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Behavioral Exchanges between Teachers and Children Over the Course of a Typical Preschool Day: Testing Bidirectional Associations

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Abstract

In the present study, 314 preschool classrooms and 606 children were observed to understand the behavioral exchanges between teachers and children. Teachers' emotionally and organizationally supportive behaviors and children's engagement were explored for longitudinal associations throughout a day. Observations were conducted in each classroom wherein emotional and organizational supports were assessed, followed by observations of two children's positive engagement with teachers, tasks, and peers as well as negative classroom engagement. Cross-lagged autoregressive models were used to test for time-lagged associations which could be unidirectional or bidirectional. Results indicated teachers' emotionally and organizationally supportive behaviors were related to later child engagement in seven of eight models. Furthermore, in two of those seven models, we found evidence of bidirectional associations whereby children's engagement was associated with later teacher emotional and organizational supports. Findings are discussed in terms of understanding classroom processes over the course of a day in preschool.

Keywords

preschool; bidirectional associations; teacher supports; children's engagement

There are rising concerns about the persistent academic achievement gap that exists at the start of school. For early childhood education, this has led to increased attention to and emphasis on providing young, at-risk children with explicit learning opportunities for academic content such as literacy, language, mathematics, and science (Clements & Sarama, 2011; National Early Literacy Panel, 2008). However, in juxtaposition to this movement, there is a growing literature to suggest that it is the behavioral exchanges and interactions that occur between teachers and children in preschool classrooms that contribute significantly to early learning and development (Burchinal et al., 2008; Howes et al., 2008; Mashburn et al., 2008). The socially mediated nature of early learning calls for a rich

understanding of classroom interactions that support developmental progress, which to date has largely been explored by studying the unidirectional link between what teachers do in the classroom (e.g., emotional support, classroom organization) that directly supports children's outcomes (e.g., social skills, self-regulation) (Downer, Booren, Lima, Luckner, & Pianta, 2010; Mashburn et al., 2008; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). An alternative, but less frequently studied dynamic involves children as active agents in the classroom environment, seeking out and initiating engagement with teachers and tasks to learn. For example, limited research has examined how aspects of children or the class as a whole are associated with differing teacher behaviors (Skinner & Belmont, 1993). Although each perspective often acknowledges the other, there is little work that incorporates both perspectives.

In the current study, we aim to understand better the behavioral exchanges between teachers and children that past work has shown to be conducive to learning and development. We do so by taking a closer look at the reciprocal exchanges between teachers' supportive behaviors and children's engagement in the classroom through longitudinal, dynamic modeling of a typical preschool morning in over 300 classrooms across eight different states. These observational data allow us to examine the whether there were lagged associations between teachers' and children's behaviors and determine the directionality (i.e., unidirectional/bidirectional) of any lagged associations.

Understanding the nature of bidirectional behavioral exchanges is consistent with developmental theory. In fact, Bronfenbrenner and Morris (2006) explicitly hypothesize that bidirectional processes drive development. Practically speaking, studying these processes as they play out in a classroom over the course of a day may help identify potential areas of leverage in these dynamic relations. For example, if classroom organization is related to reductions in later problem behaviors, and problem behaviors are also related to less classroom organization, then it suggests that efforts to improve classroom organization will help reduce problem behaviors, which, in turn, will help sustain improvements to classroom organization. The present study tests for these types of associations across teachers' emotional support and classroom organization with children's engagement with teachers, tasks, and peers.

Bidirectional Behavioral Exchanges within the Preschool Classroom

A key idea in the developmental literature is the bidirectional (or transactional) nature of the interactions between a person and their environment (Bronfenbrenner & Morris, 2006; Sameroff & MacKenzie, 2003). The existence of this bidirectional process is well established in studies of families and parent-child relationships (Kochanska, 1997; Maccoby, 1992; Patterson, 1982), such as Besnard et al.'s (2013) recent findings of both reciprocal and unidirectional links between children's disruptive behavior and parenting across the early grades. Although classrooms have long been seen as a context exemplifying the bidirectional nature of interactions (Fiedler, 1975; Howes & James, 2002; Klein, 1971; Pianta & Walsh, 1996), there have been few observational studies in classrooms that take these bidirectional relations into account (Arnold, McWilliams, & Arnold, 1998; Skinner & Belmont, 1993). One recent exception comes from the field of language acquisition,

whereby Justice, McGinty, Zucker, Cabell, and Piasta (2013) observed child–teacher talk patterns within preschool classrooms and found that teachers’ and children’s complex syntactic use were interdependent. However, we still have little understanding about the ways in which processes may unfold between teachers and children when looking at broader patterns of teacher supports and children’s engagement in early childhood classrooms. Furthermore, not all processes may, in fact, be best characterized as bidirectional, as noted previously in the Besnard et al. (2013) study of parenting and child behavior. Although theoretically we can think of any child affecting the classroom environment, it is likely that certain domains of child and teacher behavior exert stronger influences on one another. For example, child disruptive behavior (captured herein as negative engagement) may have stronger influences on subsequent teacher behavior compared to children’s positive engagement in tasks, which may not exert much influence on teachers’ behaviors at all. Additionally, because of the nature of classrooms, classroom-to-child effects may be stronger because there is one classroom to affect each child as opposed to child-to-classroom effects whereby one child is likely to hold less sway over the entire class. Thus, if behavioral exchanges are not bidirectional, we expect to find unidirectional associations from teachers’ supportive behaviors to children’s engagement.

Teachers’ Emotionally and Organizationally Supportive Behaviors

There is growing consensus that the moment-to-moment interactions occurring between teachers and the children in their early childhood classrooms are a major supporter of learning (Dickinson & Neuman, 2006; Hamre & Pianta, 2007). These interactions can take many forms, but two central forms of teacher supports that are thought to contribute to children’s engagement in the classroom are emotional support and classroom organization (Downer, Sabol, & Hamre, 2010). Emotionally supportive behaviors speak to teachers’ social and emotional behaviors and include teachers’ efforts at providing a warm and responsive presence, supporting children’s autonomy, and valuing children’s opinions and ideas. Conceptually, these emotionally supportive behaviors are expected to increase children’s engagement by increasing their connectedness to teachers and bolstering their motivation to learn (Bowlby, 1969; Connell & Wellborn, 1991). Classroom organization speaks to teachers’ management of children’s behavior and activities and includes teachers’ proactively managing behavior, orienting and redirecting children’s engagement toward learning, and reducing down-time and distraction. These teacher behaviors may help foster children’s engagement by providing external regulation and structure to children’s behavior, time, and attention (Emmer & Stough, 2001; Kounin, 1970; Pintrich, 2000).

Both emotionally and organizationally supportive behaviors are linked with positive engagement in early childhood classrooms. For example, teacher positivity and a child-centered environment were linked with more instances of observed on-task behavior in kindergarten classrooms across several states (Pianta, La Paro, Payne, Cox, & Bradley, 2002). Research also suggests that children in well-organized and managed classrooms exhibit greater engagement (Bohn, Roehrig, & Pressley, 2004; Bruner, 1996; de Kruif, McWilliam, Ridley, & Wakely, 2000; Rimm-Kaufman et al., 2009).

Children's Classroom Engagement with Teachers, Peers, and Tasks

As a construct, engagement in classrooms has a long, rich history, beginning in the process-product literature of the 1970s (Brophy & Evertson, 1978) and moving to early childhood classroom applications in the 1990s through ecobehavioral analysis (Kontos & Keyes, 1999) and examination of preschool classroom experiences for children with disabilities (McWilliam & Bailey, 1995). For the purposes of this paper, we draw from Fredricks and colleagues' (2004) conceptual framework, which acknowledges the multi-dimensionality of children's classroom engagement and defines it as a child's capacity to interact with teachers, peers, and activities in a school environment. This definition provides a nuanced representation of children's engagement, recognizing that their connection to the classroom environment encompasses interrelated behavioral, cognitive, and emotional components (both positive and negative) that coalesce during observable interactions with teachers, peers, and tasks (Fredricks et al., 2004; Skinner, Kindermann, & Furrer, 2009). The present study, investigates four aspects of preschool children's engagement: positive engagement with teachers, tasks, and peers, as well as negative classroom engagement. Although conceptually negative engagement could be delineated into negative engagement with teachers, tasks, and peers, as in positive climate, empirical work using the InCLASS measure used in this study only found evidence for one negative engagement factor across interactions with teachers, tasks, and peers (Bohlmann et al., 2013; Booren, Downer, & Vitiello, 2012; Vitiello, Booren, Downer, & Williford, 2012). Thus, we adopt the four aspects of engagement as measured by our instrument. The following is a brief summary of research that establishes the link between children's engagement with teachers, peers, and tasks in an early childhood classroom setting and an array of school readiness outcomes.

Positive engagement with teachers

Children who display positive engagement with teachers demonstrate warmth and closeness in their interactions and conversations and, therefore, are better able to learn and develop in positive ways (Kontos & Wilcox-Herzog, 1997; Pianta, 1999). This positive and supportive teacher-child connection has been linked to several adaptive outcomes, including higher achievement and social competence in preschool and elementary school (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002), better social-emotional skills, and fewer problem behaviors (O'Connor, Dearing, & Collins, 2011).

Positive engagement with peers

Children who exhibit more positive engagement with peers display more prosocial behaviors, have more mutual friends, and display fewer externalizing behaviors than children who exhibit less positive engagement (Criss, Pettit, Bates, Dodge, & Lapp, 2002). Within the context of positive peer relationships, children practice social skills as well as learn how to cooperate and communicate (Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006), thus developing academic competence and better school adjustment (Ladd, Herald, & Kochel, 2006).

Task orientation

Children who positively engage with tasks display enthusiasm and active involvement with classroom activities and materials. They exhibit self-directed, self-reliant, and persistent behavior when managing the social and academic demands of the classroom. These adaptive behaviors, also referred to as approaches to learning, learning behaviors, or learning-related skills, have been associated with fewer problem behaviors (Bulotsky-Shearer, Fernandez, Dominguez, & Rouse, 2011) and higher academic achievement (DiPerna, Lei, & Reid, 2007; McClelland, Acock, & Morrison, 2006), beyond the effects of intelligence (Schaefer & McDermott, 1999) and early academic skills (Li-Grining, Votruba-Drzal, Maldonado-Carreño, & Haas, 2010).

Negative classroom engagement

In contrast, negative engagement in the classroom – with teachers, peers, or tasks – is associated with less-optimal outcomes because it can detract from learning opportunities. Conflictual interactions with teachers, for example, are associated with more behavior problems, less social competence, and greater academic difficulty early in school (Pianta & Stuhlman, 2004). Similarly, having preschool peer relationships characterized by relational or physical aggression is related to greater adjustment problems (Crick, Casas, & Ku, 1999) and peer rejection (Ostrov & Keating, 2004). In addition, children who are dysregulated behaviorally and emotionally tend to have lower emergent literacy, vocabulary, and math skills in preschool than children who are not dysregulated (McClelland et al., 2007; Miller, Gouley, Seifer, Dickstein, & Shields, 2004) and through second grade (McClelland et al., 2006).

Though each of these elements of classroom engagement have demonstrated links to children's learning and development in early childhood (Burchinal et al., 2002; Li-Grining et al., 2010; Miller et al., 2004), there is very little work examining the interplay between this comprehensive approach to engagement and the emotional and organizational supports teachers offer. Allowing for a bidirectional view of classrooms may uncover behavioral cycles that typify certain classroom exchanges. One example of this comes from literature on early reading instruction, whereby teachers' affect during the reading of a book to young children and children's affective reactions had positive bidirectional relations with one another (Moschovaki, Meadows, & Pellegrini, 2007). Though bidirectional, this back and forth process was driven more by teachers than by children. Building from this type of work, the current study looks to examine the extent to which teachers' observed emotionally and organizationally supportive behaviors were linked reciprocally with children's engagement over the course of a typical preschool day.

Research Question and Hypotheses

Teachers spend their days providing children with support. Children spend their days interacting with the teacher, teacher-assigned tasks, and peers. These interactions may be best characterized as bidirectional behavioral exchanges, though few have attempted to model them in a truly reciprocal way. We propose that teachers' emotionally and organizationally supportive behaviors are tied to children's prior and following engagement

with teachers, tasks, and peers, as well as negative engagement. Thus, the purpose of the present study is to investigate the nature of these processes in the context of a typical preschool day.

In a study of over 300 preschool classrooms, we conducted observations of teachers' behavior (emotional and organizational supports at the classroom level) and individual children's engagement across an entire half-day. Our hypotheses can be summarized by the following:

1. We expect teachers' earlier emotionally and organizationally supportive behaviors to positively relate to children's later positive engagement with teachers, tasks, and peers as well as negatively relate to children's later negative engagement.
2. We expected significant, but weaker effects of children's earlier engagement on teachers' later emotionally and organizationally supportive behaviors.

Method

Participants

This study utilized data that were collected as part of a larger randomized controlled trial called the National Center for Research on Early Childhood Education (NCRECE) Professional Development Study, which aimed to improve everyday teacher-child and instructional interactions through an early childhood, 14-week course, and individualized, web-mediated coaching (MyTeachingPartner). A full description of the intervention and its results are described elsewhere (Hamre et al., 2012). Two cohorts of teachers participated in the larger study for three consecutive years. Data for the current study were used from the second year of the project for all control and intervention teachers across both cohorts (10 sites total from eight states including New York, NY; Hartford, CT; two sites in Chicago, IL; Stockton, CA; Dayton, OH; Columbus, OH; Memphis, TN; Charlotte, NC; and Providence, RI).

A total of 402 teachers participated in the second year of the project. Of these, a total of 88 attrited from the study, with a majority of those stating they were no longer teaching (other top reasons included being too busy, not being rehired/relocating, and personal/health issues). Therefore, a total of 314 teachers (287 females) were in the sample for the current study with 310 having at least one child with the child data used for current analyses. Teachers' mean age was 42 years ($SD = 10.84$), and 47% of them were African American with the second highest reported category being White at 33%. Most teachers had experience in prekindergarten where 27% of them had five or less years of experience, and 58% had 10 or less. Of children in these classrooms, 53% of them were Head Start funded, the average number of children in the classroom was 17.86 ($SD = 3.44$), and the average reported income-to-needs was 1.08 ($SD = 0.72$). A substantial proportion of classrooms were in public schools (36%).

Of the classrooms included in this study, there were 606 children (306 girls and 300 boys) who had available data. Children's mean age was 4.18 years ($SD = 0.45$), and 48% were Black or African American and 31% Hispanic or Latino. The income-to-needs ratio among

children in this sample was 1.15 ($SD = 1.03$), and mothers, on average, had 12.83 years of education ($SD = 2.10$). In terms of languages used in the home, 88% of children in this sample spoke English and 25% spoke Spanish. (This adds up to greater than 100% because some children spoke both in the home). There were no significant differences between the full sample ($N = 1407$ children & 401 teachers) and this subsample on classroom, teacher, or child demographics.

Procedure

Recruitment—The recruitment process targeted large community preschool and Head Start programs across the country by collaborating with program administrators for agreements. Teachers were considered eligible for participation if they were the lead teacher in a publicly-funded classroom in which the majority of children were eligible for kindergarten the following school year and did not have an Individualized Education Plan at the start of the current school year. In addition, classroom instruction must have been done in English for the majority of the school day, and high-speed internet access was available for the teacher's use at the program site. Teachers were invited to attend recruitment meetings in each location to learn about the study details, and additional follow-up was done by phone and email; consent forms and surveys were also completed at this time. Once teachers consented to participate, they were randomized at the site level into control and treatment sites. (One teacher was not randomized, but was retained because these are non-experimental analyses.) Teachers were provided with small stipends upon completion of various study elements.

Following teacher consent, parental consent forms and family questionnaire forms were distributed to their classrooms. Data collectors visited classrooms of consented teachers during the fall, retrieved completed parental consent forms, and determined child eligibility for study participation. Data collectors determined positive consent and eligibility (no IEP, 4-year-olds, language: English or Spanish) and then conducted a random selection procedure (using either a gender-focused or income-focused process depending on the criteria for the program). Of consented children, four children were randomly selected from each classroom for participation (two girls and two boys whenever possible). Two of those children were randomly chosen for individual observation of their engagement within the classroom. If a selected child was absent during observations, the observer automatically replaced the child with the next eligible random replacement that was present. The average number of consented children per classroom was 9.98 ($SD = 3.83$, Range 2–20).

Training—All data collectors were trained on two observational measures, the *Classroom Assessment Scoring System* (CLASS; Pianta, La Paro, & Hamre, 2008) and the *Individualized Classroom Assessment Scoring System* (inCLASS; Downer et al., 2010). All observers were required to attend an intensive two-day training on each measure and reliably code training segments before observing live in the field. Each two-day training involved a detailed review of all dimensions, combined with watching, coding, and discussing training video segments of classrooms. At the end of each training, data collectors were required to code five reliability segments independently (without discussion), and code within one point of a master code on 80% of the items to be deemed reliable for live data collection. If coders

did not meet this standard of reliability, they received individual consultation and were required to repeat reliability with new video segments. All training and reliability video segments were master coded by a group of researchers, educators, and authors of the observational systems. Average reliability rates for the first reliability test ranged from 88–91% for the CLASS, and from 90–94% for the inCLASS. Throughout the coding period, all observers attended weekly meetings that focused on assessing progress and reliability, as well as addressing potential issues of calibration. Supervised by a gold-standard-trained staff member, these meetings occurred via conference call. All observers maintained their reliability status over the five calibration segments, ranging from 80–93% on CLASS and inCLASS segments.

Observational protocol—Data collection occurred during the middle of the academic year (January-March) during two observational visits to each classroom. Observations were scheduled at the teachers' discretion and lasted for approximately four hours during the day from the beginning of the day through lunch/nap or dismissal. During each classroom visit, the teacher (using the CLASS) and two children (using the inCLASS) were observed. A typical data collection segment involved observing with the CLASS (15-minute observation and 10 minutes of coding), then observing two children in succession with the inCLASS (10-minute observation and 5 minutes of coding for each child). These classroom and child observation segments were repeated three to four times across a day. The observations occurred across all classroom activity settings except naptime, and for the CLASS observations except recess. For the current sample, the mean number of cycles observed using the CLASS was 3.51 ($SD = .60$; range = 2 to 6) and using the inCLASS was 3.32 ($SD = .62$; range = 1 to 6). In a few instances, observations began with the children (for example, because the lead teacher was out of the room). Thus, the number of teachers observed during the second cycle ($n = 312$) was greater than the number observed during the first cycle ($n = 305$). The teacher was coded as being present with the child in 67% of children's individual cycles of observation.

Measures

Both of the observational measures used in the present study – the CLASS (Pianta et al., 2008) and the inCLASS (Downer et al., 2010) – used a 7-point scale guided by detailed descriptors to indicate *low* (1, 2), *mid-range* (3, 4, 5), and *high* (6, 7) with higher ratings indicating more frequent interactions and, in most cases, higher quality.

Teachers' behavior toward children in the class (i.e., not necessarily dyads) were observed using the CLASS (Pianta et al., 2008). These behaviors are measured at the classroom level such that they are intended to reflect the average experience of a child in that classroom. Thus, they do not necessarily represent dyadic interactions, and scores reflect the behavior toward all children in the classroom, not just children being observed by the inCLASS. The CLASS measures global quality of teacher-child interactions across 10 dimensions organized into three domains: Emotional Support (Positive Climate, Negative Climate [reverse coded], Teacher Sensitivity, and Regard for Student Perspectives); Classroom Organization (Behavior Management, Productivity, and Instructional Learning Formats); and Instructional Support (Concept Development, Quality of Feedback, Language

Modeling). Following the 3-factor model validated in other studies using the CLASS (Hamre et al., 2013) codes were aggregated into the three domains at each cycle of observation during the day. Internal consistencies were calculated for each domain: Emotional Support ($\alpha = .94$), Classroom Organization ($\alpha = .84$), and Instructional Support ($\alpha = .91$). Inter-rater reliability was calculated across 20% of all cycles during live observations as two data collectors independently observed and coded the classroom where mean agreement within one point was calculated by CLASS dimensions was 90%. These levels of inter-rater reliability are comparable to that reported for the preschool CLASS when used for live observation in large-scale observational studies (La Paro, Justice, Skibbe, & Pianta, 2004; NICHD Early Child Care Research Network, 2002; Pianta, Barnett, Burchinal, & Thornburg, 2009). Intraclass correlations for the CLASS averaged .83 (ranging from .78-.88) based on blind double-coding during 20% of live visits.

Children were observed using inCLASS (Downer et al., 2010), which measures children's engagement in the classroom. Ten dimensions are rated and organized into four domains: Positive Engagement with Teachers (Teacher Engagement, Teacher Communication), Task Orientation (Engagement within Tasks, Self-Reliance with Tasks), Positive Engagement with Peers (Peer Sociability, Peer Assertiveness, Peer Communication), and Negative Engagement (Teacher Conflict, Peer Conflict, Behavior Control [reverse coded]). Following the four-factor model validated in other studies using the inCLASS (Bohlmann et al., 2013; Booren, Downer, & Vitiello, 2012; Vitiello, Booren, Downer, & Williford, 2012), ratings were aggregated into the four domains at each observation cycle during the day. Internal consistencies were calculated for each domain: Positive Engagement with Teachers ($\alpha = .68$), Task Orientation ($\alpha = .61$), Positive Engagement with Peers ($\alpha = .82$), and Negative Engagement ($\alpha = .78$). Intraclass correlations for the inCLASS averaged .80 (ranging from .65-.87) based on blind double-coding during 20% of live visits.

Data Analytic Approach

This study utilized cross-lagged autoregressive models in a Structural Equation Modeling framework (Ferrer & McArdle, 2003). The autoregressive aspect of the models refers to the fact that each variable is predicted by the same variable at the previous time point. In this case, each model had three sets of variables at four time points: one classroom domain (e.g., teachers' provision of Emotional Support) and the two children's scores from one domain of the inCLASS (e.g., children's Positive Engagement with Teachers). Because the children were randomly selected, we would not expect differences to systematically exist in the relation between variables across children. Thus, both children were included in the same model, but we constrained values to be the same across the two children. Error terms at a given time point were allowed to correlate for the children. Because CLASS domains are correlated, we wanted to account for those associations in our models. Thus, when one CLASS domain (e.g., Emotional Support) was used when relating to children's behavior, we controlled for the other two CLASS domains on the CLASS domain being tested (e.g., Classroom Organization and Instructional Support). Lastly, because data came from a study with an intervention for teachers, we controlled for study condition on the CLASS domain being tested. This model constituted the unconditional model that served as the initial basis for comparison.

Cross-lagged model comparisons—The cross-lagged aspect of the models refers to the fact that subsequent models added in associations (one set at a time) between child and teacher variables across time. For example, teachers' emotionally supportive behaviors at times 1, 2, and 3 were used to predict children's positive engagement with teachers at times 2, 3, and 4, respectively. These cross lags allowed us to test if teacher behaviors were leading indicators of children's later behavior and vice versa. Initially, both single cross lags were tested (e.g., teachers' Emotional Support to children's Positive Engagement with Teachers, then children's Positive Engagement with Teachers to teachers' Emotional Support) to see if each of these models accounted for variance in the data better than the unconditional model. Then, a model was run that included both sets of lagged relationships.

Figure 1 presents a simplified version of our model. It can be seen that there were four measurement occasions for both the teacher (middle row) and the children (one row at the top for one child and one row at the bottom for the other child). The autoregressive portions of the model are presented as the arrows that are contained within one participant (i.e., row). The lagged relationships are presented as arrows that cross from one person to another.

Determination of the best fitting model—The best fitting model was determined by examination a series of chi-square change tests. A significant decrease in the chi-square statistic means that the model was a better representation of the data than the preceding model. First, each unidirectional model was tested relative to the unconditional model. Then, the bidirectional model was tested relative to the best-fitting unidirectional model. Although the emphasis in cross-lagged autoregressive models are on the relative fit to determine the best fitting models, two other fit statistics are provided to allow for interpretation of how well the final model fit the data. Using the Comparative Fit Index (CFI) models with values of .90 or greater are considered to have adequate fit (Bentler & Bonnett, 1980). Using the Root Mean Square Error of Approximation (RMSEA), models with values below .05 are considered good and values less than .10 considered reasonable (Fan, Thompson, & Wang).

Results

Descriptive statistics for all variables used in the study are presented in Table 1. Relatively high levels of teachers' Emotional Support ($M_{T1-4} = 5.11$) and Classroom Organization ($M_{T1-4} = 5.04$) were evident in this sample. Children on average were experiencing low-moderate levels of Positive Engagement with Teachers ($M_{T1-4} = 2.44$), moderate levels of Task Orientation ($M_{1-4} = 4.39$), low-moderate levels of Positive Engagement with Peers ($M_{T1-4} = 2.56$), and little Negative Engagement ($M_{1-4} = 1.39$).

A summary of the models tested with the chi-squared difference tests are presented in Table 2 for Emotional Support and Table 3 for Classroom Organization. In our first Emotional Support model, we tested for longitudinal associations between teachers' emotionally supportive behaviors and children's positive engagement with teachers (Figure 2a). In the model testing process, both unidirectional models fit better than the unconditional model (emotional support $\rightarrow$ positive engagement with teachers $\chi^2 = 58.76$, $df = 1$, $p < .001$; positive engagement with teachers $\rightarrow$ emotional support $\chi^2 = 5.36$, $df = 1$, $p < .01$), and the bidirectional model provided a statistically better fit than the best fitting unidirectional

model ($\chi^2 = 5.10$, $df = 1$, $p < .01$; CFI = .90; RMSEA = .07). Thus, the bidirectional model was considered to best represent the data, and we concluded that teachers' Emotional Support and children's Positive Engagement with Teachers were positively related with one another over time. In other words, when teachers exhibited more emotionally supportive behaviors, children were more positively engaged with teachers at the next time point ($b = 0.23$, $\beta = 0.14 - 0.21$) and vice versa to a small extent ($b = 0.02$, $\beta = 0.02 - 0.04$). Notably, the teacher effect was much larger than the child effect.

In our second Emotional Support model, we tested for longitudinal associations between emotionally supportive behaviors and children's task orientation (Figure 2b). The best fitting model was the unidirectional model with associations from earlier emotional support to later task orientation ($b = 0.21$, $\beta = 0.14 - 0.18$), relative to the unconditional model ($\chi^2 = 53.70$, $df = 1$, $p < .001$; CFI = .91; RMSEA = .06).

In our third Emotional Support model, we tested for longitudinal associations between emotionally supportive behaviors and children's positive engagement with peers (Figure 2c). The best fitting model was the unidirectional model with associations from earlier emotional support to later positive engagement with peers ($b = 0.11$, $\beta = 0.07 - 0.12$), relative to the unconditional model ($\chi^2 = 14.88$, $df = 1$, $p < .001$; CFI = .89; RMSEA = .07).

In the fourth Emotional Support model, we tested for longitudinal associations between teachers' emotionally supportive behaviors and children's negative engagement (Figure 2d). Contrary to our hypothesis, no model provided a statistically better fit to the data than the unconditional model (all χ^2 's < 3.84 ; CFI = .87; RMSEA = .08). In other words, the best fitting model was the unconditional model, which had no lagged associations between child and teacher variables. This was confirmed by examination of the regression coefficients provided by the bidirectional model, which were both near zero.

In our first Classroom Organization model, we tested for longitudinal associations between teachers' organizationally supportive behaviors and children's positive engagement with teachers (Figure 3a). The best fitting model was the unidirectional model with associations from earlier organizational support to later positive engagement with teachers ($b = 0.17$, $\beta = 0.10 - 0.14$), relative to the unconditional model ($\chi^2 = 26.49$, $df = 1$, $p < .001$; CFI = .85; RMSEA = .08).

In our second Classroom Organization model (Figure 3b), we tested for longitudinal associations between teachers' organizationally supportive behaviors and children's task orientation. The best fitting model was the unidirectional model with associations from earlier organizational support to later task orientation ($b = 0.21$, $\beta = 0.15 - 0.18$), relative to the unconditional model ($\chi^2 = 42.88$, $df = 1$, $p < .001$; CFI = .88; RMSEA = .07).

In our third Classroom Organization model, we tested for longitudinal associations between teachers' organizationally supportive behaviors and children's positive engagement with peers (Figure 3c). The best fitting model was the unidirectional model with associations from earlier emotional support to later positive engagement with peers ($b = 0.08$, $\beta = 0.05 - 0.08$), relative to the unconditional model ($\chi^2 = 6.40$, $df = 1$, $p < .05$; CFI = .86; RMSEA = .08).

In our fourth Classroom Organization model, we tested for longitudinal associations between teachers' organizationally supportive behaviors and children's negative engagement (Figure 3d). In the model testing process, both unidirectional models fit better than the unconditional model (classroom organization $\rightarrow$ negative engagement $\chi^2 = 13.24$, $df = 1$, $p < .001$; negative engagement $\rightarrow$ classroom organization $\chi^2 = 42.37$, $df = 1$, $p < .01$), and the bidirectional model provided a statistically better fit than the best fitting unidirectional model ($\chi^2 = 13.87$, $df = 1$, $p < .01$; CFI = .86; RMSEA = .08). Thus, the bidirectional model with Classroom Organization and children's Negative Engagement negatively associated with each other over time, was considered to represent the data the best of the four models. The results suggest that when teachers evidenced more organizationally supportive behaviors, children were less negatively engaged at the next time point ($b = -0.05$, $\beta = -0.07 - -0.09$) and, likewise, when children were more negatively engaged, teachers provided fewer organizational supports at the next time point ($b = -0.15$, $\beta = -0.09 - -0.10$). Notably the child effect was somewhat larger in magnitude than the teacher effect according to the unstandardized estimate (which is constrained to be equal over time), but were virtually identical from the vantage point of standardized estimates (which can vary because of modeled error).

Because of the non-normality of the negative engagement variable, we conducted a Bayesian estimation of the Negative Engagement models: One model for Emotional Support and the other for Classroom Organization. Bayesian estimation allows for non-normality in the data because it is a non-parametric test. We looked to see whether lags were statistically significant using Bayesian estimators (and with uninformed priors). The results mirrored the results of the maximum likelihood analyses and thus the maximum likelihood estimates are presented in the figures and tables for consistency.

Discussion

Three findings emerged from the present study. First, we found strong evidence for lagged directional associations from teachers to children. Second, lagged associations from children to teachers were found in the cases of two bidirectional models. Third, we found no evidence for any lagged associations between teachers' emotionally supportive behaviors and children's negative engagement.

Associations from Teachers to Children

Developmental theory states that the behavioral exchanges between a person and their environment produces development (Bronfenbrenner & Morris, 2006) whereby the environment affects the person and the person affects the environment (Sameroff & MacKenzie, 2003). However, in classroom settings, certain behavioral exchanges between teachers and children may be more powerful in one direction than in others. In our study, seven of eight models (five unidirectional and two bidirectional), found evidence for associations from teachers' behavior to children's engagement. This is, perhaps, not surprising given the nature of classrooms whereby teachers are meant to affect children's development more so than children affecting the teacher. Ultimately, even relatively passive teachers are directing the activities for the class throughout the day. Thus, the present study

supports the notion that classrooms are unique developmental contexts whereby teachers tend to exert strong influences on children's behavior, but that children can in some instances affect the teachers' later behaviors as well.

Emotionally supportive behaviors had positive associations with later positive engagement with teachers, tasks, and peers. This suggests that multiple facets of children's engagement are connected to interactions with the teacher (Fredricks et al., 2004). Classrooms that have positive, supportive environments seemed to help children engage in classroom activities. This is reminiscent of Maslow (1943) whose model, applied to education, implies that children's emotional needs must be met before learning needs. Emotional support seems to be meeting children's emotional needs during preschool, which may allow children to engage productively in the classroom.

The fact that organizationally supportive behaviors had positive associations with later engagement with teachers, tasks, and peers, suggests that orderly classrooms help children display adaptive classroom behaviors and avoid negative, maladaptive behaviors. This finding is consistent with past research that found classroom organization, in particular, to be particularly important in children's development of self-regulation (Rimm-Kaufman et al., 2009). Just as teachers may be important in setting positive classroom tone, teachers' behaviors can establish an organizationally supportive environment that supports children's work. Children's ability to actively engage with tasks can help avoid problem behaviors and promote academic achievement (Bulotsky-Shearer, Bell, Romero, & Carter, 2013; McClelland et al., 2006).

Examination of the coefficients suggests stronger effects were evident for teachers' behavior with children's positive engagement with teachers and task orientation than for positive engagement with peers. This makes sense in light of the fact that teachers have more control over children's interactions with themselves and with the tasks. Engagement with peers on the other hand can be set up by the teachers' emotionally and organizationally supportive behaviors, but, ultimately, the teacher is not directly a part of the peer-to-peer interactions.

Associations from Children to Teachers

Teachers' emotionally supportive behaviors and children's positive engagement with the teachers formed an asymmetric behavioral cycle whereby the social-emotional features of teachers' behaviors were related to higher levels of children's engagement with teachers later and children's positive engagement was related to teachers but only to a small extent. This offered some support for the view of classrooms as settings for bidirectional behavioral exchanges (Bronfenbrenner & Morris, 2006). Stronger evidence was found between teachers' organizationally supportive behaviors and children's negative engagement, but, in this instance, higher levels in the teacher behavior were related to lower levels in the corresponding child behavior at the next time point and vice versa.

What is it about these two sets of associations that may account for their reciprocal nature? One way to explain this is to note that some child behaviors draw the attention of the teacher, even if that teacher is not present with the child. In other words, certain child behaviors are potent directors of teachers' behaviors, regardless of whether or not the

teacher is working with that child in a whole group, small group, individually, or not at all. An example can be seen in instances of negative engagement where a child may draw the ongoing attention of a teacher who is not even nearby. In this way, a disruptive child's behaviors continue to echo (negatively) in the teacher's behaviors, even if the disruption has stopped. In other words, a single negatively engaged child may be disruptive to the classroom atmosphere. The teacher may struggle with effectively dealing with the negatively engaged student and, in turn, have lower levels of organizational support that persist. This highlights the need for the equipping of teachers to better handle these conflictual interactions in the moment, so that classroom organization does not suffer throughout the day.

The bidirectional associations were not just seen with negative engagement. There was also some support for the view of bidirectional, positive relations between teachers' emotionally supportive behavior and children's positive engagement with teachers. It could be that teacher behavior with positive, social-emotional features may help to promote a child's positive orientation toward the teacher – a welcome finding. In other words, a positive classroom environment appears to some extent to be self-sustaining. Because these emotionally supportive environments have been linked to children's social development (Mashburn et al., 2008), these efforts are not only more pleasant for children, but are also helpful in developing important skills. This pattern of bidirectional associations implies that these elements of classroom processes cannot be fully disentangled from one another. Thus, it is important to view development in context, in this case, over the course of a typical preschool day.

It is helpful to look at the relative sizes of the coefficients that compare the paths from the teacher to the child and from the child to the teacher. In the model examining teachers' emotionally supportive behaviors and children's positive teacher engagement, the size of the effect was much greater from the teacher to children than from children to the teacher. This indicates that teachers may be particularly important in setting the positive emotional tone for the classroom and that children may be particularly sensitive to the positive elements of the classroom environment (Moschovaki et al., 2007). Conversely, the model examining teachers' organizationally supportive behaviors and children's negative engagement suggests the opposite. Teachers' organization may inoculate children from negative engagement to a limited extent, but if children are negatively engaged, the levels of organization are likely to suffer even more.

No Links Between Teachers' Emotionally Supportive Behaviors and Children's Negative Engagement

Much classroom-based research involves helping teachers manage and address the challenging behaviors of children who are negatively engaged (Raver et al., 2008). The present study suggests that teachers' provision of emotionally supportive behaviors will not help prevent children's negative engagement. In other words, children's negative engagement was not associated with the teachers' emotional supportiveness over time. However, as noted earlier, teachers' provision of organizational supportiveness was related to lower levels of children's negative engagement over time. Other research has indicated

that teachers' provision of emotional support and classroom organization form a positive feedback loop with one another during the day (Curby, Grimm, & Pianta, 2010). And teachers' emotionally supportive behaviors have a number of positive relations to later child outcomes (Burchinal et al., 2008; Howes et al., 2008). Thus, teachers' provision of emotional support can still be seen as important in classroom functioning and child outcomes even though it was not an effective way to prevent negative engagement. The present study simply delimits the utility of teachers' emotionally supportive behaviors in producing more positive outcomes and not decreasing negative ones within a day (Downer et al., 2010).

Limitations and Future Directions

A few limitations require mention in the study. First and foremost, it is notable that the CLASS measures what is being offered to a typical child in the classroom (Pianta et al., 2008) and not necessarily what is being offered to the two specific children that were observed. This may be one reason why we found teachers had more instances of statistical influence on children's later behaviors. It could be that if similar observations were made of children, whereby all children were observed and their scores were aggregated, children's behaviors may have been found to affect teachers more than we found. Furthermore, teachers' behaviors can and do vary by the child with which they are interacting. Thus, future work should observe the dyadic associations between teacher and child pairs and even incorporate more children in a classroom. This approach may allow for an exploration of gender differences, which we could not explore because both children were modeled simultaneously and in most instances the genders were mixed across InCLASS classroom observations. Additionally, we note that the child and teacher observations were not measured simultaneously. Ideally, future research would not only offer sequential (i.e., longitudinal) observations of teachers and children, but would also have multiple observers in the classroom to capture both classroom supports and child behaviors simultaneously. Relatedly, the present design also had the same observer coding classrooms and children (thus requiring the sequential design). Thus, we cannot rule out bias as a source of variance in the associations. As such, future research could have multiple raters of teachers and children either conducted live in the classroom or later with classroom videos. Lastly, internal consistencies of the task orientation and positive engagement with teacher scales were adequate, but lower than the reliability for other key variables. This was likely due in part to these scales having only two indicators, but, even so, could have attenuated relations in our models.

Implications

Despite the rising acknowledgment that learning in early childhood classrooms is a socially-mediated process, limited research has explored the dynamic and bidirectional nature of behavioral exchanges between teachers and students. Results from the present study indicate that throughout the day, teachers' emotionally and organizationally supportive behaviors are linked with how children subsequently engage with the teachers, available tasks, children's peers, and, to some extent, how the children negatively engage. This underscores the ongoing, challenging work that teachers face each day to sustain an emotionally and organizationally supportive stance, but also the powerful role that teachers have in setting

the stage for children's engagement. Since classroom-to-child associations were generally stronger than child-to-classroom associations, the findings suggest that, overall, there is some efficiency offered with teacher-oriented interventions. In other words, children's behavior is generally more contingent on teacher behavior than teacher behavior is contingent on child behavior. Then again, the fact that Classroom Organization and children's Negative Engagement were bidirectional suggests that joint teacher- and child-focused interventions in these respective domains may provide the largest changes in teachers' supportive behaviors and children's engagement (Raver et al., 2009). In addition, it might be useful to embed messages about the reciprocal relations between certain teacher and child behavior in the classroom within professional development offerings for teachers and center directors. Teaching can be a highly stressful endeavor, particularly when serving high-need, at-risk children, leading to burnout and turnover. Perhaps some of the perceived pressure faced in this role could be partially reduced by acknowledging how much the children are bringing to each behavioral exchange.

The fact that some teacher and child behaviors were bidirectional, and others were not, suggests that further work is needed in developmental theory to account for when certain environmental-child influences are best characterized as bidirectional and when they are not. In other words, some sets of behaviors operate more independently than others, whereby children's behaviors are linked to some aspects of teacher behaviors but others are not. The most robust bidirectional association was between classroom organization and children's negative engagement. This is an area that has received a lot of attention as disruptive behavior is a hindrance to learning and a concern of teachers (Graziano, Reavis, Keane, & Calkins, 2007). Furthermore, this negative behavior spiral can be compared to a coercive parenting cycle (Patterson, 1982) whereby the negative behaviors of parents and children build off of one another (Arnold et al., 1998). Given the negative nature of these interactions, and the fact that emotional states can emanate beyond just an individual teacher and child (Barsade, 2002), the present study suggests that interventions should focus on disrupting this cycle to promote positive classroom environments.

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Figure 1.

A.

B.

C.

D.

Figure 2.

A.

B.

C.

D.

Figure 3.

Table 1

Descriptive statistics for each variable used in study

	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Emotional Support Time 1	305	5.27	0.94	2.50	7.00
Emotional Support Time 2	312	5.09	1.02	2.00	7.00
Emotional Support Time 3	297	5.05	1.05	1.75	7.00
Emotional Support Time 4	171	5.02	1.00	2.25	7.00
Classroom Organization Time 1	305	5.18	0.90	2.00	7.00
Classroom Organization Time 2	312	5.13	0.96	1.67	7.00
Classroom Organization Time 3	297	4.97	1.00	1.67	7.00
Classroom Organization Time 4	171	4.86	0.96	1.33	7.00
Instructional Support Time 1	305	2.47	1.09	1.00	5.33
Instructional Support Time 2	312	2.45	1.10	1.00	5.67
Instructional Support Time 3	297	2.23	1.07	1.00	5.67
Instructional Support Time 4	170	2.07	0.98	1.00	5.00
Child 1 Positive Engagement with Teachers Time 1	306	2.73	1.40	1.00	7.00
Child 2 Positive Engagement with Teachers Time 1	292	2.64	1.42	1.00	7.00
Child 1 Positive Engagement with Teachers Time 2	303	2.54	1.43	1.00	6.50
Child 2 Positive Engagement with Teachers Time 2	294	2.37	1.29	1.00	6.50
Child 1 Positive Engagement with Teachers Time 3	289	2.35	1.24	1.00	6.50
Child 2 Positive Engagement with Teachers Time 3	273	2.26	1.17	1.00	6.00
Child 1 Positive Engagement with Teachers Time 4	135	2.36	1.22	1.00	7.00
Child 2 Positive Engagement with Teachers Time 4	112	2.30	1.13	1.00	5.50
Child 1 Task Orientation Time 1	306	4.33	1.15	1.00	7.00
Child 2 Task Orientation Time 1	293	4.41	1.20	1.50	7.00
Child 1 Task Orientation Time 2	303	4.50	1.23	1.50	7.00
Child 2 Task Orientation Time 2	294	4.49	1.23	1.50	7.00
Child 1 Task Orientation Time 3	289	4.49	1.20	1.00	7.00
Child 2 Task Orientation Time 3	273	4.32	1.13	1.00	7.00
Child 1 Task Orientation Time 4	135	4.35	1.21	1.50	7.00
Child 2 Task Orientation Time 4	112	4.25	1.12	1.00	7.00

	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Child 1 Positive Engagement with Peers Time 1	306	2.89	1.38	1.00	7.00
Child 2 Positive Engagement with Peers Time 1	293	2.63	1.34	1.00	6.67
Child 1 Positive Engagement with Peers Time 2	303	2.62	1.32	1.00	7.00
Child 2 Positive Engagement with Peers Time 2	294	2.63	1.27	1.00	6.67
Child 1 Positive Engagement with Peers Time 3	290	2.65	1.34	1.00	6.33
Child 2 Positive Engagement with Peers Time 3	273	2.44	1.13	1.00	6.67
Child 1 Positive Engagement with Peers Time 4	135	2.42	1.18	1.00	5.67
Child 2 Positive Engagement with Peers Time 4	112	2.23	0.95	1.00	5.00
Child 1 Negative Engagement Time 1	306	1.38	0.57	1.00	4.83
Child 2 Negative Engagement Time 1	293	1.37	0.54	1.00	4.00
Child 1 Negative Engagement Time 2	303	1.40	0.63	1.00	4.67
Child 2 Negative Engagement Time 2	294	1.38	0.55	1.00	4.67
Child 1 Negative Engagement Time 3	290	1.40	0.63	1.00	4.67
Child 2 Negative Engagement Time 3	273	1.32	0.55	1.00	5.33
Child 1 Negative Engagement Time 4	135	1.46	0.69	1.00	6.00
Child 2 Negative Engagement Time 4	112	1.45	0.73	1.00	6.33
Intervention Condition (1 = yes)	314	0.70	0.46	0.00	1.00

Table 2

Model comparison tests for emotional support and children's engagement

Emotional Support (EMO) and Positive Engagement with Teachers (PET)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{EMO} \rightarrow \text{PET}}$	$b_{\text{PET} \rightarrow \text{EMO}}$	
Unconditional	484.66	184	-	-	-	0.87			
EMO $\rightarrow$ PET	425.90	183	58.76	1	<.001	0.89	0.23		
PET $\rightarrow$ EMO	479.30	183	5.36	1	<.01	0.87		0.02	
*Bidirectional	420.83	182	5.07	1	<.01	0.90	0.23	0.02	
Emotional Support (EMO) and Task Orientation (TO)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{EMO} \rightarrow \text{TO}}$	$b_{\text{TO} \rightarrow \text{EMO}}$	
Unconditional	456.06	184	-	-	-	0.88			
*EMO$\rightarrow$TO	402.36	183	53.70	1	<.001	0.91	0.21		
TO $\rightarrow$ EMO	443.81	183	12.25	1	<.001	0.88		0.01	
Bidirectional	401.13	182	1.24	1	n.s.	0.91	0.21	0.01	
Emotional Support (EMO) and Positive Engagement with Peers (Peers)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{EMO} \rightarrow \text{Peers}}$	$b_{\text{Peers} \rightarrow \text{EMO}}$	
Unconditional	445.90	184	-	-	-	0.89			
*EMO$\rightarrow$Peers	431.02	183	14.88	1	<.001	0.89	0.11		
Peers $\rightarrow$ EMO	445.90	183	0.00	1	n.s.	0.89		0.00	
Bidirectional	431.02	182	0.00	1	n.s.	0.89	0.11	0.00	
Emotional Support (EMO) and Negative Engagement (NE)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{EMO} \rightarrow \text{NE}}$	$b_{\text{NE} \rightarrow \text{EMO}}$	
*Unconditional	509.83	184	-	-	-	0.87			
EMO $\rightarrow$ NE	508.80	183	1.03	1	n.s.	0.87	-0.01		
NE $\rightarrow$ EMO	508.20	183	1.63	1	n.s.	0.87		0.03	

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Bidirectional	507.20	182	1.00	1	0.87	–	0.01	0.03
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* = best fitting model

Table 3

Model comparison tests for classroom organization and children's engagement

Classroom Organization (ORG) and Positive Engagement with Teachers (PET)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{ORG} \rightarrow \text{PET}}$	$b_{\text{PET} \rightarrow \text{ORG}}$	
Unconditional	554.98	184	-	-	-	0.84			
* ORG$\leftrightarrow$PET	528.49	183	26.49		1 < .001	0.85	0.17		
PET $\rightarrow$ ORG	551.54	183	3.44		1 n.s.	0.84		-0.02	
Bidirectional	524.89	182	3.60		1 n.s.	0.85	0.17		-0.02
Classroom Organization (ORG) and Task Orientation (TO)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{ORG} \rightarrow \text{TO}}$	$b_{\text{TO} \rightarrow \text{ORG}}$	
Unconditional	526.38	184	-	-	-	0.85			
* ORG$\leftrightarrow$TO	473.46	183	52.92		1 < .001	0.88	0.21		
TO $\rightarrow$ ORG	525.80	183	0.58		1 n.s.	0.85		-0.01	
Bidirectional	472.90	182	0.56		1 n.s.	0.88	0.21		-0.01
Classroom Organization (ORG) and Positive Engagement with Peers (Peers)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{ORG} \rightarrow \text{Peers}}$	$b_{\text{Peers} \rightarrow \text{ORG}}$	
Unconditional	515.67	184	-	-	-	0.86			
* ORG$\leftrightarrow$Peers	509.27	183	6.40		1 < .05	0.86	0.08		
Peers $\rightarrow$ ORG	512.89	183	2.78		1 n.s.	0.86		-0.02	
Bidirectional	505.88	182	3.40		1 n.s.	0.86	0.08		-0.02
Classroom Organization (ORG) and Negative Engagement (NE)									
Model	χ^2	df	χ^2	df	p	CFI	$b_{\text{ORG} \rightarrow \text{NE}}$	$b_{\text{NE} \rightarrow \text{ORG}}$	
Unconditional	580.14	184	-	-	-	0.84			
ORG $\rightarrow$ NE	566.90	183	13.24		1 < .001	0.85		-0.05	
NE $\rightarrow$ ORG	551.64	183	42.37		1 < .001	0.85			-0.15

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	-0.15	-0.05	0.86	0.001	< 1	13.87	182	537.77	Bidirectional ^a
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									^a = best fitting model