Family, Schooling, and Community Influences on Children's Achievement
PAA 2004 Meeting

Objectives

Using data from the Early Childhood Longitudinal Study (ECLS-K) and growth curve analysis, this paper has two objectives. First, I examine how achievement gains of children in low-income families differ according to children's family backgrounds, their classroom and community environments. Second, I decompose the inequality in children's achievement into three components: family characteristics; classroom practices; and community factors. The decomposition analysis measures the extent to which a change in one of those domains (family, classroom and community) is likely to change achievement when other factors are unchanged.

Rationale

Educational investments involve intervention on several dimensions from the family, school, classroom and community, each of which can affect learning outcomes (Anderson, et. al., 1998). If children's educational experiences come from not only formal schooling but also from the family and their community then insufficient exposure in any one of these domains might continue to suppress achievement gains as children mature and move through the school system (Natriello, McDill and Pallas, 1990). However, a barrier to understanding how children's achievement progresses over time has been the difficulty in disentangling the separate and the joint effects from each of the three domains (Garner and Raudenbush, 1991; Epstein, 1994; Bransford et. al., 1999).

One mechanism by which the effects associated with family background can be differentiated from those of schooling is by examining how the achievement progress differs in periods when school is in session compared to periods when school is closed. Studies that have taken this analytic approach demonstrate that the rate of growth in achievement is quite substantial, especially for low-income children, while school is in session. However, between grades when school is out, the rate of growth in learning declines among low-income students (Allinder et. al., 1992; Cooper et. al., 1996; Entwisle and Alexander, 1992; Alexander, et. al., 2001). The conclusions drawn from those findings are that school matters and that schooling mediates the impact of family socioeconomic background on achievement, at least when school is in session.

However, these studies do not isolate which aspects of schooling are most important in sustaining achievement over time; nor do they identify how much of children's achievement over time can be attributed to their community environment, particularly as children transition between grades when school is out. This study begins to address this gap by identifying how much of the gains in achievement can be attributed to family backgrounds such as family income and children's participation in summer activities; how much is due to the children's classroom instructional experiences during school; and how much is due to their community environment.

The study advances our understanding on academic achievement in several ways. First, unlike prior research that examines the effectiveness of school as children transition between grades, this study uses a national representative sample of kindergarten cohort as they transition into elementary school to identify where along the scale of achievement children in low-income families are most likely to either gain or regress in their achievement between grades. Second, the study investigates whether the role of the community is more or less important than family income in the growth rates in achievement of children in low-income families during the summer. Third, the study provides evidence whether educational reform that promotes certain approaches to

classroom instruction are more conducive in helping children sustain what they learn especially when school is out.

Research Design

The analysis draws data from the ECLS-K, which follows a nationally representative sample of the 1998-1999 kindergarten cohort in public and private kindergarten programs. The data collect information from students, parents, teachers and school administrators. The dual-frame design sampling of the ECLS-K may lead to positive intra-cluster correlations among the sample schools and students. Therefore, I use the design effect to adjust for sampling errors (Skinner, et. al., 1989; Tourangeau et. al., 2002). Zip-code level demographic data from Census are appended to the ECLS-K to measure characteristics of the community where the child lives.

The analysis is based on a sample of children that are interviewed in fall and spring kindergarten, and fall and spring first grade. The sample consists of 4,419 children in 215 public kindergarten programs in 144 public school districts, and 52 private kindergarten programs.

The outcome variables are the probability scores in five mathematics skills that children are expected to learn in elementary school: number and shape, relative size, ordinality and sequence (children can recognize two-digit numbers, identify the number in a sequence, and identify the ordinal position of an object), addition and subtraction, and multiplication and division. The probability scores take on values between zero and one. These scores allow for comparison in achievement over time not only of the children's total score but also where along the scale children are making the largest gains in achievement.

The primary variables include: family income; and poverty status, which captures whether the family's income is below the poverty level, whether income is between 100 to 200 percent of poverty or near poverty, or whether income is at or above 200 percent of poverty. Low-income families are defined as those families whose income is below 200 percent of poverty. Classroom instructional practices include two measures that capture approaches to instruction that are either child-centered or teacher-centered. The first, active learning instructional practice, is a child-centered instructional approach and is defined from a set of 25 teacher-reported classroom math activities and skills. The second, conventional instructional practice, is a teacher-centered approach and is defined from a set of 21 teacher-reported classroom math activities and skills. The items for both measures are on a 6-point scale for math activities, and 7-point scale for math skills. The basic data are transformed so that teachers who spend more class time on difficult content topics receive a higher score than teachers who spend more class time on less difficult content topics. Both of these variables are summed composite that are standardized to have mean of zero and standard deviation of one. From the Census data I measure community characteristics. The measures include median family income, concentration of poverty among children under the age of 18, immigrant concentration, residential stability, and adult educational attainment.

Other variables from the ECLS-K include: parents' level of education, single parent household, the number of siblings, parent employment, child's gender and child's age in years, race and ethnicity, whether the primary language is not English, the number of places the child lived; and the degree of the child's engagement in math and in reading activities during the summer. Given the children's age, they are likely to be in some type

of child care arrangements while their parents are at work. Summer child care arrangement is included to capture the potential learning experiences that different types of care arrangements may provide while school is out.

Methods

For the first objective I use an individual growth model. This is a three-level model in which students within schools are tracked over time from kindergarten through the first grade. In order to capture the unobserved heterogeneity that are common to students drawn from the same school, I allow for school effects. Since there are four waves of data, the model allows for curvilinear growth.

To address the second objective I make use of a concentration index method, which is based on the same principle as the Gini coefficient (Pebley and Sastry, 2002), the most common method used to measure income equality. As in the analysis conducted by Pebley and Sastry, the concept of concentration index is adapted here to measure achievement inequality. First, I measure the concentration of math scores according to the distribution of children by family income. This is a gross concentration index, which reflects the degree of inequality in math scores by family income. Second, I obtain predicted test scores using the estimated coefficients from the growth curve model. These predicted values along with the gross index are used to calculate a net concentration index, which allows the factor of interest to vary while other variables are held constant. For example, I estimate predicted values allowing family income to vary while holding other factors remain constant. This net index is compared to the gross index to provide an indication of the degree to which, for a given level of family income, inequality in math skills due to family income is independent of other factors (Pebley and Sastry, 2002).

Results

New information that is not evident from prior studies is that children in high-income families reach a ceiling effect in basic skills such as number and shape, relative size, and ordinality and sequence by the end of kindergarten. Thus, before completing kindergarten children in high-income families begin to learn more advanced skills such as addition and subtraction, and multiplication and division. The achievement inequality between children in low-income families and those in high-income families increases in these more advanced skills; but achievement inequality is eliminated in the basic skills. During the summer break after kindergarten children continue to improve their math skills albeit at a slower pace when compared to their growth patterns when school is in session. However, when children reach a ceiling effect in a particular skill (achieve a score close to 100 percent), their risk of not remembering what they know diminishes. This is consistently the case across children of all income levels and ethnicity.

The results from the growth curve analysis show that kindergarteners continue to improve their score by an average of 11-26% at each testing point through first grade. The rate of change over the summer ranges from a loss of 19% in their knowledge of ordinality and sequence to a loss of 24% in their knowledge of relative size. There appears to be minor losses in addition and subtraction, and in multiplication and division. This is because the average child has not gained substantial skills in these two content math content areas at the end of the first year of formal schooling. It is primarily children from high-income families who are making progress in those skills; and these children tend to experience lower risk of summer loss in their skills between grades.

Children who are engaged in summer math activities improve their score by about 1% from their initial status through the summer months. There is no relationship between the child's achievement gains and their level of engagement in summer reading activities. Minority students have slower cognitive gains than non-minority students. However, it is shown that it is not income per say that slowed progress of minority students. It is potentially the fact that these students enter school with meager skills in their math toolbox. Therefore, their growth rate proceeds at a slower pace than white students through school and into the summer months.

There is no evidence that any one particular instructional practice has lasting effect on children's achievement progress over time. Both approaches to classroom instruction appear to improve expected mean score at the start of first grade; and both types of instructional practices improve the growth rate in achievement during school at the same rate. Immigrant concentration in the community does not differentiate growth rates in achievement. The median income of the community is positively associated with math gains over the summer, which is stronger than family income.

The results from the concentration index analysis show that after adjusting for other factors, family income and other home characteristics explain 25% of the total variation in growth rates in achievement. Community characteristics explain 30% of the total variation in growth rates in achievement, which is more that what is explained by family income and other home characteristics. Thus, a significant proportion of children's achievement gains or losses over time and during the summer is related to influences from their community. Classroom practices account for 10% of the total variation in achievement gains. The remainder is due to unobserved family, community and neighborhood and classroom characteristics.

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