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Measuring students' school context exposures: A trajectory-based approach

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ABSTRACT

Studies of school effects on children's outcomes usually use single time-point measures. I argue that this approach fails to account for (1) age-based variation in children's sensitivity to their surroundings; (2) differential effects stemming from differences in the length of young people's exposures; and (3) moves between contexts and endogenous changes over time within them. To evaluate the merits of this argument, I specify and test a longitudinal model of school effects on children's academic performance. Drawing on recent advances in finite mixture modeling, I identify a series of distinct school context trajectories that extend across a substantial portion of respondents' elementary and secondary school years. I find that these trajectories vary significantly with respect to shape, with some students experiencing significant changes in their environments over time. I then show that students' trajectories of exposure are related to their 8th grade achievement, even after controlling for point-in-time measures of school context.

1. Introduction

Despite complex theories about the process of human development and the influences of childhood environments (see, e.g., Bronfenbrenner and Morris, 1998; Heckman, 2007; Sharkey, 2008; Shonkoff and Phillips, 2000), scholars in the social sciences have tended to rely on relatively crude measurement techniques to characterize children's social surroundings—including their primary and secondary schools. The basic setup is fairly standard: contextual characteristics like pupil-teacher ratio or per pupil expenditures are measured at a particular moment in time, or within a short observation period, and then these measurements are related to outcomes that are observed either contemporaneously or at some point in the future (Bankston and Caldas, 1996; Condron and Roscigno, 2003; Crosnoe, 2009; Legewie and DiPrete, 2012; Mayer and Jencks, 1989). Historical data describing young people's previous environments are rarely incorporated, and variation in the length and/or timing of their exposures is frequently ignored.

I argue that this conceptualization of "context" is problematic for at least two reasons. First, if the characteristics of young people's environments vary in meaningful ways over the course of their early life (either because they move between contexts or because their contexts change around them), then one-time assessments of those environments will misrepresent their lived experiences, compromising the ability of researchers to properly evaluate the importance of different contextual characteristics (Wolfe et al., 1996). Second, if the effects associated with childhood settings are conditional on the age of the individual or the duration of their exposure (Baumert et al., 2012; Doyle et al., 2009; Haveman and Wolfe, 1994;

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Heckman, 2006; Reynolds et al., 2011; Shonkoff, 2010), the findings that emerge from traditional cross-sectional analyses may be incomplete (or worse yet, inaccurate), failing to reflect differential effects stemming from individuals' time-indexed circumstances (Bronfenbrenner, 1995).

In this article, I explore these possibilities through an examination of school effects on young people's academic performance. Using a nationally-representative longitudinal data set and a specialized application of latent class analysis, I identify a distinct set of school context *trajectories* that extend across a significant portion of individuals' childhood and adolescent years (beginning in kindergarten and ending in the eighth grade). These trajectories provide useful summaries of students' long-term school context exposures (to school-level attributes like low pupil-teacher ratios or high-levels of economically disadvantaged students), and can be used to predict important distal outcomes like student achievement. In the analyses that follow, I use this approach to (1) characterize students' full history of school context exposures, including any changes that occurred over time in the characteristics of their surroundings; and (2) evaluate whether certain kinds of trajectories are associated with better or worse learning outcomes.

2. Prior school effects research

Debate surrounding school effects dates back nearly 50 years to the release of the "Coleman Report" (Coleman et al., 1966). Originally commissioned by the U.S. Department of Education, the controversial study startled researchers by suggesting that schools have only a modest effect on student performance and that most of the variation in learning is a product of differences in family background. Critiques of this finding accumulated quickly (Bowles and Levin, 1968; Cain and Watts, 1970; Hauser, 1969; Jencks et al., 1972), with scholars in a number of fields seeking to better identify the school-level variables that contribute to students' achievement and later success in the labor market and elsewhere (Alexander et al., 1997; Arum and LaFree, 2008; Bankston and Caldas, 1996; Card and Krueger, 1998; Condron and Roscigno, 2003; Halpern-Manners et al., 2009; Hanushek et al., 2009; Heckman et al., 1996; Jennings and DiPrete, 2010).

Results from these studies have been mixed. Some researchers have found little or no evidence of a relationship between school characteristics and student achievement (Betts, 1995; Grogger, 1996b; Hanushek, 2003; Hoxby, 2000b; Jencks, 1975; Jencks et al., 1972; Milesi and Gamoran, 2006), especially once differences in student background are taken into account. Others have argued that the effects associated with schools may actually be quite substantial (see, e.g., Arum and LaFree, 2008; Condron and Roscigno, 2003; Hanushek et al., 2009; Imberman et al., 2012; Legewie and DiPrete, 2012; Park et al., 2013), identifying factors like class size, teacher quality, and the sociodemographic characteristics of students' peers as potentially important determinants of learning and achievement (see, e.g., Bankston and Caldas, 1996; Chaudhary, 2009; Crosnoe, 2009; Downey and Shana, 2004; Goldhaber, 2002; Jennings and DiPrete, 2010; Konstantopoulos and Chung, 2009; Milesi and Gamoran, 2006).

Although these studies have often produced divergent results, researchers working in this area have been remarkably consistent in one important respect: they typically observe school characteristics at a single moment in time (usually early in the elementary school years or when students first enter high school), and then use those cross-sectional measurements as regressors in multivariate models predicting students' achievement and/or post-secondary outcomes (including college enrollment and income). Well-known examples include Bankston and Caldas' (1996) study of school composition (when students' were in the tenth grade) and academic achievement; Condron and Roscigno's (2003) investigation into school spending (observed during the third grade) and standardized test scores; and Grogger's (1996a) work linking educational inputs like pupil-teacher ratio and class size to students' wages and future labor market outcomes.

This approach raises important conceptual questions. If students' school exposures remain stable over time and across institutional boundaries, then a single-point-in-time measurement of school characteristics should suffice. In other words, if students who attend advantaged (disadvantaged) secondary schools are the same students who attend advantaged (disadvantaged) primary schools, then the difference between a cross-sectional indicator and a variable that captures over-time variation in contextual characteristics would be mostly inconsequential. If, however, education is better understood as an additive process (Baumert et al. 2012; Entwisle et al. 2005; Heckman, 2008)—in which resources, enrollments, and institutional environments vary in from one school year to the next (either because schools themselves change or because students move between schools)—then ignoring the chronological patterning of students' exposures would seem to pose a potentially serious problem.

Unfortunately, there are good theoretical reasons to think that the latter scenario is the more likely one. Over the course of their childhood and adolescent years, many children move from one neighborhood setting to another (DeLuca and Dayton, 2009; Ihrke and Faber, 2012; Raudenbush et al., 2011). Estimates indicate that roughly five out of six youth change their place of residence at least once prior to turning age 15 (Duncan and Raudenbush, 1999), and nearly three out of five experience a corresponding transfer between schools (Rumberger, 2003). If these moves are not all lateral moves with respect to school characteristics (e.g., transferring out of a low pupil teacher ratio school and into a school with similar pupil teacher ratios), heterogeneity over time should result. Some students will attend qualitatively similar schools for the entirety of their academic career, whereas others will experience significant changes as they make their way through the educational system.

This suggests that students' experiences may vary not only in terms of *where* they went to school, but also in terms of *when* they were exposed to a particular school environment and *how long* their exposure lasted. These temporal