Research Protocol
Network-Based Classroom Intervention for Language Impairment

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I. Objectives

The goal of this study is to apply a social-network approach to investigate the effects of a peer-mediated intervention to improve socialization processes in preschool inclusive classrooms for children with language impairment, as a mechanism for improving interactions with peers, exposure to peer talk, and children's social, behavioral, and linguistic skills.

II. Background and Rationale

Language impairment (LI) is a high-incidence developmental disability that significantly elevates a child's susceptibility for peer maltreatment, including exclusion from peer social networks and victimization by peers. Studies find, for instance, that nearly 40% of preschoolers with LI are excluded from their classroom social network (Justice, Chen, Jiang, Tambyraja, & Logan, 2019) and a similar percentage of primary-grade pupils with LI are regularly victimized by their peers (Conti-Ramsden & Botting, 2004). These circumstances reflect in part the relatively poor social competence and pragmatic-language skills of children with LI (Longobardi, Spataro, Frigerio, & Rescorla, 2016), but also the socialization processes that characterize classroom settings. Specifically, as early as the preschool years, children demonstrate strong homophilic behaviors in establishing peer relationships in their classrooms (Chen, Lin, Justice, & Sawyer, 2019), preferring to play with others of the same gender, age, skill levels, and disability status. In preschool settings, children with LI tend to interact most frequently with other children with LI, even in inclusive settings serving children with disabilities and typically developing peers (Justice, Chen, et al., 2019).

The social difficulties experienced by children with LI, particularly social exclusion, can lead to numerous adversities in the short and longer term; this includes school avoidance and disliking, dis-engagement in classroom learning activities, academic under-achievement, and escalating externalizing behaviors (Buhs & Ladd, 2001; Bulotsky-Shearer et al., 2012; Fantuzzo, Sekino, & Cohen, 2004; Nakamoto & Schwartz, 2010). Peer maltreatment via social exclusion also inhibits the opportunity for children with LI to interact with peers with more sophisticated language skills, representing a key mechanism for improving the language skills of children with LI in inclusive classroom settings via well-documented 'peer effects' (Justice, Logan, Lin, & Kaderavek, 2014a). Peer effects is the phenomenon in which children's language growth is positively linked to their classmates' level of linguistic ability (Justice et al., 2014a). Peer effects have been measured by comparing the performance of individual students to the aggregated score of the group to examine effects on literacy, self-regulation, and development (Chen et al., 2019). These methods may capture a global overview of interactions, but are limited in capturing the more in-depth experiences of individual children and their teachers. The mechanism by which those peer effects work is not typically measured.

In the proposed study, we apply a social-network approach to investigate the effects of a peer-mediated intervention to improve socialization processes in preschool inclusive classrooms for children with LI, as a mechanism for improving interactions with peers, exposure to peer talk, and children's social, behavioral, and linguistic skills. We build upon a large body of work showing the positive effects of peer-mediated interventions, especially for children with autism spectrum disorder, but innovate further by (1) studying this approach for children with LI, (2) applying advanced technologies from computer engineering to rigorously explore social processes for children with LI targeted by the intervention, and (3) using social network indices in addition to child-level outcomes to assess intervention effects.

The specific goals for this study are:

1. To determine the extent to which peer-mediated pivotal response training yields direct effects on peer social interactions for children with LI in the classrooms social network.
2. To determine the extent to which peer-mediated pivotal response training yields indirect (mediated) effects on the social, behavioral, and linguistic skills of children with LI
3. To determine the extent to which peer-mediated pivotal response training targeting focal children may broadly effect the social network dynamics at the classroom level.

III. Procedures

a. Research Design

In order to validate the technology, the research team will conduct a small pilot in the summer of 2021 in two central Ohio classrooms. The goal of this small pilot is to ensure the accuracy, validity, and feasibility of technology and observation instruments that will be used in the large study overviewed below. This pilot study involves 2 inclusive preschool classrooms and an estimated 40 3- to 5- year-old children from these classroom, comprising approximately 25 children with disabilities and 15 typically developing peers. Sample estimates are based on the same calculations used in the larger study that are overviewed in the paragraph below. The same classroom eligibility criteria will be used for the pilot as the larger study (i.e., an eligible classroom must serve $\geq$ 3 children with educational determination of LI per a certified speech-language pathologist). The study team will use the same method to establish focal children and peers as the larger study overviewed below (Focal children (n = 1 per classroom): First, we identify all children's positions within the classroom social network using a teacher matrix (TRPI) conducted in summer 2021; from this network we calculate a child-level social network index (i.e., individual degree centrality; lower scores are characteristic of social exclusion (Justice, Chen, et al., 2019)). Second, teachers simultaneously complete the Developmental Pragmatic Profile (DPP) (Wiig, Secord, & Semel, 2004) for each child in the classroom. This is a 26-item psychometrically sound checklist assessing children's pragmatic skills (e.g., conversational abilities, giving information), and DPP scores have strong classification accuracy in differentiating children with LI from non-affected classmates (Justice, Ahn, & Logan, 2019). Third, teachers also use a checklist to identify children with LI in each classroom per four criteria: the child (1) is on the caseload of a speech-language pathologist, (2) has no known additional diagnoses causal of LI, such as ASD, (3) primarily communicates in English, and (4)

is greater or equal than 42 months of age. Finally, among the children with LI, we select the target child based on the lowest centrality scored weighted by DPP score, so that focal children represent the most socially isolated children with the poorest social-pragmatic communication skills.

The two classrooms/teachers participating in the pilot will complete a 6 week suite of activities to include: trainings, three storybook readings and corresponding peer mediated strategy facilitations during weeks (e,g,. Monday, Wednesday, Friday), observation of facilitation sessions by research staff

The main study involves 90 inclusive preschool classrooms/90 teachers and an estimated 900 3- to 5-year-old children from these classrooms, comprising approximately 770 children (approximately 423 of which have diagnosed disabilities) and 770 parents (N=1630). Sample estimates are based on Ohio's inclusive model of preschool special education and our prior work in these settings, in which 55% of students have disabilities (Justice, Logan, Lin, & Kaderavek, 2014b). For the proposed study, an eligible classroom must serve $\geq$ 3 children with educational determination of LI per a certified speech-language pathologist.

The study uses a wait-list **experimental design** to estimate treatment impacts, with 30 ohio classrooms assigned to the treatment condition and 20 to the control condition. All remaining 40 classrooms will be recruited by our partners at external sites and serve control condition classrooms. Within each classroom, the focal participants are 30 children with LI, one selected per classroom using a priori exclusionary and inclusionary criteria. The wait-list design allows eligible children with LI in control classrooms to receive treatment in the spring semester; this also allows for ongoing evaluation of changes in socialization processes in treatment classrooms through spring. Study methods with OSU classrooms use a sequential cohort design, with 15 classrooms participating in each of two consecutive years to disperse study activities over a 24-month period. Classrooms will be recruited via our extensive network of affiliated preschool programs across the state of Ohio, with eligible classrooms utilizing a 50/50 inclusive service delivery model (50% of children with disabilities). In the fall of each year, once all 15 classrooms are recruited, simple random assignment will be used to allocate 10 classrooms to the treatment group and 5 to the control group, with the latter implementing intervention in spring per the wait-list design. In addition, our colleagues at the University of Kansas, are employing similar observation methods. We will thus incorporate 20 classrooms (University of Kansas) to serve as control condition classrooms, allowing for a more robust sample of natural conditions in preschool classrooms across contexts.

b. Sample

This study examines the socialization experiences of preschool children with LI inclusive classrooms and the entire classroom social network. Thus, we seek to consent all children in each classroom as participants in this study. For children who are not focal children or peers assisting with the intervention, we will seek caregiver consent to observe their children in the classroom and for caregivers to complete a simple questionnaire about their children. We typically are able to actively or passively consent 90% of children in a classroom.

Focal children (n = 30). We describe inclusionary and exclusionary criteria for the 30 focal children with LI. First, we identify all children's positions (n = 495) within the classroom social network using a teacher matrix conducted in fall of the academic year; from this network we calculate a child-level social network index (i.e., individual degree centrality; lower scores are characteristic of social exclusion (Justice, Chen, et al., 2019)). Second, teachers simultaneously complete the Developmental Pragmatic Profile (DPP) (Wiig, Secord, & Semel, 2004) for each child in the classroom. This is a 26-item psychometrically sound checklist assessing children's pragmatic skills (e.g., conversational abilities, giving information), and DPP scores have strong classification accuracy in differentiating children with LI from non-affected classmates (Justice, Ahn, & Logan, 2019). Third, teachers also use a checklist to identify children with LI in each classroom per four criteria: the child (1) is on the caseload of a speech-language pathologist, (2) has no known additional diagnoses causal of LI, such as ASD, (3) primarily communicates in English, and (4) is greater or equal than 42 months of age. Finally, among the children with LI, we select the target child based on the lowest centrality scored weighted by DPP score, so that focal children represent the most socially isolated children with the poorest social-pragmatic communication skills.

c. Detailed Study Procedures

Pilot: Children and teachers participate for a 6 week period, and primary procedures are described here.

Main Study: Children and teachers participate for a 9-month period, and primary procedures are described here.

Intervention Implementation

Pilot: Focal children in the two classrooms participating in the pilot will receive peer-mediated PRT per procedures detailed by Brock et al. (Brock, Dueker, & Barczak, 2018). PRT procedures are facilitated by a classroom facilitator—a classroom teacher or teaching assistant—who will receive ongoing training and support from research staff. Focal children receive peer-mediated pivotal response treatment. With carefully identified classroom peers, facilitators hold four 15-minute training sessions with the peer group, each developing 1 of 4 strategies to use to engage with the target child. The facilitator explicitly identifies the focal child ('buddy') and asks the children to use four strategies to play with the child during center time: a) offer your buddy some play options; b) show and talk about how to play with your buddy; c) compliment your buddy; and d) show your buddy how to take turns. After the trainings are complete, the facilitator provides ongoing support to peers during center time to implement the strategies by regularly encouraging them and supporting them to use the strategies, praising them when they use the strategies well, and reviewing their interactions with the focal child at the end of center time. Facilitators provide this support during center time at least 3 times weekly for athe duration of the 6 week pilot.

Main Study: Focal children in OSU-based treatment condition classrooms will receive peer-mediated PRT per procedures detailed by Brock et al (Brock, Dueker, & Barczak, 2018). PRT procedures are facilitated by a classroom facilitator—a classroom teacher or teaching assistant—who will receive ongoing training and support from research staff. Focal children receive peer-mediated pivotal response treatment. With carefully identified classroom peers, facilitators hold four 15-minute training sessions with the peer group, each developing 1 of 4 strategies to use to engage with the target child. The facilitator explicitly identifies the focal child ('buddy') and asks the children to use four strategies to play with the child during center time: a) offer your buddy some play options; b) show and talk about how to play with your buddy; c) compliment your buddy; and d) show your buddy how to take turns. After the trainings are complete, the facilitator provides ongoing support to peers during center time to implement the strategies by regularly encouraging them and supporting them to use the strategies, praising them when they use the strategies well, and reviewing their interactions with the focal child at the end of center time. Facilitators provide this support during center time at least 3 times weekly for a 12-week period.

Data collection

Main Study and Pilot: Classroom social networks will be observed using: (1) researcher observations and (2) location tracking.

Caregivers and teacher surveys and questionnaires will be collected in the following ways 1) recorded on forms that are directly scanned into centralized study databases or 2) via an online TeleForm template accessed through a website link or on a tablet, or 3) via a survey in Qualtrics. All caregiver and teacher-report measures will use web links that automatically feed into a centralized database. Derived scores for specific measures are programmed for automatic computation. We will adhere to the highest standards in data management practices (McCartney, Burchinal, & Bub, 2006) to ensure the integrity of our data, including double-entry for any hand-entered data and regular data audits.

d. Measures and Instrumentation

Researcher observations. Researcher observations of peer social interactions are adapted from a validated observation protocol (Schaefer, Light, Fabes, Hanish, & Martin, 2010).

Pilot Study: Using trained, reliable observers blind to study hypotheses and classroom study condition, a ˜40-min observation session will be conducted in each classroom once per week during weeks 2-6 of the pilot. The observer will observe the classroom during center time and use the list of peer and focal children to structure four partial interval observation cycles; in each cycle, the observer observes each child for 15 s followed by 15 s recording and then moves to the next child. At the end of one cycle, the observer takes a 5-min break. When observed, each child is recorded for any interaction partners (up to five) based on presence of a verbal or physical exchange or parallel play in the same activity during the 15-s observation. Reliability estimates will be assessed for 10% of cycles via double-coding. Based on researcher

observations, a social network will be created for each classroom per observation window. It will be stored in a symmetric square matrix, where the rows and columns represent the classroom roster and each cell value refers to the frequency at which the pair of children play with each other.

Main Study: Using trained, reliable observers blind to study hypotheses and classroom study condition, a ˜40-min observation session will be conducted in each classroom 8-16 times over the academic year. The observer will observe the classroom during center time and use a randomized list of children to structure four partial interval observation cycles; in each cycle, the observer observes each child for 15 s followed by 15 s recording and then moves to the next child. At the end of one cycle, the observer takes a 5-min break. When observed, each child is recorded for any interaction partners (up to five) based on presence of a verbal or physical exchange or parallel play in the same activity during the 15-s observation. Reliability estimates will be assessed for 10% of cycles via double-coding. Based on researcher observations, a social network will be created for each classroom per observation window. It will be stored in a symmetric square matrix, where the rows and columns represent the classroom roster and each cell value refers to the frequency at which the pair of children play with each other.

Location tracking.

Pilot: We augment researcher observations with automated continuous location tracking to capture children's social contact with each other in the classroom. The tracking approach compensates researcher observation by continuously capturing peer social contact across classroom activities and context. For the present purposes, we will use pilot observation to validate the system of indoor location tracking to be used in the main study. For the purposes of the pilot, we will validate a Bluetooth-based identification and proximity detection system only. The Bluetooth tags, also called beacons, will be worn by children and teachers 3 per week during weeks 2-6 of the pilot. The goal is to ensure accuracy and feasibility during the main study.

Main Study: We augment researcher observations with automated continuous location tracking to capture children's social contact with each other in the classroom. The tracking approach compensates researcher observation by continuously capturing peer social contact across classroom activities and context. For the present purposes, we will use a Bluetooth-based identification and proximity detection system for a six-hour period on 8-16 rendomly selected observation days throughout the year. A bluetooth beacon and up to two audio recorders will be attached to a vest/pouch that will be worn by children and teachers participating in the study. A set of antennas located in the corners of the classroom will emit radio frequency signals, which will be detected by the tags in each participant vest/pouch. The tags will also communicate with other participants' tags to measure proximity. Based on the patterns of emission and reception of these signals, the bluetooth system identifies and locates each participant in the classroom. The set of location tracks are be analyzed to determine instances and time durations of person-to-person proximity (e.g., child near child, child near teacher). Based on the location information among children, a classroom social network will be created for each observation window.

For the proposed study, researcher observations are executed on days these location recordings occur, so that we can not only triangulate the social network data, but also validate that social networks based on location tracking validly represent authentic forms of peer socialization. Based on each social network generated from either researcher observation or location tracking across the 8-16 timepoints, the social status of each child in the classroom network will be represented by two types of individual centrality indices: degree centrality (i.e., the amount of social interactions directly associated with a child) and eigenvector centrality (i.e., the amount of social interactions directly associated with a child and indirectly associated with the child through their peers, e.g., "friends' friends"). Classroom network density is also calculated to represent the average interaction intensity in the classroom, with higher values representing a more closely connected classroom network.

Focal Child Observations and Assessments

Focal Child observations.

Pilot Study: To ensure we are able to accurately capture this proximal treatment outcome during the main study, we examine focal children's social interactions with classmates in terms of peer interactions and peer talk. These activities are conducted on the same day as the researcher observations and occur during weekly during weeks 2-5 of the pilot study. For this observation, observers will observe the focal child for 30 minutes during center time and apply a partial interval recording system involving 15 s of observation and 15 s of documentation. Two variables are captured: (1) peer interactions and (2) play interactions. For peer interactions, each interval is coded for whether nonverbal or verbal interaction was directed to or from the focal child. These simply capture the extent to which focal children interact with peers in the classroom. For play interaction, each interval is coded for four possible categories of play: appropriate peer play, appropriate solitary play, inappropriate play, and no play. These observational data are derived to represent the percentage of intervals in which behaviors are coded. Reliability estimates are assessed for 20% of observations via double-coding.

Main Study: As a proximal treatment outcome, we examine focal children's social interactions with classmates in terms of peer interactions and peer talk. These activities are conducted on the same day as the researcher observations and occur 8-16 times annually (three at least 3 during intervention). For peer interactions, we observe the peer interactions of the focal children during observations conducted over the academic year using an established protocol (Brock et al., 2018). These are conducted on the same day as the prior observation (researcher observation), with order randomized. For this observation, observers will observe the focal child for 30 minutes during center time and apply a partial interval recording system involving 15 s of observation and 15 s of documentation. Two variables are captured: (1) peer interactions and (2) play interactions. For peer interactions, each interval is coded for whether nonverbal or verbal interaction was directed to or from the focal child. These simply capture the extent to which focal children interact with peers in the classroom. For play interaction, each interval is coded for four possible categories of play: appropriate peer play, appropriate solitary play, inappropriate play, and no play. These observational data are derived to represent the percentage of intervals in

which behaviors are coded. Reliability estimates are assessed for 20% of observations via double-coding with observers blind to classroom and child condition.

Peer Talk: For peer talk, we will record the amount of incoming and outgoing talk focal children experience using a hands-free voice-activated recorder worn by each child in the vest, with audio capture transcending the entire classroom day. Teachers follow a protocol for placing the vest on each child at the start and end of the day. With multiple hours of audio recorded per child, we will process these recordings to capture duration of outgoing/incoming talk with proximate peers using the following process: (i) augment the voice-recorder ability/voice detection/processing algorithms from the Matlab Audio Systems Toolbox to determine if people are speaking, and how long they are speaking; and (ii) use 2D-proximity data from continuous location tracking to parse the audio tracks across time into the cases where there is simultaneous peer proximity and recorded voice (i.e., peer-to-peer talk for some duration of time that we can obtain from stamp data from proximity/audio recording). While our initial plan does not involve transcribing or otherwise capturing the quality of peer talk, we will pursue additional funds to analyze these audio data later.

Activity: Main Study Only: The children's and teacher's vest will also house a small accelerometer as a motion sensor. The output of this sensor will be used to detect classroom activities such as running, sitting, and sleeping.

The audio, proximity, and activity data will be processed using machine learning algorithms that will perform speech annotation, speaker diarization and analyzed for word count estimates, automatic transcriptions, sentiment analysis, and classification of the nature of the interactions, including automatic identification of child-directed speech. Some of these programs require pre-trained machine-learning models housed in the OSU-configured cloud-computing provider Amazon Web Services (AWS), i.e., the computations are carried out in AWS servers, while the data remains accessible only to OSU project staff.

Focal Child assessments.

Pilot Study: We examine focal children's language skills. For language skills, we use the teacher DPP and PLRS and parent report DPP at pre- during week one of the pilot.

Main Study: We examine focal children's social, behavioral, and language skills as potential mediated outcomes. Measures are administered at three time-points—fall, winter, and spring—of the academic year. All measures are administered using tablet-based devices for efficiency and real-time data processing. For social and behavioral skills, we use the teacher-report Teacher-Child Rating Scale (TCRS (Hightower et al., 1986)), a 32-item teacher-report instrument that captures children's social, behavioral, and emotional competence. For the proposed study, we will use the behavior control items to assess children's problem behaviors and the social competence items to capture three areas of interest: task orientation, assertiveness, and peer social skills. Teachers respond to statements on a 5-point scale (1 = strongly disagree, 5 = strongly agree) to describe each child in relation to these descriptions. This tool is easy and inexpensive to administer and yields psychometrically valid outputs on children's social and behavior issues that are applicable to children with disabilities in inclusive classrooms (Juvonen

& Bear, 1992). For language skills, we use the Developmental Pragmatic Profile (DPP) (Wiig et al., 2004), which is administered on each child in the classroom in the fall and spring (in accordance with the approved/signed infrormed consent materials), but to focal children again in winter. We examine change on each of three sub-scales: nonverbal skills; conversational skills; and asking for, giving, and responding to information. Teachers rate the child linguistic-pragmatic skills on a 4-point scale for each of 26 items. Also, we administer one subtest of the Preschool Language Screener-5 Assessment: expressive language (Zimmerman et al., 2011). We will explore avenues for data reduction, including use of a latent-variable modeling strategy. The benefit of using this measure is that we have used it in extensive prior studies of similar samples and contexts, thus permitting us to explore study findings in relation to considerably larger samples of children with LI (Justice et al., 2014a) and their approximate annual language growth.

Descriptives and possible covariates

Pilot: Teachers: Teachers will complete a survey prior to the pilot and provide demographics. The survey will also include the peer matrix and 5 questions about past social supports and experience with peer-mediated interventions. During week 6 of the pilot, teachers will complete an 8 item questionnaire to provide information on the feasibility and tolerance of implementing the pilot intervention in their classrooms; Parents: will complete an IFQ with their consent form to determine eligibility. Caregivers of peers and target children will be asked to complete one survey during the pilot, which will collect the following information: demographics, household socioeconomic status (caregiver education levels), a set of 5 items to capture child social network information; the DPP. Only focal child and peer parents who will complete the survey during the pilot.

Peer and target children will be asked to complete a brief 4 minute interview during weeks 1 and 6 of the pilot.

Main Study: Descriptives and potential covariates to be captured and explored in analyses include (1) classmates' language skills (fall and spring DPP completed for each child by teacher), (2) classroom composition characteristics including percentage of children with disabilities, gender, and age (provided by teachers in fall), and (3) focal child sociodemographic factors. For the latter, we collect a questionnaire from the primary caregiver in the fall and spring (in accordance with the approved/signed infrormed consent materials) to assess household socioeconomic status (caregiver education levels and employment status, household composition, and transience—including whether or not the family experienced a serious family event over the last school year to be answered in spring), home literacy activities per established protocols (Justice, Logan, Işıtan, & Saçkes, 2016), and child language history.

e. Confidentiality of Data

Any data collected will be de-identified to maintain confidentiality. Any participants will be assigned a subject ID. Subject IDs and names will be separated. All data will be stored in a locked cabinet. Audio, proximity, activity, observation and questionnaire record data will be downloaded to a password-protected computer. Only study personnel will have access to this data. Segments of audio, proximity, and activity data will be processed in the cloud using OSU-

configured cloud-computing service, which provide in-transit and in-use encryption of data. OSU will serve as the central data hub and the IRB of record for all study activities.

f. Internal Validity

Standardized procedures of all instrumentation will be utilized to ensure proper administration

g. Data Analysis

Aim 1 investigates the effects of peer-mediated PRT on the peer interactions and social status (indicated by individual centrality) within the classroom social network for children with LI. We assess this aim based on 6 to 24 repeated measurements for each outcome variable using multilevel growth models (Raudenbush & Bryk, 2002) to investigate changes in key outcomes over the school year and to accommodate the wait-list experimental design. Longitudinal measurements will be nested within participants and predicted by the time of measurement as well as time-specific intervention status. We include interaction terms between time of measurement and intervention status so that any accelerating or decelerating effects of intervention can be captured. In all models, we control for relevant covariates to increase precision of parameter estimates and power (Hox, Moerbeek, & Van de Schoot, 2010; Raudenbush, Martinez, & Spybrook, 2007). To assess treatment effects on peer interactions, we use the number of peer interaction, number of appropriate peer play, and duration of peer talk for the focal children as the outcome variables in the growth models. Depending on the distribution of the variables, appropriate linear or generalized linear models (e.g., Poisson) will be fitted. To examine treatment effects on social status, we compare the trajectories of individual centrality for the focal children and their classmates, controlling for classroom-level variation. Specifically, intervention effects are tested on key components of the trajectories, such as intercept, linear slope and quadratic slope (i.e., the slowing or acceleration of growth). The growth curves for different groups (treatment, wait-list control, and peer) can then be estimated. Aim 2 determines the extent to which peer-mediated PRT contributes to focal children's social, behavioral, and linguistic skills via the mediation of improved socialization experiences. For this aim, we employ multivariate latent growth models, where latent growth curves of socialization indices and child skills can be modelled simultaneously and the relationships between latent growth parameters examined. In particular, two latent slopes (fall and spring) will be specified for the socialization growth curve to capture the differential growth rate with and without intervention; intervention status will be used as a predictor of the two socialization slopes. Due to the sample size limitation, we will examine one socialization index and one skill variable at a time. We will focus on the following pathways: (a) effect of intervention on focal children's socialization experiences at fall, winter, and spring; and (b) effects of socialization experiences on child skills at fall, winter, and spring. Paths (a)*(b) allow us to test the indirect effects of PRT on social, behavioral, and linguistic skills. To estimate the mediation effect, we use the product-of-coefficient approach (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002) with a bootstrapping procedure (Preacher & Hayes, 2004, 2008). This method does not require the assumption of normality for the sampling distribution of the product-of-coefficient. Finally, Aim 3 examines changes in classroom social network dynamics over the school year, and tests the effects of peer-mediated PRT on peer socialization at the classroom level. To address this aim,

we adopt multilevel growth models similar to those described in Aim 1, except with classroom-level social network indices as outcomes and classrooms as the level-2 unit of analysis. With repeated measurements across the school year, the change rates in socialization indices can be estimated for and compared between the intervention period and control period.

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