Examining the role of preschool classrooms' behavioral composition

as a predictor of the quality of teacher-child interactions

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Abstract

Research Findings: This study examined the relation between classroom behavioral composition and teacher-child interactions in preschool classrooms and the potential for teachers' experience, education level, and area of study to buffer against the challenges of teaching in classrooms with high levels of disruptive behaviors. Classroom behavioral composition was operationalized in two ways (classroom mean and classroom proportion of children at or above 90th percentile) using teacher reports of children's disruptive behaviors. Results indicated that the proportion of children at or above the 90th percentile was linked to a decline in the quality of teacher-child interactions in classroom organization and instructional support across the year. Marginally significant interaction effects suggested that holding a bachelor's degree may be a protective factor for teachers' emotional support quality at the beginning of the year, but more years of teaching experience seemed to worsen the negative effect of challenging classroom behavioral composition on the quality of emotional interactions over the course of the school year. *Practice or Policy:* The quality of preschool teachers' practice showed declines across the year when teachers perceived very disruptive behaviors in the classroom. The results of this study have implications for preservice training, teacher professional development, and quality rating and improvement systems focused on teacher-child interactions.

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The extent to which children's experiences in preschool classrooms benefit their learning and development hinges in large part on the quality of the interactions in the classroom (Hamre, 2014; Mashburn et al., 2008). Teacher-child interactions that are warm and responsive to children's needs promote positive development across a range of domains including language, pre-academic skills, and social skills (Burchinal et al., 2008; Curby et al., 2009; Roorda, Koomen, Spilt, & Oort, 2011). In contrast, teacher-child interactions that are punitive or insensitive to children's needs put children at risk for maladaptive outcomes (Hamre & Pianta, 2001; Reinke, Herman, & Newcomer, 2016).

As the leader of the classroom, the teacher is primarily responsible for shaping classroom interactions, yet the teacher is only one part of these back-and-forth exchanges. Characteristics of children themselves also contribute to the classroom environment. However, most research examining factors that may influence the quality of classroom interactions has focused on characteristics of the teacher such as mental health (Jennings, 2015; Roberts, LoCasale-Crouch, Hamre, & DeCoster, 2016; Sandilos et al., 2015) and professional qualifications such as level of education and experience (Connor, Son, Hindman, & Morrison, 2005; Early et al., 2006, 2007; Lin & Magnuson, 2018). Much less research has focused on how compositional characteristics of the children in the classroom may play a role (Friedman-Krauss, Raver, Morris, & Jones, 2014), or how these may intersect with teachers' qualifications to support positive classroom interactions (Ansari & Pianta, 2018). This study aimed to understand the factors that promote positive teacher-child interactions in preschool classrooms by addressing the way in which children and adults together create classroom environments. In particular, teachers' perceptions

of children's disruptive behaviors in the classroom and teachers' professional qualifications, including their experience in the classroom, education level, and area of study, are considered.

An ecological perspective on teacher-child interactions

The bioecological model of human development conceptualizes individuals as nested within their direct and indirect environments and emphasizes the role of proximal processes, or the ongoing interactions between individuals and their environments, in shaping human development (Bronfenbrenner & Morris, 2006). The classroom is a key environment in which children spend a significant amount of their time and, through the daily interactions with their peers and teacher, shapes children's learning and developmental outcomes. These interactions are reciprocal, or bidirectional, in nature, such that children not only receive input from their teacher, but also produce output that, in turn, informs the teacher's reaction to children. The current study is informed by the bioecological model, and in particular the dual role of children and teachers, as a basis for creating classroom environments characterized by high-quality teacher-child interactions.

Teacher-child interaction quality

Significant investments are being made across the country to expand access to preschool driven by promising evidence of short- (Barnett et al., 2018; Weiland & Yoshikawa, 2013) and longer-term impacts for children (McCoy et al., 2017; Phillips, Gormley, & Anderson, 2016). As scale-up efforts continue, a key aim of researchers, practitioners, and policymakers is to ensure that the programs serving children are of high quality. While many features of preschool classrooms are important for children's experiences, the quality of teacher-child interactions is arguably the most central (Hamre, 2014). High-quality interactions across three domains of classroom processes (emotional, organizational, and instructional) consistently show positive

benefits for children's learning. Provision of warm, emotionally-supportive interactions supports children's social competence (Brock & Curby, 2014; Mashburn et al., 2008). Children who experience well-managed classrooms that set clear expectations for children's behavior show better self-regulation and fewer behavior problems (Broekhuizen, Mokrova, Burchinal, Garrett-Peters, & The Family Life Project Key Investigators, 2016; Hamre, Hatfield, Pianta, & Jamil, 2014; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). And interactions that scaffold children's higher-order thinking skills support academic achievement and language development (Carr, Mokrova, Vernon-Feagans, & Burchinal, 2019; Howes et al., 2008; Johnson, Markowitz, Hill, & Phillips, 2016; Mashburn et al., 2008).

Given the importance of teacher-child interactions, it is important to consider factors that may support (or inhibit) children's experiences of high-quality interactions over the course of the year. The overall quality of teacher-child interactions in preschool classrooms is typically moderate to low depending on the type of interaction (Justice, Mashburn, Hamre, & Pianta, 2008; LoCasale-Crouch et al., 2007), but significant variability in quality exists across teachers (Early et al., 2005; Hamre, 2014). Time of year may influence the quality of teacher-child interactions, but since there is limited evidence documenting the stability or change in interaction quality within teachers across a school year, it is difficult to hypothesize whether it would support or inhibit teachers' provision of high-quality interactions. On the one hand, interaction quality could improve over time as teachers get to know the children in their classrooms, set expectations, and delve into curricula that provide engaging and cognitively stimulating instructional activities. However, time could also detract from high-quality interactions if teachers cannot build upon successes in the classroom but rather develop negative cycles of interactions that become difficult to break.

Reflecting both the importance of teacher-child interactions for ensuring high-quality preschool programs and the drive to hold preschool programs accountable for providing such quality, the CLASS tool is becoming more commonly used in state-wide quality rating and improvement systems (QRIS) (Vitiello, Bassok, Hamre, Player, & Williford, 2018). The CLASS tool is a framework for conceptualizing, observing, and measuring teacher-child interactions (Pianta, La Paro, & Hamre, 2008). It captures 10 dimensions of interaction quality, which are organized into three overarching domains: emotional support, classroom organization, and instructional support. Higher ratings of these content-general, classroom-wide interactions indicate higher quality classroom environments, and numerous studies indicate positive associations between higher CLASS scores and children's learning outcomes (e.g., Burchinal, Vernon-Feagans, Vitiello, Greenberg, & The Family Life Project Key Investigators, 2014; Mashburn et al., 2008).

In light of the evidence indicating that a sizeable proportion of preschool programs are of poor quality (Justice et al., 2008; LoCasale-Crouch et al., 2007) and the additional QRIS policy relevance for program improvement, understanding the factors that influence the quality of teacher-child interactions is paramount. The focus of this study is on one salient feature of preschool classrooms – the presence of disruptive behaviors.

Disruptive behaviors in preschool classrooms

Managing children's disruptive behaviors is a stressful part of early childhood educators' jobs (Kaiser, Rogers, & Kasper, 1993; Quesenberry, Hemmeter, Ostrosky, & Hamann, 2014). Teachers report that the stress related to behavior management is one of the most disliked aspects of their job (Kontos & Stremmel, 1988), as well as low self-confidence in their ability to manage disruptive behaviors (Li Grining et al., 2010). Teachers of low-income children are more likely

to experience disruptive behaviors in the classroom, as low socioeconomic status is a risk factor for developing behavior problems (Qi & Kaiser, 2003). With few supports related to disruptive behaviors (Wells, 2017) or limited uptake of such opportunities among preschool teachers, one outlet for handling misbehaviors has been suspension or expulsion from preschool programs (Zinsser, Zulauf, Das, & Silver, 2017). The national expulsion rate for preschoolers due to behavioral concerns is estimated to be nearly 7 children per 1,000 enrolled, a rate that is over three times as high as the national rate in K-12 settings (Gilliam, 2005).

Even if children who display disruptive behaviors remain in the classroom, they are not as likely to benefit from the learning environment to the same degree as students without behavioral concerns. Teachers issue more commands to children whom they perceive as demonstrating greater disruptive behaviors compared to those they perceive as demonstrating fewer problem behaviors (Dobbs & Arnold, 2009). And children who display disruptive behaviors are less likely to develop positive relationships with their teachers (Birch & Ladd, 1998; Doumen et al., 2008; Roorda, Verschueren, Vancraeyveldt, Craeyevelt, & Colpin, 2014) despite the positive buffering effects that such relationships can offer (Buyse, Verschueren, Doumen, Van Damme, & Maes, 2008; Hamre & Pianta, 2005). Some research suggests that children's behaviors drive this association, such that heightened disruptive behavior lead to more conflictual teacher-child relationships (Mejia & Hoglund, 2016).

The negative effects of disruptive behaviors extend beyond teacher-child relationships. The peer effects literature shows that peers' disruptive behaviors can undermine children's social-emotional development and academic outcomes. More exposure to peers' disruptive behaviors can lead to higher levels of aggressive behavior, particularly for children already exhibiting elevated levels of challenging behaviors (Hanish, Martin, Fabes, Leonard, & Herzog,

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2005; Kellam, Ling, Merisca, Hendricks Brown, & Ialongo, 1998). Additionally, exposure to more severe problem behaviors in preschool classrooms (i.e., proportion of children in classroom who scored above the sample 75th percentile) is linked to greater internalizing behaviors in kindergarten (Yudron, Jones, & Raver, 2014). Interestingly, in terms of academic outcomes, studies that looked at the average or mean-level disruptive behavior in the classroom did not find significant associations with children's reading and math outcomes (Bulotsky-Shearer, Dominguez, & Bell, 2012; Georges, Brooks-Gunn, & Malone, 2012; Neidell & Waldfogel, 2010). However, disruptive behavior at the 75th and 90th percentiles led to decreases in kindergarten math scores (Neidell & Waldfogel, 2010). These discrepant findings suggest that the classroom mean of disruptive behaviors may be capturing a different quality of the classroom environment than the extent to which disruptive behaviors are more severe (e.g. falling at the 75th or 90th percentile), a point that is discussed in more detail in the following section.

The extent to which the presence of disruptive behaviors influences global teacher-child interactions in a classroom is an under-researched topic yet important to understand in order to create environments that best support children's learning and development. The prosocial classroom model (Jennings & Greenberg, 2009) provides a useful framework for conceptualizing the role of behavioral challenges in the classroom for teachers' ability to engage in effective interactions with children. This model posits that teachers' ability to effectively manage children's behaviors, develop positive relationships with children, and ultimately provide a classroom experience supportive of children's learning is greatly influenced by teachers' own social-emotional competencies. Teacher stress can undermine these competencies, introducing a "burnout cascade" in which children's behaviors and teachers' responses to them continue to worsen in a repeated cycle over time. Given that teacher perceptions of disruptive behaviors are

related to higher levels of teacher stress (Friedman-Krauss, Raver, Neuspiel, & Kinsel, 2014), classroom-level behavior problems may undermine the quality of global teacher-child interactions if teachers' stress prevents them from engaging in positive, responsive, and cognitively-stimulating interactions with all children in the classroom.

The only study to our knowledge that has explored the relation between classroom-level behavior problems and teacher-child interactions in preschool (Friedman-Krauss, Raver, Morris, et al., 2014) examined the relations between fall classroom-level behavior problems and the emotional climate of the classroom in the spring (controlling for fall) and tested whether this relation was mediated by teacher stress. Classroom-level behavior problems were operationalized as the classroom average of children's externalizing behaviors as reported by teachers, classroom emotional climate was assessed using the emotional support domain of the CLASS observational measure (Pianta et al., 2008), and teacher stress was self-reported. Results suggested that classroom-level behavior problems significantly predicted higher job stress among teachers in the spring. Job stress significantly predicted spring classroom emotional climate, but this relation was characterized by an inverse-U shape. Specifically, low levels of stress and high levels of stress predicted poorer classroom emotional climates, while moderate levels of stress predicted more positive classroom emotional climates. Contrary to expectations, higher levels of classroom-level behavior problems significantly predicted higher classroom emotional climate in the spring, and teacher job stress was not found to mediate the relation between classroom-level behavioral problems and classroom emotional climate. The authors suggest that the unexpected findings may be due to a lack of variation in emotional climate across classrooms (with most classrooms scoring in mid-to-high range), the fact that only variance in spring classroom emotional climate not accounted for by fall emotional climate was being predicted, or classroom

assignment processes in which higher-performing teachers were assigned children with greater

behavioral challenges. The goal of the present study is to build upon the work of Friedman-

Krauss, Raver, Morris, et al. (2014) to explore the relation between classroom behavioral

composition and the quality of teacher-child interactions across three domains (emotional,

organizational, and instructional), as well as teachers' professional qualifications that may

moderate these associations.

Conceptualizing classroom behavioral composition

Classroom behavioral composition is broadly defined as the compilation of behavioral

characteristics of children comprising a classroom. It can be operationalized in multiple ways,

according to particular properties of a classroom's distribution (Yudron et al., 2014). The

classroom mean is the most commonly used approach for operationalizing behavior problems at

the classroom level and reflects the average level of behavior problems. Intuitively, it makes

sense that the classroom mean is an important feature of the classroom environment to consider

in the context of compositional studies, however, it is also important to recognize that the mean

only provides one piece of information about the classroom environment. While relatively

straightforward to calculate and interpret, classroom mean scores alone do not account for other

properties of a classroom's distribution of scores, an omission that could lead one to draw

misinformed conclusions about a specific research question related to classroom composition

(Glewwe, 1997; Yudron et al., 2014). For example, the mean provides useful information about a

classroom, as classrooms with higher means are likely more difficult to manage, but the mean

may be driven by a few students with extreme disruptive behaviors or a majority of students with

moderate-to-high disruptive behaviors. These two potential classroom environments present

different challenges for teachers' classroom management skills. A teacher of a classroom with

more students in the moderate-to-high range may be able to generally carry out daily tasks with some interruptions, while a teacher of a classroom with a few students displaying extreme challenges may be more hampered in her ability to execute instructional activities as planned due to time and attention being constantly devoted to more severe management issues. While these compositional metrics of a particular classroom are related to each other, each represents a distinct aspect of the environment that may contribute to teachers' and children's experiences in the classroom.

Moderating role of teacher qualifications

Our primary interest in teachers' classroom experience, education level, and area of study is to explore whether these professional qualifications matter for teachers' ability to handle behaviorally challenging classrooms. Although teachers' experience, education levels, and area of study are inconsistently linked to the quality of teacher-child interactions (Early et al., 2007; Lin & Magnuson, 2018; Pianta et al., 2005), these associations are not well-understood. Yet, teachers' qualifications continue to be a common policy lever for improving the quality of preschool programs (Friedman-Krauss et al., 2019). Therefore, it is important to better understand the role of these qualifications and in particular whether they may be important factors when considering the effect of teaching in more challenging environments on teacher-child interactions.

Most of the current literature reports on average associations between these qualifications and the quality of teacher-child interactions, but only looking at average associations could mask the potential benefits these qualifications may confer when faced with a difficult classroom context. Indeed, Ansari and Pianta (2018) found this to be the case for years of experience and education levels. In their study on the effects of classroom age diversity on teacher-child

interactions, more years of experience and education buffered preschool teachers against the challenges of teaching in mix-aged classrooms. Only among teachers with fewer years of education did classroom age diversity predict worse instructional support, and only among teachers with fewer years of experience did classroom age diversity predict worse instructional and emotional support. We suspect that a similar rationale could apply to teachers' ability to handle more behaviorally challenging classrooms. Therefore, we will explore the moderating role of teachers' years of experience, bachelor's degree attainment, and area of study in the relation between classroom behavioral composition and teacher-child interactions.

To summarize, it is well-established that the quality of teacher-child interactions is important for promoting children's positive academic and social outcomes, yet disruptive behaviors may undermine the quality of teacher-child interactions. Research focused on the effects of disruptive behaviors in the classroom has mostly focused on children's social-emotional and academic outcomes, as well as dyadic teacher-child relationships. Much less work has examined the role of classroom-level disruptive behaviors on classroom-wide teacher-child interactions. Furthermore, while teacher experience, education, and area of study are generally not strong predictors of classroom quality, their contribution may be more evident when examining teaching contexts that present particular challenges to teachers (e.g., behaviorally challenging classrooms).

Present study

The goal of this study is to advance our understanding of the relation between classroom behavioral composition and teacher-child interactions and the potential for teachers' qualifications to buffer against the challenges of teaching in classrooms with high levels of disruptive behaviors. The following research questions are addressed: (1) To what extent do

different classroom behavioral composition factors (e.g., mean, proportion of children at or above the 90th percentile) predict teacher-child interactions at the beginning of the year and change in teacher-child interactions over the school year? Three types of teacher-child interactions (e.g., emotional, managerial, and instructional) will be considered, adding to the unique contribution of this paper. (2) Are teachers with more years of experience, a bachelor's degree, or early childhood major better able to provide high-quality teacher-child interactions amidst more behaviorally challenging classroom environments?

Regarding the first research question, we expect that initial teacher-child interactions and change in interactions over time will be worse in classrooms with higher mean levels of disruptive behavior and higher proportions of children at or above the 90th percentile, but we expect the 90th percentile threshold to be a stronger predictor than the classroom mean because this metric plausibly represents a classroom environment that is more likely to hamper teachers' ability to provide emotionally warm, productive, and academically-oriented interactions. Regarding the second research question, we expect that having more years of experience, bachelor's degree attainment, and majoring in early childhood will buffer against lower-quality teacher-child interactions in all domains, particularly in the case of preventing diminished quality in teacher-child interactions over the course of the year. Compared to instructional interactions, we suspect that teachers' emotional and organizational interactions may be more susceptible to the negative effects of challenging classroom behavioral composition, due to the strong conceptual alignment between these types of interactions and children's disruptive behaviors, and therefore have more to gain from the positive buffering effects that teachers' qualifications may offer under challenging behavioral contexts. However, differences across domains are exploratory.

Method

Participants

The current study used data that was collected as part of a randomized control trial (RCT) of the Banking Time intervention, a teacher-child, dyadic intervention aimed at improving preschool children's disruptive behaviors (see Williford et al., 2017 for a detailed description of the intervention and results). The larger RCT sample included 183 teachers, 173 classrooms, and 2,427 children. Due to various reasons, ten lead teachers turned-over during the course of the study and all were subsequently replaced by a different lead teacher. Thus, ten classrooms were linked to two lead teachers in the data. For the purposes of the present study, one teacher from each of these classrooms was dropped so that each classroom was associated with only one lead teacher. In all cases, we retained the teacher who completed the baseline ratings of children's disruptive behaviors (described in more detail below). An additional 13 classrooms and teachers were dropped from the original RCT sample due to non-participation in any study activity. The current study includes classrooms from three conditions tested in the impact study, as the intervention is not related to the current study's research questions and is unlikely to interact with the classroom processes being investigated in the present study. There were no significant differences between the intervention conditions on baseline program, teacher, or child demographic variables (see Williford et al., 2017 for more detailed information).

The final sample for the current study consists of a total of 2,427 children spread across 160 teachers and 90 preschool centers. Teachers were racially diverse, with 53% identifying as White, 41% identifying as Black/African American, and the remaining identifying as either multiracial (3%), Latino (1%), or Native American, Asian, or other (all less than 1%). Teachers were majority female (97%) and were on average 41 years old with 12 years of teaching

experience. Sixty-seven percent of teachers held at least a bachelor's degree and 40% majored in early childhood. Children were also racially diverse, with 40% identifying as Black, 38% as White, 10% as Latino, 9% as multiracial, and a small percentage as Native American, Asian, or other. Children came from a broad range of economic backgrounds but the majority were from low-income families. Children were 48% female and 4-years-old on average. Classrooms had a mix of funding sources, with 26% being federally-funded, 19% state-funded, and 55% privately-funded. The average class size was 15.17 children and ranged from 5 to 25. The average number of classrooms per center was 2.33 and ranged from 1 to 7.

Procedures

Preschool centers of various types (e.g., Head Start, public PreK, and privately funded) were recruited across three sites in two Mid-Atlantic states to participate in the Banking Time RCT. After the center directors approved of the study, lead teachers were invited to participate. Once teachers consented to participate, they completed a personal and classroom demographic survey. Parental consent was requested for all children in the classroom, with majority of parents (76%) consenting for their child participate in the study. Parents completed a short demographic survey. Six weeks into the school year, teachers rated all consented children in their classroom on two disruptive behavior rating scales, Attention-Deficit/Hyperactivity Disorder Rating Scale-IV (ADHDRS-IV; DuPaul, Power, Anastopoulos, & Reid, 1998) and Oppositional Defiant Disorder Rating Scale (ODDRS; Hommersen, Murray, Ohan, & Johnston, 2006). In the larger Banking Time RCT, only the two boys and one girl with the highest disruptive behavior ratings received the intervention ($n = 470$ children), however, the current study uses the behavior ratings from all children ($n = 2,427$) regardless of whether they were selected to receive the intervention.

Data collection

Data for this study were collected at two points during the year: baseline (October) and end of year (May). Teacher and child demographic data were collected at baseline. Trained data collectors blind to intervention condition conducted classroom observations using the CLASS (Pianta et al., 2008) at baseline and end of year. At each time point, teachers were observed for approximately five observation cycles ($M = 4.88$, $SD = 1.78$). Each cycle consisted of data collectors observing the teacher for 15 minutes and coding for 10 minutes. Before conducting classroom observations, data collectors attended a 2-day CLASS training and achieved acceptable reliability. To demonstrate reliability, the coders independently coded five video clips and scored within one point of a master code on 80% of the dimensions.

Measures

Classroom behavioral composition

Classroom behavioral composition was operationalized using children's scores from the ADHDRS-IV and ODDRS rating scales. These behavior rating scales are used in clinical research with preschool-aged children and have been shown to be valid and reliable (McGoey, DuPaul, Haley, & Shelton, 2007). The ADHDRS-IV has 18 items, of which 9 assess inattention and 9 assess hyperactivity and/or impulsivity. Sample items for inattention include "has difficulty organizing tasks and activities" and "does not seem to listen when spoken to directly." Sample items for hyperactivity and/or impulsivity include "fidgets with hands or feet or squirms in seat" and "has difficulty awaiting turn." The ODDRS has 8 items, including "argues with adults" and "is touchy or easily annoyed by others." Both rating scales are reported on a 4-point Likert scale: never/rarely (0), sometimes (1), often (2), and very often (3). We used a summed score across the 26 items ($\alpha = .96$). Within the sample, scores ranged from 0 - 78 ($M = 14.3$, $SD = 15.0$), with higher scores reflecting more disruptive behaviors.

The classroom mean level of disruptive behavior was the first way in which we operationalized behavioral composition. To calculate the classroom mean, we averaged all children's disruptive behavior scores within a classroom. Classroom mean scores were variable across the sample, with a range of 1.13 – 37.6 (M = 14.6, SD = 7.3). The proportion of children in a classroom whose disruptive behavior score is at or above the 90th percentile was the second way we operationalized classroom behavioral composition. We chose this method because we were interested in capturing the extent to which classrooms contained children with clinically significant behavior problems and based on prior research demonstrating divergent findings when using the classroom mean versus proportion of children meeting a higher threshold (Neidell & Waldfogel, 2010; Yudron et al., 2014). In our sample, the proportion of children in classrooms at or above the 90th percentile ranged from 0 to 0.70 (M = 0.11, SD = 0.12).

Teacher-child interaction quality

The quality of teacher-child interactions was measured from live observations using the CLASS (Pianta et al., 2008). The CLASS tool captures classroom quality along 10 dimensions that are organized into one of three domains: Emotional Support, Classroom Organization, and Instructional Support. Classroom quality is measured on a 7-point Likert scale (1 = low to 7 = high). At each time point (e.g., baseline and end of year), trained data collectors observed classrooms for approximately five data collection cycles. Scores from these cycles were averaged together to create three domain scores at each time point. Across 20% of observations, two data collectors rated the same cycle to determine interrater reliability. Intraclass correlations (ICCs) were .82 for Emotional Support, .76 for Classroom Organization, and .73 for Instructional Support. Multiple studies have demonstrated reliability and validity of the CLASS measure (e.g., Hamre et al., 2013, Mashburn et al., 2008).

Teacher experience and education

The teacher survey conducted at the beginning of the year asked teachers to report on how many years they had taught and their highest degree earned. We created a dichotomous indicator for whether the teacher had at least a bachelor's degree (1 = yes, 0 = no).

Covariates

A set of teacher- and classroom-level covariates hypothesized to relate to classroom behavioral composition and teacher-child interaction quality were included to limit the likelihood of obtaining biased associations. In addition to teachers' experience and education mentioned above which are used as moderators, teacher covariates include age and beliefs about teaching young children. Beliefs about teaching young children was assessed using the modernity scale (Schaefer & Edgerton, 1985) on the baseline teacher survey (α =.79). This scale captures whether teachers hold more traditional, authoritarian views (e.g., teacher-centric) versus more modern or progressive views (e.g., child-centric) related to teacher-child interactions. This variable was included as a covariate in order to control for teacher beliefs which may relate to both teachers' ratings of disruptive behavior and the quality of teacher-child interactions. Classroom covariates include percent male, percent non-White, percent children age 3, average income-to-needs ratio, class size, intervention status, and cohort (e.g., site and year). Demographic variables were collected via teacher and parent surveys, and child-level data were aggregated to the classroom level. Intervention status and cohort were assigned by the research team. Table 1 presents descriptive statistics for all variables in this study.

Analytic Strategy

First, bivariate correlations were examined among the two classroom behavioral composition predictor variables, CLASS outcome variables (beginning and end of year),

teachers' qualifications (education levels, years of experience, and area of study), and control variables. Results indicated that the classroom mean of disruptive behavior and the proportion of children at or above the 90th percentile were highly correlated ($r = .83$, $p < 0.001$). Multicollinearity concerns prevented us from including both predictors in the same model, however, we were still interested in examining differential associations since they conceptually represent distinct aspects of the classroom environment. Table 2 presents bivariate correlations for the key study variables.

To address the current study's research questions, linear regression models were run in the Stata software package version 14.2. Eight models were examined for each CLASS domain in the fall and spring controlling for fall (i.e., change over time). Models 1 and 2 considered the main effects of classroom behavioral composition (measured as classroom mean and proportion of children at or above the 90th percentile) on teacher-child interactions. Model 3 included the interaction of classroom mean with years of teaching experience, Model 4 included the interaction of classroom mean with an indicator for bachelor's degree, and Model 5 included the interaction of classroom mean with an indicator for early childhood major. Models 6, 7, and 8 followed the same pattern but substituted the proportion of children at or above the 90th percentile for the classroom mean. All child-level covariates were aggregated to the classroom level prior to analyses. Standard errors were adjusted to account for clustering of classrooms within preschool centers. Missing data ranged from 0-20.6% across the study variables (see Table 1 for the percent of missing data for each variable). Multiple imputation using the Blimp software (Enders, Keller, & Levy, 2017; Keller & Enders, 2018) was used to handle missing data. Results were estimated across twenty imputed datasets. Interaction terms were specified in the imputation phase to preserve any potential interaction effects that may exist in the data.

Results

   Here we present results for associations between classroom behavioral composition and the quality of teacher-child interactions at the start of the year and change over the course of the year. The top half of Table 3 displays results for initial teacher-child interactions, while the bottom half displays results for change in teacher-child interactions over time. Following the results for the main effects of classroom behavioral composition, we present results for the moderation analyses, to address whether teacher qualifications (e.g., years of experience, bachelor's degree, and early childhood major) are important factors for understanding the relation between classroom behavioral composition and the quality of teacher-child interactions. Standardized beta coefficients are presented, which can be interpreted as effect sizes.

Classroom behavioral composition predicting teacher-child interactions at the start of the year

   We found no statistically significant relation between classroom mean or proportion of children at or above the 90th percentile and teachers' initial scores in Emotional Support, Classroom Organization, or Instructional Support.

Classroom behavioral composition predicting change in teacher-child interactions over time

   In this section, we present results for the associations between classroom behavioral composition and spring CLASS scores, controlling for fall. This set of outcomes can be thought of as variance in teacher-child interactions at the end of the year that is explained by classroom behavioral composition while taking into account the quality of teacher-child interactions at the beginning of the year. In other words, this outcome captures the extent to which behavioral composition is associated with change in teacher-child interactions from the beginning to the end of the year. Paired t-tests indicated that on average teachers' Emotional Support ($t = 0.72$, $p = .47$) and Classroom Organization ($t = 0.19$, $p = .85$) did not change from fall to spring, but

Instructional Support decreased over this period of time ($t = 3.93$, $p < .001$). We found that the proportion of children at or above the 90th percentile was significantly and negatively associated with change in Classroom Organization ($\beta = -0.15$, *SE* = .07, *p = .04*) and Instructional Support ($\beta = -0.19$, *SE* = .07, *p* = .01) over the course of the year. As the proportion of children with extreme behavioral challenges in a classroom increased, teachers showed declines in the quality of Classroom Organization and more steep declines in Instructional Support over the year. There was also a trending negative association between the proportion of children at or above the 90th percentile and change in Emotional Support ($\beta = -0.17$, *SE* = .09, *p* = .05).

Teacher qualifications as moderators of links between classroom behavioral composition and teacher-child interactions

Regarding our second research question whether teachers' years of experience, bachelor's degree, or early childhood major matter for teachers' ability to provide high-quality teacher-child interactions amidst more behaviorally challenging classroom environments, we found some *marginally* significant interactions with differing patterns at the beginning and end of the year. At the beginning of the year, we found a trending interaction between bachelor's degree and classroom mean predicting Emotional Support ($\beta = .27$, *SE* = .14, *p* = .05). A graph of the interaction (Figure 1) suggests that when teachers held a bachelor's degree, they provided roughly the same amount of Emotional Support regardless of the classroom mean of disruptive behaviors. However, among teachers without a bachelor's degree, Emotional Support varied depending on the classroom behavioral composition. In classrooms with low levels of disruptive behavior, teachers provided a great deal of Emotional Support, but in classrooms with higher levels of disruptive behaviors, teachers provided less Emotional Support.

We found different patterns for change in the quality of Emotional Support across the

school year. When looking at change in Emotional Support, we found *marginally* significant

moderation of classroom mean (β = -.12, *SE*= .07, *p* = .09; Figure 2) and classroom proportion at

or above the 90th percentile (β = -.10, *SE* = .06, *p* = .07) by teachers' years of experience, but the

direction of the effect was opposite that for holding a bachelor's degree. Teachers with high

levels of experience showed greater declines in Emotional Support across the year in classrooms

with a high mean or high proportion of children with very disruptive behaviors compared to less

experienced teachers in similarly challenging classrooms. We present this trending moderation

effect for classroom mean in Figure 2, however the pattern of results was the same for the

proportion at or above the 90th percentile. We found no evidence that majoring in early

childhood moderated the association between classroom behavioral composition and the quality

of teacher-child interactions.

Discussion

Guided by the importance of teacher-child interaction quality for young children's

positive learning and development (Hamre, 2014), reports of preschool teachers' stress related to

children's disruptive behaviors in the classroom (Quesenberry et al., 2014), and the increasingly

common use of classroom process measures in statewide QRIS (Vitiello et al., 2018), we

explored the role of classroom behavioral composition on teacher-child interactions and whether

teachers' experience, holding a bachelor's degree, or majoring in early childhood may act as a

protective factor for teaching in more behaviorally challenging classrooms. Classroom

behavioral composition was operationalized in two ways – first, as the classroom mean level of

disruptive behavior, and second, as the proportion of children in the classroom at or above the

90th percentile of disruptive behaviors – using teacher report of children's externalizing

behaviors. Additionally, we were interested in determining the extent to which these factors

influenced the quality of teacher-child interactions at the beginning of the year and change over the course of the school year.

The first research question examined whether classroom behavioral composition is related to teacher-child interactions at the beginning of the year and change over the course of the year. Neither classroom mean nor classroom proportion at or above the 90th percentile for disruptive behaviors was related to teacher-child interactions at the beginning of the school year. However, the proportion of children at or above the 90th percentile for disruptive behaviors was significantly related to change in the quality of teacher-child interactions over the course of the year. Specifically, teachers who perceived higher classroom proportions of children with extreme disruptive behaviors showed declines in the quality of their organizational and instructional interactions across the year. The effect size was -.15 for Classroom Organization and -.19 for Instructional Support. Although these effect sizes are small, they are above and beyond fall teacher-child interaction quality. To compare the magnitudes of these associations to those of the lagged fall scores (not presented in Table 3), the effect corresponds to a little less than half of the effect of fall Classroom Organization scores ($ES = .33$) and a little less than three-quarters of the effect of fall Instructional Support scores (ES = .28). Given that intervention work has shown that the quality of teacher-child interactions is not easily improved when delivering professional development at scale, particularly with regard to Instructional Support (Early, Maxwell, Ponder, & Pan, 2017), these declines in quality across the school year are meaningful. The association between classroom proportion at or above the 90th percentile for disruptive behaviors and change in teachers' Emotional Support was marginally significant but in the expected direction.

Developmental theory assumes bidirectionality between children and teachers, however, the influence of teachers on children is more commonly examined. These results, although not

causal, indicate that the opposite direction is true as well in that children's disruptive behaviors can negatively influence teacher practice over time, a finding that is in line with reports from teachers that children's disruptive behaviors often cause stress and impact their classroom practice (Quesenberry et al., 2014). Additionally, it is important to note that since these declines in quality are at the classroom level, a few very disruptive children may be contributing to a poorer quality preschool experience for all children in the classroom.

While we expected both the classroom mean and classroom proportion at or above the 90th percentile to matter for the quality of classroom interactions, we hypothesized that the 90th percentile threshold would be the more salient feature, and these findings align to that aspect of our hypotheses. For preschool teachers, the presence of children with more severe disruptive behaviors may create circumstances for which it is harder to maintain or improve upon high-quality interactions over time, compared to the presence of a group of children displaying moderate disruptive behaviors. It is possible that moderately disruptive behaviors can be redirected more easily, even when a larger number of students is involved, than that of more severe behaviors among only a few children. Clinical research identifying severity of disruptive behavior as a risk factor for continued behavior problems in early childhood supports this notion (Shaw, Gilliom, & Giovannelli, 2000).

These findings have implications for education practice and policy. Early childhood teachers have reported a desire to receive more training around how to manage disruptive behaviors in the classroom (Granja, Smith, Nguyen, & Grifa, 2018), and these findings suggest that filling this gap in teacher professional development is warranted to help ensure high-quality teacher-child interactions for all children. From a policy perspective, the CLASS tool is increasingly being used in state-wide QRIS evaluation systems to determine the quality of

classroom environments. In the present study, teachers who reported more children in the classroom who were very active, impulsive, inattentive, and oppositional showed declines in the quality of their practice over time, so it is important to consider the proportion of children in a classroom who display severe disruptive behaviors when interpreting teachers' CLASS scores and making decisions based on those scores.

The second research question this study explored was whether having more years of teaching experience, a bachelor's degree, or early childhood major helped teachers provide high-quality teacher-child interactions amidst more behaviorally challenging classroom environments. We found *marginal* evidence for both bachelor's degree and years of teaching experience, though the patterns were in the opposite directions and differed depending on whether the outcome was initial interaction quality or change in quality over time. Specifically, in the domain of Emotional Support, we found a trend result showing that that holding a bachelor's degree was associated with teachers being observed to have a more positive classroom climate at the beginning of the year despite perceiving greater disruptive behaviors among children. We also found a trend effect that showed that more years of teaching experience was linked to increasing the negative association between level of disruptive behaviors at the classroom level and the quality of emotional interactions over the course of the school year. Majoring in early childhood neither helped nor hindered teachers' ability to productively handle challenging classroom environments. We acknowledge that these are only trend level associations and, while interesting, more research is needed to determine if these results replicate before describing the potential implications of these results.

Limitations and Future Research

Several limitations to this study are important to mention. First, the measurement of

classroom behavioral composition posed a challenge. Similar to previous studies related to classroom behavioral composition (Friedman-Krauss et al., 2014; Yudron et al., 2014), we relied on teachers' reports of individual children's behaviors to create the classroom composition variables. To better capture the potential influence of children's disruptive behaviors on the quality of teacher-child interactions, validating these scores with other measures such as observations or direct assessments will be an important area for future research. Additionally, in this study, high collinearity between classroom mean and proportion at or above the 90th percentile for disruptive behaviors prevented these compositional factors from being analyzed together in the same model. Future research should work towards developing novel ways to measure classroom composition that allow researchers to tease apart various features of a classroom without sacrificing conceptual clarity. Second, the findings are correlational and thus we are unable to detect causal effects of classroom behavioral composition on the quality of teacher-child interactions. Third, the three CLASS domains were highly correlated in this sample, so the main effect of proportion at or above the 90th percentile on change in quality across all domains may be driven by considerable shared variance in the outcomes rather than unique associations with the three domains. Fourth, our interaction effects were trending toward significance and should therefore be interpreted cautiously. Future research should continue to pursue these questions to determine if the effects replicate in other samples.

Conclusion

Given that teacher-child interactions are one of the most significant features of early childhood classrooms (Hamre, 2014), as well as the increasingly widespread assessment of interactions in classrooms (Vitiello et al., 2018), understanding the contribution of both children and teachers is important for identifying points of intervention. The current study is unique in

that it examined classroom behavioral composition using two metrics – the classroom mean and the proportion of children at or above the 90th percentile for disruptive behaviors – and its role on emotional, organizational, and instructional teacher-child interactions at the beginning of the year and change over time, as well as whether teachers' years of experience, education levels, or area of study may be an asset for teachers who are tasked with teaching behaviorally challenging classrooms. Findings highlight that teachers' perceptions of extreme disruptive behaviors (e.g., those reaching clinically significant levels) were linked to a decline in the quality of teacher-child interactions over time and that this metric was more consequential than the average level of disruptiveness in a classroom. Additionally, holding a bachelor's degree seemed to serve as a resource for teachers' ability to provide warm, emotionally responsive interactions at the beginning of the year, however, more teaching experience seemed to undermine teachers' ability to engage in emotionally warm and supportive interactions throughout the school year. Given the prevalence with which preschool teachers report that handling disruptive behaviors is an area of challenge, it is important to support teachers in this area through PD in order to prevent declines in the quality of teacher-child interactions.

Table 1. Descriptive Statistics for Key Study Variables ($N_{classrooms}$ = 160)

	Mean	Standard Deviation	Range	% Missing
Classroom Behavioral Composition Predictors				
Classroom mean	14.58	7.32	1.13 – 37.60	0%
Classroom proportion 90th percentile	0.11	0.12	0 – 0.70	0%
Teacher Moderators				
Years of teaching experience	12.31	9.23	0 – 43.00	5.00%
Bachelor's degree or higher [a]	0.67	0.47	0 – 1.00	2.50%
Early childhood major [a]	0.40	0.49	0 – 1.00	3.75%
Outcomes				
Fall emotional support	5.12	0.76	2.90 – 6.50	4.38%
Spring emotional support	5.13	0.69	3.25 – 6.71	20.63%
Fall classroom organization	4.80	0.74	2.58 – 6.44	4.38%
Spring classroom organization	4.86	0.80	2.00 – 6.39	20.63%
Fall instructional support	2.22	0.64	1.03 – 5.21	4.38%
Spring instructional support	1.99	0.66	1.00 – 4.72	20.63%
Classroom and Teacher Covariates				
Class size	15.17	3.58	5.00 – 25.00	2.50%
Classroom income-to-needs	1.93	1.25	0.25 – 4.87	0%
% of boys in classroom	0.52	0.14	0.11 – 0.92	4.38%
% children age 3 in classroom	0.32	0.41	0 – 1.00	8.13%
% of children non-White in classroom	0.61	0.34	0 – 1.00	0%
Teacher age in years	40.88	11.67	21.00 – 67.00	3.13%
Teacher beliefs about children	2.36	0.60	1.19 – 3.88	3.13%

Notes.
[a] Indicates proportion of sample with a value of 1 (= yes).

Table 2. Bivariate Correlations

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Classroom mean	-																	
2. Classroom proportion 90th percentile	0.83***	-																
3. Years of experience	0.08	0.03	-															
4. Bachelor's degree	-0.01	0.04	-0.10	-														
5. Early childhood major	-0.09	-0.05	-0.01	-0.25**	-													
6. Emotional support baseline	-0.06	-0.02	0.13	-0.04	-0.07	-												
7. Emotional support EOY	-0.13	-0.16	0.05	0.06	0.11	0.52***	-											
8. Classroom organization baseline	-0.07	-0.08	0.06	0.01	-0.01	0.80***	0.48***	-										
9. Classroom organization EOY	-0.12	-0.17	0.00	0.18	0.12	0.47***	0.88***	0.47***	-									
10. Classroom instructional support baseline	-0.03	-0.08	0.01	0.06	-0.11	0.58***	0.29**	0.52***	0.22*	-								
11. Classroom instructional support EOY	-0.14	-0.20*	0.07	0.01	-0.08	0.27**	0.62***	0.21*	0.57***	0.33**	-							
12. Classroom size	-0.18*	-0.17*	0.04	0.13	0.05	-0.01	-0.06	-0.05	-0.03	0.04	-0.02	-						
13. Classroom income-to-needs	-0.08	-0.06	-0.06	-0.20*	-0.09	0.15	0.09	0.14	0.02	0.11	0.10	-0.22**	-					
14. Classroom % male	-0.05	0.03	0.04	-0.02	0.09	-0.14	-0.05	-0.12	-0.03	-0.19*	-0.05	0.11	-0.03	-				
15. Classroom % age 3	0.13	0.06	-0.05	-0.38***	0.05	0.08	-0.08	0.07	-0.18	-0.01	-0.09	-0.15	0.23**	0.09	-			
16. Classroom % non-White	0.08	0.02	0.07	0.18*	0.06	-0.25**	-0.20*	-0.25**	-0.14	-0.18*	-0.18*	0.13	-0.84***	0.00	-0.13	-		
17. Teacher age	0.02	-0.02	0.51***	-0.08	0.01	0.04	0.07	-0.01	0.08	0.02	0.25**	0.13	-0.08	0.09	-0.02	0.02	-	
18. Teacher beliefs about children	0.09	0.04	-0.08	-0.17*	-0.02	-0.43***	-0.33**	-0.31**	-0.36***	-0.26**	-0.23*	-0.06	-0.09	0.10	0.15	0.17*	-0.18*	-

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

Table 3. Associations between classroom behavioral composition and the quality of teacher-child interactions

	CLASS Domain		
	Emotional Support β (SE)	Classroom Organization β (SE)	Instructional Support β (SE)
Classroom composition and beginning of year quality			
Main effects models			
Classroom mean	-0.08 (.06)	-0.10 (.08)	-0.02 (.07)
Classroom proportion at or > 90th percentile	-0.06 (.06)	-0.12 (.08)	-0.07 (.07)
Interaction Models			
Classroom mean x experience	-0.06 (.06)	0.01 (.06)	-0.05 (.07)
Classroom mean x bachelor's degree	0.27† (.14)	0.14 (.14)	0.05 (.16)
Classroom mean x early childhood major	0.01 (.15)	0.00 (.16)	-0.11 (.16)
Classroom proportion at or > 90th percentile x experience	-0.06 (.07)	-0.03 (.08)	-0.04 (.07)
Classroom proportion at or > 90th percentile x bachelor's degree	0.18 (.16)	0.15 (.14)	-0.00 (.15)
Classroom proportion at or > 90th percentile x early childhood major	-0.03 (.15)	-0.16 (.16)	-0.23 (.14)
Classroom composition and change in quality over year			
Main effects models			
Classroom mean	-0.10 (.09)	-0.05 (.08)	-0.13 (.08)
Classroom proportion at or > 90th percentile	-0.17† (.09)	-0.15* (.07)	-0.19* (.07)
Interaction Models			
Classroom mean x experience	-0.12† (.07)	-0.07 (.06)	0.00 (.07)
Classroom mean x bachelor's degree	0.02 (.17)	0.01 (.18)	-0.15 (.16)
Classroom mean x early childhood major	-0.05 (.18)	0.12 (.17)	0.23 (.15)
Classroom proportion at or > 90th percentile x experience	-0.10† (.06)	-0.03 (.06)	0.03 (.05)
Classroom proportion at or > 90th percentile x bachelor's degree	-0.04 (.20)	-0.03 (.21)	-0.10 (.16)
Classroom proportion at or > 90th percentile x early childhood major	0.08 (.17)	0.20 (.17)	0.13 (.17)

Notes.
All main effects and interaction models were examined separately.
Standardized coefficients are presented and serve as measures of effect sizes.
All models control for percent classroom male, percent classroom non-white, percent classroom age 3, average classroom income-to-needs ratio, class size, teacher beliefs about children, teacher age, intervention status, and cohort.

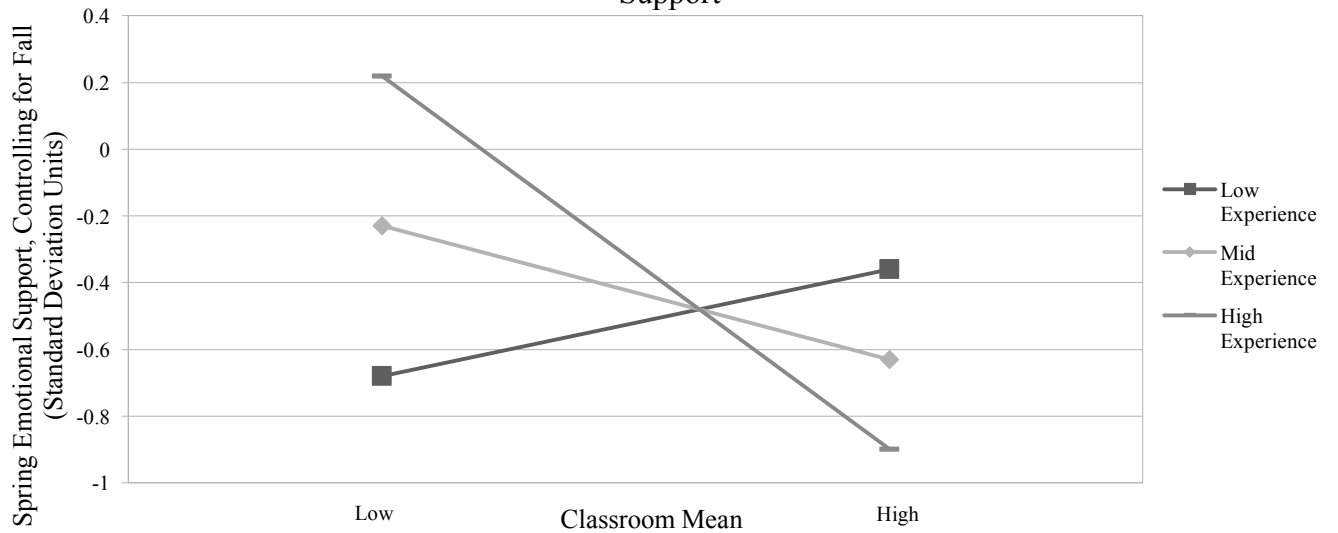Standard errors were adjusted to account for clustering of classrooms within preschool centers.
* p <.05. † p < .10.

Figure 1: Moderating Effect of Bachelor's Degree on Initial Emotional Support
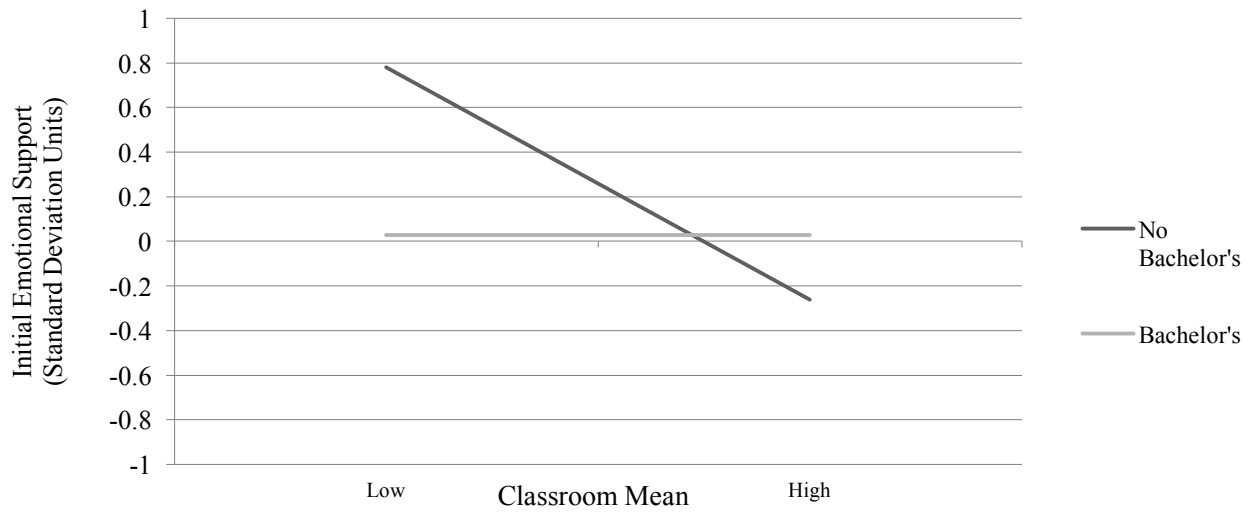
Note: The interaction is marginally significant (*p* = .05)

Figure 2: Moderating Effect of Years of Experience on Change in Emotional Support

Note: The interaction is marginally significant (*p* = .09)

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