Identifying Between and Within Classroom Differences in Science Engagement: The Role of Supportive Learning Environments for English Learners

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Background/Context: Students from diverse ethnic and language backgrounds are expected to become the majority in the United States school system within the next decade (US Census Bureau, 2012). Recent reforms in science education, including the Next Generation Science Standards, (NRC, 2012) raise expectations for all students to engage with language-intensive practices. This shift presents unique challenges given the growing number of students learning English (Lee, Quinn, & Valdes, 2013). The field needs exploration of policies and practices to improve outcomes for English learners (ELs) with the goal of eliminating academic disparities between them and their English-speaking peers.

Purpose/Objective/Research Question: Prior research points to the importance of supportive learning environments for reducing academic disparities (Hamre & Pianta, 2005). Classroom supportiveness refers the degree to which students feel their classmates are helpful, caring, and collaborative (Developmental Studies Center, 2005) and may be critical for promoting engagement in learning. However, limited research has utilized student-report data on classroom supportiveness, particularly in elementary settings (Wentzel

We investigated the relationship between students' perception of classroom supportiveness and their engagement in science learning. Specifically, we were interested in how this relationship might vary depending on the classroom composition (high, medium, or low percentage of EL students). We had two hypotheses: (1) students who perceived their classroom as supportive would also report high levels of engagement in science, and (2) that the relationship between perceived classroom supportiveness and engagement might be particularly important in classrooms with a higher proportion of EL students.

Setting: This study used survey data from a small randomized-controlled trial of a project-based learning (PBL) science curriculum in a large, urban district in the southeastern United States.

Population/Participants: Teachers and students (N = 726) in 39 4th grade science classes completed a series of measures about their experiences in science. Teachers were primarily white (87.18%) and female (94.87%), with an average of 10 years of prior teaching experience. 24 of the teachers in the sample (75.00%) held a Master's degree.

The student sample was 47.40% female and ethnically diverse (31.92% African American, 30.97% white, 23.45% Hispanic). On average, 23.09% of students in each classroom were EL (range 0-100%). With the exception of student gender and survey response data, all student demographics were collected at the classroom level.

Research Design: Due to the limited amount of student-level information available, a multi-level regression model was used to identify individual and classroom-level contributions to students' engagement in science. Analysis included teacher-reported classroom demographic data and student-reported measures of classroom supportiveness and engagement.

Student surveys were adapted from existing measures. (Developmental Studies Center, 2005; Ryan et al., 2007; Skinner et al., 2009). Classroom supportiveness was measured using a fourteen-item scale that asked students to rate how much they agreed with statements like,

"When I'm having trouble with my schoolwork, at least one of my classmates will help," and "My class is like a family," (Developmental Studies Center, 2005).

We assessed the relationship between classroom supportiveness and two distinct domains of engagement in science. Behavioral engagement was measured using a five-item scale that asked students to rate how true statements like "I try to do well in science" and "I pay attention in science class" were for them (Skinner et al., 2009). Social engagement was measured using a five-item scale that asked students to rate items like "I share my ideas and materials with other kids in science," and "I answer questions about science in class," (Ryan et al., 2007).

Data Collection and Analysis: Teachers administered surveys to their students within a four-week data collection window. Each set of classroom surveys was accompanied by a coversheet where teachers provided classroom demographics. Double data entry was used to compile survey data to ensure accuracy. Data were then merged and analyzed in Stata.

To account for the nested structure of the available student and classroom data, associations between student-reported classroom supportiveness, classroom composition with respect to EL student enrollment, and engagement in science learning were examined using two-level hierarchical linear models (Raudenbush & Bryk, 2002). Separate models were estimated for the behavioral and social dimensions of engagement.

Findings/Results: Correlations and descriptive statistics are reported in Table 1. As hypothesized, we found significant positive correlations between student-reported classroom supportiveness and behavioral (r = .38, p < .001) and social (r = .38, p < .001) engagement. A simple regression revealed that classroom support contributed significantly to both behavioral ($F(4, 34) = 9.07$, R^2 = .45, p < .001) and social engagement ($F(4, 34) = 8.86$, R^2 = .45, p < .001).

Next, we estimated two multi-level regression models to identify between-student and within-classroom contributions to predicted behavioral and social engagement in science depending on the proportion of students in the classroom designated as ELs. The results of these models are reported in Table 2.

In addition to the predictors of interest, condition in the RCT, teacher years of experience, and whether the teacher held a Master's degree were included in the model as covariates. As expected, individuals' report of perceived classroom supportiveness was positively predictive of higher behavioral (.22, *SE*=.02) and social (.41, *SE*=.04) engagement in science. Conversely, a higher proportion of ELs in the classroom was predictive of lower behavioral (-1.38, *SE*=.59) and social (-2.98, *SE*=1.37) engagement.

No main effect for the classroom-level average of perceived supportiveness on engagement was observed. However, we did find a significant interaction between classroom-level supportiveness and the proportion of EL students for both behavioral (.34, *SE*=.16) and social (.79, *SE*=.36) engagement, plotted graphically in Figure 1. This indicates a significant impact on the average difference in behavioral and social engagement between classrooms with a high and low proportion of EL students when perceived classroom supportiveness increased by one unit. The association between supportiveness and engagement was stronger in classes with more EL students.

Conclusions: Students' own perceptions of the supportiveness of the classroom offers insight into their engagement in learning, which is a key correlate of academic learning. Given that this

relation is even more noted in classrooms with more EL students, future work should explore explanatory mechanisms.

	1	2	3	4	5
Level 1 (Student)					
1. Perceived supportiveness	--				
Level 2 (Classroom)					
2. Perceived supportiveness	.52***	--			
3. Percentage ELs	.12***	.24***	--		
Outcomes					
4. Behavioral engagement	.38***	.22***	.01	--	
5. Social engagement	.38***	.23***	.05	.56***	--
M(*SD*)	3.45(.69)	3.57 (.42)	.23 (.42)	3.50 (.49)	3.72 (.92)

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

Table 1. Descriptive statistics and correlations

	Behavioral engagement		Social engagement	
	Coefficient	*SE*	Coefficient	*SE*
Intercept	2.81***	.20	2.37***	.46
Level 1 (Student)				
Perceived supportiveness	.22***	.02	.41***	.04
Level 2 (Classroom)				
Perceived supportiveness	-.02	.06	-.03	.14
Percentage ELs	-1.38*	.59	-2.98*	1.37
Perceived supportiveness X Percentage ELs	.34*	.16	.79*	.36

Note. Coefficients are displayed only for primary predictors of interest. All models include condition, teacher years of experience, and whether the teacher held a Master's degree as covariates.
*<.05. **p<.01. ***p<.001.

Table 2. HLM estimates of the relationship between perceived classroom supportiveness and engagement in science by EL percentage

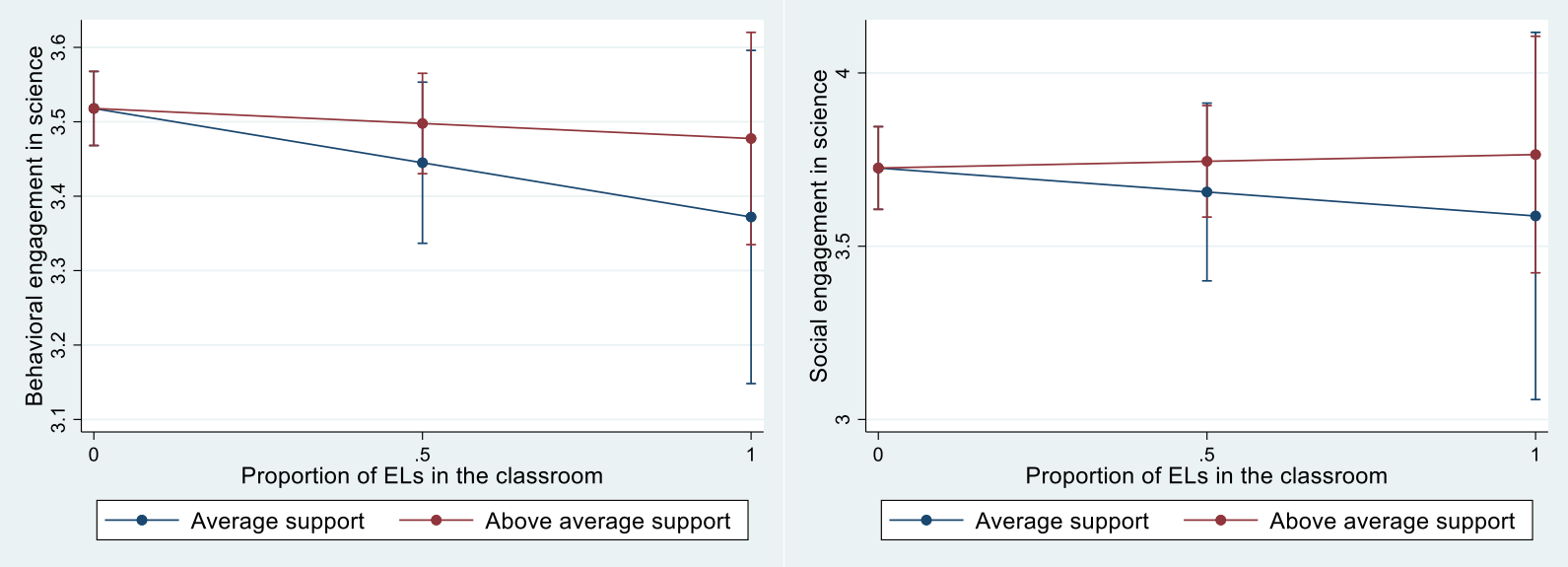

Figure 1. Interaction between classroom supportiveness and proportion of EL students in predicting behavioral and social engagement in science