Pre-kindergarten classroom characteristics and pre-kindergarten gains of children living in rural areas

Identification of educational practices that promote preschool children's skills is a priority because federal and state governments have invested heavily in providing access of "high-quality" preschool to promote school readiness, especially among children from low-income families. Evidence indicates that high-quality early preschool education can reduce achievement gaps (Yoshikawa et al., 2013) and is positively related to the development of children's academic and social-emotional skills (Burchinal, Kainz, & Yaping, 2011). The existing literature, however, raises questions about what constitutes high-quality education (Burchinal, in press; Cantrell & Kane, 2013).

A review of the early childhood literature suggests there are practices and curricula that promote academic and social skills among preschoolers. Considerable evidence suggests that children benefit when preschool classrooms are characterized by warm and stimulating teacher-child interactions in organized classroom environments (Hamre, 2014). Frequent verbal interactions in which adults elaborate and elicit information appear to underlie language development (Snow& Oh, 2010). Some evidence suggests that learning is more likely to occur when teachers interact with children in small groups (Foorman, & Torgesen, 2001). Moreover, children show moderate to large gains in specific content areas when teachers spend time instructing within those specific areas (Burchinal et al., 2015). Yet few studies have examined the independent contribution of these educational practices to children's skill acquisition.

Finally, there is growing concern that different types of educational practices may promote acquisition of rote academic skills and higher order skills such as language, executive functioning, and self-regulation (Burchinal, in press). Evidence suggests that acquisition of basic literacy and numeracy skills predict academic outcomes in early elementary school, but language and problem solving skills are more predictive of gains in later years (Pace, 2017). To date, considerable evidence suggests that programs like pre-kindergarten promote the basic literacy and numeracy skills, but not higher-order skills (Phillips et al., 2017).

Purpose of Study

This study examined relationships between selected educational practices and children's gains from fall to spring of pre-kindergarten year in basic literacy skills (decoding, sound fluency) and basic numeracy skills and in selected higher-order skills: vocabulary, learning behavior skills, and executive function (inhibitory control and flexibility). We aimed to identify the educational practices that appear to promote both basic and higher order skills among preschool children. We anticipated that gains in rote skills in literacy and math would be most strongly related to measures of instruction in that content area and would be negatively related to the use of a global, rather than content-specific, curriculum. In contrast, we anticipated that higher quality teacher-child interactions and more frequent language interactions, especially those involving elaborations and elicitations, would promote acquisition of the higher-order skills.

Participants

This study was conducted in six rural counties in North Carolina, randomly selecting pre-kindergarten classrooms within each county and children within each classroom. Our sample consisted of 351 pre-kindergarten children in 64 classrooms assessed in the fall and in the spring of the pre-kindergarten school year. Of the participating children, 49% were boys, 37% were African American, and 33% of Hispanic origin. Teacher practices and classroom quality were assessed during winter months.

Data Collection:
Quality of prekindergarten classrooms and teacher practices were assessed through several instruments: Classroom Assessment Scoring System (CLASS; Pianta, LaParo, & Hamre, 2008), Language Interaction Snapshot (LISn; Atkins-Burnett, Sprachman, & Caspe, 2010) measuring frequency, quality, content, and settings of language interchanges between teachers and children; an adaptation of Boston pre-kindergarten's fidelity instrument to capture global process quality of classrooms; and the curricula used as reported by teachers. A factor analysis of all indices yielded five composites that were used in subsequent analyses: global Process Quality (CLASS domains and Boston fidelity score), Complex Conversations (teacher-child talk involving elaborations, elicitations, or multi-turned conversations), Math Activities (math activities, teacher elaborations/elicitations); Reading Activities (reading or other print-related activities) and Sound-Learning Activities. Analyses examined children's gains as a function of the global quality, complex conversations, and content-specific composites along with small group setting and use of Creative Curriculum (the most frequent curriculum). Descriptive statistics are presented in Table 1.

Research Design:
This observational study used two-level HLMs to examine the relations between the identified educational practices and the difference scores (spring score minus fall score) in each academic skill under consideration. Covariates included county, race, gender, maternal education, and home language. Missing value dummy variables were employed to account for missing data. All variables were standardized (M=0, SD=1). Due to correlations among educational practices (see Table 2), backward elimination of predictors was applied when none of predictors were statistically significant in the full model.

Results:
The fixed effect coefficients, *SEs*, and random effect variance estimates are shown in Table 3. Results indicated that children showed gains in: language skills when teachers engaged them in more complex verbal interactions (β=.23, p<.01); early reading skills when process quality was higher (β=.20, p<.01) and when the classroom did not use Creative Curriculum (β=-.20, p<.05); sound fluency when more time was spent in sound-related activities (β=.12, p<.05); early math skills when more time was spent in math activities (β=.13, p=.07); cognitive flexibility when were time was spend in small group settings (β = .19, p = .07); and inhibitory control when the classroom did used Creative Curriculum (β = .18, p<.05).

Conclusions:
These findings indicate that different educational practices appear to promote different school readiness skills. Gains in basic decoding and math skills were related to the amount of instruction in that content area. Acquisition of vocabulary was related to more frequent complex verbal interactions with the teachers. In contrast, gains in other areas were not as closely aligned with instructional contents. Use of the global curricula was related to smaller gains in early literacy and inhibitory control skills, but larger gains in teacher reported approaches to learning. More time in small group was related to cognitive flexibility skills. As such, these findings suggest that we need to broaden our conceptualization of high-quality early childhood education beyond process quality, and attend more closely to educational practices such as time and quality of instruction within content areas and of verbal interactions between teachers and children.

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Table 1. Descriptive statistics for study variables

Variable	*N*	*Mean*	*SD*	*Min*	*Max*
Child Outcomes					
WJ Picture Vocabulary gain	351	2.16	9.87	-19.00	66.00
WJ Letter Word ID gain	351	4.19	10.32	-25.00	40.00
WJ Applied Problems gain	351	3.75	9.76	-24.00	57.00
DIBELS-first sound fluency gain	350	3.86	8.97	-26.00	40.00
EF Inhibitory control (Flanker) gain	273	1.50	17.54	-73.20	71.20
EF Flexibility (Card sort) gain	227	-0.76	16.61	-37.70	46.70
Learning Behavior Skills	348	0.05	0.40	-1.95	1.82
Classroom Process Quality (α=.90)					
PK-CLASS: Emotional Support	452	5.31	0.67	3.50	6.31
PK-CLASS: Classroom Organization	452	5.06	0.62	2.50	6.42
PK-CLASS: Instructional Support	452	2.67	0.64	1.50	4.17
Global high quality practices	452	2.60	0.73	1.17	4.20
Reading Practices (α=.67)					
Activity: Print related	446	0.05	0.05	0.00	0.21
Any adult reads	446	0.03	0.04	0.00	0.17
Any adult talks with child	446	0.42	0.12	0.18	0.75
Complex Conversation (α=.68)					
Any adult elaborates	446	0.02	0.02	0.00	0.08
Adult elicits information	446	0.02	0.02	0.00	0.11
Sustained conversation with any adult	446	0.01	0.01	0.00	0.02
Math Practices (α=.74)					
Activity: Math/Color/Num	446	0.16	0.12	0.00	0.67
Any adult elaborates	446	0.02	0.02	0.00	0.08
Adult elicits information	446	0.02	0.02	0.00	0.11
Creative Curriculum	426	0.79	0.41	0.00	1.00
Small Group Setting, %	446	0.08	0.11	0.00	0.38
Sound-Related Activities	446	0.18	0.12	0.00	0.50
Covariates					
Child's Race: Black	456	0.33	0.47	0.00	1.00
Child's gender	456	0.50	0.50	0.00	1.00
Mother (or CG) Highest Ed Level	445	3.51	1.55	1.00	7.00
Child speaks Spanish at home	454	0.39	0.49	0.00	1.00

Table 2. Correlations among classroom predictors

	Reading practices	Sound activities	Math practices	Small group	Complex Conversation	Creative curriculum
Process quality	.29***	-.03	.13**	-.15***	.22***	.23***
Reading practices		.38***	.36***	.00	.47***	-.23***
Sound activities			.21***	.03	.35***	-.29***
Math practices				.50***	.61***	-.35***
Small group					.25***	-.31***
Complex conversation						-.16***

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

Table 3. HLM results

Outcomes	WJ Picture Vocabulary gain	WJ Letter Word ID gain	DIBELS first sound fluency gain	WJ Applied Problems gain (reduced model)	Executive Functions gain: Inhibitory control (reduced model)	Executive Functions gain Cognitive Flexibility	Learning Behavior Skills (reduced model)
Predictors of interest	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*
Process quality	.03 (.06)	.20** (.07)	.04 (.07)			.01 (.09)	
Reading practices		.02 (.09)					
Sound-related activities		-.02 (.07)	.12* (.06)				
Math practices				.13^{+} (.07)		-.21 (.20)	
Complex conversation	.23* (.09)	.08 (.10)	.08 (.11)			.02 (.20)	
Small group setting	-.07 (.06)	.05 (.07)	.02 (.07)			.19* (.09)	
Creative curriculum	.06 (.07)	-.21* (.09)	-.12 (.07)		-.20* (.09)	.02 (11)	.18* (.10)
Random variance terms	σ^2	σ^2	σ^2	σ^2	σ^2	σ^2	σ^2
Classroom	0	.07 (.05)	0	.02 (.04)	.05 (.05)	0	.11(.05)
residual	.83 (.06)	.83 (.07)	.94 (.07)	.84 (.07)	.94 (.09)	.99 (.11)	.88 (.07)
n	351	345	344	345	268	223	348

+ .1 < p < .05 * p<.05; ** p<.01

Model included district, child race, gender, home language, and maternal education as covariates. Due to the correlations among predictors, backwards elimination was applied when none of the classroom predictors was statistically significant

How Does Quality of Curricular Implementation Support Low-income Children's Skill Development in Early Childhood Education?: Evidence from the Boston Public Schools PreK Program

Background. Achievement gaps in language and mathematics skills between children from more versus less advantaged backgrounds are large and have widened in recent decades (Reardon, 2011). There are also smaller (but worrisome) gaps by income in children's executive functioning skills (Raver et al., 2011). Most of these gaps are present at kindergarten entry and do not decrease, typically widening slightly as children progress through elementary school (Duncan & Magnuson, 2011). Although high-quality preK is one promising avenue for reducing early skill gaps (Haskins & Brooks-Gunn, 2016), instruction is generally low-quality (Mashburn et al., 2008). Rigorous studies have found that preK quality is bolstered by curricular and professional development approaches that pair domain-specific curricula (targeting language, math, or social-emotional skills) with regular in-classroom coaching (Yoshikawa et al., 2013). Yet, little is known about how variation in the quality of curricular implementation may differentially relate to students' gains. Moreover, districts typically do not have reliable and valid tools to measure curricular implementation. Thus, they may be limited in their ability: 1) to understand whether quality of implementation matters for supporting student gains; and 2) to structure responsive professional development for teachers. Districts may also be particularly interested in understanding linkages between implementation quality and gains in skills for lower-income students, as preK programs are oftentimes explicitly interested in helping those students catch up to the school readiness skills of their more affluent peers.

Objective. This paper examines how quality of language/literacy and math curricular implementation – as measured through an observational tool collected by district staff – predicts gains in children's language, math, and executive functioning across the preK year. We then consider whether associations vary for lower-income versus more affluent children.

Setting, Participants, and Research Design. This study was conducted in Boston, MA in partnership with the Boston Public Schools Department of Early Childhood. In the Fall of 2016, the research team randomly selected 20 schools offering preK to participate in the study. Ten community-based organizations (CBO) implementing the BPS curriculum were also selected. All general ed. teachers in each school or CBO were invited to participate and 95% (N = 51) agreed. Eighty-one percent of preK children in participating schools/centers consented, and the research team randomly selected 375 children to engage in research activities. Students in the sample are diverse (see Table 1 for sample descriptives). Data on child skills were collected in the Fall and Spring of preK, and information on curricular implementation and classroom quality were collected in the Winter. This data collection strategy allows the team to use a residualized change approach to predict spring skills from winter curricular implementation, adjusting for baseline skill scores, global classroom quality, and student, classroom, and school covariates.

Intervention. All classrooms used Focus on K1, a synthesis of two evidence-based curricula: an adapted version of Opening the World of Learning (Schickedanz and Dickinson, 2004), a language and literacy curriculum, and Building Blocks (Clements & Sarama, 2007), an early mathematics curriculum that also promotes language development by requiring children to explain their mathematical reasoning. PreK teachers received some curriculum-specific training

and in-class support from district coaches.

Data. The research team collected assessments of children's language (Peabody Picture Vocabulary Test; Dunn & Dunn, 2007), math (Woodcock Johnson Applied Problems; Woodcock et al., 2001), and executive functioning (Hearts & Flowers; Diamond et al., 2011). Teacher reports of children's externalizing and internalizing behavior were captured with the Social Skills Improvement System (Gresham et al., 2011). Data on classroom quality (Classroom Assessment Scoring System; Pianta et al., 2008) and quality of curricular implementation (team-developed observational tool) were collected by observing each classroom for about two hours each on two separate days. At the end of each observation of curricular fidelity, the observer rated 13 items assessing the quality of implementation across that observation period. The mean of these items was taken across the two observations in each classroom to operationalize a global quality of implementation score. The team has done preliminary work to demonstrate the reliability and validity of this observational tool and will provide such evidence as part of the proposed presentation. Demographic characteristics at the child-, classroom-, and school-level were made available by the district.

Analysis. Multi-level models with random intercepts for classroom and school were used to examine study aims. We regressed each spring child assessment score (language, math, executive functioning) on: (a) quality of curricular implementation; (b) CLASS composite score; (c) Fall assessment scores for language, math, executive functioning, externalizing, and internalizing behaviors; (d) student-level demographic variables; and (e) classroom and school characteristics. We then included an interaction term between quality of curricular implementation and free/reduced lunch eligibility in each regression to test whether associations varied by child socioeconomic status (SES). A Benjamini-Hochberg (1995) approach was used to adjust for multiple comparisons.

Findings. Findings discussed here are preliminary and the team is continuing to work to describe the magnitude of these associations. However, this early work demonstrates statistically significant associations between quality of curricular implementation and gains in language and math skills across the preK year. There were no significant associations between curricular implementation and executive functioning. The second set of models demonstrated that the interaction between SES and quality of implementation was significant when predicting math skills, suggesting that lower-SES students' gains in math may stand to benefit most from strong curricular implementation in preK. Associations were evident after controlling for classroom quality, providing preliminary support for the hypothesis that curricular implementation on its own may be an effective way to support children's skill development.

Conclusions. Findings suggest that quality of domain-specific curricular implementation matters in bolstering gains in PreK students' language and math skills. Quality of implementation may be particularly important for lower-income students. Findings indicate a need to not only implement curricular standards for early childhood education programs, but also to support effective implementation of programming. Further analyses will examine specific components of curricular implementation to test whether there are particularly important aspects to support and consider the roles of dosage and fidelity in operationalizing dimensions of implementation.

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Understanding the Effects of Classroom Processes
on Child Outcomes in Pre-Kindergarten

Public investment for over four decades has enabled access to early education services for low-income children as a means of mitigating achievement and opportunity gaps that can have long term negative consequences for them and for society (Magnuson et al., 2004; Tout et al., 2010). At present, almost 70% of low income 4-year olds are enrolled in public preschool programs (Barnett et al., 2013). Public early education shows clear promise for improving children's learning (Lipsey et al., 2013; Puma et al., 2012), yet typical programs offered in the U.S. do not consistently deliver on this promise. Evaluations suggest that Pre-K has small effects that can fade over time and may be undetectable by third grade (Camilli et al., 2010; Puma et al., 2012).

Importantly, recent evaluations of successful state and city models suggest a cluster of classroom processes that consistently relate to children's learning gains: teacher-child interactions (Burchinal et al., 2000; Pianta et al., 2005), developmentally-aligned instruction (Curby et al., 2009; Vitiello et al., 2012), and time exposed to content across pre-k (Camilli et al., 2010; Chien et al., 2010; Claessens et al., 2015; Clements & Sarama, 2008; Weiland et al., 2013). In pre-kindergarten, children's skills in language, literacy, and math are the central focus of most states' early learning standards (Daily, Burkhauser, & Halle, 2010), the Federal Head Start early learning standards (USDHHS, 2015), and a large amount of effort in the areas of curriculum, assessment, and professional development (e.g., Clements & Sarama, 2008). Because these skills are influenced by classroom processes (Curby, Downer, & Booren, 2014; Duncan et al., 2007), capturing classroom processes and skills in these domains over pre-k is a key aspect of understanding of how early education has its intended effects. In this study, we will explore the following questions:

1. Are teacher-child interactions, instructional content, and dosage of instruction positively associated with children's academic learning gains in preschool?
2. Is there evidence that effective teacher-child interactions moderate the associations between content, dosage of instruction, and child outcomes, such that greater content exposure and more challenging content are more strongly associated with gains when teachers interact effectively with children?

Method

Participants

Children included 1,445 preschool children who were eligible for kindergarten the following year, drawn from 125 classrooms in a large, urban school district. All children were in publicly funded preschool spots, which were located within Head Start, school-based preschool, and community-based preschool programs. Children were ethnically and linguistically diverse (54.5% Hispanic, 17.8% black/African American, 10.4% Asian, 6.5% white, 10.8% multiracial or other ethnicity; 45.4% spoke Spanish, 44.7% spoke English, and 9.9% spoke another language at home) and most families had incomes below the federal poverty line (mean income-to-needs ratio = .86, *SD* = .53). Teachers were predominantly white (57.5%), had an average of 16.9 years

of education (*SD* = 1.6), and had 15.7 years of teaching experience (*SD* = 9.7). About one third (38.9%) had majored in early childhood education.

Measures and Procedures

Parents and teachers completed demographic questionnaires at the start of the year. Children were directly assessed in the fall and spring on language, literacy, and math using four subtests from the Woodcock-Johnson III Tests of Achievement (Picture Vocabulary, Letter-Word Identification, Applied Problems, and Quantitative Concepts; Woodcock, McGrew, & Mather, 2001). Trained data collectors assessed each child individually.

Trained data collectors also observed each classroom 2-3 times during the year using the Classroom Observation Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008) and the Behavioral Coding System (BCS). The CLASS is a measure of teacher-child interactions grouped into three broad domains (Emotional Support, Classroom Organization, and Instructional Support) rated on a scale of 1 to 7. Classrooms were observed for 15-minutes followed by 10 minutes to code, with observe/code cycles repeated several times across a morning. The BCS is an interval coding system designed to capture classroom-level information about content and activities, adapted from the Classroom Observation System (COS; La Paro, Pianta, & Stuhlman, 2004). BCS was coded in 10-minute cycles divided into intervals (30 seconds to observe, 30 seconds to code). Data collectors alternated between CLASS and BCS cycles across each morning, completing four of each on each visit.

Teachers completed a survey in the spring reporting on which literacy and math skills they taught during the year. Skills were coded by content experts as typifying pre-k, kindergarten, first, or second grade skills, and assigned 1-4 points on that basis. Scores represent the average level of math and literacy skills taught by each teacher.

Analytic Approach

Models were analyzed in MPlus using multilevel modeling and FIML to account for missing data. CLASS scores were averaged across observations to arrive at a single set of domain scores for each classroom. BCS scores were also aggregated across observations; scores represent the proportion of coding intervals in which each activity or behavior was noted. Preliminary analyses used raw WJ-III scores.

Results and Discussion

We report preliminary analyses here on research question 1 only. Final analyses will use WJ-III w-scores as the outcome variables, as these are scaled to best assess change in child outcomes, and will include tests of the proposed interactions.

Preliminary analyses indicate that Classroom Organization was significantly and positively associated with gains on Quantitative Concepts, but no other process variables were associated with outcomes (see Table 1). This result is unexpected given consistent prior associations between classroom process variables and gains in child outcomes, but may be explained in part by low observed variance between classrooms.

We expect that when we include tests of interactions, we may find more significant effects, as research suggest that the effects of the measured classroom processes may be interdependent: math activities may stimulate cognition because of the amount of time the child is exposed or the high-quality interactions through which the content is delivered (Clements, Sarama, Spitler, Lange, & Wolfe, 2011). Results will be discussed in the context of

understanding whether and how classroom processes jointly or independently predict child learning gains.

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Table 1. *Classroom Processes Predicting Child Outcomes*

	(1) Letter/Word ID b/se	(2) Picture Vocab b/se	(3) Applied Problems b/se	(4) Quant Concepts b/se
Fall_LWID	0.79***			
	(0.02)			
Fall_PV		0.77***		
		(0.02)		
Fall_AP			0.67***	
			(0.02)	
Fall_QC				0.74***
				(0.02)
Child Covariates				
SpanLang	--0.06*	-0.09**	-0.11***	-0.03
	(0.03)	(0.03)	(0.03)	(0.02)
OtherLang	0.04*	0.00	-0.06*	0.01
	(0.02)	(0.02)	(0.03)	(0.03)
Hispanic	0.05	0.04	-0.09*	-0.01
	(0.03)	(0.04)	(0.04)	(0.03)
Black	0.01	0.04	-0.09***	0.01
	(0.03)	(0.03)	(0.03)	(0.03)
Asian	-0.03	0.00	-0.03	0.03
	(0.02)	(0.03)	(0.03)	(0.03)
White	-0.02	0.02	-0.03	0.02
	(0.02)	(0.02)	(0.03)	(0.03)
Inc-to-Needs	0.02	0.02	0.04	0.06**
	(0.02)	(0.02)	(0.02)	(0.02)
Teacher Covariates				
TchYrEd	0.35**	0.17	0.44	0.28+
	(0.13)	(0.18)	(0.42)	(0.15)
YrsExp	0.02	0.19	0.40	0.08
	(0.11)	(0.15)	(0.38)	(0.14)
TchNonWhite	-0.18	-0.08	-0.45	-0.02
	(0.12)	(0.16)	(0.35)	(0.13)
Classroom Processes				
CLASS-CO	0.29	0.49+	0.59	0.45*
	(0.17)	(0.19)	(0.48)	(0.21)
CLASS-IS	-0.26+	-0.51+	-0.26	-0.12
	(0.14)	(0.18)	(0.39)	(0.20)
CLASS-ES	0.03	-0.03	-0.23	0.06
	(0.14)	(0.20)	(0.43)	(0.23)
pkLangLev2	0.12	0.02	0.21	0.10
	(0.15)	(0.18)	(0.31)	(0.16)
pkMatLev2	-0.08	-0.05	-0.12	-0.08
	(0.76)	(0.17)	(0.34)	(0.16)

BCS-AcademicInstr	.18	0.06	0.10	0.17
	(0.11)	(0.19)	(0.24)	(0.13)
Constant	1.64	4.25**	5.75**	-2.46
	(2.37)	(1.33)	(1.72)	(2.29)
Within-classroom variance	10.64***	4.10***	9.86***	9.22***
	(0.64)	(0.35)	(0.45)	(0.42)
Between-classroom variance	1.03**	0.08	0.00	0.41**
	(0.31)	(0.06)	(0.14)	(0.13)
N	1445	1445	1445	1445

Classroom quality and classroom network structure predicting student outcomes

Background

The quality of the classroom environment has long been examined as a predictor of student academic and behavioral skills. Relations among these constructs are historically mixed, and at best modest in size (Keys et al., 2013). One possible reason for the weak relations is that measures of the classroom environment are relatively narrow in scope, with the most commonly used measures, such as the Classroom Assessment Scoring System (CLASS) focused on the interactions between teachers and students.

While students spend a great deal of time in their classrooms, only a fraction of that time is spent in contact with their teachers. Students spend the majority of their time is in direct contact with their peers. The influences of children's interactions and relationships with their peers has been demonstrated to be similarly related to children's outcomes in the first few years of school (e.g., Justice, Logan, Lin, & Kaderavek, 2016), as well as the breadth, depth, and quality of peer relationships within a classroom (Schaefer et al., 2010), and the global social structure of the classroom (e.g., Ahn et al., 2010). Social networks can have profound effects on who a child interacts most frequently with, and the nature of those interactions (Mashburn et al., 2008; Yudron et al., 2014). For example, psychological research suggests that students who experience aggression are less likely to participate productively in their classroom activities, and as a result may experience adverse social and academic effects (Buhs & Ladd, 2001).

While both classroom quality and classroom network factors have been demonstrated as potentially important to children's development of academic and behavioral skills, what is less understood is how these two constructs work together to contribute to children's development.

Purpose

The global purpose of this research was to take a wider, more comprehensive examination of the classroom environment as it relates to students' skills. Specifically, we predict children's gains in the academic (reading and language) and behavioral (behavior control and social skills) domains as a function of the quality and structure of their classroom environments.

Setting and Participants

This place-based research was conducted in 42 classrooms across three grades all within a single Central Ohio school district. Data were analyzed for 570 students across five grades (prek n = 170, kindergarten n = 199, and grade 1 n = 201). Students were recruited via their classroom teachers, and every student within each classroom was asked to participate. Twenty percent of families requested not to participate, for an overall 80% positive response rate.

Research Design

This is a correlational research design, examining development within prek, k, and grade 1. Data on student performance were collected in the fall of 2016 and the spring of 2017, with classroom quality observations conducted in January 2017.

Academic Outcomes were assessed using the *Woodcock Johnson Test of Achievement-III* (WJ; Woodcock, McGrew, & Mather, 2007). For this study, we elected to focus on children's language and reading skills, which were assessed using the Picture Vocabulary and Letter-Word Identification subtests, respectively.

Social-Behavioral Outcomes were assessed using the *Teacher-Child Rating Scale* (TCRS; Hightower et al., 1986), a 32-item teacher-report instrument. In this study, we focus on the two subtests examining children's behavior competence (also known as behavior problems) and social skills.

Classroom Quality was assessed with the Classroom Assessment Scoring System (CLASS; quality; Pianta, La Paro, & Hamre, 2008), and one total composite score was used to represent global classroom quality.

Classroom Structure. In the spring, teachers rated the extent to which each pair of children in the classroom played or worked with each other during a typical school week from 0 (never plays together) to 4 (always plays together). These ratings were used to construct a social network of each classroom (Ahn et al., 2010), and classroom centralization was calculated from this measure. Centralization represents the hierarchy of a classroom network. A highly hierarchical classroom is characterized by a cohesive core of children surrounded by peripheral subgroups (Ahn et al., 2010). In comparison, an egalitarian classroom is characterized by a more uniform distribution of children across the network, and more level social status. Centralization has been linked to children's social outcomes, such that hierarchical classrooms may exacerbate children's aggressive and deviant behaviors (Ahn et al), potentially because these foster a social norm of competition and social dominance.

Data Analysis

Four predictive regression models were fit to the data, one per child outcome: language, reading, behavior control, and social skills. Hierarchical Linear Modeling (SAS Proc MIXED) was used to account for the nesting of children within classrooms. Each model included the within-domain pretest, classroom network centrality, and global classroom quality

Results

Presented in Table 1, the results are different across the domains of interest. For children's literacy and language development, we saw no effect of the classroom density, but did find an effect of the quality of the classroom environment. The opposite was true of the behavioral outcomes: Children's behavior and social skills were reliably predicted from the density of their classroom's friendships, but not from the global index of quality of care.

Conclusions

These results begin to unpack the complex relations within a classroom environment. In addition to the analyses presented here, we want to next explore whether classroom quality and classroom

network can have moderating effects on one another, such students in a high-quality classroom may not be as susceptible to the influences of their peer network.

Table 1.

Results of multilevel models predicting student outcomes (table spanners) from within-domain pretest, classroom quality, and classroom network density. All outcomes are in raw score units.

	Estimate	*t*	*p*
Vocabulary			
Intercept	2.88	2.38	0.022
Picture Vocabulary Fall	0.73	29.41	<.0001
Classroom Centrality	0.01	0.07	0.946
CLASS	0.55	2.29	0.023
Letter Word ID			
Intercept	-5.13	-0.95	0.350
Letter Word ID Fall	0.89	36.42	<.0001
Classroom Centrality	0.38	0.75	0.452
CLASS	2.81	2.44	0.015
Behavior Control Fall			
Intercept	0.06	0.02	0.987
Behavior Control Fall	0.85	29.06	<.0001
Classroom Centrality	1.26	2.44	0.015
CLASS	0.25	0.34	0.732
Social Skills Fall			
Intercept	-0.52	-0.17	0.867
Social Skills Fall	0.73	21.27	<.0001
Classroom Centrality	3.56	6.73	<.0001
CLASS	0.44	0.70	0.483

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Table 1

Demographic Information for Boston P-3 Preschool Year Sample

Characteristic (%)	(%)
Eligible for free or reduced price lunch	57.7
Race and ethnicity	
White, non-Hispanic	22.7
Black, non-Hispanic	29.9
Asian/Pacific Islander	18.1
Hispanic/Latina	29.3
Other	0.0
Horne language other than English	27.1
Parent married or in domestic partnership	70.4
Parent's highest level of education completed	
No formal schooling	1.2
Less than 9th grade	3.7
9th grade to 12th grade, no GED or diploma	4.9
High school diploma or GED	17.6
Some college, but not a degree	13.5
Vocational/technical training or certificate	4.9
Associate's or two year college degree	6.1
Four year college degree	17.2
Some graduate coursework	2.5
Graduate or professional degree	28.3
Annual household income (before taxes)	
$0	0.5
$1 to $9,999	7.8
$10,000 to $14,999	6.8
$15,000 to $19,999	9.2
$20,000 to $24,999	5.8
$25,000 to $29,999	3.9
$30,000 to $34,999	4.9
$35,000 to $39,999	2.4
$40,000 to $44,999	3.9
$45,000 to $49,999	1.5
$50,000 to $59,999	3.9
$60,000 to $69,999	3.4
$70,000 or more	46.1
Sample size	375