

Urbanicity and Academic Self-Concept

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Abstract

The main focus of this study was the relationships between school urbanicity (size of community in which the school is located) and fifth-grade students' academic self-concepts. Using multi-level modeling methodology (HLM) we were able to investigate "school effects", net of individual students' characteristics. School urbanicity had no effect on reading, math, or general academic self-concept. School-level effects were found consistently for aggregate school achievement in reading and math, congruent with Marsh's Big-Fish-Little-Pond effect. Less consistent school-level effects were found for proportion of minority students and school-average SES. Individual level effects mirrored those reported in other literature with tested achievement having the greatest effect.

Educational researchers increasingly have become attuned to the possibility of "school effects" on educational outcomes. "School effects" refers to the idea that various outcomes may be, in part, due to school-wide characteristics, over and above individual student or teacher characteristics. For example, Lee and Smith (1997) found that mid-size high schools produce larger achievement gains from students' freshman to senior years than do either small or large high schools, *net* of individual student characteristics, and that achievement in these schools was more equitably distributed across students' SES. Similarly, Lee and Smith (1996) found that high schools in which teachers, *as a group*, believed in collective responsibility for student achievement produced stronger achievement gains than did schools whose teachers, *as a group*, held different attitudes. "School effects" are just one example of an "ecological effect", in which features of the larger environment have demonstrable effects on various outcomes *net* of individual variables. The school psychology literature contains little research that truly explores ecological effects, although some recent studies (e.g., Stage, 2001) have included such variables.

Testing for ecological effects also raises methodological issues. Most such research has used ordinary least-squares regression (OLS) to assess school effects net of individual variables through the straightforward practice of using ordered regression procedures in which individual student characteristics are entered as a block on the first step, and school-wide variables are entered on the second step. A significant increase in R^2 then serves as the measure of school-wide variables while controlling for individual variables. Alternatively, one might use an ANOVA and use covariates to partial out various effects. While these procedures have intuitive appeal and are reasonably easily understood, Lee (2000) delineates the methodological shortcomings of this approach: (a) aggregation bias – in which the same variable (e.g., SES) may have different meanings at different levels of aggregation (e.g., individual vs. school levels), (b) non-independence of cases (e.g., an individual student's achievement may be related to the achievement levels of other students in the school), and (c) heterogeneity of regression.

To counter these shortcomings, researchers may use multi-level modeling (MLM) methodology that allows for the modeling all of these effects. The most commonly used statistical program for performing such analyses is Hierarchical Linear Modeling (HLM) (Raudenbush, Byrk, Cheong, Congdon, & du Toit, 2004). Studies using HLM have begun to appear in the school psychology literature (Rhodes, Roffman, Reddy, & Fredriksen, 2004; Stage, 2001). Most recently Clements, Bolt, Hoyt, & Kratochwill (2007) have championed the use of MLM methodology to study school-based interventions.

Research on school effects has focused primarily on achievement as outcomes, but such logic and

analysis can be applied to social-emotional outcomes as well. Over a 20-year period, Herbert Marsh and his colleagues (e.g., Marsh & Hau, 2003) have conducted a substantial amount of research investigating the effects of school average ability on student's academic self-concepts (ASC). Marsh and his co-workers discovered that school characteristics moderated the relationship between ASC and achievement. Humorously dubbed the "big-fish-little-pond effect (BFLPE)", Marsh found that students with the same academic achievement level had somewhat lower ASCs when embedded in schools with higher average student ability, although the effect size is relatively small. Other recent research has further explored school effects on ASC. Trautwein, Ludtke, Koller, and Baumert (2006) found that the learning environment moderates the development of self-concept for a set of seventh grade students. Specifically, "meritocratic" schools produced more accurate ASCs than did "ego-protective" school environments. School average ability and meritocratic structure are excellent examples of "school effects".

None of these studies, above, investigated school urbanicity (size of community). Ozturk (2007) investigated math self-concept and other variables and found complex interactions between schools' urbanicity, minority concentration, and poverty concentration with reference to high school students' mathematics course-taking. Signer, Beasley, and Bauer, (1997) found that urban students' academic self-concepts were influenced by a set of interactions between ethnicity and the type of educational program in which they were engaged. The goal of the present study was to use HLM methodology on data from the Early Childhood Longitudinal Study, Kindergarten – Fifth Grade (ECLS-K) to address the following questions:

1. Are there "school effects" on the levels of elementary school students' self-concepts in English, math, and "all subjects", after accounting for relevant individual child characteristics. Particularly, does school urbanicity have a significant effect on individual student academic self concept?
2. Are there "cross-level interactions", such that school characteristics modify the relationships among various student characteristics and ASCs?

Methodology

Samples

The ECLS-K dataset is comprised of a base-year nationally stratified sample of 17,401 students who began kindergarten in Fall 1998. Data were collected at various points in students' kindergarten, first and third grade years, and in the spring semester of 2004 when most students were in the fifth grade. The present study used only fifth grade data. Consistent with suggestions on the use of HLM methodology (Raudenbush & Bryk, 2002), students were only selected if there were at least five students in the dataset from each school. The resulting sample was comprised of 6250 fifth grade students from 615 elementary schools. See Table 1 for demographic information.

Measures

Based on data available in the ECLS-K dataset and on the extant literature on ASC and its relationship with other variables, we chose to include five measures in this study: Academic Self-Concept (dependent measures), tested reading and math achievement, student socio-economic status (SES), minority status, and gender. School-level variables included urbanicity, and school-average achievement in reading and math, SES, and proportion of minority students.

Table 1: Student Demographics

Demographic	N	%	Demographic	N	%
Unweighted N	6250	100			
<u>Gender</u>			<u>Ethnicity</u>		
Male	3064	49	European-Am.	4026	64.5
Female	3186	51	African-Am.	683	10.9
			Latino/a	1147	18.4
<u>SES Quintile</u>			Asian-Am.	159	2.6
1 st	893	15.5	Native Am. ¹	224	3.6
2 nd	1261	21.9			
3 rd	1192	20.7			
4 th	1242	21.6	Disadvantaged		
5 th	1163	20.2	<u>Minority</u> ²		
			No	4185	67
			Yes	2065	33

Note. Except for total N, all N's and percentages are weighted by a normalized weight

¹ Native American includes Alaskan and Pacific Island natives.

² Historically educationally Disadvantaged Minority includes African-American, Latino/a, and Native American students

Academic Self-Concept (ASC). The ECLS-K dataset includes three ASC subscales from the Self-Description Questionnaire (SDQ) (Reading, Math, All Subjects), each having 6 – 8 Likert items, each with a 4-point scale. The SDQ is a widely-used research measure of self-concept with amply demonstrated reliability and validity. Reliabilities (alpha coefficients) for fifth graders in the larger data set are excellent ranging from .83 - .92. The composite score for each scale is the average of the scale's items, such that the composite score can range from 1.00 to 4.00.

Achievement. Achievement scores in reading and math are standardized T-scores resulting from direct assessments of the child. Extensive evidence supporting the tests' validity is reported in the ECLS-K manuals. Reported reliabilities for all fifth graders are excellent (reading - .93; math - .94).

Socioeconomic Status (SES). The SES measure in the ECLS-K that we used is a composite based on parental education and occupation, and family income. This continuous measure is a standardized measure (z-score) ranging in the larger dataset from -2.48 – 2.54 .

Minority Status. Ethnicity in the ECLS-K dataset is obtained from parental report or from school records and is comprised of several categories of race/ethnicity. For the present study, we dichotomized this variable into a variable titled "Minority", which divided the sample into historically educationally disadvantaged minorities (African-American, Latino/a, Native American) and non-minority (European-American, Asian-American). We dropped students coded as "multi-ethnic" since it is not possible to tell to which of the dichotomized groups they belong.

Standardization of Individual Level Variables. All of the continuous variables (three types of ASC, reading and math achievement, and SES) were converted to Z-scores based on the entire sample of 6250 children.

School Level Measures. Five school-level (i.e., characteristics of schools) measures were used as independent variables, and were simply the aggregated values (school-wide means) of individual students' standardized reading achievement, math achievement, and SES scores, each school's proportion of minority students in the sample, and the urbanicity status (urban, not urban) of the school.

Data Analysis

All analyses of individual student variables used data weighted by a normalized weight from the ECLS-K that most closely corresponded to the subset of data that we used. Following descriptive analyses of all data (see Table 2), we performed a series of four HLM analyses separately for each of the three ASC independent variables, in the following order: (a) an Unconditional Model, used to establish a base for comparison and to assess the amount of variance due to “group effects”; (b) a Within-Schools Model in which only individual, student characteristics were modeled, (c) an Intercept-as-Outcome Model, which analyzed the relationships between hypothesized school characteristics and students' ASCs, *net* of student's individual characteristics, and (d) a Cross-Level Interaction Effects Model, which analyzed the effects of school-wide characteristics on relationships between ASCs and student characteristics *within* schools (also referenced in the literature as Slopes-as-Outcomes models).

Table 2: Descriptive Information for Outcomes and Predictors

Variable	<u>Individuals</u>		<u>School Aggregate</u>	
	Mean	S.D.	Mean	S.D.
<u>Self-Concept</u>				
Reading	2.98	0.74	3.00	0.28
Math	2.93	0.76	2.94	0.28
All Subjects	2.72	0.64	2.75	0.25
<u>Achievement</u>				
Reading	51.04	9.1	51.19	4.90
Math	51.20	9.45	51.64	5.10
SES Composite	-0.07	0.75	-0.11	.51
Minority Status			1.35	.35

Notes. N's for individuals range from 6250; N's for all school variables = 615. Self-concept scores could range from 1 – 4. Achievement scores are T-scores. The SES Composite is a Z-score based on the entire ECLS-K database. Data for individuals are weighted; data for schools are unweighted.

Results and Discussion

Analyses from the unconditional model revealed that between 8% and 13% of the variance in academic self-concept was due to school-level effects. Although group effects were modest, these represent meaningful influence of ecological effects on students' ASCs (intraclass correlations (ICC): reading - .13; math - .08; all subjects - .12). These results are similar to Rhodes et al.'s (2004) findings for “self-esteem” of middle school students. Although the ICCs are modest, these represent meaningful influence of ecological effects on students' ASCs.

Within schools (the Level I model), reading and math achievement were substantially, and about equally,

related to their respective self-concepts (see Table 3). These correlations of about .40 are very similar to those found elsewhere in the literature. Marsh and Hau's (2003) cross-national study of ASC in 26 countries found a mean correlation of .38 between achievement and ASC. Both math and reading achievement were also significantly related to all subjects self concept. With respect to gender, girls had higher reading and general self-concepts but had lower math self-concepts, again in the context of including their actual academic achievement in math.

Students' minority status was not significantly related to any of the academic self concept measures. The literature relating minority status to ASC is mixed. Earlier literature indicated that African-American students had lower ASCs than did European-Americans. However, more recent research has found that there may be few differences, or that African-American students may have *higher* ASCs (Rhodes et al., 2004). By contrast, Bouchley & Harter (2005) found that Latino middle school students had lower ASCs than did European-American students, even when achievement levels of the two groups did not differ. In the present study, we combined several historically educationally disadvantaged minorities into a single "minority" group. This may have obscured differences between these subgroups.

Students' SES was not significantly ($p > .05$) related to reading or math self-concepts, and was only weakly related ($\beta = -.07$; $p < .05$) to all-subjects self-concept. This was somewhat unexpected, given that the literature frequently indicates a positive relationship between SES and ASC (Rhodes et al., 2004). Some literature (Trusty, Peck, & Matthews, 1994) suggests that the SES/ASC relationship is confounded by interactions between student SES and achievement, such that low-achieving, high-SES students are particularly vulnerable to having low ASCs. **We did not test for such interactions; future research might do so.** It is also important to note that, given the methodology used, all of the coefficients relating individual student characteristics (within schools) to ASC exist within the context of one another. Indeed, statistically significant ($p < .01$), but small zero-order correlations (.06 – .13) were found between student SES and the ASC measures.

School urbanicity, the primary focus of our study, was not significantly related to any of the self-concept measures nor to cross-level interactions between Level I and Level II. There is a possibility that the construct of "urbanicity" could have been better operationalized. In this study, "urbanicity" was defined only on the basis of community size and also combined "large" and "mid-sized" cities as "urban". Any school that was not designated as a large or mid-sized city was placed in the "non-urban" category. Though this method of defining urbanicity is efficient, a dichotomous categorization based on the community that the school is in probably does not capture differences between schools. It is possible that a different operational definition of "urbanicity" would produce different effects.

Consistent with the earlier-referenced literature on the Big-Fish-Little-Pond Effect (BFLPE), we found negative coefficients between school-average achievement in reading and math, and student's ASCs in these respective areas, after accounting for student's measured achievements in these areas (see Table 4). In both cases (reading achievement/reading self-concept; math achievement/math self-concept) the coefficients were $-.21$. The magnitude of the BFLPE seems to be remarkably consistent across studies. In their multi-national study of ASCs in 26 countries Marsh and Hau (2003) found a composite effect of $-.206$, although there was significant variation across countries. Several studies within the US have found similar results. Thus, our study confirmed the BFLPE on a large, representative sample of American elementary children, a population on which the BFLPE has been less researched than for older students. For the all-subjects self-concept, a BFLPE ($-.24$) was found between school-average math achievement and ASC, and the relationship between school-average reading achievement and ASC was not statistically significant ($p > .05$).

Again, it is important to note that *both* school-wide reading and math achievement were included in the all-subjects analysis, so the intercorrelation between these variables would affect each of the coefficients. Still, it is interesting that school-wide math achievement may have a greater influence on students' general view (all-subjects) of their competence than school-wide reading achievement.

Table 3: Within-School Effects on Self-Concept (Level I)

	Reading <u>Self-Concept</u>		Math <u>Self-Concept</u>		All Subjects <u>Self-Concept</u>	
	Coeff.	S. E.	Coeff.	S.E.	Coeff.	S. E.
Gender	.26***	0.03	-.10**	0.03	.20***	0.04
Minority Status	0.06	.06	0.06	.06	-0.07	.05
Student SES	0.03	.02	0.02	.02	.07*	.03
Reading Achievement	.38***	.02	---	---	.08**	.02
Math Achievement	---	---	.38***	.02	.17***	0.13

Notes. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4: Between-School Effects on Self-Concept (Level II)

	Reading <u>Self-Concept</u>		Math <u>Self-Concept</u>		All Subjects <u>Self-Concept</u>	
	Coeff.	S. E.	Coeff.	S.E.	Coeff.	S. E.
School-Wide Aggregate						
Urbanicity	0.08	0.04	0	0.04	0.04	0.04
Minority Composition	.10	0.1	0.11	0.09	.21*	.09
School Average SES	.04	.04	-.03	.04	.05	.05
School Average Reading Ach.	-.21***	.06	---	---	0.02	0.07
School Average Math Ach.	---	---	-.21***	0.06	-.24**	0.07

Notes. * $p < .05$; ** $p < .01$; *** $p < .001$.

Minority composition of schools (% of educationally disadvantaged minorities) was not related to either reading or math self-concept, but was related to the broader general academic self-concept. Students in schools with higher proportions of minorities tend to have higher broad academic self-concept, over and above the effects of students' individual characteristics. Schools' minority proportions significantly and substantially affected all-subjects self-concepts ($\gamma = .21$ $p < .05$), net of students' achievement. No such effect was found for math or reading self-concept.

HLM methodology allows for testing of "cross-level interactions", i.e., effects of school-level variables

on the relationship between individual-level variables. In this study in total across all three types of academic self-concept we investigated 62 such interactions. Given the possibility that testing this many interactions overly capitalizes on chance, we are interpreting only those interactions significant beyond the .01 level. Three such cross-level interactions were found. For reading self-concept, a meaningful ($\gamma = .17$) cross-level interaction was found for individual reading achievement and school-wide reading achievement. **In schools with higher school-average reading achievement, there was a greater relationship between reading achievement and reading self-concept.** One might argue that in higher-achieving (reading) schools, students' reading self-concepts are more "accurate", or at least, more closely tied to actual achievement within the context of *that school*. Analogous relationships were clearly *not* evident for math or all-subjects self-concept. It is not clear why these different ASCs would have different cross-level interactions.

Two cross-level interactions were found for all-subjects self-concept. First, the schools' minority proportions had a significant ($p < .01$) and positive ($\gamma = .32$) effect on the relationship between students' math achievement and all-subjects self-concepts. As the proportion of minorities increased, the correlation between math achievement and all-subjects self-concept increased. Perhaps in high-minority schools competence in math is perceived to be more indicative of general academic competence than is true in schools with fewer minority children. A smaller, significant ($p < .01$) negative ($\gamma = -.18$) effect was also found for school-wide SES on the relationship between individual student SES and all-subjects self-concept. As the school-wide SES rose, the relationship between SES and all-subjects self-concept (within each school) decreased. This finding could, in part, be the result of restriction of range in student SES (students' SES in higher SES schools clustered at the top). Again, however, the lack of analogous findings for reading and math self-concepts make this result difficult to understand.

In summary, this research replicated several findings from the research literature on academic self-concept at the individual (within-school) and school (between schools) levels. At the individual level, students' reading and math achievement was related positively to their self-concepts in these respective areas, and the magnitude of these relationships was very similar to that found by other researchers typically using older students. At the school level, School Urbanicity seems to have a negligible effect on student academic self concept, net of individual student factors, though the operational definition of "urbanicity" should be reconsidered. The BFLPE was again evident, and to a degree highly similar to that reported in a number of other studies. Relationships between schools' minority proportion and students' ASCs were also found, adding to the literature on the ASC of minority students and ecological effects around minority composition of schools. Several cross-level interactions raise some interesting questions, but must be viewed with some caution.

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