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Student Characteristics as Predictors of Teachers' Implementation of a Kindergarten Readiness Program

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Abstract

Recent years have seen increasing numbers of classroom-based interventions designed to enhance the school readiness of at-risk preschoolers. Even the most comprehensive, well-designed programs can suffer from limited effectiveness due to low-frequency implementation by teachers. The current study presents findings from the Building Bridges project (BB), an integrated program targeting school readiness in Head Start and low-income child care centers. Previous studies have reported the role of teacher-level and program-level characteristics in predicting teacher implementation of an intervention. The present study examines the role of student characteristics—language and math ability, social skills, and behavioral functioning—in predicting implementation exposure. These associations were examined in the context of program type (Head Start, child care) and intervention condition (consultation, no consultation). 88 classrooms (41 Head Start, 47 child care) participated in the BB intervention. Implementation exposure was predicted by several distinct student characteristics. Teachers whose students exhibited poorer language skills implemented significantly more BB activities, a finding that was consistent across program types and intervention conditions. A marginally significant trend was identified for oppositional behavior when interacted with intervention group in that teachers whose students demonstrated higher rates of oppositional behavior implemented fewer intervention activities when they did not have a consultant. Teachers in child care centers with a BB consultant had higher rates of implementation than did teachers in all other groups. These findings provide important information regarding the student-level characteristics that should be evaluated in order to optimize implementation of an intervention.

Keywords

PRESCHOOL; IMPLEMENTATION; STUDENT CHARACTERISTICS

School readiness has become a key concern for policymakers and educators alike, with a particular focus on at-risk children. Children whose early years are characterized by poverty, limited resources, and a lack of exposure to learning opportunities typically enter school much less skilled than their peers across many areas of functioning (McLoyd, 1998).

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Numerous school readiness intervention programs have been developed in recent years to provide comprehensive, evidence-based strategies and resources to meet this need. School-based universal programs are considered one of the best avenues for promoting children's functioning because schools serve as the setting in which the greatest number of children are served. At the preschool level, enrollment in child care, public prekindergarten, and Head Start continues to increase, with as many as 67% of young children attending these settings (Innes, Denton, & West, 2001).

Yet even the best interventions are likely to be limited in their success if they are not implemented as designed (e.g., Durlak & DuPre, 2008). Traditional intent-to-treat (ITT) analyses rely on the assumption that an intervention was implemented as intended, an assumption that can lead to an underestimate of treatment effectiveness when the actual implementation differs from its original design (Lochman, Boxmeyer, Powell, Roth, & Windle, 2006). Dane & Schneider (1998) describe five essential components of implementation fidelity: exposure, adherence, quality of delivery, participant responsiveness, and, program differentiation. The present study focuses on predictors of *exposure*—specifically, the quantity of program activities conducted.

To date, implementation research on school-based interventions has focused largely on teacher characteristics and school-level variables as predictors of implementation. Some researchers report that years' experience was negatively related to acceptability of an intervention (e.g., Ghaith & Yaghi, 1997) while others found no significant relationship (Baker, Kupersmidt, Voegler-Lee, Arnold, & Willoughby, 2009). Baker et al. (2009) reported that education was not a significant predictor of participation for preschool teachers, but teachers' concern about the intervention predicted less participation. Expectancy of success and perceived limited cost were associated with more implementation (Abrami, Poulsen, & Chambers, 2004). Teacher self-efficacy predicted higher rates of implementation in some studies (Ghaith & Yaghi, 1997; Kallestad & Olweus, 2003) but not in others (Baker et al., 2009).

A number of school and program characteristics have also been found to predict implementation. In a large-scale study of school-based prevention programs, school size, principal support, and organizational capacity were significant predictors (e.g., Payne, Gottfredson, & Gottfredson, 2006). Similar findings were reported at the preschool level, with perceived availability of organizational resources predicting teachers' use of the program (Shernoff & Kratochwill, 2007). Implementation was also predicted by program type, such that child care teachers implemented more activities than did Head Start teachers (Baker et al., 2009).

As the context in which school-based intervention activities take place, the classroom is comprised of numerous proximal factors that may impact teachers' use of a program. Such features of the classroom environment as student abilities and characteristics, class size, provision of resources, and overall classroom quality might be instrumental in promoting or impeding teachers' use of a new curriculum. Among these, student-level characteristics are of interest for several reasons. First, student characteristics themselves might directly influence implementation if a class is comprised of students with significant skills and/or

deficits that could impact the use of a curriculum. Second, these characteristics could be of particular relevance when the characteristics are direct targets of the intervention. For example, if students' language development is delayed, an intervention designed to teach language skills might be more fully implemented. Yet few studies were located that evaluated the relationship between student characteristics and implementation of an intervention.

Given that little prior research is available to guide specific hypotheses regarding student-level predictors of implementation, the literature on perceived need and value provides a basis for our hypotheses. Kallestad & Olweus (2003) examined teachers' perceived need for an intervention, finding that teachers' reports of bullying were related to their use of classroom strategies to reduce bullying. Other researchers found that implementation was predicted by the perceived value of the program (Abrami, Poulsen, & Chambers, 2004) or the belief that it fit with the needs of the class (Shernoff & Kratochwill, 2007). This suggests that teachers who perceive greater need and/or value for a program will be more likely to implement it.

Student characteristics related to disruptive classroom behavior have received the most empirical attention with regard to program implementation. In a review of studies that evaluated contextual effects on school-based violence prevention programs, six studies examined classroom characteristics and their effect on implementation and program outcomes (Ozer, 2006). One study reported that more aggressive classes had better child outcomes (Kellam, Ling, Merisca, Brown, & Ialongo, 1998), while another found that classrooms with less aggressive norms had better program response (Aber, Jones, Brown, Chaudry, & Samples, 1998). These findings did not indicate a consistent pattern regarding the impact of aggression on program outcomes; furthermore, none examined the association between aggression and implementation. While teachers with more challenging classes might be more motivated to implement a program that addresses reduction of aggressive behaviors, the demands of managing such a class might preclude teachers' ability to adequately implement a new program. Similarly, high prevalence of inattention, overactivity, and/or oppositionality might also pose a barrier to implementation.

Children's prosocial functioning presents another potentially influential student-level characteristic affecting implementation, particularly of a program targeting social and emotional learning (SEL). Kowalski and colleagues (2001) found that teachers rated social-emotional skills as more important than academic skills, a belief reflected in an increased emphasis on SEL in early childhood teacher training. Little is known about the role of children's social skill level in impacting teachers' use of an SEL curriculum. As awareness grows regarding the importance of SEL, teachers who observe social skill deficits might be more likely to utilize an SEL program.

It is likely that other characteristics such as children's language skills might also impact the extent to which a teacher will implement a new intervention. Teachers who have students with poor language skills might be more willing to implement a language curriculum. While a number of studies have evaluated outcomes of programs that target language skill development for children with language difficulties, no studies were located that examined

classroom-level indices of language ability and their association with implementation of a curriculum.

Even less attention has been extended to the impact of children's mathematics skills on implementation of a math intervention. Findings that preschoolers are able to acquire math skills more readily than previously believed led to the recommendation by the National Council of Teachers of Mathematics that math instruction be included in preschool (NCTM, 2000). Head Start teachers participating in a math intervention reported great interest and increased skill in math teaching following participation in the intervention (Arnold, Fisher, Doctoroff, & Dobbs, 2002). Together these findings suggest that the early childhood field is receptive to participate in interventions targeting mathematics. Thus, teachers whose students exhibit poorer math skills might be more inclined to implement activities promoting math development.

Study Aims

The first aim of this study was to examine the association between specific student characteristics and teachers' implementation of a kindergarten readiness program. Consistent with previous findings, we hypothesized that higher rates of inattentive, overactive, and aggressive behaviors would be negatively associated with implementation exposure. While the BB program was specifically designed to assist teachers in preventing and managing challenging classroom behaviors, it is likely that teachers with many students exhibiting disruptive behavior problems would be less able and/or willing to take on the challenge of implementing a new program. Consistent with theory regarding perceived need and/or value, lower rates of social skills, language skills and math skills would be associated with higher rates of implementation exposure since teachers would perceive a greater need and/or value of the intervention.

The second aim of the study was to evaluate the unique contribution of student characteristics to the prediction of implementation in the presence of program (Head Start, child care) and intervention (with, without consultation) characteristics. In contrast to Head Start programs, child care programs tend to have less infrastructure and fewer resources to address children's behavioral, language, and social-emotional skill development and we anticipated that they would thus be more likely to utilize an intervention targeting those needs. With respect to intervention condition, we hypothesized that teachers who received consultation in the use of the BB program would be more likely to more fully implement the intervention than would teachers who did not receive consultation (Dane & Schneider, 1998; Lochman, 2001).

Method

Overview

The present study is part of a longitudinal study of the effectiveness of the Building Bridges (BB) Program, a kindergarten readiness program utilizing an integrated curriculum that targets social, emotional, emergent literacy, communication, mathematics, and behavioral skill development. Teachers and children were recruited from Head Start and child care

programs serving low-income populations. Full details of the BB study including recruitment and assessment procedures as well as curriculum content have been described elsewhere (Kupersmidt et al., 2010). Centers were randomly assigned to one of three conditions: Workshops Plus (WP), which provided training, materials, and weekly on-site classroom consultation; Workshops Only (WO), which provided training, materials, and telephone support; and Control. The current study is restricted to classrooms that participated in the two intervention groups (WP and WO).

Participants

Of the 119 classrooms that participated in the BB evaluation, 88 classrooms (41 Head Start, 47 child care) were in the two treatment groups included in the present study. All lead teachers were invited to participate in the study and 100% (N=88) agreed. The majority of teachers were female (98%); 68% were African-American, 28% White, and 4% other ethnicity. Their highest education level was described as: 10% with a high school degree, 20% with some college, 32% with an associate's degree, and 38% with a bachelor's degree or higher. Teachers reported 11.0 mean years (range =0.3–33.0 years) of teaching experience in early childhood.

Within the 88 classrooms in the current sample, 547 children participated in the study. Participants were four years old in the fall of the intervention year ($M=4.6$, $SD=0.4$). Sixty-one percent of the sample was African-American, 33% Caucasian, and 6% Hispanic. The sample was evenly distributed by child gender (50% male) and setting (50% Head Start, 50% child care).

Procedure

Child assessments, teacher ratings of children's behaviors, and parent questionnaires were administered at several timepoints during the study. Predictor variables used in the current study were obtained from data collected at the fall pre-test timepoint. Teacher report of program implementation was gathered throughout the intervention year.

Project staff met individually with each teacher and child in a private setting at the center. Teacher ratings of students took approximately 60 minutes to complete and teachers were compensated \$15. Child assessments were conducted over the course of two sessions, for 30–45 minutes at each session. Children were given a book and stickers for participating. Parent questionnaires were mailed home with a pre-addressed, stamped envelope. The questionnaire took approximately 45 minutes to complete. Parents were given a \$25 gift card as compensation.

Teachers completed weekly activity logs, the source of the outcome variable in this study. They were paid \$10 for each completed log regardless of how many activities were reported. Thus, a teacher who completed only one activity (or less) in a week was paid the same as a teacher who reported completing many or all activities. This procedure was used to maximize submission of logs and encourage teachers to be as accurate as possible in reporting.

Intervention Design

The BB intervention, developed after seven years of preliminary research in Head Start and low-income child care centers, was designed to promote social, emotional, academic, and behavioral school readiness. The intervention was implemented by classroom teachers, who integrated BB activities into their current teaching practices and weekly lesson plans.

Social-Emotional Learning—The Second Step Violence Prevention Curriculum, Third Edition (SS; Committee for Children, 2002) provided the foundation for SEL skill building and has been empirically demonstrated to benefit preschoolers (Moore & Beland, 1992). Full implementation would include teaching 25 lessons delivered in a group setting once per week.

Social-Emotional Learning and Communication Skills—Integrated with the Second Step lessons were Dialogic Reading (DR) activities. DR is an empirically-validated intervention that enhances language and emergent literacy skills in preschoolers by making shared reading more interactive (Arnold, Lonigan, Whitehurst, & Epstein, 1994). Full exposure would consist of reading 25 children's books aloud to small groups of children, one per week.

Emergent Literacy and Communication Skills—Full implementation of the BB emergent literacy and communication activities would involve teaching five activities per week in the areas of Strengthening Speaking Skills, Things We Read, Listening to Language, Getting Ready to Write, Attending and Remembering. Each communication activity was designed to provide additional practice of each SEL goal. Scripted activity cards and ancillary materials were provided to each teacher to facilitate implementation (e.g., CDs, felt board, game cards).

Mathematics skills—Full program exposure would be indicated through teaching three mathematics activities each week across 25 weeks, for a total of 75 activities. The math activities were equally divided across three domains: Counting and Numbers, Shapes and Sizes, Measuring and Estimating. Mathematics activities were integrated with each weekly SEL theme.

In sum, teachers were provided a set of ten activities per week for each of the 25 weeks of lessons: one Second Step lesson, one Dialogic Reading book, five Emergent Literacy and Communication activities, and three Math activities. Taken together, full program exposure across an academic year would be indicated by implementation of a total of 250 activities.

Implementation

Training—Teachers attended 30 hours of group training during the summer prior to the intervention year and were paid \$10 per hour for their attendance. Topics included proactive teaching strategies, relationship building and behavior management, as well as direct instruction in implementing BB activities and incorporating BB components into teachers' lesson plans.

Consultation—After the training, teachers were randomly assigned to the Workshops Plus (WP) or Workshops Only (WO) condition. Each WP classroom was assigned a consultant who provided weekly on-site mentoring. Consultants were specialists in either early childhood education or children's mental health. They received extensive training in the BB program as well as weekly individual supervision and biweekly group supervision from the project's clinical supervisor. Consultants established a schedule of weekly classroom visits across the intervention year, and teachers received an average of 224 ($SD = 66$) minutes of consultation per week.

Measures

Predictor variables: Student characteristics—For each predictor variable, a classroom mean score was calculated based upon fall pre-test assessment results.

Aggression—Teachers rated children's aggressive behavior using the *Types of Aggression* measure (TOA; Kupersmidt, Bryant, & Willoughby, 2000), which consists of 10 items that assess the frequency of overt and covert aggression. Items are rated on a 5-point Likert scale (1=Once a month or less; 2=Once a week; 3=2–4 times a week; 4=Once a day; 5=Many times a day). The TOA has acceptable test-retest and inter-rater reliability, and demonstrated criterion validity for measures of conduct problems, hyperactivity, and peer conflict in the classroom.

Oppositional behavior—Teachers rated oppositional behavior using the Oppositional/Defiant subscale of the *IOWA Conners Teacher Rating Scale* (Loney & Milich, 1982). Five items assess oppositional behavior, using a 4-point Likert scale (0=Not at all, 1=Just a little, 2=Pretty much, 3=Very much). Pelham, Milich, Murphy & Murphy (1989) presented normative data for this scale on a sample of 608 children, and estimated internal consistency as .92. There are abundant validity data on this widely-used scale (e.g., Pelham et al., 1989).

Inattention—Teachers rated children's attention difficulties using the Inattentive/Overactive subscale of the *IOWA Conners Teacher Rating Scale* (Loney & Milich, 1982). Five items assess attention and overactivity problems, using a 4-point Likert scale (described above). Pelham et al. (1989) presented normative data for this scale on a sample of 608 children, and estimated internal consistency as .89.

Social skills—Teachers completed the Social Skills Rating System (SSRS; Gresham & Elliott, 1990), a 30-item assessment of children's cooperation, assertion, and self-control skills. Items are rated on a 3-point Likert scale (0=Never, 1=Sometimes, 2=Very often). Internal consistency of this scale has been estimated at .93. Extensive validity data support this scale and include samples of diverse preschool children (e.g., Rich, Shepherd, & Nangle, 2008).

Language, communication, and emergent literacy skills—Six tests were administered to assess children's language, communication, and emergent literacy skills. Children were administered the *Woodcock-Johnson-III Tests of Achievement* (Woodcock, McGrew & Mather, 2001) Letter Word Identification and Sound Awareness subtests. Letter-

Word Identification measures decoding skills, and Sound Awareness assesses phonetic knowledge. The reliability of these scales has been estimated as .98 and .71, respectively. Strong content and concurrent validity has been established for these measures (Woodcock et al., 2001).

The *Story and Print Concepts* task (Administration on Children, Youth, and Families, 2003) was administered to assess children's book knowledge, print knowledge, and story comprehension. It was used in the FACES Head Start study with diverse preschoolers. Reliability estimates for subscales of this measure ranged from .43 to .74.

The Language and Literacy subscale of the *Academic Rating Scale* (ARS; West, Denton, & Germino-Hausken, 2000) was designed to assess a range of skills for children in kindergarten and early elementary grades; while some skills might not be evident in preschool-aged children, the measure can evaluate children's change in language skills over time. Teachers rated children on 9 items using a 5-point scale (1=Not Yet, 2=Beginning, 3=In Progress, 4=Intermediate, 5=Proficient). Coefficient alpha for this sample was .89.

Teachers rated children's interest in language activities using the Language subscale of the *Level of Interest Survey* (LIS; Arnold, Fisher, Doctoroff, & Dobbs, 2002). Three items are rated on a 7-point Likert scale (1=Not at all interested, 4=Moderately interested, 7=Extremely interested). This measure has demonstrated appropriate correlations with other measures of interest and good reliability (Arnold, et al., 2002). Coefficient alpha for this sample was .75.

Parents rated children's adaptive language skills using the "Your Child's Activities" measure, used in the FACES Head Start study (Administration on Children, Youth, and Families, 1997). The scale consists of 10 items that assess skills associated with emergent literacy and language development. All but two items are scored dichotomously (0=No, 1=Yes); the other two items were converted to dichotomous scores and an overall mean score was created.

Mathematics skills—Four measures were used to assess children's mathematics functioning. The Applied Problems subtest of the *Woodcock-Johnson III: Tests of Achievement* (WJIII; Woodcock, McGrew, & Mather, 2001) was administered as a direct assessment to children. This subtest has high reliability, with an internal consistency estimate of .94 (Woodcock et al., 2001), and well-demonstrated validity as described above.

The Mathematical Thinking subscale of the *Academic Rating Scale* (ARS; West, Denton, & Germino-Hausken, 2000) was designed to assess math skill development in children from kindergarten through early elementary grades; some skills might not be relevant for preschoolers but the measure was included to assess change in math skills over time. Teachers rated children on 7 items using a 5-point scale (described above). Coefficient alpha for this sample was .93.

Teachers also rated children's interest in math using the Math subscale of the *Level of Interest Survey* (LIS; Arnold, Fisher, Doctoroff, & Dobbs, 2002). The subscale consists of 3 items are rated using a 7-point Likert scale (described above). This measure has

demonstrated appropriate correlations with other measures of interest, good reliability, and sensitivity to treatment effects (Arnold, et al., 2002). Coefficient alpha for this sample was .73.

Parents assessed children's numeracy development using one item from the "Your Child's Activities" measure described above. Parents rated the question, "How high can your child count?" on a scale from 1 to 6 (1=Not at all, 2=Up to five, 3=Up to ten, 4=Up to twenty, 5=Up to fifty, 6=Up to 100).

Outcome variable: Implementation

Implementation—Teachers' implementation exposure was measured using the Weekly Classroom Activities Log (WCAL; Kupersmidt & Voegler-Lee, 2003), designed specifically for this project. The WCAL is a highly-structured, face-valid report of implementation of BB activities. Each week teachers recorded the date an activity was conducted and the initials of the teacher who conducted it. Implementation exposure was calculated as a percentage score by dividing the number of activities completed (range 0–250) by the total possible number of activities (250). Missing WCAL data were considered incomplete activities. Of the maximum 25 forms that could be completed per classroom, the average number of forms received was 18.9.

Analysis Strategy

Analysis of the data proceeded in multiple phases. First, we reduced the dimensionality of our language and mathematics models using confirmatory factor analysis (CFA). A CFA on the fall language measures resulted in a good fit for a single language factor, $N=909$, $\chi^2(8)=10.0$, $p=.27$, $CFI=1.0$, $RMSEA=.02$. A CFA on the fall mathematics measures was conducted resulting in good fit for a single mathematics factor, $N=899$, $\chi^2(1)=0.3$, $p=.62$, $CFI=1.0$, $RMSEA=.00$. For both factors, factor scores were centered at the mean score within each time point.

Second, we regressed implementation on each predictor and tested all three-way and two-way interactions (as well as main effects) with program type and intervention group. Separate regression models were estimated for each predictor, and type-III ANOVA test results were used to identify which predictors would be used in the third phase of the analysis. In the third phase, we considered simultaneous influences on the expected implementation using predictors identified in the second phase. Specifically, if a predictor was significant only as a main effect, we limited our consideration of its influence on expected implementation to a main effect specification. The appropriate interaction terms involving a predictor were included if evidence for an interaction was identified in the second phase.

Statistical models estimated in the second and third phases accounted for possible conditional dependence in the outcomes among teachers within the same preschool center. We imposed a compound symmetry structure (common covariance plus diagonal) within blocks (classrooms) of the N by N variance covariance matrix of the residuals. Regression models were estimated using the MIXED procedure in SAS. Models from both phases

included main effects for program type and intervention as well as product terms which captured possible interaction effects. Prior to being entered into the model, each continuous variable was centered on its respective sample mean, allowing for straightforward interpretation of the intercept and main effect terms in the model. In addition, we dummy-coded the program type and intervention group variables, using Head Start and Workshops Plus as the reference categories, respectively.

Results

Descriptive Statistics

Table 1 presents descriptive statistics for the predictor and outcome variables separately for each of the four categories of teachers formed by the cross-classification of program type (Head Start, child care) and intervention group (Workshops Plus, Workshops Only).

Relationships among Predictor and Outcome Variables

Table 2 presents correlations among the predictor and outcome variables. Interscale correlations between predictor variables ranged from nonsignificant (math, inattention, oppositional behavior, and aggression) to strongly significant (math and language skills correlated .73). Consistent with expectations, language skills were negatively although marginally associated with implementation. Intervention group was significantly related to implementation, such that teachers who received consultation implemented significantly more intervention activities. All other correlations with implementation were not significant.

Prediction of Implementation

The results from the second phase of analysis are presented in Table 3. When considered individually, three of the six predictor variables were significantly associated with the implementation outcome variable. The main effect for the Language composite measure was significant, $F(1,36)=7.24$, $p=.01$, such that lower language scores were associated with higher rates of implementation for all teachers, across program types and intervention groups.

The Inattention score, $F(1,33)=4.79$, $p=.04$, and Oppositional score, $F(1,33)=7.09$, $p=.01$, were significantly related to implementation exposure when interacted with intervention group. Higher scores on these predictor variables were associated with fewer activities implemented, but only for teachers in the Workshops Only group (i.e., without a consultant).

All significant terms were next entered into a statistical model which considered the simultaneous influences of the predictors identified above. In terms of statistical significance, the results from the individual significance tests were partially replicated in the multivariate analysis, reported in Table 4. Language remained a significant predictor of implementation across program types and intervention conditions, with lower language skills predicting higher rates of implementation. Oppositional behavior was a marginally significant predictor, with higher rates of oppositional behavior associated with lower rates of implementation. With regard to the main effect of the Language composite, an increase in 1 standard deviation on this score (~ 4.0) yields a 9.6-point decrease in the expected

compliance rate ($4.0^*-.024\%=-9.6\%$), or a little less than two-fifths of a standard deviation in the outcome—a moderate effect size.

For Oppositional behavior, we obtained a trend toward significance in the interaction with intervention group. While the association with implementation was not significant for the WP group, WO teachers who rated their students high on Oppositional behavior had lower rates of implementation [$-0.14(.09)$, $p=.11$]. In this case, a standard deviation increase in the Oppositional score (0.42) yielded a 5.7-point decrease in the expected implementation rate, approximately one-tenth of a standard deviation in the outcome—a small effect size.

The program type and intervention group variables were also included in the full model to evaluate whether the effects of the individual predictor variables operated differentially based on the type of program in which the teacher worked and whether or not she had the support of a consultant. Results indicated that the program type*intervention group term was statistically significant. Holding all other covariates constant, child care teachers in the WP (consultant) group implemented significantly more intervention activities (74%) than did Head Start teachers in the WP group (42%), and more than teachers in either of the WO groups (44% and 43%).

Analysis of Participation by Activity Subtype

In order to determine if specific student characteristics differentially predict implementation of specific types of intervention activities, analyses were also conducted using each of the four activity subtypes (Second Step, Dialogic Reading, Literacy and Communication, and Math) as outcome variables. The pattern of results for each activity subtype did not differ significantly from that of the total implementation rate, suggesting that the student characteristics operate similarly for the intervention as a whole as they do for activities within specific domains.

Discussion

The primary aim of this study was to evaluate the relationship between preschool student characteristics and teachers' implementation of a kindergarten readiness program. The results of this study are the first to identify student-level characteristics associated with implementation. These findings provide support for the importance of examining proximal features of the classroom context in understanding the process of implementation in early childhood programs.

Children's language skills emerged as the most robust predictor of implementation of the intervention. The inverse relationship between language scores and teachers' implementation exposure was independent of program type and intervention group. Across subgroups, teachers were more likely to implement BB activities when their students, as a whole, displayed poorer language skills. There are several possible reasons for this finding. First, educators generally understand the importance of language development for children's concurrent and later achievement and as a result, might be especially attentive to their students' language skills. The language measures used in this study included both teacher ratings and direct child assessment, suggesting that teachers recognized and consistently

identified language abilities and deficits in their students. Because language skill deficits constitute a critical and widely-accepted target for intervention (e.g., Justice, Mashburn, Pence, & Wiggins, 2008), teachers might then have been motivated to implement a program designed to enhance language skills. The BB program includes proportionally more language activities than other types of activities. BB provides teachers with multiple options for language-building lessons and teachers might therefore have implemented more BB activities in order to address identified language deficits. Second, while early math skill development has only recently been emphasized, language skill development is a more familiar domain for preschool teachers. Teachers might thus be more motivated to implement activities focusing on language skills such as those in BB.

While inattention and oppositional behavior predicted lower rates of implementation when examined independently, only inattention remained marginally significant in the presence of other predictors. Teachers who rated their students as more inattentive were less likely to implement the BB program if they did not receive on-site consultation. While a core goal of BB is to provide resources and strategies to prevent and decrease disruptive behaviors and enhance on-task behaviors, our findings suggest these resources are less likely to be utilized if teachers do not have ongoing support to do so. It is likely that teachers who perceive their students as off-task must expend energy on managing behavior and are less able to marshal the effort needed to implement a new program without support. Alternatively, it can be interpreted that consultation provides a buffering effect for implementation, such that the provision of a consultant kept teachers from dropping their rates of implementation (as seen in the WO group) when faced with challenging behaviors. This finding highlights the importance of providing ongoing support to teachers, especially during the initial phase of implementing a program (Lochman, 2001).

Notably, the classroom level of aggression did not significantly predict implementation, either alone or in the presence of other variables. It is possible that aggressive behavior was observed at a relatively low frequency for classrooms as a whole and therefore did not have a strong impact on teacher behavior with regard to implementation of the program.

Contrary to our hypotheses, children's math skills and social skills were not related to implementation. It is possible that, unlike inattention and language skills, math abilities and prosocial behaviors are less salient for teachers and therefore do not impact implementation of a program targeting these areas. Preschool teachers have been found to vary widely in the amount of math they incorporate into their teaching and thus might be less likely to attend to and/or recognize deficits in students' math skills (Klibanoff, Levine, Huttenlocher, Vasilyeva, & Hedges, 2006). Similarly, social skill deficits might garner less attention than the presence of disruptive behaviors and therefore do not play a significant role in implementation.

Interestingly, students' particular skill deficits did not predict implementation of lessons specific to those skill areas. Teachers who reported higher levels of disruptive behavior, for example, implemented more activities across the board rather than those targeting SEL and behavior management. Likewise, teachers of children with poorer language skills implemented more activities in general and not just more language activities. Perhaps BB's

integrated design resulted in teachers' comfort in using the entire curriculum to address students' needs.

The significant interaction between program type and intervention group underscores the importance of evaluating predictors of implementation in the context of the program setting and intervention conditions. While this study focused on student-level predictors, teachers' behavior continues to be influenced by the broader context in which they work. Child care educators implemented more activities than did Head Start teachers, suggesting that BB was an especially good fit for child care programs. Yet implementation was higher only when a consultant was provided, indicating the importance of ongoing support for optimal implementation.

This study had several limitations. First, our outcome variable was operationalized using teacher self-report. For weeks in which teachers did not submit logs, we did not have data on whether they conducted activities but did not complete logs or whether they did not conduct the activities. We chose to count missing logs as non-completed activities. While this produces a source of measurement error, our project staff's considerable efforts to obtain completed forms suggests that teachers did not submit forms primarily when they did not implement activities.

A second and related limitation was the study's reliance on teacher report as the sole measure of implementation exposure. While utilizing other informants such as classroom observers might have theoretically provided a more objective estimate of implementation, the fact that multiple activities were implemented across the course of each school day and each week of a school year suggests that observers would potentially see only a small percentage of activities conducted. Our procedure was consistent with other studies of implementation; in their review of studies examining implementation exposure, Dane & Schneider (1998) reported that 80% of these studies utilized implementers as the informants of their own implementation.

These results suggest several directions for future research. An important next step is to examine implementation exposure as a moderator of program effectiveness. In order to examine the impact of the BB program on teacher and child outcomes, including exposure provides a better and more appropriate assessment of the specific effect of the program on outcomes.

A second line of research would examine the *quality of delivery* of the intervention activities. Evaluating characteristics that best predict high quality implementation can provide valuable information regarding the implementation process. Furthermore, it will be important to examine the interplay between quantity and quality of teachers' implementation efforts and the unique and combined contribution of each to children's outcomes.

A third line of research is to evaluate other classroom-level predictors of implementation. Specific features of the classroom environment—such as class size, availability of classroom resources, and overall classroom quality—might provide further insight regarding the proximal features that impact teachers' use of a new curriculum.

Future research could examine teachers' self-report of their motivation for implementing (or not implementing) an intervention. Having teachers evaluate—at the conclusion of the intervention period—such factors as their perceived need for specific components of an intervention as well as their belief that the intervention would address could help illuminate the ongoing processes teachers utilize when choosing what to implement in their classrooms.

Finally, additional research might examine the timing of consultation in facilitating teachers' implementation of a program. This study provided further evidence of the importance of consultation, yet the high cost of providing on-site consultation can be prohibitive for many programs. Identifying a specific window during which consultation efforts are maximally effective would provide critical information for the cost-effective implementation of new interventions.

This study is among the first to identify specific student-level predictors of program implementation. Student adjustment, particularly in areas most salient or relevant to preschool teachers, was associated with implementation. These findings broaden our knowledge base of the correlates of implementation and provide direction for future research in the ongoing effort to better understand the processes involved in implementation of novel, school-based interventions.

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Table 1
Descriptive Statistics for Predictor and Outcome Variables by Intervention Group and Program Type

	Intervention Group										Total Sample	
	WO					WP						
	Program Type					Program Type						
	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std
Inattention	15	1.05	0.46	17	0.84	0.41	28	0.97	0.44	22	1.05	0.45
Oppositional Behavior	15	0.71	0.46	17	0.49	0.47	28	0.78	0.41	22	0.66	0.49
Aggression	15	1.68	0.61	17	1.55	0.54	28	1.82	0.54	22	1.68	0.54
Social Skills	14	103.45	8.26	17	107.02	8.08	28	103.95	8.40	22	101.11	8.31
Language Skills	16	0.84	4.36	19	-0.59	3.45	28	2.45	3.72	22	-1.05	3.98
Math Skills	16	2.09	3.71	19	-1.51	3.44	28	2.47	4.09	22	-2.56	4.18
Implementation %	18	0.41	0.27	19	0.52	0.33	29	0.70	0.15	22	0.53	0.26

Note. WO = Workshops Only; WP = Workshops Plus; CC = Child Care; HS = Head Start.

Table 2

Correlations and Descriptive Statistics for Predictor and Outcome Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Intervention Group (WP=1)	—								
2. Program Type (HS=1)	-.08	—							
3. Inattention	.07	-.05	—						
4. Oppositional Behavior	.14	-.17	.62***	—					
5. Aggression	.13	-.14	.42***	.55***	—				
6. Social Skills	-.16	-.01	-.42***	-.25*	-.24*	—			
7. Language Skills	.11	-.34**	-.28*	-.16	-.06	.33**	—		
8. Math Skills	.01	-.53***	-.09	-.04	-.02	.25*	.73***	—	
9. Implementation %	.31**	-.13	.08	.10	.05	.01	-.19 ⁺	-.06	—

Note: N = 88;

⁺ p < .10

* p < .05

** p < .01

*** p < .001; WP = Workshops Plus condition; HS = Head Start.

Table 3

Prediction of Implementation by Student Characteristics: Main Effects, Two-way, and Three-way Interactions

Label	TYPE III F TEST [Main Effect]	TYPE III F TEST [2-Way: Intervention]	TYPE III F TEST [2-Way: Program]	TYPE III F TEST [3-Way: Program * Interv]
Inattention	1.968	4.793 *	1.444	1.809
Oppositional Behavior	0.352	7.085 *	0.026	0.432
Aggression	0.024	2.055	0.195	0.353
Social Skills	0.34	1.224	1.663	3.323
Language Skills	7.238 *	0.203	3.333	0.054
Math Skills	2.353	0.346	0.594	0.01

*
p < .05

Table 4

Regression Estimates from Full Model Predicting Implementation from Student Characteristics

Parameter	Result
Intercept	0.491(0.049) ***
Intervention Group (WO)	−0.068(0.075)
Program Type (CC)	0.254(0.07) *
Intervention * Program Type (CC, WO)	−0.236(0.106) *
Inattention	0.02(0.09)
Inattention * Intervention (WO)	−0.022(0.152)
Oppositional Behavior	0.025(0.082)
Oppositional Behavior * Intervention (WO)	−0.168(0.14) +
Language Skills	−0.024(0.007) **

p < .001

**
p < .01

*
p < .05,

+
p = .10