_{0j} = \gamma_{00}$ $\beta_{1j} = \gamma_{01}$ $\beta_{2j} = \gamma_{02}$ $\beta_{3j} = \gamma_{03}$	X	X
13	$Y_{ij} = \beta_{0j} + r_{1j}$ $\beta_{0j} = \gamma_{00} + \gamma_{1j}MedInc_j + \gamma_{3j}Bach_j + \gamma_{2j}Labor_j + u_{ij}$	X	
14	$Y_{ij} = \beta_{0j} + iIncD_{ij} + \beta_{2j}EduD_{ij} + \beta_{3j}OccupD_{ij}$ $+ \gamma_{1j}MedInc_j + \gamma_{2j}Labor_j + \gamma_{3j}Bach_j + r_{1j}$ $\beta_{0j} = \gamma_{00} + \beta_{4j}MedInc_j + \beta_{5j}Bach_j + \beta_{6j}Labor_j + u_{ij}$ $\beta_{1j} = \gamma_{01}$ $\beta_{2j} = \gamma_{02}$ $\beta_{3j} = \gamma_{03}$	X	X

Student-level indicators: Inc = parental income, Occup = parental occupation, Educ = parental education. *Neighborhood-level indicators*: MedInc = median family income, Bach = percentage of the community with a bachelor's degree or higher, Labor = percentage of the neighborhood in the labor force.

Note. Variables followed by "D" were dichotomized by median split.

Table 2.

Demographic Characteristics of the 2002 and 2006 CIRP Samples

		Year	
		2002	2006
Sample Size		778	1530
Gender			
	Male	42.2%	41.7%
	Female	57.8%	58.3%
Age			
	16 or younger	0.2%	0.0%
	17	1.4%	1.7%
	18	57.2%	64.2%
	19	32.2%	31.1%
	20	4.2%	1.6%
	21 to 24	3.4%	1.3%
	25 or older	1.5%	0.1%
Race*			
	White/Caucasian	90.5%	91.9%
	African American/Black	6.3%	6.0%
	American Indian	0.6%	1.4%
	Asian American/Asian	1.3%	1.5%
	Mexican American/Chicano	0.3%	0.5%
	Puerto Rican	0.5%	0.4%
	Other Latino	0.3%	1.0%
	Other	1.9%	1.9%

Note. These data refer to the total population of 2002 and 2006 NKU CIRP respondents. Only SES data were provided for the sample used in the current study.

*Percentages will add to more than 100% if any student marked more than one category.

Table 3.

Assignment of Occupational Prestige Scores to CIRP Job Classifications

Job Classification	1980 Census Job Code	1980 Census Occupational Category	Nakao & Trace Updated SEI Score
Accountant	023	Accountants and Auditors*	76
Actor	187	Actors and Directors*	72
Architect	043	Architects	84
Artist	188	Painters, Sculptors, Craft-Artists, and Artist Printmakers	63
Business clerk	379	General Office Clerk	38
Business exec	019	Managers and Administrators	64
Business owner	019	Managers and Administrators	64
Business sales	N/A	AVERAGE "Sales Occupations"	49
Clergy	176	Clergy	74
College admin	014	Administrators, Education and Related Fields	85
College teacher	N/A	AVERAGE "Professor"	85
Conservationist	079	Forestry and Conservation Scientists	72
Dentist	085	Dentist	96
Dietitian	097	Dietitians	55
Engineer	N/A	AVERAGE "Engineer"	88
Farmer/Rancher	473	Farmers, Except Horticultural	37
Foreign service	--	N/A	0
Homemaker	--	N/A	0
Interior decorator	185	Designers	61
Lab technician	203	Clinical Laboratory Technologists and Technicians	65
Laborer	889 or 869	Laborers: construction or non-construction	29

Table 3 (cont).

Assignment of Occupational Prestige Scores to CIRP Job Classifications

Job Classification	1980 Census Job Code	1980 Census Occupational Category	Nakao & Trace Updated SEI Score
Law enforcement	N/A	AVERAGE "Protective Service Occupations"	51
Lawyer	178	Lawyer	92
Military science[†]	--	N/A	0
Musician	186	Musicians and Composers	57
Nurse	095	Registered Nurses	73
Optometrist	087	Optometrist	93
Other	--	N/A	0
Other religious	176	Clergy	74
Pharmacist	096	Pharmacist	89
Physician	084	Physicians	97
Policy/Govt	005	Administrators and Officials, Public Administration	70
Programmer	229	Computer Programmers	76
Psychologist	167	Psychologists	83
School counselor	163	Counselors, Educational and Vocational*	81
School principal	014	Administrators, Education and Related Fields*	85
Sci researcher	N/A	AVERAGE of scientist positions	84
Semi-skilled	779	Machine Operators, Not Specified*	28
Skilled trades	N/A	AVERAGE Trade positions	34
Social worker	174	Social Workers	69
Teacher-elem	156	Teachers, Elementary School	79
Teacher-second	157	Teachers, Secondary School	80
Therapist	N/A	Average of all therapist positions	70
Unemployed	--	N/A	0

Table 3 (cont).

Assignment of Occupational Prestige Scores to CIRP Job Classifications

Job Classification	1980 Census Job Code	1980 Census Occupational Category	Nakao & Trace Updated SEI Score
Veterinarian	086	Veterinarians	90
Writer	183	Authors	76

* Although the occupational category is provided here, one of the occupational titles contained within this category matched the CIRP classification exactly.

†Nakao & Trace specifically noted that military occupations were excluded from their update, since they are also excluded from Census job classifications.

Table 4.

Response Rates to CIRP Items

Variable	Year		Total
	2002	**2006**	**Total**
Total Sample	779	1535	2314
SSN	526 (67.5%)	543 (35.4%)	1069 (46.2%)
Zip Code	749 (96.1%)	1518 (98.9%)	2267 (98.0%)
Income	675 (86.6%)	1374 (89.5%)	2049 (88.5%)
Occupation	707 (90.8%)	1382 (90.0%)	2089 (90.3%)
Education	762 (97.8%)	1464 (95.4%)	2226 (96.2%)
Valid Responses	404 (51.9%)	472 (30.7%)	876 (37.9%)

Table 5.

Descriptive Statistics for Level-1 and Level-2 Variables

	M	*SD*	Median	Minimum	Maximum
Level-1 Variables (*n=876*)					
Parental Income	8.04	2.88	8.50	1	14
Parental Education	4.99	1.78	5.00	1	8
Parental Occupation	52.56	30.24	64.00	0	97
SES Composite	0.00	2.27	0.10	-6.43	4.24
First-year GPA	2.51	1.14	2.80	0	4
Level-2 Indicators (*k=177*)					
Median Family Income*	51217.40	14993.97	50677.00	16564	109713
% of the Population with Bach. Degree or higher	19.79	13.81	15.73	1.93	61.72
% of the Population in the Labor Force	65.48	6.76	66.28	38.81	78.06

Note. The values in parentheses indicate the phi correlations for the dichotomized versions of each continuous variable.

* In thousands of 1999 dollars.

Table 6.

Correlations for Level-1 and Level-2 Variables

	1.	2.	3.	4.	5.	6.	7.
1. FGPA							
2. Parental Income	0.087 ** (0.070)						
3. Parental Education	0.086* (0.043)	0.324** (0.147)					
4. Parental Occupation	0.076* (0.070)	0.304** (0.219)	0.441** (0.429)				
5. SES Composite	0.110** (0.087)	0.718** (0.443)	0.779** (0.576)	0.770** (0.603)			
6. Median Family Income*	0.077*	0.154**	0.153**	0.117**	0.187**		
7. % of the Population with Bach. Degree or higher	0.050	0.119**	0.219**	0.153**	0.217**	0.813**	
8. % of the Population in the Labor Force	0.030	0.096**	0.040	0.009	0.064	0.682**	0.372**

Note. Correlations in parentheses refer to the dichotomized versions of the variables.
**$p < .01$
*$p < .05$

Table 7.

Frequency of Number of Students per Neighborhood

Number of Students	Number of Neighborhoods w/ Specified # of Students	Cumulative Frequency of Neighborhoods	Cumulative Frequency of Students
1	85	85	85
2	28	113	141
3	12	125	177
4	9	134	213
5	9	143	258
6	10	153	318
7	1	154	325
8	2	156	341
9	2	158	359
10	1	159	369
11	2	161	391
12	1	162	403
13	2	164	429
14-15	0	164	429
16-30	5	169	537
>30	8	177	876

Table 8.

Fit Statistics and Variance Accounted for: All Models

Model	-2LL	AIC	BIC	Error Var.	% Var. Explained
Research Question 1					
(0) Intercept Only Model	2715.4	2719.4	2729	1.299	--
(1) Parental Income	2708.8	2714.8	2729.1	1.290	0.75%
(2) Parental Occupation	2710.4	2716.4	2730.7	1.292	0.58%
(3) Parental Education	2708.9	2714.9	2729.2	1.290	0.74%
(4) SES Composite	2704.8	2710.8	2725.1	1.284	1.21%
(5) Income, Education & Occupation	2704.6	2714.6	2738.5	1.283	1.23%
Research Question 2					
(6) Dichot. Parental Income	2711.1	2717.1	2731.4	1.293	0.49%
(7) Dichot. Parental Occupation	2711.2	2717.2	2731.5	1.293	0.48%
(8) Dichot. Parental Education	2713.8	2719.8	2734.1	1.297	0.18%
(9) Dichot. SES Composite	2708.8	2714.8	2729.1	1.290	0.75%
(10) Dichot. Income, Dichot. Occupation, Dichot. Income	2708.2	2718.2	2742.1	1.289	0.82%
Research Questions 3a and 3b					
(11) Int. only model (nested)[1]	2715.4	2721.4	2731	1.299	
(12) Income, Education & Occupation[2]	2704.6	2714.6	2738.5	1.283	1.23%
(13) Median Income, % of Population w/ Bach. Or Higher, % of Population in Labor Force	2708.0	2718.0	2741.9	1.289	0.84%
(14) All SES Indicators[3]	2699.3	2715.3	2740.7	1.276	1.82%

Note. "-2LL" = -2 Log Likelihood, "AIC" = Akaike Information Criterion, "BIC" = Bayesian Information Criterion

[1] Model 11 indicated that neighborhoods did not vary in FGPA (Level-2 error variance=0.0004, $X^2(1) =$ 0.0003, p=1.00, ICC=0.0002). Thus, level-2 error variance was not estimated for Models 12-14 and their fit was compared to the original Intercept Only Model, Model 0.

[2] Within-neighborhood variance was not modeled, Model 12 is equivalent to Model 5.

[3] Includes Parental Income, Parental Occupation, Parental Education, Median Income, Percentage of the Population with a Bachelor's Degree, and Percentage of the Population in the Labor Force.

Table 9.

Likelihood Ratio Tests Comparing Models 1-14 to the Intercept Only Model

Model	-2LL	df	p-Value
0 (Intercept only model)	2715.4	--	--
1	2708.8	1	0.010
2	2710.4	1	0.025
3	2708.9	1	0.011
4	2704.8	1	0.001
5	2704.6	3	0.013
6	2711.1	1	0.038
7	2711.2	1	0.040
8	2713.8	1	0.206
9	2708.8	1	0.010
10	2708.2	3	0.066
11	2715.4	1	1.000
12	Equivalent to Model 5		
13	2708.0	3	0.060
14	2699.3	6	<.001

Table 10.

Regression Coefficients for Models 1-5

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coefficient	*se*	*Coefficient*	*se*	*Coefficient*	*se*	*Coefficient*	*se*	*Coefficient*	*se*
Intercept	2.237*	0.114	2.364*	0.077	2.240*	0.114	2.515*	0.038	2.091*	0.138
Parental Income	0.035*	0.013							0.024	0.014
Parental Occupation			0.003*	0.001					0.001	0.001
Parental Education					0.055*	0.216			0.033	0.245
SES composite							0.055*	0.017		

* $p < .05$

Table 11.

Regression Coefficients for Models 6-10: Dichotomous Variables

	Model 6		Model 7		Model 8		Model 9		Model 10	
	Coefficient	*se*	*Coefficient*	*se*	*Coefficient*	*se*	*Coefficient*	*se*	*Coefficient*	*se*
Intercept	2.435*	0.054	2.447*	0.051	2.471*	0.051	2.416*	0.543	2.387*	0.063
Dichot. Income	0.160*	0.077							0.130	0.079
Dichot. Occupation			0.161	0.078					0.119	0.087
Dichot. Education					0.100*	0.078			0.029	0.086
Dichot. SES composite							0.198*	0.077		

* p < .05

Table 12.

Regression Coefficients for Models 12-14: Student and Neighborhood-Level Indicators

	Model 12		Model 13		Model 14	
	Coefficient	*se*	*Coefficient*	*se*	*Coefficient*	*se*
Intercept	2.515*	0.038	2.746*	0.586	2.749*	0.585
Parental Income	0.014	0.014			0.020	0.144
Parental Occupation	0.033	0.025			0.033	0.025
Parental Education	0.001	0.001			0.001	0.001
Median Income			0.000	0.000	0.000*	0.000
% w/ Bachelor's or Higher			-0.015	0.011	-0.010	0.007
% in Labor Force			-0.008	0.007	-0.014	0.011

Figure Captions

Figure 1. Bollen et al.'s (2001) SES measurement decision tree.

Figure 2. Unitary single-indicator models of SES. (Bollen et al., 2001).

Figure 3. Unitary multiple-indicator models of SES. (Bollen et al., 2001).

Figure 4. Component multiple-indicator models of SES. (Bollen et al., 2001).

Figure 5. Frequency distribution of FGPA.

Figure 6. Frequency distribution of Parental Occupation.

Figure 1
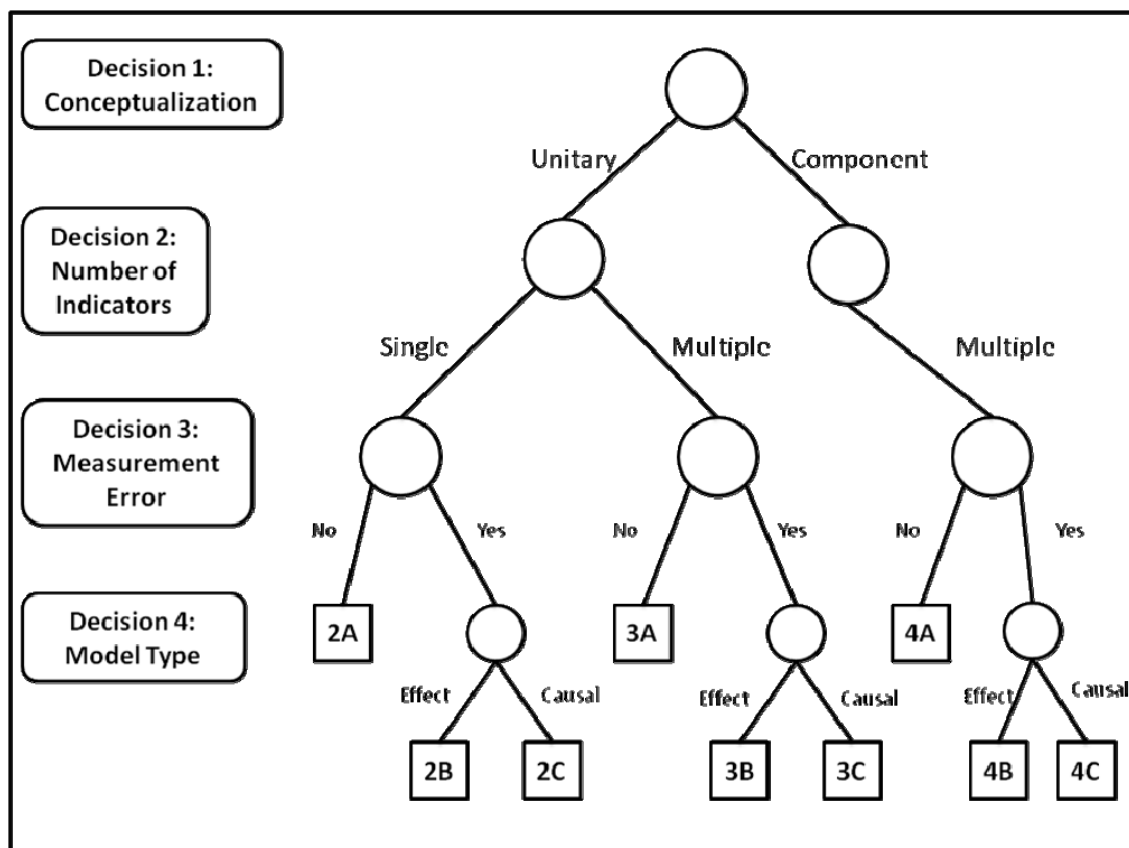
Figure 2
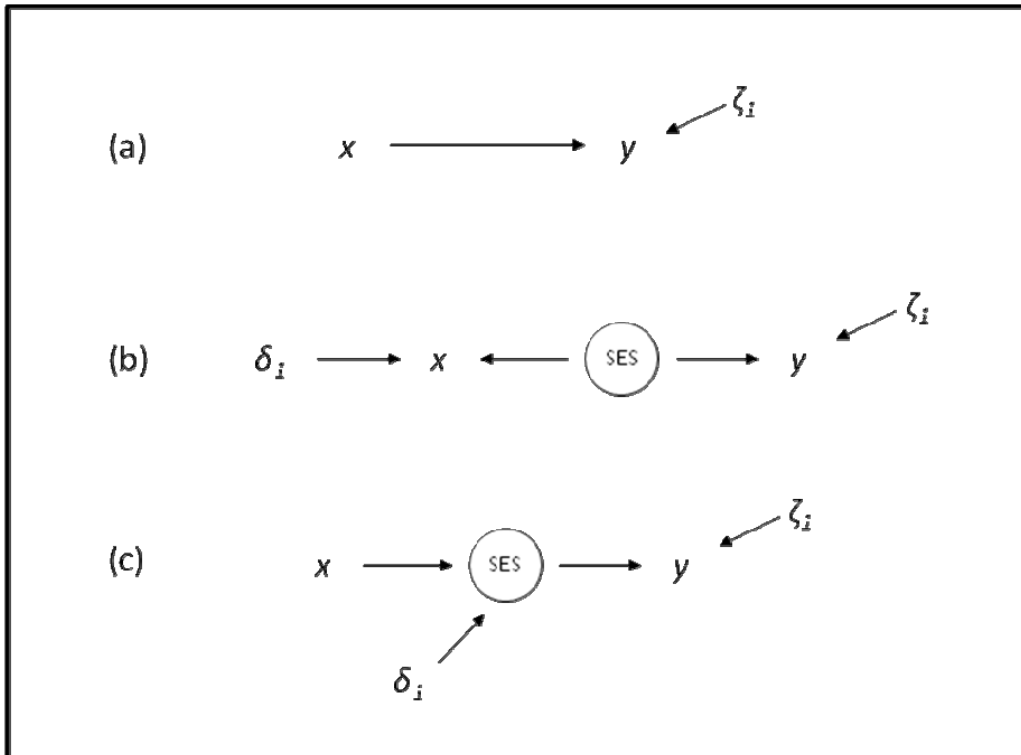
Figure 3
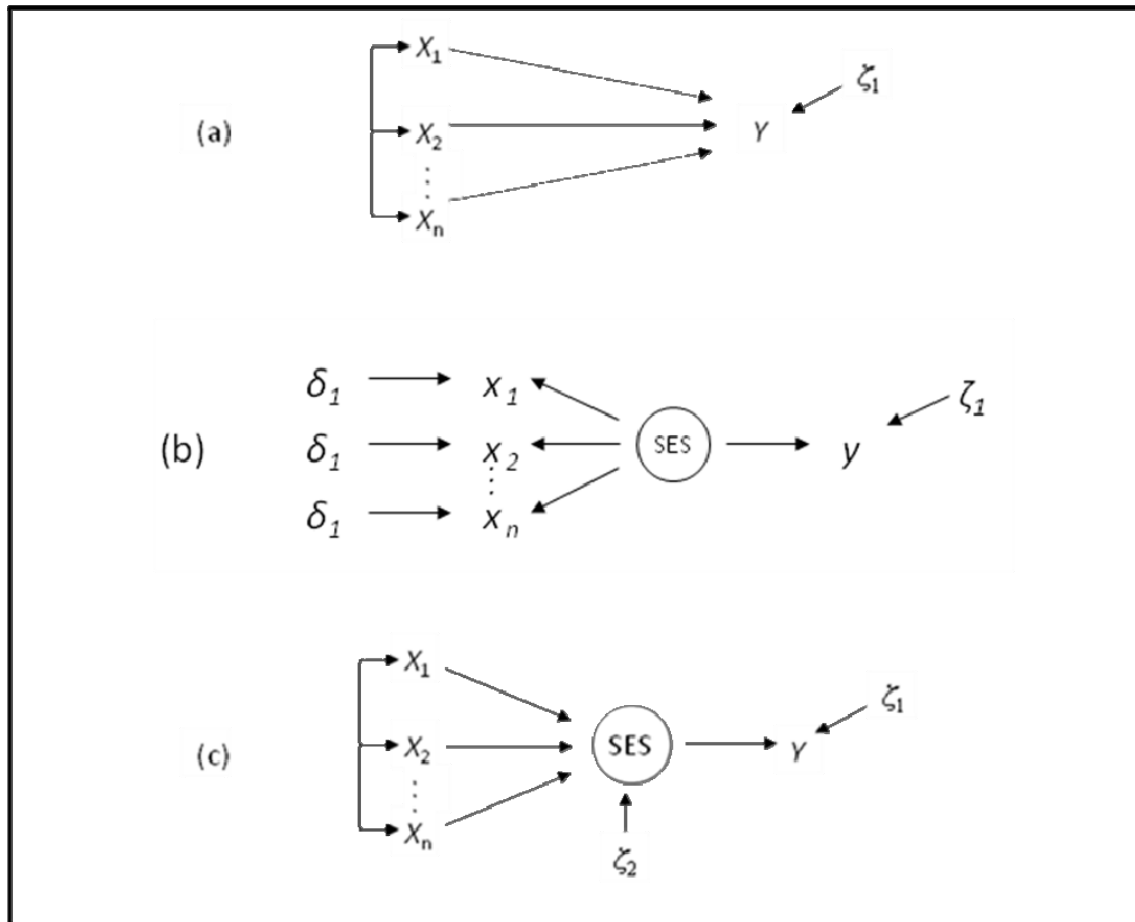
Figure 4
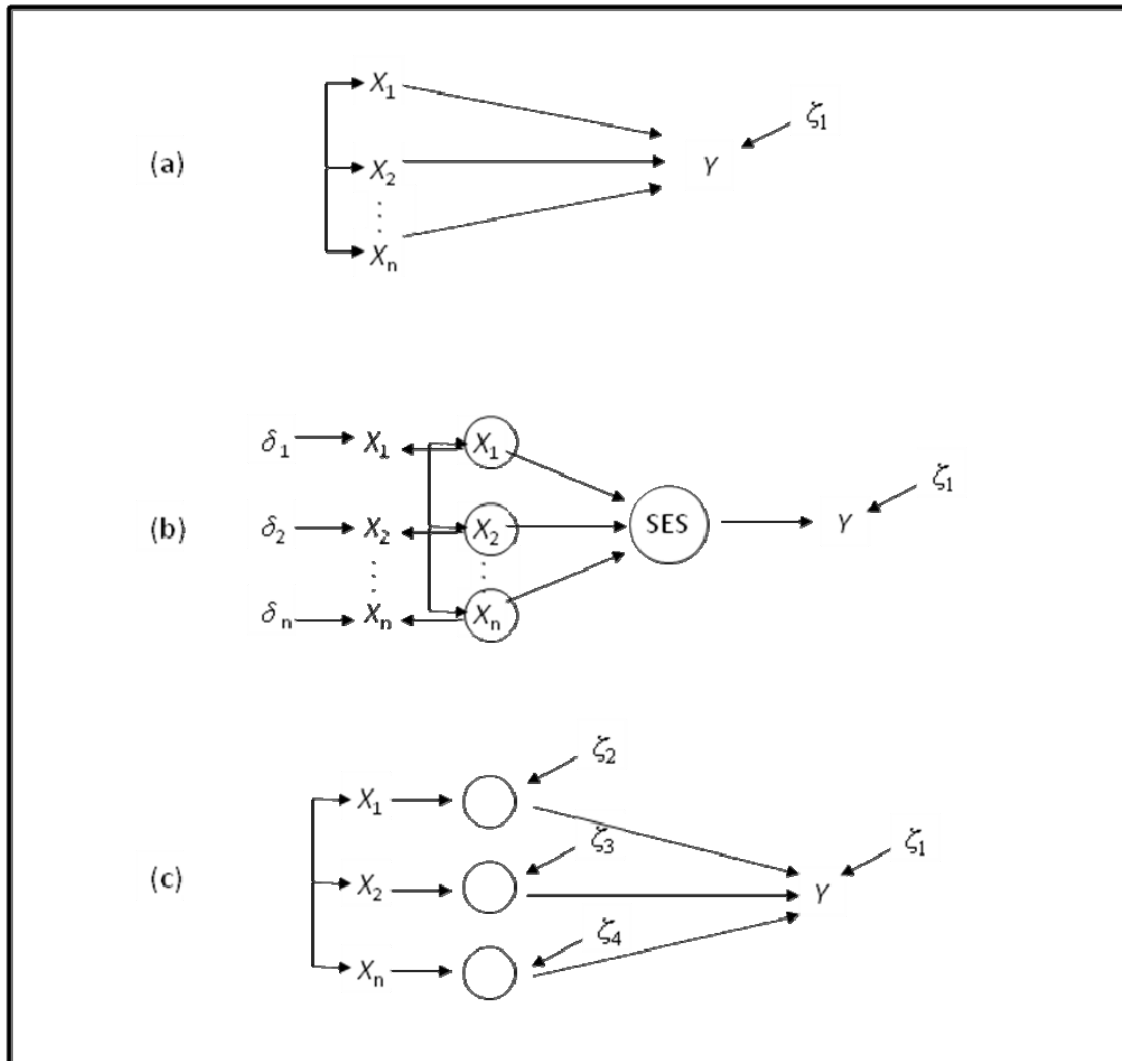
Figure 5
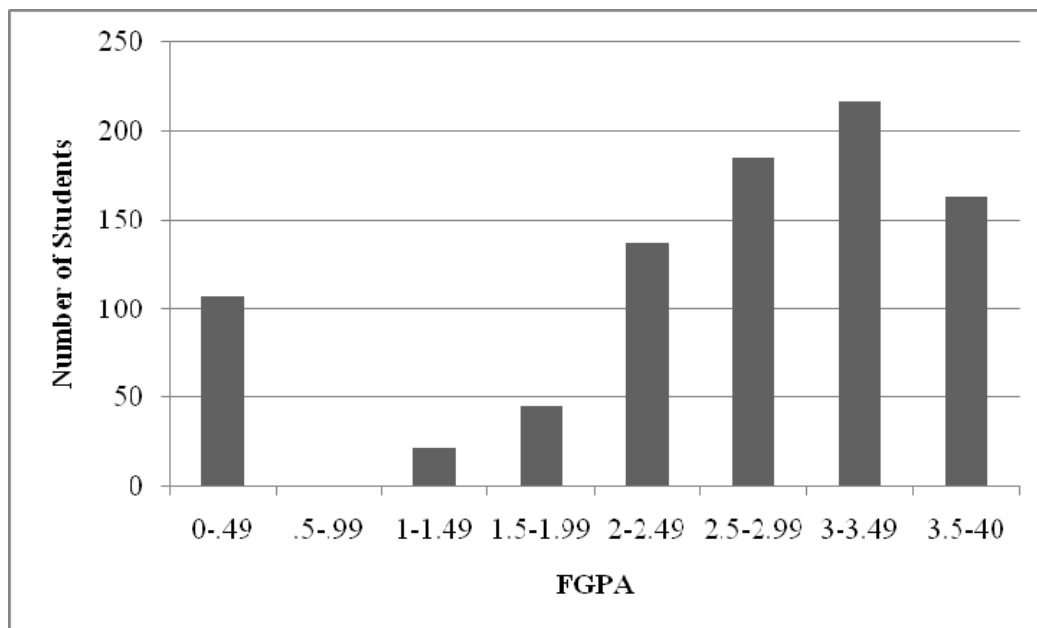
Figure 6
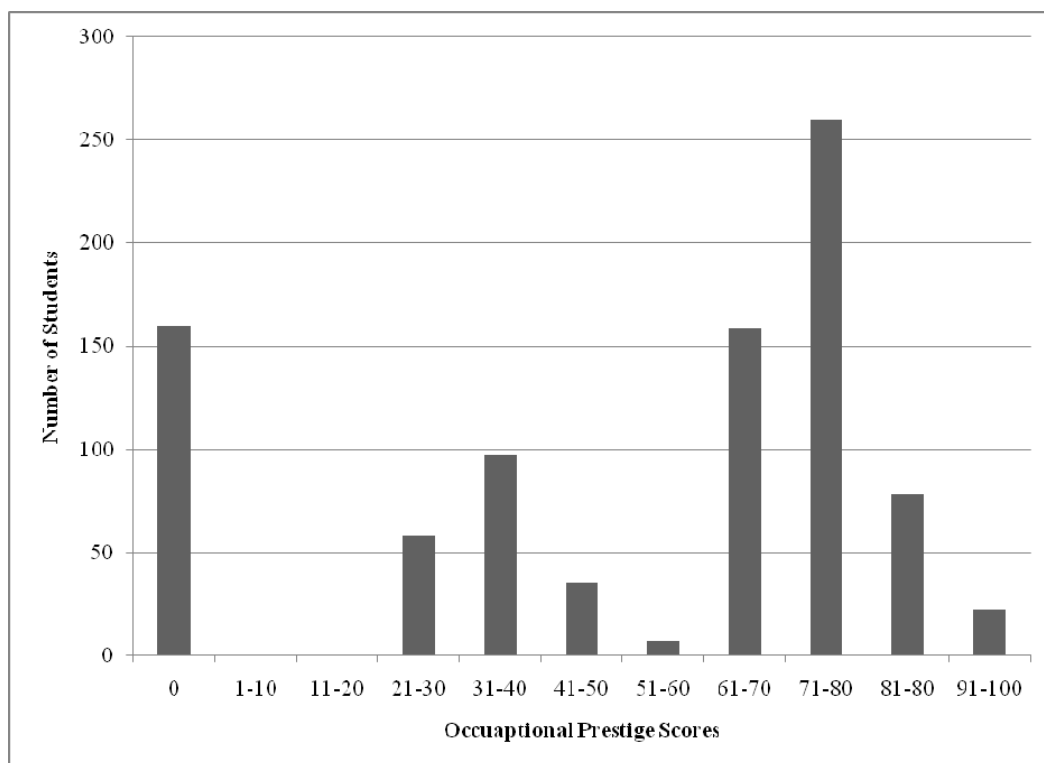
Appendix A

CIRP SES Items

What is your best estimate of your parents' total income last year? Consider income from all sources before taxes. (Mark <u>one</u>)

o Less than $10,000	o $50,000-59,999
o $10,000-14,999	o $60,000-74,999
o $15,000-19,999	o $75,000-99,999
o $20,000-24,999	o $100,000-149,999
o $25,000-29,999	o $150,000-199,999
o $30,000-39,999	o $200,000-$249,999
o $40,000-49,999	o $250,000 or more

What is the highest level of formal education obtained by your parents? (Mark one for each column)

	Father	Mother
Grammar school or less	O	O
Some high school	O	O
High school graduate	O	O
Postsecondary school other than college	O	O
Some college	O	O
College degree	O	O
Some graduate school	O	O
Graduate degree	O	O

Mark <u>only three</u> responses, <u>one</u> in each column.

	<u>Your</u> Probably Occupation	Your <u>father's</u> occupation	Your <u>mother's</u> occupation
Accountant or actuary	○	○	○
Actor or entertainer	○	○	○
Architect or urban planner	○	○	○
Artist	○	○	○
Business (clerical)	○	○	○
Business executive (management, administrator)	○	○	○
Business owner or proprietor	○	○	○
Business salesperson or buyer	○	○	○
Clergy (other religious)	○	○	○
Clinical psychologist	○	○	○
College administrator/staff	○	○	○
College teacher	○	○	○
Computer programmer or analyst	○	○	○
Conservationist or forester	○	○	○
Dentist (including orthodontist)	○	○	○
Dietitian or nutritionist	○	○	○
Engineer	○	○	○
Farmer or rancher	○	○	○
Foreign service worker (including diplomat)	○	○	○
Homemaker (full-time)	○	○	○
Interior decorator (including designer)	○	○	○
Lab technician or hygienist			
Law enforcement officer	○	○	○
Lawyer (attorney) or judge	○	○	○
Military service (career)	○	○	○
Musician	○	○	○
Nurse	○	○	○
Optometrist	○	○	○
Pharmacist	○	○	○
Physician	○	○	○
Policymaker/Government	○	○	○
School counselor	○	○	○
School principal or superintendent	○	○	○
Scientific researcher	○	○	○
Social welfare, or recreation worker	○	○	○
Therapist (physical, occupational, speech)	○	○	○
Teacher or administrator (elementary)	○	○	○
Teacher or administrator (secondary)	○	○	○
Veterinarian	○	○	○
Writer or journalist	○	○	○
Skilled trades	○	○	○
Laborer (unskilled)	○	○	○
Semi-skilled worker	○	○	○
Unemployed	○	○	○
Other	○	○	○

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