Behavior Management and Engagement During Small-Group Instruction as Predictors of

Preschoolers' Literacy Skill Outcomes

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Abstract

Research Findings: The current study examined whether collective small-group behavioral engagement and teacher behavior management during small-group instruction predicted print knowledge, phonological awareness, letter writing, and expressive vocabulary gains for preschoolers at-risk for literacy difficulties. This study, part of a larger project, included 23 teachers delivering a small-group literacy intervention to 75 preschool children identified as at-risk for literacy difficulties. Hierarchical linear modeling results revealed that collective small-group behavioral engagement was predictive of child expressive vocabulary gains ($d = 0.13$), but teacher behavior management was not a significant predictor. *Practice or Policy*: The results demonstrate that high levels of collective small-group behavioral engagement during small-group literacy instruction contributed small positive effects to preschoolers' expressive vocabulary skills. As many small-group interventions are intended for children at-risk for literacy difficulties, these results are promising because preschool children at-risk for literacy difficulties appear to benefit from the intervention when collective small-group behavioral engagement is high. Including activities that prompt strong child engagement may be a critical factor in realizing the full potential of small-group literacy instruction in young children.

Keywords: teacher behavior management, behavioral engagement, small-group instruction, emergent literacy skills, early childhood

Behavior Management and Engagement During Small-Group Instruction as Predictors of Preschoolers' Literacy Skill Outcomes

During the preschool years, young children begin to develop the literacy skills that are foundational to later reading success, including print knowledge, phonological awareness, emergent writing, and oral language (National Early Literacy Panel [NELP], 2008). Code-focused skills in preschool such as, print knowledge and phonological awareness contribute to child reading achievement in first grade (Chaney, 1998). Letter writing, a code-focused skill that is a component of emergent writing, has received less attention; however, research has shown that the development of letter writing in preschool is related to other emergent literacy skills (Puranik et al., 2011), as well as subsequent writing and word reading skills in preschool and kindergarten (Molfese et al., 2011). Additionally, stronger meaning-focused skills such as expressive vocabulary skills, an aspect of oral language, are associated with better reading skills upon kindergarten entry (Morgan et al., 2015). These foundational code-focused and meaning-focused skills are interconnected and have important implications for later reading and writing ability (Chaney, 1992; Dickinson et al., 2003; Dickinson et al., 2006; Puranik et al., 2011; Storch & Whitehurst, 2002). Consequently, literacy instruction is often embedded across a variety of learning environments throughout the preschool day to foster educational achievement (Cabell, DeCoster, et al., 2013). Of concern, some children struggle to develop age-appropriate skills in one or more of these key areas, prompting the need for teachers to provide them with targeted instructional supports (Cabell, Justice, et al., 2013; Catts et al., 2001; Phillips et al., 2009).

Small-group literacy instruction is a commonly used format for delivering targeted instruction in K-12 settings and is growing in use at the preschool level. This approach is shown to encourage skill development in many preschool children who demonstrate risk for later

literacy difficulties (Bailet et al., 2009, 2013; Ehri, 2001; Goldstein et al., 2017; Gonzalez et al., 2011; Kelley et al., 2015; Kruse et al., 2015; Lonigan, Farver, et al., 2011; Pollard-Durodola et al., 2016; Zettler-Greeley et al., 2018). The limited size of the small group, which typically is restricted to five or fewer children, enables teachers to provide children with more targeted instruction, dialogue, and direct attention beyond that typically experienced in whole-group settings (Connor et al., 2014; Ehri et al., 2001; Wasik, 2008).

However, despite more direct teacher-child contact during small groups, intended learning outcomes may be compromised if children are not engaged and/or the teacher has difficulty managing child behaviors during instruction (Emmer & Stough, 2001). Children's literacy learning is related to their collective small-group behavioral engagement (Harn et al., 2017) and teachers' use of behavior management strategies (Gage et al., 2015) during small-group literacy instruction. Collective small-group behavioral engagement and teacher behavior management may also synergistically contribute to children's literacy gains within a small group learning environment. From the perspective of social control theory, a theory that continues to be supported in the current literature (Costello & Laub, 2020), behavior is managed through social interactions in which positive interactions with others contribute to displays of positive behavior (Hirschi, 1969). Finn's (1989) participation-identification model extends the social control theory, remaining relevant in the current literature (Jiang et al., 2022), to posit that child participation and positive social relations are key to child engagement and ultimately successful academic outcomes. Within a small-group learning context, these elements may be particularly critical. A small-group learning environment is associated with greater behavioral engagement than a whole-group learning environment (Downer et al., 2007) likely due, in part, to increased opportunities for participation and improved peer and teacher relations (Pianta et al., 2012;

Rimm-Kaufman et al., 2005). To strengthen participation and positive interactions with peers and teachers in group learning environments, use of effective behavior management strategies is vital (Powell et al., 2006; Sutherland et al., 2018).

As small-group literacy instruction bolsters literacy skills for children at-risk for later literacy difficulties and offers a setting in which teachers' use of behavior management may bolster group engagement, we use this learning context to evaluate whether collective small-group behavioral engagement and teacher behavior management strategies independently and synergistically contribute to early literacy gains for children who demonstrate risk for later literacy difficulties. Understanding the relations among child behavioral engagement (Ponitz et al., 2009), teacher behavior management (Dobbs-Oates et al., 2011), and literacy learning may illuminate opportunities to maximize preschool children's gains from small-group instruction. Yet, little is known about how these behavioral components interact during small-group instruction and to our knowledge, there are no existing studies that evaluate the collective small-group behavioral engagement of preschool children receiving small-group literacy instruction in which the behavioral engagement of the small group is assessed. As such, this study examined whether: 1) collective small-group behavioral engagement among children participating in small-group instruction, and 2) teachers' behavior management of children in small-group instruction are independently related to literacy gains for preschoolers at-risk for literacy difficulties, and 3) whether teachers' behavior management skills during small-group instruction moderate the relation between children's collective small-group behavioral engagement and subsequent literacy gains.

Behavioral Engagement is Important for School Success

Behavioral engagement is one of several forms of child engagement important for school success (Fredricks et al., 2004; Parsons et al., 2015). It refers to a child's ability to follow directions, participate, and attend to tasks (Fredricks et al., 2004; Parsons et al., 2015). Behavioral engagement is the focus of the current study because it is considered amongst the strongest indicators of child academic skills (Fredricks et al., 2004; Landis & Reschly, 2013), is strongly associated with literacy learning (Ponitz et al., 2009), and is closely linked to teachers' use of behavior management strategies (Allday et al., 2012; Downer et al., 2007; Hiralall & Martens, 1998; MacSuga-Gage & Simonsen, 2015; Simonsen et al., 2008). Behavioral engagement has been measured by observing active engagement activities (i.e., on-task behavior) and passive engagement activities such as listening to a teacher during instruction (Cappella et al., 2013), both of which are examined in this study. However, whereas most studies have examined young children's individual level of behavioral engagement (Baroody & Diamond, 2016; Ponitz et al., 2009), we evaluated the collective engagement of the small group because teacher behavior management strategies are associated with engagement at the group level (Korpershoek et al., 2016). The few studies examining preschoolers' collective engagement at the whole-group level have shown a relation between teacher's whole-group behavioral strategies and the engagement levels of the entire class (Ling & Barnett, 2013).

Behavioral Engagement is Related to Literacy Learning

Child behavioral engagement has implications for children's literacy learning throughout the school years. Younger children's behavioral engagement is associated with later academic outcomes (Fredricks et al., 2004; Ladd & Dinella, 2009; Luo et al., 2009). For example, Ladd and Dinella (2009) found that child behavioral engagement in first grade predicted reading achievement seven years later. Kindergarten children who were more behaviorally engaged, as

measured by attending to tasks and following instructions, performed better on letter-word identification and phonological awareness skills than children who were less engaged in the classroom (Ponitz et al., 2009). As early as preschool, studies have demonstrated that child engagement is related to emergent literacy skills (Baroody & Diamond, 2016; Qi & Kaiser, 2004). Preschool children who were more engaged during whole-group instruction had better print knowledge, phonological awareness, and expressive vocabulary skills than preschoolers who were less engaged (Baroody & Diamond, 2016). Additionally, preschool children with language difficulties displayed more disruptive behaviors and were less engaged than their peers without language difficulties (Qi & Kaiser, 2004). Collective small-group behavioral engagement also is associated with child literacy gains. Although not examined in preschool, kindergarten children's collective small-group behavioral engagement was related to their early literacy skills (Harn et al., 2017). Specifically, when more children were engaged during small-group literacy instruction, children tended to have higher phonological awareness and decoding skills than when fewer children were engaged.

Effective Teacher Behavior Management Strategies are Related to Engagement

Small-group instruction may facilitate improved behavioral engagement; however, teachers also need to effectively manage child behaviors to promote engagement in early childhood settings (Hiralall & Martens, 1998; Webster-Stratton et al., 2008). Effective teacher behavior management is defined in various ways. Here, we define it consistent with more recent meta-analyses (Korpershoek et al., 2016; Wang et al., 2020), as a teacher's ability to use both proactive and corrective techniques, such as setting clear behavioral expectations, offering positive praise, developing supportive relationships, and addressing problem behaviors that promote child engagement (Korpershoek et al., 2016; Simonsen et al., 2008; Wang et al., 2020).

Behavior management techniques, such as setting clear expectations and offering positive reinforcement, are related to higher levels of child engagement (Allday et al., 2012; Hiralall & Martens, 1998; MacSuga-Gage & Simonsen, 2015; Simonsen et al., 2008). For example, Allday and colleagues (2012) showed that more positive praise from teachers was associated with improved on-task child engagement. Powell and colleagues (2008) found that children were more engaged in small-group settings when teachers praised and monitored child behaviors and less engaged when teachers provided directions and instructions.

Teacher Behavior Management May Promote Early Literacy Learning

Teachers who effectively manage child behaviors also may promote learning outcomes via small-group literacy instruction. A meta-analysis by Nelson and colleagues (2003) revealed that child behavior problems had one of the strongest associations with early literacy intervention responsiveness as children with behavior problems did not benefit from the intervention. Importantly, however, when interventions target and improve teacher behavior management, children's academic outcomes also improve (Korpershoek et al., 2016) as teacher's use of effective behavior management strategies are suspected to strengthen child engagement and learning opportunities (Fritz et al., 2019). During whole-group instruction, teachers' effective management of child behavior was positively associated with preschool children's early print knowledge; this included setting clear expectations, using positive behavioral strategies, and preventing or effectively addressing problem behaviors (Dobbs-Oates et al., 2011). Thus, even as early as preschool, teachers' ability to manage child behavior contributes to child early literacy learning. Although it was not conducted in preschool, one study examined the relation between teacher behavior management skills and children's literacy skills in grades K-3 during a small-group literacy intervention (Gage et al., 2015). Following small-group instruction, higher child

literacy outcomes were associated with strong teacher behavior management skills for elementary children at-risk for literacy difficulties. This study indicates that effective teacher behavior management skills may support the effectiveness of small-group literacy interventions for elementary children (Gage et al., 2015).

A Combination of Behavioral Engagement and Teacher Behavior Management May Contribute to Literacy Learning

Independently, behavioral engagement and teacher behavior management are related to preschooler's literacy learning (Baroody & Diamond, 2016; Dobbs-Oates et al., 2011); however, both may need to work synergistically to support literacy gains. Teachers who effectively manage children's behaviors in a group setting may strengthen that group's engagement with the task (Emmer & Stough, 2001; Korpershoek et al., 2016), increasing the likelihood of improved learning outcomes (Fredricks et al., 2004; Hughes & Kwok, 2007). To that end, Dobbs-Oates and colleagues (2011) found an interaction between teacher behavior management and children's orientation to the task, in which higher teacher behavior management and better child task orientation, predicted gains in preschoolers' receptive vocabulary skills. Additionally, Mashburn and colleagues (2009) demonstrated a stronger positive relation between peers' expressive language abilities and a child's receptive and expressive language skills when effective teacher behavior management strategies were used in preschool. However, to date, we have found no study that has examined how teacher behavior management and collective small-group behavioral engagement work together during small-group instruction to support preschoolers' literacy gains. We expect the strength of the relation between collective small-group behavioral engagement and child literacy skills will be moderated by teacher behavior management.

Purpose

The purpose of this study was to examine how collective small-group behavioral engagement and teacher behavior management relate to emergent literacy gains during small-group literacy instruction for preschoolers at-risk for literacy difficulties. This study addressed two research questions. First, do collective small-group behavioral engagement and teacher behavior management during small-group instruction independently predict child print knowledge, phonological awareness, letter writing, and expressive vocabulary gains? We hypothesized that there would be positive and significant relations between predictor variables and emergent literacy gains, given previous research demonstrating these relations in a whole-group class environment (Dobbs-Oates et al., 2011; Ponitz et al., 2009). Second, we examined whether teacher behavior management during small-group instruction moderated the relation between collective small-group behavioral engagement and child print knowledge, phonological awareness, letter writing, and expressive vocabulary gains. Here, we hypothesized that a combination of better collective small-group behavioral engagement and better teacher behavior management would be associated with greater literacy gains (Dobbs-Oates et al., 2011; Emmer & Stough, 2001). Thus, when teacher behavior management and collective small-group behavioral engagement are combined and interact positively, we expect to see a stronger positive association with child literacy gains.

Method

The current study was part of a larger project examining the efficacy of Nemours BrightStart!: The Complete Program for Early Literacy Success, Level One (Nemours BrightStart!, 2010). Whereas classrooms were randomized to one of three conditions: teacher-implemented intervention, community aide implemented intervention, or no-treatment control

(see Piasta et al., 2022), for the current study, we included only the teacher-implemented

intervention condition, specifically to examine the behavior management skills of classroom

teachers. Additional inclusionary criteria were applied for this study, as described below.

Participants

For the larger project, eligible preschool classrooms were those that served children 3–5

years old in which a lead or co-lead teacher voluntarily provided informed consent and

committed to all study activities, and at least one child in the classroom was identified as being

eligible to receive the Nemours BrightStart! (NBS!) intervention. For the current study, we

applied two additional inclusionary criteria. First, we only included classrooms in which the

same teacher implemented NBS! throughout the study; we removed two classrooms because the

NBS!-trained teacher left their role and was replaced with another teacher part way through

implementation. Second, we included only those classrooms for which we had data available to

code collective small-group behavioral engagement and teacher behavior management; as

explained below, these data were derived from video recordings of lessons that were submitted

to research staff. Although all teachers were asked to submit these videos, these data were

unavailable for eight classrooms, as the teachers did not implement any of the lessons. Thus, the

current analytic sample included 23 of the original 33 classrooms/teachers and 75 of the original

101 children. See Table 1 for descriptive characteristics of participating classrooms and teachers.

Children were eligible to receive intervention if they were enrolled in a participating

classroom, were between 3–5 years of age, had a parent or legal guardian who provided

informed consent, and were identified as at-risk for later literacy difficulties based on a 10-min,

25-item early literacy screener, the Get Ready to Read!-Revised (GRTR-R, Whitehurst &

Lonigan, 2010). Psychometric properties of the GRTR-R are well-established (Farrington &

Lonigan, 2015; Lonigan, Allan, & Lerner, 2011; Wilson & Lonigan, 2009), with high internal

consistency (α = .88), adequate sensitivity of .90, and specificity of .69 (as reported by Wilson &

Lonigan, 2010), and concurrent and predictive validity with oral language and reading

comprehension measures (Phillips et al., 2009). We excluded children with chronically poor

attendance and severe behavioral difficulties as reported by the teacher and limited English

proficiency and medical conditions or disabilities that had a substantial impact on learning as

reported by the parent. We used these exclusionary criteria to ensure that the intervention and

assessments utilized were appropriate for those participating. Of the children meeting eligibility

criteria, we randomly selected up to four per classroom to participate; these children comprised

the small group to which the teacher provided NBS! intervention and who completed project

assessments. Notably, child attendance, and therefore small-group composition, varied across

lessons. See Table 2 for descriptive information for participating children and their caregivers.

Procedures

As part of determining children's study eligibility, trained assessors completed the

GRTR-R with children at their respective preschool programs. Trained assessors also

administered emergent literacy assessments to enrolled children at the beginning and end of the

intervention year (pre-post intervention). The assessment battery included measures of print

knowledge, phonological awareness, letter writing, and expressive vocabulary (see the initial

study's Open Science Framework preregistration; doi:10.17605/OSF.IO/UWNRF). We chose

these assessments from the larger project's assessment battery to examine specific emergent

literacy skills that were taught during the intervention and that contribute to later reading

success. Children completed these assessments one-on-one in a quiet space at their preschool.

During the preschool year, classroom teachers implemented the NBS! intervention with a small group of children selected from their classrooms. The NBS! program is a supplemental small-group intervention providing systematic emergent literacy skill instruction for children identified as at-risk for literacy difficulties (see Bailet et al, 2009, 2013; Piasta et al., 2022; Zettler-Greeley et al., 2018, for more details). The program is comprised of 20 scripted multisensory lessons, with visual, auditory, kinesthetic, and tactile components that follow a scope and sequence designed to support print knowledge, phonological awareness, emergent writing, and oral language. All lessons follow a seven-part routine, with repeated exposure of foundational emergent literacy skills. Instruction aligns with a gradual release of responsibility model (Pearson & Gallagher, 1983), in which teachers introduce concepts by explicit modeling followed by supported and independent practice. Lessons were divided into two 20–30 min sessions, delivered on separate days. Prior to implementation, teachers received a 2-day professional development workshop that included: 1) an explanation of the program and its instructional design, 2) step-by-step training of each lesson element, 3) demonstrations and video exemplars of implementation, and 4) interactive practice opportunities, in addition to recommendations for lesson preparation and scheduling.

Teachers submitted videos of every implemented lesson to research staff for fidelity coding. In the larger project, research staff coded the first two lessons plus a randomly selected 50% of subsequent lessons using the Nemours Fidelity Implementation Record (NFIR; Nemours BrightStart!, 2016) and the Quality of Intervention Delivery and Receipt tool (QIDR; Harn et al., 2012). Coders did not have direct contact with teachers or participate in data collection. Coders adhered to a training protocol and met 90% exact coding agreement with a master-coder prior to coding. Double coding of 20% of randomly selected videos demonstrated high interrater

reliability (intraclass correlation coefficients [ICCs] of .96 for the NFIR and .82 for the QIDR).

In the current study, we used a subset of items from these coding schemes to measure collective

small-group behavioral engagement and teacher behavior management.

Measures

Behavioral Composites – Collective Small-Group Behavioral Engagement and Teacher

Behavior Management

To create the behavioral composites, we used seven items (described below) from the

NFIR and the QIDR that assessed collective small-group behavioral engagement and teacher

behavior management strategies. The NFIR measured lesson delivery adherence, defined as the

extent to which teachers delivered lesson components as outlined during the professional

development training. The QIDR measured the quality of implementation, in which

implementation processes such as lesson familiarity and clear and consistent instructions and

procedures were evaluated. We first conducted principal component analysis with the seven

items to determine the number of factors, which revealed two factors (eigen values of 3.95 and

1.72). We then conducted exploratory factor analysis using oblique rotation on the seven items

identified for collective small-group behavioral engagement and teacher behavior management

across the 23 small groups. The factor loadings of the three items selected to measure collective

small-group behavioral engagement ranged from .83–.90, and Cronbach's α was .88. The factor

loadings of the four items selected to measure teacher behavior management ranged from .34–

.88, and Cronbach's α was .76.

Collective Small-Group Behavioral Engagement. To create a composite for the

collective behavioral engagement of the small group that reflected the extent to which most

children were following directions, paying attention to tasks, and participating during the lesson

(Harn et al., 2017), we identified three items across the two fidelity measures that aligned with this definition. One item from the NFIR assessed group participation and interest during the lesson and was measured on a five-point scale, ranging from 1 (*most children are disinterested*) to 5 (*all children are engaged*). Two items from the QIDR assessed active engagement and listening and whether the group attended to teacher directions. Both items were measured on a four-point scale, ranging from 1 (*the behavior is demonstrated < 50% of the time during the lesson; most children are not engaged/following directions*) to 4 (*the behavior is demonstrated > 95% of the time during the lesson; all children are engaged/following directions*). We used linear transformation to convert the five-point scale to a four-point scale so that all items were on the same numeric scale. Then we summed the items to create the collective small-group behavioral engagement composite, with higher scores indicating higher levels of collective small-group behavioral engagement (i.e., more children were engaged). As there was some variability in the collective small-group behavioral engagement composite scores across lessons ($SD = 1.62$) and as the number of lessons used to compute the composite varied per small group from 1 to 11 ($M = 5.30$, $SD = 3.40$), we computed the composite score for each lesson and then averaged across lessons (within small group) for use in analyses.

Teacher Behavior Management. To create a composite that reflected use of teacher behavior management strategies during small-group instruction, we identified four items on the QIDR. The selected items assessed the quality with which teachers a) set expectations and adhered to routines, b) reinforced positive behavior (e.g., praise), c) addressed problem behavior (e.g., use of redirection, corrective feedback), and d) connected with children by building rapport (Korpershoek et al., 2016; Simonsen et al., 2008; Wang et al., 2020). All four items were on a four-point scale, ranging from 1 (*the teacher demonstrated the behavior < 50% of the time*

during the lesson) to 4 (*the teacher demonstrated the behavior > 95% of the time during the lesson*). We summed the items to create the teacher behavior management factor, with higher scores indicating stronger teacher behavior management skills. As there was some variability in the teacher behavior management composite scores across lessons (*SD* = 1.84) and as the number of lessons used to compute the composite varied per small group from 1 to 11 (*M* = 5.30, *SD* = 3.40), we computed the composite score for each lesson and then averaged across lessons for each small group for use in analyses.

Child Literacy Skills

Print Knowledge. We assessed children's understanding of print using the Print Knowledge subtest of the Test of Preschool Early Literacy (TOPEL; Lonigan et al., 2007). This standardized measure includes 36 items that range from tasks requiring the child to produce a letter name or sound to multiple-choice questions with picture prompts (e.g., "What sound does this letter make?" and "Find the picture that has a word in it."). Items are scored as incorrect (0) or correct (1) and summed to provide a total score. Pretest internal consistency and test-retest reliability in the current sample, comprised exclusively of children identified as at-risk for literacy difficulties, was α = .93 and *r* = .58, respectively. In a normative sample, internal consistency and test-retest reliability was α = .93-.96 for children 3-5 years and *r* = .89, respectively.

Phonological Awareness. We assessed children's abilities to delete and blend sound units using the Phonological Awareness subtest of the TOPEL (Lonigan et al., 2007). This standardized measure includes 27 items that range from elision and blending tasks requiring the child to produce a response on their own to multiple-choice questions with picture prompts (e.g., "What word do these sounds make?" and "Point to the word you hear."). Items are scored

incorrect (0) or correct (1) and summed to provide a total score. Pretest internal consistency and test-retest reliability in the current sample, comprised exclusively of children identified as at-risk for literacy difficulties, was $\alpha = .68$ and $r = .50$, respectively. In a normative sample, internal consistency and test-retest reliability was $\alpha = .86-.88$ for children 3-5 years and $r = .83$, respectively.

Letter Writing. We assessed children's letter writing abilities using a task created by Gerde and colleagues (2015). Children are given pieces of paper and a marker and directed to write ten commonly known letters (i.e., T, B, H, M, S, A, D, J, C, and P). Research staff recorded children's responses, and data were scored by staff trained to reliability standards. Double coding to assess interrater reliability was high ($k = .92$). We scored children's letter writing by applying the previous coding system with some slight adaptations (i.e., Diamond et al., 2008, Gerde et al., 2015; merging scribbling and drawing into one category as there was little variance between these two codes). Children's letter writing was scored as 0 = *refusal/no response*, 1 = *scribbling/drawing*, 2 = *letter-like shape*, 3 = *a letter other than the letter dictated to the child*, or 4 = *correct letter*. We calculated a composite letter writing score that was averaged across all ten letters. Pretest internal consistency and test-retest reliability in the current sample was $\alpha = .90$ and $r = .62$, respectively.

Expressive Vocabulary. We assessed children's expressive vocabulary using the Picture Naming subtest of the Individual Growth and Development Indicators of Early Literacy, 2nd edition (IGDIs; McConnell et al., 2012). This standardized measure includes 15 pictures that children are asked to name. Items are scored as incorrect (0) or correct (1) and summed to provide a total score. Pretest internal consistency and test-retest reliability in the current sample, comprised exclusively of children identified as at-risk for literacy difficulties, was $\alpha = .53$ and r

= .81, respectively. Using item response theory, the developers reported that internal consistency

was .74 (Wackerle-Hollman et al., 2017); test-retest reliability was r = .93-.97.

Data Analysis

We included all children assigned to a teacher's small group in the analyses, regardless of

the number of lessons received (four children received zero lessons) to provide a conservative

estimate of the contribution of the small-group behavioral environment to child literacy gains.

Each teacher was assigned one small group. We conducted correlation analyses to determine

child, caregiver, or teacher demographic variables that were associated with each outcome

measure and included them as covariates in the main analyses. Demographic variables that

significantly correlated with outcomes included child age, child and teacher race, and teacher

education level. As child age was significantly correlated with all outcome measures, we

included it as a covariate in each model. We dummy coded child race/ethnicity for each

racial/ethnic group. Two of the six racial/ethnic dummy coded groups (child race–Black and

child race–White) were significantly correlated with outcome variables, such that we included

child race–Black as a covariate for phonological awareness, and child race–White as a covariate

for phonological awareness, letter writing, and expressive vocabulary. For child race, we coded

child race–Black as 1 = Black and 0 = all other racial/ethnic categories, and child race–White as

1 = White and 0 = all other racial/ethnic categories. We added teacher race as a covariate for

print knowledge and expressive vocabulary, and coded teacher race as Black (1) or White (0);

these were the only racial/ethnic categories reported by teachers. We included teacher education

level as a covariate for print knowledge and coded it from 1–6 (1 = high school diploma/GED, 2

= some college, 3 = associates degree, 4 = bachelor's degree, 5 = postgraduate coursework, 6 =

master's degree). In addition, we entered the pretest score for each outcome as a covariate to

model residualized gains in literacy skills. We grand-mean centered covariates and predictors

unless they were dummy coded.

Missing data ranged between 0.0%–10.7%. Little's missing completely at random test

and logistic regression analyses revealed missingness was not related to the variables in the

analyses. We utilized multiple imputation with an iteration of 20 and a singularity threshold of

10^{-8} (Wang & Johnson, 2019). Five imputed datasets were generated, and we created a final data

set using the bar procedure to aggregate the mean of the continuous variables and the mode of

the categorical variables (Baranzini, 2018; van der Kamp et al., 2020). We used the final

aggregated, multiply-imputed data set for hierarchical linear modeling (HLM) analyses.

Although the percentage of missing data was low, we used multiple imputation because it is a

recommended approach for handling missing data in behavioral research (Enders, 2017; Woods

et al., 2021).

We conducted two-level HLM analyses for each of the four outcome variables (print

knowledge, phonological awareness, letter writing, and expressive vocabulary) to account for

nesting of children (Level 1) within small groups (Level 2). In preliminary analyses, we

estimated separate unconditional models for each outcome variable to determine the ICCs. The

model for expressive vocabulary revealed a significant unconditional ICC of .207. The other

models revealed small, non-significant ICCs for print knowledge (.080), phonological awareness

(.001), and letter writing (.060); non-significance could be due to small sample size, and there is

a risk of producing Type 1 errors when conducting linear regressions even with ICCs as small as

.01 (Huang, 2018). Moreover, ICCs as small as .05 to .80 are not typically ignored because

significant group-level effects may be demonstrated even with trivial differences between groups

(Clarke, 2008). As such, we conducted HLM analysis for all outcomes.

We used HLM (Version 7; Raudenbush et al., 2011) to conduct the two-level HLM analysis separately for print knowledge, phonological awareness, letter writing, and expressive vocabulary and examined the relations among collective small-group behavioral engagement, teacher behavior management, and emergent literacy gains. To address the first research question, we entered covariate (pretest score, child age, child race, teacher race, and/or teacher education level) and predictor (collective small-group behavioral engagement and teacher behavior management) variables to test the relation of collective small-group behavioral engagement and teacher behavior management to children's literacy gains. Analyzing these predictor variables first allowed us to examine the unique contribution of collective small-group behavioral engagement and teacher behavior management to child literacy gains. The intercept (γ_{00}) was the mean emergent literacy outcome score. The models included Level 1 child covariates [e.g., pretest score (γ_{30}), age (γ_{10}), and race–White (γ_{20})], and/or Level 2 small-group covariate [e.g., teacher race (γ_{01}),] and Level 2 small-group predictor variables, behavioral engagement (γ_{02}) and teacher behavior management (γ_{03}) to examine the predictive relation to child literacy outcome scores (β_{0j}), with r_{ij} representing Level 1 child random error and u_{0j} representing Level 2 small-group random error. We tested the extent to which the slopes of the Level 1 covariates should be random. Only child race–White (u_{2j}) showed a significant variation in the slopes for letter writing and expressive vocabulary, and the random slope estimation was maintained for the remaining analyses for both models. Whereas a mediator is intended to explain how two variables are related, a moderation approach is used to examine whether a moderator strengthens the relation between two variables (Fairchild & McQuillin, 2010). As such, to address the second research question and examine whether teacher behavior management moderated or strengthened the relation between collective small-group behavioral

engagement and child literacy gains, we added the interaction between collective small-group

behavioral engagement and teacher behavior management to the models. We included the

interaction term (γ_{04}) to examine whether it predicted emergent literacy gains.

Results

Child pretest and outcome literacy score descriptive statistics are reported in Table 3. We

correlated demographic variables with predictor variables, pretest literacy scores, and outcome

literacy scores; significant correlation coefficient (*r*) absolute values ranged from .23–.54

between demographic variables and outcome scores (see Table 5). Collective small-group

behavioral engagement and teacher behavior management were relatively high and stable across

the lessons (see Table 4). The average collective small-group behavioral engagement and teacher

behavior management sum score means and standard deviations (*SD*s) were, 10.57 (1.17) and

12.06 (1.45), respectively. These average summed score means are equivalent to scoring 3s for

items measuring collective small-group behavioral engagement (*the behavior is demonstrated >*

80% of the time during the lesson; most children are engaged/following directions) and items

measuring teacher behavior management (*the teacher demonstrated the behavior > 80% of the*

time during the lesson). As such, most children were engaged for more than 80% of the lessons

and teacher behavior management was effectively implemented for more than 80% of the

lessons. Additionally, the predictors, collective small-group behavioral engagement and teacher

behavior management, were positively and moderately correlated, *r* = .49 (see Table 5 and

Figure 1). All assumptions for HLM analyses, including linearity, normality, and

homoscedasticity, were met.

Collective Small-Group Behavioral Engagement and Teacher Behavior Management as

Independent Predictors of Emergent Literacy Gains

Collective small-group behavioral engagement and teacher behavior management were not significant predictors of preschool children's print knowledge, phonological awareness, or letter writing gains (ps >.05). The full model for print knowledge explained 43% of the variance. After controlling for Level 1 and Level 2 covariates, the final HLM results (see Table 6) revealed that collective small-group behavioral engagement and teacher behavior management were not statistically significant predictors of children's print knowledge (estimate = 0.92, p = .267 and estimate = -0.31, p = .637, respectively); effects were small for both predictors, (ds = 0.10 and -0.04, respectively). For phonological awareness, the full model explained 40% of the variance. After controlling for Level 1 covariates, the final HLM results (see Table 7) revealed that collective small-group behavioral engagement and teacher behavior management were not statistically significant predictors of children's phonological awareness (estimate = -0.39, p = .371 and estimate = 0.07, p = .821, respectively); effects were small for both predictors (ds = -0.09 and 0.02, respectively). The full model for letter writing explained 52% of the variance. After controlling for Level 1 covariates, the final HLM results (see Table 8) revealed that collective small-group behavioral engagement and teacher behavior management were not statistically significant predictors of children's letter writing (estimate = 0.16, p = .059 and estimate = -0.09, p = .165, respectively); effects were small (ds = 0.22 and -0.12, respectively).

There was a statistically significant, independent relation between collective small-group behavioral engagement and preschool children's expressive vocabulary gains. The full model for expressive vocabulary explained 79% of the variance. After controlling for Level 1 and Level 2 covariates, the final HLM results (see Table 9) revealed that collective small-group behavioral engagement was a statistically significant and positive predictor of children's expressive

vocabulary gains (estimate = 0.35, p = .033); however, teacher behavior management was not (estimate = -0.13, p = .305). Effects were small (ds = 0.13 and -0.05, respectively).

Interactions Between Collective Small-Group Behavioral Engagement and Teacher Behavior Management in Predicting Emergent Literacy Gains

There were no significant moderating relations among collective small-group behavioral engagement, teacher behavior management, and preschool children's literacy gains. The interaction term was not a statistically significant predictor of children's print knowledge (estimate = 0.53, p = .362), phonological awareness (estimate = 0.11, p = .695), letter writing (estimate = 0.07, p = .204), or expressive vocabulary gains (estimate = -0.11, p = .320).

Discussion

In the current study, we examined whether: 1) collective small-group behavioral engagement and teacher behavior management during small-group intervention were related to the print knowledge, phonological awareness, letter writing, and expressive vocabulary gains of children at-risk for later literacy difficulties, and 2) whether teacher's behavior management skills during small-group intervention moderated the relation between collective small-group behavioral engagement and literacy gains. The findings demonstrate that collective small-group behavioral engagement during small-group instruction may facilitate preschoolers' gains in meaning-focused skills. Children's collective small-group behavioral engagement during the lessons was predictive of expressive vocabulary gains. However, teacher behavior management, as measured in this study, did not contribute independently or synergistically with collective small-group behavioral engagement to children's skill gains in print knowledge, phonological awareness, letter writing, or expressive vocabulary.

There are two important findings to be gleaned from this study, which we discuss in detail below. First, collective small-group behavioral engagement has the potential to maximize preschoolers' meaning-focused skill growth, such as expressive vocabulary, via small-group instruction. This contributes to the literature in identifying ways to 1) maximize child learning during small-group instruction, which is recommended for use in early childhood settings and often associated with effective literacy instruction (NELP, 2008; Wasik, 2008), and 2) bolster expressive vocabulary skills which are skills that tend to show limited growth over time, particularly for children at-risk for literacy difficulties (Roseth et al., 2012). Whereas most engagement research examines individual child engagement, this work contributes to the literature by demonstrating that collective small-group behavioral engagement during small-group instruction also contributes to child literacy gains. Second, although teacher behavior management during small-group instruction was not predictive of child gains, its contribution to engagement and children's literacy skill development is worth further investigation.

Collective Small-Group Behavioral Engagement During Small-Group Intervention as a Predictor of Child Literacy Gains

Collective small-group behavioral engagement was predictive of expressive vocabulary gains, a meaning-focused skill, but it was not predictive of gains in code-focused skills (i.e., print knowledge, phonological awareness, or letter writing). Consistent with previous research, collective small-group behavioral engagement was relatively high and stable across lessons (Harn et al., 2017). In the current study, most small groups were engaged for more than 80% of the lesson. The lack of variability in collective small-group behavioral engagement may, in part, explain the reason engagement did not significantly contribute to children's code-focused skill development. We would not expect to see a strong relation between the collective behavioral

engagement of small groups and gains in children's skills if most groups were already highly engaged. However, as elaborated below, the reason that collective small-group behavioral engagement predicted gains in a meaning-focused skill such as expressive vocabulary may be related to active forms of engagement that are enhanced within small-group learning environments (Rimm-Kaufman et al., 2005).

As defined in this study, collective small-group behavioral engagement included both active engagement (i.e., participating in tasks) and passive engagement (e.g., attending and listening to the teacher; Cappella et al., 2013). The NBS! intervention, as the small-group intervention examined in the current study, includes explicit instruction, teacher-child interaction, and child practice. Although NBS! lessons offered opportunities for hands-on practice, the allocation of time to instruction versus practice differed across lesson activities. For example, lesson activities that address phonological awareness skills tend to have more time allotted to direct instruction than lesson activities dedicated to expressive vocabulary development, in which more time might be available for children to practice producing words. Powell and colleagues (2008) found that children were more likely to be actively engaged when teachers were monitoring behavior and more passively engaged when teachers were providing directions. Perhaps teachers in the current study provided more directions during code-focused activities, yielding a more passive form of collective small-group behavioral engagement, compared to meaning-focused activities, in which teachers spent more time monitoring tasks as children engaged in practice activities, yielding more active collective behavioral engagement of the small group. Importantly, active child engagement is particularly important for development of expressive vocabulary skills (Gonzalez et al., 2011, 2014). Although expressive vocabulary gains tend to be more stable, we suspect gains in vocabulary skills are, in part, associated with

the aspects of the small-group environment that support more active child participation and engagement, supporting development of meaning-focused skills (Gonzalez et al., 2011). Gonzalez et al. (2011) noted that children's active involvement in the lesson provided them with more opportunities to practice producing words. Likewise, in this study, the small-group environment may have contributed to increased engagement and practice opportunities for word production, supporting child vocabulary growth. Moreover, a recent intervention study demonstrated that small-group interventions led to improved preschooler's gains in meaning-focused skills including expressive vocabulary (Phillips et al., 2021), demonstrating that these more stable skills can be improved through targeted small-group instruction.

Peer-to-peer interactions during small-group instruction also may contribute to child gains in expressive vocabulary. Young children's expressive language abilities are correlated reciprocally with those of their peers (Henry & Rickman, 2007; Mashburn et al., 2009). In the present study, highly behaviorally engaged groups of children may have capitalized on opportunities to build their expressive vocabulary skills relative to small groups that were less engaged, leading to additional vocabulary growth. The influence of peers during small-group instruction requires further study, as it could inform decisions on which children to group together to maximize their expressive vocabulary gains.

In the present study, we were interested in the teacher's management and engagement of the collective small group. Previous studies have used observational tools to measure individual child engagement during classroom activities (Baroody & Diamond, 2016; Ponitz et al., 2009). Baroody and Diamond (2016) found a significant relation between better individual child engagement during whole-group activities and preschoolers' expressive vocabulary, but that relation was not statistically significant during child play activities. Like small-group instruction,

play activities involve more peer interactions (Rimm-Kaufman et al., 2005; Test & Cornelius-White, 2013), and these peer interactions are associated with sustained task engagement (Test & Cornelius-White, 2013). As such, each child's level of engagement contributes to the overall engagement of the group. The relation between engagement and child skill may be missed if the collective group engagement is not examined. Indeed, in the current study we found that the collective behavioral engagement of the small group predicted child expressive vocabulary gains. This may suggest that both individual behavioral engagement and collective group behavioral engagement should be examined, as each may contribute to child literacy gains.

Teacher Behavior Management During Small-Group Intervention Did Not Predict Literacy Gains

Contrary to our expectation and to previous research with elementary-aged children (Gage et al., 2015), teacher's behavior management, as measured in this study, did not contribute to gains in children's emergent literacy skills. However, on average, teacher behavior management was effectively implemented, as teachers in the study utilized proactive and corrective behavior management strategies for most (greater than 80%) of the lessons. Such techniques are related to higher levels of child engagement (Korpershoek et al., 2016; Simonsen et al., 2008; Wang et al., 2020). Moreover, collective small-group behavioral engagement and teacher behavior management were positively and moderately correlated. Thus, teacher behavior management may have strengthened collective small-group behavioral engagement, but perhaps due to a lack of variability, this moderation was not apparent in the present study. Follow-up research is needed to examine whether specific teacher behavior management techniques contribute to collective group behavioral engagement during small-group instruction.

Alternatively, teacher behavior management may not be as strongly related to child gains in a small-group context as in a whole-group environment. Previous research demonstrates that child engagement tends to be higher during small-group instruction than whole-group instruction (Downer et al., 2007; Finn et al., 2003), thus the teacher's management of child behavior may not be as strongly associated with child literacy development during small-group instruction as it is during whole-group instruction. This is not to say that teacher behavior management is unimportant during small-group instruction, but perhaps the contribution of teacher behavior management is not as strongly associated with child literacy gains when the collective behavioral engagement of the group is already high and relatively stable across the intervention, consistent with the current study findings and previous research (Harn et al., 2017).

Teacher and Child Characteristics Contribute to Literacy Gains

Although not the focus of the current study, it is notable that our results were consistent with previous literature reporting relations between teacher and child demographic variables and preschoolers' literacy gains. Higher teacher educational attainment predicted higher print knowledge outcome scores, consistent with previous research (Brown et al., 2008). Additionally, the results of this study indicate that an opportunity gap in education continues to persist between White and non-White children (Matthew et al., 2016; Stevenson et al., 1990), as White children scored higher than non-White children on measures of phonological awareness. These findings highlight the continued need to address discrepancies around education and race that persist in early childhood education.

Limitations and Future Research

As this work is a first step in examining the contributions of collective small-group behavioral engagement and teacher behavior management during small-group instruction in

preschool, further research is warranted. Several limitations are noted that warrant attention in future work. First, this study contributes to the literature by examining the relation of collective small-group behavioral engagement on preschool literacy gains; however, individual child behavioral engagement is another important contributor, and both types of behavioral engagement should be examined together. Second, it is possible that relations among collective small-group behavioral engagement, teacher behavior management, and gains in print knowledge and phonological awareness were not detected due to limited statistical power. Similarly, the study also was likely underpowered to detect an interaction effect for child literacy gains. An a priori power analysis was run for the larger intervention project, from which these subsequent analyses derive; however, further analysis with a sample size powered to detect the contribution of collective small-group behavioral engagement and teacher behavior management on child literacy gains is recommended, given that collective small-group behavioral engagement did contribute to preschool children's gains in expressive vocabulary skills. Moreover, although not statistically significant, the effect size of collective small-group behavioral engagement on letter writing gains ($d = 0.22$) is educationally meaningful (Kraft, 2020), further suggesting that the study was likely underpowered to detect statistically significant findings. Third, although the collective small-group behavioral engagement and the teacher behavior management composites had strong reliability and were aligned with previous literature, these composites may not have captured other important aspects of behavioral engagement and teacher behavior management. For example, items measuring effort and persistence were not measured independently from participation when evaluating behavioral engagement (Fredricks et al., 2004; Parsons et al., 2015), and items that measured teacher behavior management did not assess the degree to which teachers anticipated problem behaviors or their level of behavior monitoring (Simonsen et al.,

2008). Thus, future research should examine broader components of collective small-group

behavioral engagement and teacher behavior management. Associated with these measurement

concerns, we note that the internal consistency reliability for expressive vocabulary was low in

our sample, although it was acceptable in the developer's technical report (Wackerle-Hollman et

al., 2017). Although we utilized a standardized measure to assess children's expressive

vocabulary, the low internal consistency in the current sample is likely a result of all children in

the sample being identified as at-risk for later literacy difficulties based on age-based scores on

the GRTR-R. As such, the children in this study scored much lower than would be expected,

which resulted in limited variance. Fourth, collective small-group behavioral engagement and

teacher behavior management may not have contributed to print knowledge and phonological

awareness gains because some children included in the analyses received few or no lessons. The

contribution of dosage (number of lessons received) and its relations with collective small-group

behavioral engagement, teacher behavior management, and child learning requires further study

with a larger sample size. Notably, despite variability in dosage, collective small-group

behavioral engagement did positively contribute to child gains in expressive vocabulary. Fifth, as

only one small-group literacy intervention was examined, replication with other small-group

intervention studies is needed to inform the generalizability of these findings. Finally, the

children in this study were identified as at-risk for literacy difficulties, placing them at

concomitant risk for behavioral difficulties (Bulotsky-Shearer & Fantuzzo, 2011; Fantuzzo et al.,

2003; McClelland et al., 2007). Replication with additional populations would be helpful to

determine whether the relation between collective small-group behavioral engagement and

literacy gains is reproduced and generalizes to a wider spectrum of young children.

Conclusion

Results of this study suggest that the collective behavioral engagement of the small group independently contributes to individual child gains in expressive vocabulary. Further investigation is necessary, as varying elements of the small-group environment, teacher behavior management techniques, and teacher and child characteristics likely contribute to the dynamic and complex relation among collective small-group behavioral engagement, teacher behavior management, and learning. Overall, this work indicates that when children in small groups are engaged, they are best positioned to gain fundamental literacy skills. To that end, curriculum and intervention developers must create highly engaging content, and teachers must help groups of children maintain engagement during lessons.

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Table 1

Sample Characteristics of Teachers, Classrooms, and Small-Groups

	n	%	Range	*M*	*SD*
Female	23	100.0			
Race					
Black	10	43.5			
White	13	56.5			
Education					
High school diploma/GED	1	4.3			
Some college	2	8.7			
Associates degree	7	30.4			
Bachelor's degree	10	43.5			
Post graduate coursework	1	4.4			
Master's degree	2	8.7			
Teaching license	4	17.4			
Only one lead teacher in the classroom	17	73.9			
School setting					
Rural	1	4.3			
Suburban	2	8.7			
Urban	20	87.0			
School type					
Center-based	19	82.6			
Public-school based	3	13.0			
Neither	1	4.4			
Affiliated with Head Start	10	43.5			
Years of preschool teaching experience	23		0–28	9.83	7.91
Whole-class size	23		6–20	14.00	4.02
Small-group size	23		1–4	3.26	1.10
Collective small-group behavioral engagement	23		8–12	10.57	1.17
Teacher behavior management	23		10–15	12.06	1.45
Number of lessons provided	23		1–20	9.96	6.37

Table 2

Sample Characteristics of Children and their Caregivers

	n	%	Range	*M*	*SD*
Gender					
Female	38	50.7			
Male	36	48.0			
Race					
Black	45	60.0			
White	13	17.3			
Asian	1	1.3			
Multiracial	8	10.7			
Other	2	2.7			
Latinx	16	21.3			
Dual language learners	6	8.0			
Maternal education					
No high school diploma/GED	6	8.0			
High school diploma/GED	14	18.7			
Some college/technical certificate	40	53.3			
Associates degree	6	8.0			
Bachelor/post graduate degree	8	10.7			
Paternal education					
No high school diploma/GED	18	24.0			
High school diploma/GED	16	21.3			
Some college/technical certificate	21	28.0			
Associates degree	2	2.7			
Bachelor/post graduate degree	4	5.3			
Family income					
$5000 or less	16	21.3			
$5001-$25,000	27	36.0			
$25,001-$55,000	27	36.0			
$55,001 or more	5	6.7			
Special education services (IEP)	1	1.3			
Age in years	75		3.16–5.02	4.15	0.43
Number of lessons received	75		0–20	7.37	6.09

Table 3

Descriptive Statistics of Child Pretest and Outcome Literacy Scores

	Child pretest scores				Child outcome scores			
	n	Range	*M*	*SD*	*n*	Range	*M*	*SD*
Print knowledge	73	0–28	5.95	4.75	67	1–34	13.61	9.14
Phonological awareness	75	0–22	9.35	4.41	69	4–22	11.74	4.56
Letter writing	75	0.80–3.20	1.39	0.59	69	1.00–3.70	2.10	0.78
Expressive vocabulary	74	1–10	3.89	2.24	69	1–12	6.23	2.72

Table 4

Descriptive Statistics of Collective Small-Group Behavioral Engagement and Teacher Behavior Management Across Lessons

Lesson Number	Number of Small Groups	SBE *M*	SBE *SD*	TBM *M*	TBM *SD*
1	23	10.49	1.49	12.00	1.91
2	22	10.97	1.38	12.77	2.07
6	17	9.76	1.93	11.82	1.88
8	13	10.96	1.41	12.31	1.70
9	11	10.52	1.66	11.45	2.07
12	7	10.75	1.47	10.71	1.11
13	6	10.08	1.63	11.50	1.05
14	7	9.86	2.19	11.29	1.80
16	6	10.96	2.10	12.33	1.21
17	5	11.20	0.84	12.00	1.58
20	4	10.38	1.97	11.75	2.63

SBE = Collective Small-Group Behavioral Engagement; TBM = Teacher Behavior Management.

Table 5

Correlations Between Predictors, Significant Demographic Covariates, and Child Literacy Scores

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Small-group behavioral engagement	–														
2. Teacher behavior management	.49**	–													
3. Child age in years	.24	.01	–												
4. Child race–Black	-.16	-.06	-.02	–											
5. Child race–White	.09	.07	.11	-.60**	–										
6. Teacher race–Black/White	.15	.19	-.01	-.02	-.01	–									
7. Teacher education level	-.05	.17	.01	.02	.05	-.17	–								
8. Pretest print knowledge	.11	-.01	.22	-.10	.12	-.11	.23*	–							
9. Pretest phonological awareness	.25*	.05	.32**	-.19	.21	-.15	.08	.23*	–						
10. Pretest letter writing	-.07	-.02	.52**	.12	.05	-.17	.34**	.24*	.19	–					
11. Pretest expressive vocabulary	.25*	.15	.31**	-.20	.28*	-.32**	.15	.28*	.53**	.33**	–				
12. Outcome print knowledge	.16	.01	.33**	.06	.13	-.24*	.33**	.55**	.27*	.43**	.41**	–			
13. Outcome phonological awareness	.10	.02	.41**	-.27*	.39**	-.08	.07	.45**	.48**	.39**	.49**	.49**	–		
14. Outcome letter writing	.19	-.05	.54**	-.04	.23*	-.16	.22	.33**	.27*	.62**	.36**	.74**	.52**	–	
15. Outcome expressive vocabulary	.31**	.08	.33**	-.18	.29*	-.29*	.22	.32**	.51**	.32**	.81**	.47**	.52**	.45**	–

Small-group behavioral engagement = collective small-group behavioral engagement.
*p < .05. **p < .01.

Table 6

Prediction of Print Knowledge – Hierarchical Linear Modeling

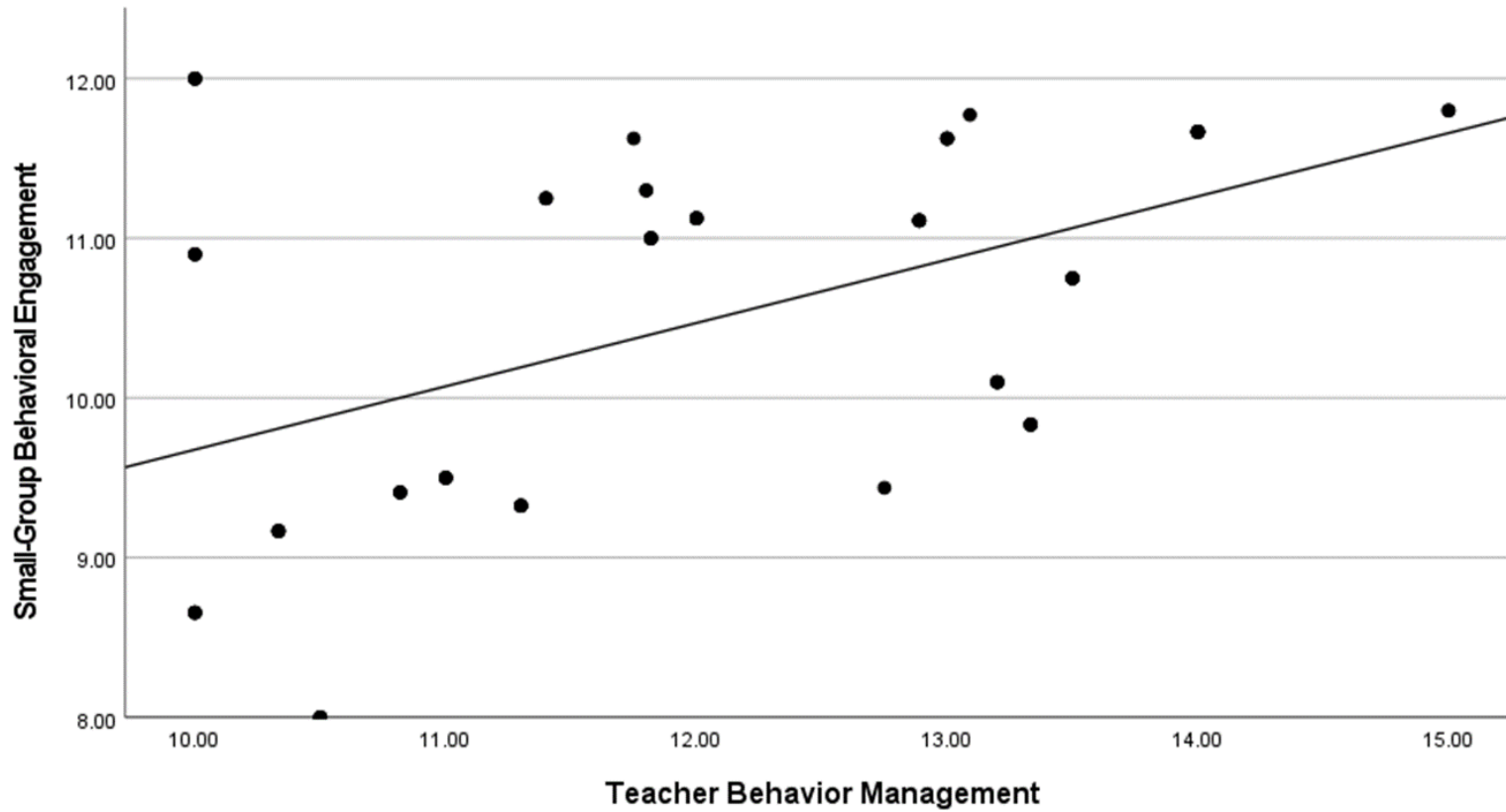| Fixed effects	Model 0 (Unconditional)		Model 1 (Covariates)		Model 2 (Independent relation)		Model 3 (Interaction)	
	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*
Intercept	13.75***	1.10	15.16***	1.09	15.30***	1.11	15.14***	1.12
Pretest print knowledge			0.81***	0.17	0.79***	0.17	0.77***	0.17
Child age in years			4.74	1.84	4.20*	1.89	4.52*	1.91
Teacher race–Black/White			-2.74	1.55	-2.87	1.58	-2.52	1.61
Teacher education level			1.52	0.68	1.64*	0.71	1.80*	0.72
Collective small-group behavioral engagement					0.92	0.80	-4.99	6.36
Teacher behavior management					-0.31	0.64	-6.19	6.31
Interaction term– Engagement X Management							0.53	0.57
Random effects	Variance	*SD*	Variance	*SD*	Variance	*SD*	Variance	*SD*
Small group	6.00	2.45	0.08	0.29	0.11	0.33	0.07	0.27
Child	69.16	8.32	43.29	6.58	42.52	6.52	42.06	6.49
Model fit								
Deviance	534.40		493.74		492.42		491.55	
Number of parameters	3		7		9		10	
Intraclass correlation coefficient	0.080		0.002		0.002		0.002	

*p <.05. **p <.01. ***p <.001.

Table 7

Prediction of Phonological Awareness – Hierarchical Linear Modeling

	Model 0 (Unconditional)		Model 1 (Covariates)		Model 2 (Independent relation)		Model 3 (Interaction)	
Fixed effects	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*
Intercept	11.72***	0.51	11.26***	1.00	11.35***	1.00	11.36***	1.00
Pretest phonological awareness			0.34**	0.10	0.35***	0.10	0.34**	0.10
Child age in years			2.86**	1.00	3.06**	1.02	3.15**	1.04
Child race–Black			-0.37	1.06	-0.52	1.07	-0.53	1.07
Child race–White			2.66*	1.14	2.58*	1.13	2.54*	1.14
Collective small-group behavioral engagement					-0.39	0.42	-1.68	3.27
Teacher behavior management					0.07	0.32	-1.20	3.21
Interaction term– Engagement X Management							0.12	0.29
Random effects	Variance	*SD*	Variance	*SD*	Variance	*SD*	Variance	*SD*
Small group	0.01	0.11	0.01	0.12	0.01	0.11	0.01	0.10
Child	19.46	4.41	11.88	3.45	11.74	3.43	11.72	3.42
Model fit								
Deviance	433.67		396.71		395.81		395.65	
Number of parameters	3		7		9		10	
Intraclass correlation coefficient	0.001		0.001		0.001		0.001	

p <.05. **p* <.01. ***p* <.001.

Table 8

Prediction of Letter Writing – Hierarchical Linear Modeling

Fixed effects	Model 0 (Unconditional)		Model 1 (Covariates)		Model 2 (Independent relation)		Model 3 (Interaction)	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	2.09***	0.09	2.02***	0.10	2.02***	0.09	2.03***	0.09
Pretest letter writing			0.71***	0.12	0.74***	0.12	0.73***	0.12
Child age in years			0.50**	0.17	0.41*	0.17	0.42*	0.17
Child race–White			0.25	0.16	0.25	0.16	0.23	0.16
Collective small-group behavioral engagement					0.16	0.08	-0.65	0.61
Teacher behavior management					-0.09	0.06	-0.88	0.60
Interaction term– Engagement X Management							0.07	0.05
Random effects	Variance	SD	Variance	SD	Variance	SD	Variance	SD
Small group	0.03	0.18	0.13***	0.36	0.11***	0.33	0.09***	0.29
Child race–White			0.16**	0.40	0.18**	0.43	0.17**	0.41
Child	0.52	0.72	0.16	0.40	0.16	0.39	0.16	0.40
Model fit								
Deviance	166.01		107.28		103.53		102.00	
Number of parameters	3		8		10		11	
Intraclass correlation coefficient	0.060		0.288		0.245		0.208	

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

Table 9

Prediction of Expressive Vocabulary – Hierarchical Linear Modeling

Fixed effects	Model 0 (Unconditional)		Model 1 (Covariates)		Model 2 (Independent relation)		Model 3 (Interaction)	
	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*
Intercept	6.21***	0.37	6.16***	0.24	6.23***	0.24	6.23***	0.23
Pretest expressive vocabulary			0.95***	0.08	0.92***	0.08	0.93***	0.08
Child age in years			0.53	0.38	0.32	0.38	0.24	0.38
Child race–White			0.24	0.55	0.29	0.54	0.30	0.54
Teacher race–Black/White			-0.20	0.34	-0.29	0.33	-0.32	0.33
Collective small-group behavioral engagement					0.35*	0.15	1.62	1.25
Teacher behavior management					-0.13	0.12	1.10	1.21
Interaction term– Engagement X Management							-0.11	0.11
Random effects	Variance	*SD*	Variance	*SD*	Variance	*SD*	Variance	*SD*
Small group	1.42**	1.19	0.04**	0.19	0.02**	0.14	0.01**	0.11
Child race–White			2.55***	1.60	2.62***	1.62	2.58***	1.60
Child	5.44	2.33	1.49	1.22	1.43	1.19	1.41	1.19
Model fit								
Deviance	351.89		258.85		254.02		252.99	
Number of parameters	3		9		11		12	
Intraclass correlation coefficient	0.207		0.009		0.005		0.003	

*p <.05. **p <.01. ***p <.001.

Figure 1

Scatter Plot – Collective Small-Group Behavioral Engagement and Teacher Behavior Management

Small-Group Behavioral Engagement = Collective Small-Group Behavioral Engagement.