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The Variables Most Closely Associated With Academic Achievement: A Review of the Research Literature

*A Report by the
Progressive Research Institute of Nebraska to the
Learning Community of Douglas and Sarpy Counties*

September 2012

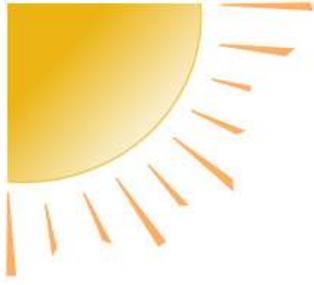## Karen Abrams, MPH

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ABSTRACT

The Learning Community (LC) of Douglas and Sarpy Counties currently bases its decisions about how to allocate funding for academic achievement on formulae that have not been validated through research. The main purpose of this literature review is to provide the LC with science-based information about the relative strength of the association between the out-of-school variables to which it has access, and academic achievement—information it can use to identify and target the populations of elementary school children with the greatest need for academic assistance. The research demonstrates that socioeconomic status (SES) is the strongest predictor of academic achievement. Of the various measures of SES, composite measures are better predictors of academic achievement than single measures. Of the composite

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measures of SES, family SES is the most commonly used. The best family SES measures across the literature include three variables: parent income, parent occupation and parent education level. We found that school SES is also a strong predictor of academic achievement. The research demonstrates that neighborhood SES is a less precise predictor of achievement than either family or school SES. We also found evidence that two of the variables currently used by the LC to allocate funding across the region— English language learners and school mobility—are most likely inadequate predictors of academic achievement. An important finding from the research is that several of the variables we examined predict children's academic achievement differently depending on whether the children are white or minority. In our conclusion, we discuss the relative merit of the variables we examined, and rank them; we also discuss ways in which the Learning Community might use the results of this review.

INTRODUCTION

The Learning Community (LC) of Douglas and Sarpy Counties is a political subdividsion of the State of Nebraska that was created by the State Legislature in 2006. The Learning Community is composed of eleven member school districts and divided into six Achievement Subcouncils. The purpose of the Learning Community is to leverage, redistribute and realign funding (from school aid and levied property taxes) and other educational resources in an equitable manner across the region in order to increase student achievement. This is being accomplished by building a web of collaborative, partner educational systems and structures across, between and among member school districts and subcouncils.

The Learning Community is involved in many projects to support its mission. One important area of work is the distribution of funding to LC subcouncils to support strategies aimed at increasing academic achievement among elementary school children. While programmatic decisions are made at the subcouncil level, the amount of funding allocated to each subcouncil is decided by the LC. This is currently accomplished through the use of two formulae:
- Formula 1: 1/3 of total funding to Subcouncil 2, 1/3 to Subcouncil 5 and 1/3 divided between Subcouncils 1, 3, 4 and 6 on the basis of Formula 2;
- Formula 2: Of the 1/3 total funding to Subcouncils 1, 3, 4 and 6, funding is subdivided using the following population-based formula:
  - 60% —Proportion of students of low socioeconomic status (SES);
  - 30% —Proportion of English language learners (ELL);
  - 10% —School mobility.

This review of the research literature is aimed at the family, school and community contextual variables shown to effect elementary academic achievement—what Hattie calls "out-of-school influences" (Hattie, 2009, p. 40). While this review includes a representative sample from a wide range of existing research, it is not intended to

include those variables under the control of educational institutions. The purpose of this report is to assist the LC in equitably distributing funding to its subcouncils by:

1. Identifying those variables most strongly associated with academic achievement;
2. Identifying the relative importance of the variables by ranking them, to include an explanation of confidence in and limits to the ranking;
3. Describing the magnitude of the importance of the top-most variables.

Dependent and Independent Variables:

Academic achievement—the variable that will be affected—is called the dependent variable. The LC uses 4th grade reading standardized test scores as its measure of academic achievement. We found that while the preponderance of researchers also use standardized test scores as their measure of academic achievement, other measures are also used, such as grades, grade-point-averages, enrollment in high-level (e.g., advanced placement) high school classes, dropout rates, high school completion, SAT scores and college attendance. The research supports the LC's policy of using a single subject as its achievement measure. The correlations between single subject achievement measures (such as the reading achievement measure currently used by the LC) are "significantly larger correlations than general achievement measures (e.g., GPA or a composite achievement test)" (Sirin, 2005, p.440).

The variables that affect academic achievement are called the independent variables. This literature review focuses only on those independent variables for which the LC can already access data across the region through either the Nebraska Department of Education (NDE) or United States Census. We paid greatest attention to those variables currently used by the LC in its Formula 2 for allocating funding to Subcouncils 1, 3, 4 and 6 (low SES, ELL and school mobility). We also examined the research related to other independent variables that the LC is not currently measuring, but that it has the potential to utilize through the available data sources mentioned above.

In order to gain a thorough understanding of each independent variable as a predictor of achievement, we analyzed several factors associated with it:

1. How it was defined and measured;
2. The strength of association between it and academic achievement (i.e., whether associations were positive or negative, and the size of the effect);
3. Its statistical and conceptual limits as a predictor of achievement.

We will discuss each of these factors for each independent variable addressed in this paper.

Controlled Variables:

Throughout this paper we will be referring to certain variables that are "controlled." In social science research there are usually many possible factors that could be influencing outcomes. Researchers use statistical analysis to try to isolate which of those factors are influencing results and having a true effect on the dependent variable.

In other words, all of the possible interfering variables are "controlled" so that the researcher can analyze the true effect of the independent variable on the dependent variable.

Types of Research:

We examined five types of research:
1. Primary research: Researcher collects own original data and analyzes it;
2. Secondary research: Researcher conducts new analysis of existing data;
3. Literature reviews: Researcher analyzes existing research studies for important findings;
4. Meta-analyses: Researcher develops statistical measures in order to provide a comprehensive analysis of results across an entire body of primary research studies;
5. Meta-analyses of meta-analyses: Researcher develops statistical measures in order to provide a comprehensive analysis across all meta-analyses associated with a particular subject area.

Throughout our review we prioritize the findings of both kinds of meta-analyses described above because they provide us with comprehensive statistical analyses of results across entire bodies of both primary research and meta-analytic studies, thereby revealing patterns and relationships (or lack thereof) that might not otherwise be seen. These studies can also increase the confidence we have in a perceived relationship between independent variables and academic achievement. We examined research over the last 25 years or so, but focused more on work that included larger sample sizes—with a particular focus on those samples that reflect national demographics. In addition, we prioritized research related to the achievement outcomes of elementary school students over other studies. Finally, we prioritized research published in peer-reviewed scientific journals, although we did examine some non-journal articles.

Hattie states that, "what a child brings to the class at the start of his or her schooling, as well as on each and every day, is critical to the outcomes of education" (Hattie, 2009, p. 40). This literature review is intended to focus on those family, school and community contextual variables that can be used by the LC to help it identify and target the populations of elementary school children with the greatest need. As a result, we intentionally excluded research that focused on achievement-related variables under the control of schools (e.g., those associated with teaching and learning), and we excluded research examining the outcomes of programs, policies and practices[1] aimed at enhancing achievement.

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[1] We define programs, policies and practices as follows: (1) Programs are structured interventions that are designed to change individual attributes of the target population in order to enhance academic achievement (e.g., mentoring/tutoring); (2) Policies are rules, regulations, standards or laws that are designed to enhance academic achievement (e.g., class size no bigger than 20); (3) Practices are standardized activities that are designed to support policy in order to enhance academic achievement (e.g., specific teacher training programs).

In addition, we focused on the research related to those variables to which the LC currently has access to the data. As a result, we did take a summary look at four variables associated with schools rather than student populations, and one variable associated with school location, because the data is available through the NDE or U.S. Census. These are: school size, class size, teacher advanced degrees, teacher salary and experience. We made this exception because of the Learning Community's direction to us to address all easily accessible data points.

INDEPENDENT VARIABLES

Socioeconomic Status

Socioeconomic status (SES) is a term that has been defined in a plethora of ways throughout the research literature related to academic achievement. Sometimes SES is defined by a single economic measure (e.g., income); sometimes it is defined by a single social factor (e.g., family structure); and at other times it is defined as a combination—or composite—of economic and social factors (e.g., income, parenting style, number of siblings in a family, etc.). Each of those different definitions of SES can be examined at the family level, at the school level, and sometimes at the neighborhood level.

On the whole, we found SES to be one of the most important out-of-school variables associated with academic achievement (Bradley, 2002; Caldas, 1993; Duncan, 1994; Duncan, 2005; Fetler, 1989; Hattie, 2009; Lacour, 2011; Levanthal, 2000; Sirin, 2005). As a result, we delved quite deeply into the research literature's findings on SES in order to untangle the often confusing assortment of definitions (single vs. composite) and levels of analysis (family, school, neighborhood).

Single vs. Composite Measures of SES:

The research literature indicates that definitions of SES that include a single measure are less powerful—that means the effect size on academic achievement tend to be smaller—than those that include composite measures (Sirin, 2005). Single measures of SES also tend to be more volatile—changing more quickly over time—than composite measures (Bradley, 2002; McLoyd, 1998). In looking over the literature, we found that composite definitions of SES include two or more of the following variables: family income, parent education, parent occupation, family structure, family size, neighborhood conditions, eligibility for free and/or reduced price meals, and home resources (Bradley, 2002; Duncan, 2005; Kiefer, 2008; Lacour, 2011; Levanthal, 2000; Rumberger, 2005; Sirin 2005).

Levels of Analysis:

How SES is defined, and the context in which it is measured depend on the theoretical interests of the authors. For example, some researchers are interested in SES as a measure of economic position because they see financial resources as the basis of

hierarchy (otherwise known as class) within our society (Bradley, 2002). Others may favor a view of SES as a measure of social status or prestige (Bradley, 2002; Gonzales, 1996). Still others may prefer to analyze SES as just one component of a much broader ecological web of factors influencing behavior (Gonzales, 1996).

Overall, SES is usually viewed as a combination of wealth, power and social status (Sirin, 2005). Others believe that the concept of "resources" should be much broader, and include "financial, emotional, mental, spiritual and physical resources as well as support systems, relationships, role models and knowledge of hidden rules" (Lacour, 2011, p. 522)—that only such a comprehensive definition can adequately distinguish between poverty and wealth.

Substantial ambiguity remains with regard to how the various factors included in measures of SES affect one another, how they should be balanced (Bradley, 2002), and which should be included at which levels of analysis. In fact, many researchers do not even take levels of analysis (family, school, neighborhood) into consideration—they simply lump a variety of measures into a composite measure of SES that may overlap between two or all three of these levels.

The school and neighborhood context of socioeconomic status has grown increasingly important to researchers who are interested in sorting out the complex, multi-dimensional interactions between the various factors that influence academic achievement as well as other outcomes related to well-being and health (McLoyd, 1998). Although SES is assessed differently at the school level (usually using the proportion of students receiving free and/or reduced price meals as a proxy for family income) versus at the neighborhood level (where definitions can incorporate a wide variety of measures), what school and neighborhood SES measures do that is particularly important is incorporate a conceptual view of SES that includes a broader array of resources than those related solely to a student's family (Sirin, 2005).

Race and SES:

The scientific literature illustrates that among variables measured outside the school setting, SES and race are the two strongest predictors of academic achievement (Caldas, 1993; Caldas, 1997). The positive correlation between minority status and SES is very high—in fact, the literature indicates that SES and minority status measure the same thing (Abott, 2009; Caldas, 1997; Mehana, 2004): Mehana & Reynolds state in their literature review that "for 23 out of the 26 studies, minority status and SES were identical (Mehana, 2004, p. 103)." In our examination of the literature, we found this was true for both those researchers examining family SES and those examining school SES. For example, Kieffer found that after a "school's concentration of poverty was taken into account, the concentration of students of color did not have a significant effect" on achievement (Kieffer, 2008, p. 861). Another way to say this is that "as the percentage of minority students increases, the percentage of the student body that is poor is highly likely to increase" (Caldas, 1997, p. 273).

A caveat is that while SES is a strong predictor of achievement for all children, it is in general a stronger predictor of achievement for white than for minority children (Brooks-Gunn, 1993; Sirin, 2005; Halpern-Fisher, 1997); in fact, it appears that "minority status acts as a moderating factor" reducing the strength of the relationship between SES and academic achievement (Sirin, 2005, p. 441). That difference is greater for children in secondary school than in elementary school. As we will describe in greater detail, below, the research finding that race/ethnicity is a moderator of the power of SES to predict academic achievement outcomes is particularly true of family SES, less true for neighborhood SES, and least true of school SES.

Family SES:

Some definitions and measures of family SES are better than others. For example, there is general agreement that composite measures of family SES are superior to single measures (Bradley, 2002; Duncan, 2005; Kiefer, 2008; Lacour, 2011; Rumberger, 1998; Sirin, 2005). The most commonly used composite measure of family SES includes family income, parent education, and parent occupation (Bradley, 2002; Hattie, 2009; Kiefer, 2008; Sirin, 2005).

Overall, the literature shows that family SES is a robust and consistent predictor of achievement for white students, no matter how it is defined or measured (Bradley, 2002; Duncan, 2005; Lacour, 2011; Sirin 2005). However, family SES is a very weak predictor of academic success for minority children (Bradley, 2002; Sirin, 2005), reducing its value for the LC. Specifically, the correlation between SES and academic achievement was minimized with the increase in the proportion of minorities in the study sample (Sirin, 2005). The strength of the association between family SES and academic achievement is weakest for students in urban schools compared with those in suburban schools (Sirin, 2005). These limits are important because they mean that family SES influences academic achievement differently depending on both minority status and where children live and go to school.

Researchers have theorized about why family SES has differential significance in relation to academic achievement between racial and ethnic groups. One explanation that may account for part of the difference is that there are fewer differences in the distribution of variables associated with family SES among minorities. Using income as an example, this means that income varies less among minorities than among whites (Sirin, 2005).

Some researchers believe that in order to make up for this lack of variance, other indicators of economic well-being should be incorporated into composite variables for SES, such as accumulated wealth (Sirin, 2005). Other researchers suggest strengthening composite measures of SES by supplementing family income—the traditional measure of financial resources—with additional measures such as "what a family pays for rent or housing" (Bradley, 2002, p. 373). One recent study (2005) that

used survey data from a nationally representative sample of 8,000 families and individuals, found that when family income was used as the single measure of family SES, the effect size on achievement was small for both whites and blacks, although it was slightly smaller for blacks (Davis-Kean, 2005).

Some of the indicators of family SES commonly used within composite measures have also been examined in the research literature as individual indicators. Of these, the LC has access to data through the Census that gets at financial measures of human capital, such as income, wealth, occupation, unemployment, etc. In addition, the LC has access to two measures of family SES that can be included as indicators of human capital: [2] parent education and family structure.

<u>Parent Education</u>:

Parent education is a statistically significant predictor of academic success across the board. However, it is a weaker predictor for minority students (Dornbusch, 1991). Overall, maternal education is a better predictor than paternal education or the combined "parental" education (Lacour, 2011). Compared to family structure (discussed below), parent education is generally found to be a stronger predictor of academic achievement, though its predictive effects are still somewhat modest (Davis-Kean, 2005; Duncan, 2005).

Some researchers posit that the relationship between parent education and student academic achievement is a function of financial capital—in other words, that parents with higher levels of education end up with better paying jobs and thus are able to provide their children with more resources than those with lesser educational attainment (Sirin, 2005). Other researchers view the relationship between parent education and student academic achievement as a function of parenting style: parents with higher levels of education create more enriching environments and interactions with their children than those with lesser educational attainment (Lacour, 2011). Finally, some researchers see it as a combination of the two. In all of these cases, parent education is conceived as an indirect variable—one that directly influences finances and/or parenting style before indirectly affecting the academic achievement of children.

An important caveat that will come up repeatedly throughout this paper regarding the strength of parent education as a predictor of academic achievement is that, while the variable is a consistent predictor of achievement (Bradley, 2002; Duncan, 2005; Lacour, 2002), it's predictive power is reduced among minority children (Dornbush, 1991; Davis-Kean, 2005). Another limit to this variable is the strong correlation between parent education and other academic advantages, in particular "cognitive endowments" (Duncan, 2005, p. 41). It is hard to know whether children of more highly educated parents tend to do better academically simply because they are smarter.

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[2] We define human capital as the economic value of an individual's capacities, made manifest in his or her knowledge, skills and abilities.

Family Structure:

Researchers are interested in the impact of family structure on academic achievement (i.e., families in which the original parent pair is intact; one-parent families; families in which parents are divorced; families in which parents are re-married). Much of this interest appears to be related to the fact that households with one parent (whether by design or due to a break-up) face poverty and/or declines in income at substantially higher rates than intact families (Duncan, 2005). Other researchers are interested in differences in the psychological well-being of children within families of different structures, and how these structures are related to such factors as nurturing and levels of conflict (Amato, 1991) as well as child adjustment and resiliency (Jeynes, 2006). According to Jeynes (2005), family structure is an indirect correlate of academic achievement, in that it is actually a measure of parental involvement; parental involvement, in turn, affects expectations, which then affect achievement.

However, the literature indicates that family structure has only a small correlation with academic achievement (Amato, 1991; Hattie, 2009; Jeynes, 2005; Jeynes, 2006). That small correlation is reduced further when family background, including SES, is controlled (Duncan, 2005; Jeynes, 2005; Ma, 2000). Hattie succinctly describes the importance of family structure as a predictor of achievement: "There are many types of families, and the effects of these different types could be classified as small compared to many other influences" (Hattie, 2009, p. 64).

The correlation between family structure and academic achievement is even smaller among blacks (Dornbusch, 1991). This reinforces an interesting point for the Learning Community to keep in mind as it seeks an accurate formula for determining the needs of the region's diverse student population: based on our survey of the literature, we now know that minority status reduces the predictive power of both family SES and family structure. Although the Dornbusch research (1991) focused on adolescents, we are highlighting this work because of the important questions it raises about race, ethnicity and academic achievement.

Dornbusch, et. al. are unequivocal in stating that we must "question the extent to which family structure can be used to predict adolescent school performance within the African American ethnic group" (Dornbusch, 1991, p. 544). It is the position of these researchers that variables within the "community context" are the critical components that are reducing the impact of family structure on achievement among minorities, and blacks in particular (Dornbusch, 1991, p. 563). Another way of stating the conclusion of Dornbusch, et al. is that intact families and parents who have attained higher educational levels act as protective factors for minority children when those minority children do not live in communities in crisis—and that living in a community in crisis overwhelms what would otherwise be a variable that would be (as is the case in white populations) highly correlated with increased academic achievement.

School SES:

Based on our findings from the literature, we believe that school SES is a potent predictor of academic achievement. Hattie—in his meta-analysis of meta-analyses of research related to achievement—found that "SES is more important at the school than at the individual level" as a predictor of achievement (Hattie, 2009, p. 63). The research is clear that as the average SES of a school increases, the academic achievement of students within that school improves (Caldas, 1997; Kieffer, 2008; Ma, 2000; Rumberger, 2005).

However, researchers disagree about which is a stronger predictor of student achievement, family or school SES. For example, while Ma concludes that school SES has substantially smaller effects on academic achievement than family SES (Ma, 2000), Rumberger states that the socioeconomic level of students' schools is at least as important as family SES (Rumberger, p. 1999). Looking only at school-level demographics, Kieffer writes that a school's "concentration of poverty had the largest effects on students' growth trajectories in reading, specifically a substantial negative impact on predicted fifth-grade status" (Kiefer, 2008, p. 861) when compared to the proportion of students of color or the proportion of students categorized as limited English proficient.

Throughout the literature, median school SES is most frequently based on the proportion of students eligible for free and/or reduced price meals. Currently, the Learning Community uses the proportion of students receiving free and reduced price meals within a subcouncil as its measure of a subcouncil's aggregate SES. Here, we will quote Sirin, who states that "the use of participation in school lunch programs as a measure of SES, though common, is conceptually problematic" (Sirin, 2005, p. 444), and as a result, "researchers should avoid using school lunch eligibility as an SES indicator for students" (Sirin, 2005, p. 444). That said, Sirin also states that eligibility for school meal programs correlates more strongly with academic achievement in the lower grades than in the higher ones—free or reduced lunch eligibility "only weakly correlates with academic achievement as grade levels rise" (Sirin, 2005, p. 444). This is likely of interest to the LC, which is focused on elementary achievement. Furthermore, while free-and-reduced lunch may not be the strongest measure of school SES, it is still moderately strong: according to Sirin, this measure accurately predicts academic achievement approximately one-third of the time—at about the same rate as family income (Sirin, 2005).

Caldas (1997) notes that peer poverty, when measured by the concentration of students eligible for free and reduced lunch, shows no relationship to academic achievement; but, when peer poverty is defined by a different measure of SES—peer family social status (Caldas uses a composite of parental education and occupation variables)— "attending school with classmates who come from high SES backgrounds does tend to positively raise one's own academic achievement, independent of one's own SES background, race and other factors" (Caldas, 1997, p. 275).

A moderating factor on the influence of school SES may be where a school is located (Caldas, 1993; Sirin, 2005). In his meta-analysis of the research on SES as a predictor of academic achievement, Sirin states that the relationship between the average family SES within a school and academic achievement "was the weakest for urban schools as compared with non-urban schools" (Sirin, 2005, p. 441). On the other hand, it may well be that school SES—unlike many other measures of SES—is nearly as accurate a predictor of achievement across all races and ethnicities: According to Rumberger, "school socioeconomic status had as much impact on advantaged as on disadvantaged students, and almost as much impact on Whites as on Blacks" (Rumberger, 2005, p. 1999). These are factors for the LC to take into consideration as it weighs the relative merit of the SES indicators available to it.

The research is very clear that school SES is not a valid predictor of achievement when it is defined as the proportion of students eligible solely for reduced price meals (Caldas, 1993; Sirin, 2005). This is an important point for the LC, which currently uses a composite measure that includes the proportion of students receiving free and reduced price meals in Formula 2. The preponderance of evidence from the research literature demonstrates that the proportion of student's eligible for "reduced price meals" (as opposed to free meals) is not an accurate proxy for school SES, and is not a good predictor of academic achievement. It is possible that the inclusion of reduced price meals in the LC's current measure of SES contributes to that measure's potential for inaccuracy.

It turns out that the research is also quite clear on the fact that the proportion of students eligible for "free meals" only is a very strong indicator of school SES, especially in elementary schools (Caldas, 1993). In other words, when student eligibility for free meals is used to measure median school SES, the variable shows a significant relationship with elementary academic achievement. Unfortunately, the proportion of children in a school receiving free meals is not data currently available through the Nebraska Department of Education.

Neighborhood SES:

In addition to family and school SES, there are also many researchers interested in the effect of neighborhood SES on school achievement. However, the research findings related to neighborhood SES are somewhat ambiguous. This may be due in part to the fact that the variables incorporated into definitions of neighborhood SES include quite a large range of measures. For example, in the research we examined, neighborhood SES was defined using single and composite measures including one or more of the following: median family income, per capita income, poverty rate, family structure, number of children in a family, average level of completed education for adults over age 25, maternal age, ethnic diversity, ethnic segregation, type of occupation, unemployment rates, male unemployment rates, residential mobility rates, and percent

owner-occupied housing units. In complex social settings such as neighborhoods, it can be difficult to tease out which factors are contributing to student outcomes (Bradley, 2002), and to determine whether different indicators are "tapping into the same underlying phenomenon" (Bradley, 2002, p. 373).

The research indicates that, in general, the effect of neighborhood SES on academic achievement appears to be smaller than that of family-level or school-level SES (Levanthal, 2000). But, when family income and parent education are controlled, neighborhood SES does correlate with academic achievement (Bradley, 2002; Levanthal, 2000): "Neighborhood effects were small to moderate and accounted for about 5% of the variance in child outcomes, after controlling for a host of family-level characteristics (family income, family structure, maternal education, maternal age, and race/ethnicity)" (Levanthal, 2000, p. 328). The research indicates that after controlling for family and child characteristics such as prior achievement, "residing in a more disadvantaged neighborhood was associated with lower math scores at the end of 5th grade" (Greenman, 2011, p. 1441).

There are also a few studies that show neighborhood SES to be a stronger predictor of academic achievement for minorities than family or school SES. For example, Dornbusch, et. al. found that neighborhood SES (defined as a combination of community income and community level of education) "was of approximately equal utility as a predictor of grades within the two ethnic groups" of blacks and whites (Dornbusch, 1991, pp. 558 and 561). So, unlike several of the measures we have investigated, community socioeconomic status seems to be predictive of academic achievement for both whites and blacks (Dornbusch, 1991).

Additionally, there is evidence that the presence of high-SES neighbors has a positive effect on elementary school achievement—although this effect is much more pronounced for white children than for black children (Brooks-Gunn, 1993; Halpern-Fisher, 1997; Levanthal, 2000). For example, "white male adolescents did better in school when there were more middle-class residents and fewer low-SES residents in their neighborhoods (Halpern-Fisher, 1997, p. 172)." According to Levanthal, it is very possible that "the influence of neighborhood characteristics, such as high SES, may have less impact on the well-being of African American children than on that of European American children" (Levanthal, 2000, p. 328).

Bradley eloquently explains some of the difficulties in unraveling neighborhood effects:

> It is methodologically difficult to establish causal relationships between complex social settings such as neighborhoods and individual behavioral outcomes because results are often consistent with more than one explanation (Duncan, 1999; National Research Council, 1993). There are a number of potentially confounding factors that make interpretations about neighborhood effects difficult. Most notably, any differences observed in the incidence of negative behaviors or outcome may be due to the characteristics of those people who selected to live there (a "selection effect"

or "omitted variables bias"). Also, major social stressors may have a direct effect on a large proportion of neighborhood residents (an "aggregation effect") (Bradley, 2002, pp. 390-91).

Many researchers are trying to determine why some measures of neighborhood SES are differentially predictive for academic achievement depending on whether children are white or minority. One provocative hypothesis is that social problems in economically depressed neighborhoods where minority children live in far larger proportions than white children restrain the potential positive influence of other variables (Dornbusch, 1991). If true, this would mean that neighborhood context—difficult as it is to measure and track—is supremely important. In this view, neighborhoods can be such potent risk factors that they undermine what would otherwise be protective factors in the lives of many minority children—factors such as higher income families, intact families, and families where parents' higher levels of education mean they are providing more enriching environments and interactions for their children.

Conclusions Regarding SES as a Predictor of Achievement:

An important limit to composite measures of SES is that no consensus exists about how the components should interact (Bradley, 2002). Perhaps even more important, there is no agreement about the predictive value of various composites (Bradley, 2002). Finally, minority status is a moderating factor for both family and neighborhood SES—though in opposite directions. That means that family and neighborhood SES appear to differentially affect black and white children—with family SES more important to the academic achievement of whites (Bradley, 2002) and neighborhood SES more important to the academic achievement of minorities (Dornbusch, 1991). As Bradley states, "there remains some uncertainty as to whether SES has the same underlying meaning in all ethnic and cultural groups" (Bradley, 2002, p. 373). There is also strong evidence that minority status is not the only moderating factor—location is also important: According to Sirin, "the impact of family SES varies for individuals depending on where they live and the cohort with whom they go to school" (Sirin, 2005, p. 441). While school SES does appear to be moderated by school location, it appears to be nearly as accurate a predictor of academic achievement among minority children as it is among white children. As a result of all of the above, we strongly believe that the best way to ensure that a composite measure of SES accurately predicts academic achievement among the LC's diverse student population is to incorporate both school SES and neighborhood SES into the measure.

English Language Learners

English language learners are a group that "is fluid, and children move in and out of being classified as an ELL according to their progress toward becoming fluent in English and the kind of policy that the state or district mandates" (Garcia, 2008, p. 11). English language learners are distinguished from native English speakers using varying terminology that focuses either on a child's level of English (e.g., English language

learner or ELL, and limited English proficiency or LEP), or on the primary language spoken in the child's home (e.g., language minority learner or LM). In this paper, we will use the term ELL, as that is the term used by the Learning Community.

The research reveals that the pool of children identified as ELL includes a wide diversity of social and economic characteristics. Nonetheless, when compared to native English speakers, children identified as ELL do have—as a group—several characteristics in common. First, children classified as ELL represent ethnic and racial minorities, and among minorities, they are also more likely to be Latino or Asian/Pacific Islander (Kieffer, 2008). Also, they tend to have lower SES, as well as to attend schools with much higher concentrations of poverty and higher concentrations of both minority students and students designated as ELL (Kieffer, 2008; Garcia, 2009).

Regardless of how ELL is defined, the literature indicates that, overall, ELL is moderately associated with elementary academic achievement when SES is controlled (Genesee, 2005; Kieffer, 2008). While the association between ELL and academic achievement is strong for children in grades K-3, it is weak for grades 4-12 (Genesee, 2005; Kieffer, 2008).

Importantly, the research shows that in the case of the strong correlation for children in grades K-3, the risk factor for lower academic achievement is *not* living in a home where a language other than English is spoken—rather, it is the level of oral English proficiency of the child at kindergarten entry that is key (Kieffer, 2008).[3] In fact, Kieffer points out that ELL children with high oral English proficiency at kindergarten entry had academic growth trajectories that were "higher in elevation than those of their demographically similar peers who attended demographically similar schools" (Kieffer, 2008, p. 861).[4] On the other hand, ELL children who enter kindergarten with limited oral English proficiency do moderately worse than demographically similar native speakers attending demographically similar schools (Kieffer, 2008). According to Kieffer, "the negative effects that accrue from living in poverty and attending a high-poverty school likely contribute to the low achievement of [language minority] learners" (Kieffer, 2008, p. 853). This finding is important to the discussion already begun in this paper regarding the significant influence of school SES on academic achievement.

Another interesting fact is that, over time, the reading achievement scores of children who enter kindergarten with limited English proficiency converge to those of students who are of the same ethnicity, SES and school demographics, but who were not limited English proficient at kindergarten entry (Kieffer, 2008). The narrowing of the gap between these two groups when ethnicity, SES and school demographics are

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[3] Kieffer points out that within the ELL group, those who are proficient in oral English at kindergarten entry are "more likely to be Asian or Pacific Islander and were less likely to be Latino and tended to have higher SES," and on average "attended schools lower in poverty, lower in concentration of students of color, and lower in concentrations" of students designated as ELL (Kieffer, 2008, p. 855).

[4] While not relevant for the purpose of this review, this finding is very important for those interested in the benefits of bilingualism. Kieffer also found that when academic growth trajectories are compared between native English speakers and ELL students, ELL status actually "moderated the negative effect of attending a high-poverty school" (Kieffer, 2008, p. 864).

controlled is an indicator that SES, ethnicity and school demographics are more important factors than ELL in influencing achievement (Abbott, 2009; Kieffer, 2008). This fact limits the extent to which ELL accurately predicts academic achievement.

An additional limit to the accuracy of ELL as a predictor of academic achievement is that the literature demonstrates that the classification system for ELL lacks validity (Abedi, 2008; Garcia, 2008) and that the instruments used to determine who is and who is not ELL lack reliability (Abedi, 2008).[5] The validity of the ELL classification system and the reliability of the instruments used to measure ELL and/or English proficiency are important. If the system and its tools are invalid and inconsistent (Abedi, 2008), then there are likely large discrepancies between—and perhaps also within—districts in the children who are classified as ELL. Furthermore, if ELL identification is inaccurate, it could well be affecting academic achievement. All of these factors are important for the LC funding allocation formula, because ELL may be affecting the accuracy of that formula.

Conclusions Regarding ELL as a Predictor of Achievement:

All in all, the research literature summarized above shows that ELL is a variable with substantial limitations that reduce its value as a predictor of academic achievement. First and foremost, for ELL to be considered an accurate predictor of academic achievement, ELL must be defined according to English proficiency entering kindergarten. Even under these circumstances, ELL is only closely associated with the academic achievement of children in kindergarten through third grades. Second, the fact that over time the achievement of ELL children is similar to that of children of the same ethnicity, SES and school demographics suggests that these four variables may all be measuring the same thing.[6] Third, there are the important questions related to the validity of ELL as a classification system, combined with doubts about the reliability of ELL assessment tools. For these three reasons, we believe ELL is a variable with substantial limitations as an accurate predictor of elementary academic achievement.

School Mobility Rate

Throughout the literature, the school mobility rate is almost always defined as the number of schools a child attends within a time period (e.g., a school year). However, the NDE definition of the school mobility rate measures the number of students who enroll in or un-enroll from a school building during a school year. In other words, this measure focuses on the school rather than the student. This school-based measure is the one currently in use by the LC in its formula for allocating funding for elementary academic achievement.

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[5] We define validity as the degree to which the classification system accurately classifies—or measures—what it claims to classify; we define reliability as the degree to which the same instruments produce consistent results under consistent conditions over time.
[6] Based on our analysis, we think the common denominator is SES.

According to the research, school mobility rates—defined as student moves from one school to another—correlate only weakly with elementary academic achievement when prior achievement is controlled (Alexander, 1996; Heinlein, 2000). In other words, "achievement prior to the move was found to be an important predictor for achievement after the move" (Mehana, 2004, p. 115). Furthermore, the research shows that only mobility prior to third grade affects achievement; moves after third grade have zero association with achievement (Heinlein, 2000, p. 355). Also, measures of school mobility rates overlap substantially with family SES (Alexander, 1996; Wright, 1999), and are less predictive of achievement than family SES (Wright, 1999).

However, when researchers analyzed the outcomes for those students who were *highly* mobile (defined as at least three moves), they found the effect on academic achievement was stronger, though still only a moderate effect at most (Heinlein, 2000; Temple, 1999). That said, the Nebraska Department of Education does provide a measure of mobility, called "highly mobile." In contrast to the school mobility rate, the measure of "highly mobile" does follow students, and classifies as "highly mobile" those students who enroll in two or more public schools during an academic year. However, even this individual-level variable has only a small to moderate influence on academic achievement, according to the research, and then only when high mobility occurs prior to third grade.

In conclusion, we found that school mobility correlates with academic achievement only when it measures the number of school moves a student is making, but not when it measures the number of students moving in and out of a particular school. High mobility has a small to moderate effect on elementary academic achievement when the mobility occurs prior to Grade 3 (Mahena, 2004); mobility after third grade has virtually no correlation with academic achievement, according to the literature (Heinlein, 2000).

Other Independent Variables

As mentioned earlier, in our review of the literature associated with academic achievement, we looked almost exclusively at the family, school and community contextual variables that can be used by the LC to help it identify and target the populations of elementary school children with the greatest need. However, we made a minor exception because of the Learning Community's directive to us to address all easily accessible data points. Therefore, we did take a summary look at five variables associated with schools rather than student populations, and one variable associated with school location, because the data associated with these variables is available through the NDE or U.S. Census.

The additional variables we examined include: school size (Caldas, 1993; Fetler, 1989; Gardner, 1999-2000; Hattie, 2009); classroom size (Caldas, 1993; Finn, 2005; Fleming, 2002; Hattie, 2009; Ready, 2008); three teacher characteristics: years of experience, master's degrees (Clotfelter, 2007; Rivkin, 2005; Wayne, 2003), and salary

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(Greenwald, 1996; Hanushek, 1989l; Hedges, 1994); and suburban, rural or urban school location (Sirin, 2005). The size and strength of the correlations between all of these variables and elementary academic achievement range from non-existent to weak.

For school size, we again confront the reality that the relationship between school size and achievement appears to differ depending on the child's race or SES (Hattie, 2009). Hattie found that "the more affluent a school's student cohort then the larger the optimal size [of a school], and the higher the proportion of minority students then the smaller the optimal size (Hattie, 2009, p. 80)." According to Gardner, the strength of the association between school size and achievement fell substantially when SES was controlled—an indicator that SES is a better predictor of academic success (Gardner, 1999-2000).

For class size, in particular, it is difficult to say whether it is class size or other contextual conditions within classrooms that is affecting achievement (Ready, 2008). Research indicates that for small class size (fewer than 20) to have an effect on achievement, students must attend between three and four years of small classes (Finn, 2005). Another interesting factor is that when students do attend small classes for at least three years, the effect on academic achievement is greater among those receiving free lunch than among those who do not (Finn, 2005). Some researchers have found that small class size is only a predictor of achievement for children in Grades K-3 (Fleming, 2002)—however, achievement in Grades K-3 is a predictor of graduation (Finn, 2005). In his massive meta-analysis of meta-analyses, Hattie found that "there is a voluminous literature that does not support the claim that learning outcomes are enhanced when class sizes are reduced" (Hattie, 2009, p. 86).

We did find some interesting results in the literature on the impact of school location. Sirin states that "even after accounting for family SES, there appear to be a number of significant differences between urban, rural and suburban schools" (Sirin, 2005, p. 420). Sirin's meta-analysis demonstrates that academic achievement in affluent suburban schools is substantially higher than in poorer, urban schools (Sirin, 2005). However, like the other variables mentioned above, we think that SES (school SES, in particular) would be an adequate proxy measure.

Because teacher quality is so difficult to measure, researchers frequently resort to proxies such as years of experience, advanced degrees (Rivkin, 2005) or salary (Clotfelter, 2007; Hedges, 1994). Frequently, these variables are also analyzed in the literature as measures of economic inputs into schools (Greenwald, 1996; Hanushek, 1989; Hedges, 1994). Our review of the research literature indicates that none of these variables is an important predictor of elementary academic achievement.

CONCLUSIONS

Summary of Findings

Of the variables we examined, socioeconomic status (SES) is the strongest predictor of academic achievement. Of the various measures of SES, composite measures are better predictors of academic achievement than single measures. Among the composites measures of SES, family SES is the most widely accepted and utilized measure. Among the sundry composite measures of family SES, the best include three variables: parent income, parent occupation and parent education level. Our review also demonstrated that school SES is a potent predictor of academic achievement. The research demonstrates that neighborhood SES remains a less precise predictor of achievement than either family or school SES.

Several variables predict children's academic achievement outcomes differently depending on whether the children are white or minority. Three variables are more predictive of white achievement than minority—family SES, parent education, and family structure. Family structure in particular provides a weak correlation with academic achievement that becomes smaller still among minorities. Both neighborhood and school SES appear to be about equally predictive of school success across categories of race and ethnicity, although there are a few studies that indicate neighborhood SES is the best predictor of minority academic achievement.

We also found evidence that two of the variables currently used by the LC to allocate funding—English language learners and school mobility—are flawed (though for quite different reasons) and in our opinion are therefore inadequate predictors of academic achievement. The classification system of ELL may also be invalid and unreliable, seriously compromising the value of ELL as an indicator.

We examined some school-based variables because this data is currently available to the Learning Community. These school-based variables include: school size; classroom size; teacher years of experience; teacher advanced degrees; teacher salaries; and suburban, rural or urban school location. These indicators would be of little value to the LC in predicting elementary academic achievement.

Recommendations

We believe it is in the best interests of the students served by the Learning Community for the LC to use a science-based, locally valid approach to allocate achievement funds based on the actual achievement needs of subcouncil student populations. We strongly recommend that the Learning Community conduct its own research in order to determine which available variables are the best predictors of academic achievement at the local level. The literature reviewed here can only point in certain directions. It will not determine that a specific cluster of variables is the most accurate composite measure of family SES for the region, nor can it tell us how to balance different variables within a formula in order to create the best predictor of academic success.

For the Learning Community, creating an accurate formula for academic success will entail both some guesswork (strongly influenced by the research literature) and some practical consideration of data availability. The vital point that we want to make at this juncture is that whatever formula the Learning Community chooses, it is critically important to use continuous evaluation to study the effectiveness of that formula as a predictor of academic achievement across the LC by scientifically analyzing how accurately it predicts academic achievement among the LC's own elementary student population. Without that scientific analysis, the best the LC will be able to say is that its formula represents an educated guess.

Socioeconomic Status:

We believe that the LC would be best served by using SES as its sole predictor of academic achievement.[7] We recommend that the LC use a weighted[8] combination of school and neighborhood SES. School SES should be based on Census data related to parent education, occupation and income[9] for the Census tracts from which the student population of each school is drawn.[10] Neighborhood SES should be based on those same Census tracts, but focus on neighborhood conditions reflected in overall employment rates, median housing values, number of vacant lots, and proportion of owner- to renter-occupied housing.

The literature is clear that the most accurate way to draw conclusions about the predictive power of variables associated with achievement is to collect data about individuals and their families and then aggregate that data. However, due to constraints on available data, the LC cannot do this. What that means is that it cannot connect family SES to a particular student and then look at that student's achievement in order to analyze the correlation, and then aggregate all the correlations related to all the students in a school. Within the LC, the smallest level at which data can be collected is the school—in other words, the school is the smallest unit of analysis for academic achievement and its associated predictor variables. As a result, the LC does not currently have the option of examining family SES as a correlate of achievement—it can only look at school SES and/or neighborhood SES.

While the LC currently uses school SES—measured through the proxy of free-and-reduced lunch eligibility—as a variable, the research demonstrates that if meals eligibility is to be used as the measure of school SES, the measure should be defined by the proportion of children receiving free lunch only (i.e. excluding children receiving lunches that are not free but provided at reduced price). However, that is currently not an option for the LC. If the LC can create a composite measure of school SES using

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[7] We will address our concerns with the other variables, below.
[8] The relative weighting of the components of school and neighborhood SES would be based on statistical analysis of local data.
[9] We recommend against the LC using family structure as part of its measure of school SES, due to the limits on that variable, described elsewhere in this report.
[10] A more accurate approach would use the address of each student in a school as the basis for collecting Census data, but this option is not available to the LC.

Census data related to parent income, education levels and occupation, that would be a more accurate predictor of academic achievement than the use of free-and-reduced lunch eligibility.[11] While it is an option for the LC to assess poverty rates across a subcouncil based on Census data, we believe that would be less accurate than collecting the data related to school SES for each school in a subcouncil and averaging the total.[12]

We believe that as the LC moves forward in reviewing its formulae for funding subcouncils, it should keep in mind that: "Although few in number, some studies suggest that neighborhood and school SES, not family SES, may exert a more powerful effect on academic achievement in minority communities, particularly in African American communities" (Sirin, 2005, p. 441). Therefore, we recommend that the LC utilize neighborhood SES as a measure in order to create some racial/ethnic equilibrium in a formula that—because it will use parent education and income—may otherwise be skewed to be more predictive of school success among whites than minorities.

Mobility:

As it is currently defined by NDE (based on the number of students moving into or out of a school—a school-level measure), "school mobility" is not a valid predictor of academic achievement and should not be used by the Learning Community. We believe that in order for mobility to be a useful measure, it would have to be re-defined to reflect the moves of individual students between schools (a student-level measure). Even then, the variable "highly mobile" student is limited: it only correlates with academic achievement from Kindergarten through Grade 3, and then there is only a small to moderate predictive effect. We did examine NDE's data around "highly mobile" students and found this category to represent so few students that much of the data is missing (the NDE does not provide data to the public when fewer than 10 students in a grade are represented by a category, in order to protect the identity of those students). Due to these factors, we would rank "highly mobile" students quite low as a predictor of achievement.

English Language Learners:

As a predictor of achievement, we believe ELL is severely limited by evidence that it is an invalid and unreliable classification system. In other words, it is likely that ELL is not measuring what it is supposed to measure—the preponderance of the evidence points to a strong likelihood that ELL is actually measuring socioeconomic status. We recommend that ELL be discarded as a variable.

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[11] Of course, we also recommend that the LC test this hypothesis when it comes time to do its own research, by comparing the relative predictive power of these measures.
[12] The existence of magnet schools and "school choice" mean that children may be traveling between subcouncils. Also, measures of school SES may turn out to be very useful to subcouncils as they re-allocate LC funding for academic achievement programs, policies and practices.

Ranking of the Variables

The Learning Community asked us to rank the variables that we have analyzed through this review of the research literature, and indicate the relative importance of the top-ranked variables. This is a somewhat problematic undertaking for several reasons: (1) there are several variables that we believe are too weak or compromised to include in a ranking; (2) there are some variables that are differentially predictive of school success depending on race/ethnicity; (3) the Learning Community is limited by practical considerations related to data availability and accessibility.

That said, we have attempted a ranking:

#1) School SES defined by:
    a. Parent education level
    b. Parent income
    c. Parent occupation
#2) Neighborhood SES defined by:
    a. Proportion of employed persons
    b. Proportion of vacant buildings
    c. Proportion of owner-occupied housing
    d. Median value of owner-occupied housing
#3) Highly mobile students

Without running the statistical analyses—based on locally collected data—it is impossible to determine the relative importance of these variables. Therefore, we can only make an educated guess. School SES and neighborhood SES are likely of comparable importance as predictors of achievement (and, if the LC were ever able to collect individual-level data in order to determine family SES, we would guess that it would rank at a slightly lower level). Due to the paucity of data on highly mobile students, and its small correlation with achievement, we would rank school mobility defined in this way at a maximum of one-tenth the power of school and neighborhood SES, combined.

Future Directions

We believe that if the Learning Community were to create an index for use in determining the relative allocation needs of its subcouncils—based on statistical analysis of the data specific to the Learning Community—it could then create a needs score for each subcouncil.[13] The results would provide a science-based, locally valid

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[13] Australia has used such an approach to develop an SES index that forms the basis of recurrent Commonwealth funding of non-government schools (Commonwealth of Australia, 1998).

approach for allocating funds based on the actual needs of subcouncil student populations.[14]

If the LC chooses this direction, we think that the needs scores of each subcouncil should be based on the aggregated scores of schools within a subcouncil. The fact that each school within a subcouncil would receive a needs score may prove to be quite useful to subcouncils as they make their own decisions about how to allocate funding locally for strategies to improve academic achievement.[15]

Work has already been done by other states in the U.S. as well as other countries to develop similar indices, and the Learning Community could study these models for ideas on how to move forward. Australia, for example, has developed a set of principles that underlie its approach to SES-based funding of schools:

- Equity: Resources should be distributed in a fair and consistent way that does not restrict choice.
- Transparency: Funding is best based on independently formulated and reliable indicators. The way a funding system works should be clearly and easily understood, and relationships between data and indicators within the funding mechanism should be obvious. The integrity of data and indicators is of paramount importance, and opportunities to manipulate data should not exist.
- Predictability: Schools need a high degree of certainty about future funding, for planning and management decisions.
- Simplicity: A funding mechanism should be as simple as possible while still retaining its validity and capacity to differentiate between the relative needs of schools.
- Flexibility: Flexibility is desirable to allow timely responses to changed circumstances.
  [Commonwealth of Australia (1998, p. 3)]

The LC could develop its own principles as the basis for funding its subcouncils using a science-based index.

Ultimately, if the LC determines that accuracy requires collecting individual-level data, there are options that could be implemented to make such a proposition possible. These include:

1. Adding questions for parents/guardians to answer that would provide measures of family SES, for use on Learning Community school enrollment forms;
2. Collecting the same and/or additional measures through student survey questions accompanying state-wide testing;

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[14] Our recommendations for a specific process of statistical analysis and explanation of how it would lead to the creation of a needs index for the LC, is laid out in "A Research Projection Brief: Analysis of Variables Associated with Achievement," September 2012.

[15] To honor the principle of science as a basis for practice, the LC may want to ensure that subcouncils require locally funded strategies demonstrate research-based evidence of effectiveness for relevant target populations, and also that participating schools can demonstrate the requisite capacity to implement selected strategies.

3. Working with the State Department of Education to advocate for the collection of additional data by all schools in the state.

An Inclusive Process:

We believe that people support what they help create. Therefore, if the LC chooses to move forward to create a needs index, it is important that the LC administration work hand-in-glove with all stakeholders to enhance readiness within the LC community to embrace a science-based approach to both funding and strategy selection. The LC coordinating council, member school districts, relevant LC subcommittees and task forces, as well as parents and students, should be included every step of the way. An inclusive process will maximize the chance of success.

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