Exportable Communication Intervention for Classroom Staff Serving Children with Autism Spectrum Disorder: Towards Improving the Feasibility of Evidence-Based Practices in Community Settings

THESIS

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Abstract

Naturalistic Developmental Behavioral Intervention (NDBI) is an intervention model for young children with autism based on behavioral and developmental principles, naturally occurring contexts and contingencies, and shared control between the interventionist and student. Recent studies have found empirical support for NDBI in controlled research trials. Further, several studies have replicated findings in community preschool settings with some degree of success. However, reported roadblocks to community implementation include teachers’ lack of time to add new components to their preschool day, insufficient staffing numbers to work in one-on-one settings with children, and difficulty understanding and applying the less structured techniques that characterize NDBI (as opposed to more manualized behavioral practices). The present study used a multiple baseline design to pilot a low intensity, exportable NDBI intervention aimed at maximizing fit with existing preschool structures. Agnostic of any one NDBI model, this study was unique in that it extracted the largely convergent, active ingredients from the literature as a whole, mapped on communication strategies to four pre-existing classroom routines, and used a low-intensity training model that prioritized feasibility. Visual inspection and points exceeding the median analyses generally supported improvements in fidelity of implementation, rate of communication, and classroom engagement for participating staff/child dyads, although results were variable across dyads. Acceptability
and feasibility feedback from preschool staff was positive, and supported this curriculum and training model as viable in community settings.
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Fields of Study

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Chapter 1: Introduction

Rationale for Early Intervention for Autism Spectrum Disorders

Autism spectrum disorder (ASD) as defined by the DSM-5 is characterized by deficits in social communication as well as presence of restricted, repetitive patterns of behavior that present during the developmental period and cause impairment in functioning (American Psychiatric Association 2013). Presently, ASD can be reliably diagnosed by 24 months of age (Lord 2007). Early detection and swift referral to services is crucial, as early intervention programs are considered pivotal in maximizing long-term outcomes (Johnson & Myers 2007). Generally, early intervention is defined as individualized instructional programs for children two to five years who are at-risk or diagnosed with Autism Spectrum Disorder. Research on this subject posits that intervention during this early, pivotal time in development can have cascading returns throughout the lifespan related to cognitive and adaptive functioning for individuals. Generally, research on populations with ASD has supported this theoretical assumption (Howlin, Magiati & Charman 2009; Turner, Stone, Pozdol & Coonrod 2006). Further, research has also supported the assumption that early intervention for children with ASD has the potential to decrease burden on the healthcare system (Jacobson, Mulick, & Green, 1998; Chasson, Harris & Neely 2007). Presently, Applied Behavior Analysis is the most widely recognized and implemented early intervention format. However in
recent years, new theories related to development have given rise to the advancement of several additional intervention models.

History of Evidence-Based Intervention for ASD

Although it is presently widely accepted in the field of ASD research that efficacious interventions exist to treat ASD, this was not always the case. Even now, there is still some debate about whether benefits of treatment for ASD justify the potential costs (Al-Qabandi, Gorter & Rosenbaum 2011). Prior to the 1980’s the prevailing belief was that children with autism were incapable of significant, meaningful improvement (Smith & Eikeseth 2010). Then in 1987, Ivar Lovaas published his seminal study “Behavioral treatment and normal educational and intellectual functioning in young autistic children,” claiming that not only could autism be treated, but that with intensive behavioral intervention, children in his study achieved “recovery” from autism symptoms (no effect size data was reported). Although subsequent research on the Lovaas/ABA model has been consistently favorable (see Reichow & Wolery 2009 for a recent review), the drastic results of his study have never been replicated, and consequently, have been called into question. However, the notion that the symptoms of autism could be effectively treated was perhaps Lovaas’ most valuable contribution to the field, and in the following decades intervention research for children with autism has grown into a large and productive field (Smith & Eikeseth 2010).

Subsequent ASD interventions based off Lovaas’ model became the first to be empirically validated, and are well supported by research (Reichow, Barton, Boyd & Hume 2014; Smith, Groen & Wynn 2000; Eldevik, Eikeseth, Jahr & Smith 2006;
Espousing operant conditioning and learning principles, Lovaas’ pioneering work gave birth to the ABA (Applied Behavioral Analysis) family of interventions for ASD. Perhaps the most well-known offshoot of Lovaas’ original work is discrete trials training (DTT), which is a common component of ASD treatment and is broadly endorsed and implemented in community settings. DTT and other members of the ABA family remain the “gold standard” in autism intervention. Presently, 45 states mandate insurance coverage for ABA-related services (Autism Speaks website). Since the language in the legislation is specific to ABA, the status of coverage for other intervention models remains uncertain.

Despite positive findings, several shortcomings of Applied Behavioral Analysis models have been characterized. Lovaas’ original model called for 40 hours a week of working at a desk for quite young children (often 3 to 4 years old) and experts have disputed whether or not this is developmentally appropriate (Weider & Greenspan 2003). Additionally, since all teaching occurs in a contrived learning environment (1:1 at a desk in an isolated, distraction-free environment) skills may generalize poorly to other settings (Smith 2001). Finally, the DTT model is composed of commands issued by the interventionist and subsequent responses by the student. Given this command-response format, it has been noted that spontaneous and social communication is not targeted (Brunner & Seung 2009; Smith 2001).

Partially in response to this, and partially as a result of advances in the field of child development, alternative intervention methods evolved which stressed the bond between the interventionist and child, natural learning contexts such as playtime, and an unstructured, child-led format. Broadly, these models are referred to as “developmental
interventions”. Some of the most popular developmental interventions include the Developmental Individual Differences Model (FloorTime), Play and Language for Autistic Youngsters (PLAY) Project and Relationship Development Intervention. Although these methods have some modest empirical support (Prizant & Wetherby 2009), they have been accurately criticized as being grounded only in theory and lacking definitive empirical support (Brunner & Seung 2009).

Along with the shortcomings of developmental interventions, the problems with ABA methods remain: limited generalizability of skills to other contexts and failure to target the social communication deficits that characterize ASD. In response to the shortcomings of both behavioral and developmental approaches, a new class of ASD interventions has emerged that attempts to combine the strengths and ameliorate the weaknesses of both.

Naturalistic Developmental Behavioral Intervention

Specifically, Naturalistic Developmental Behavioral Intervention (NDBI) is an emerging intervention model based on behavioral and developmental principles, naturally occurring contexts and contingencies, and shared control between the interventionist and student (Schreibman et al. 2015). In some ways, the emergence of NDBI can be seen as a convergence of two of the leading lines of ASD intervention research: those based on developmental and those based on behavioral principles. NDBI interventions utilize the elements that give developmental interventions strength: naturally occurring contexts and contingencies (play, daily living routines, etc.) and emphasis on the development of social, spontaneous communication. Importantly, they also stress utilization of behavioral principles and modification (ideas borrowed from the ABA family of
interventions), allowing for more structured teaching opportunities than strictly developmental interventions.

Although specific NDBI interventions may be branded differently, NDBI interventions are all characterized by the same overarching principles, and researchers have noted a need to identify and delineate principles of efficacious interventions to encourage dissemination (Rogers & Vismara 2008; Schreibman et al. 2015). Two well-researched models include the Early Start Denver Model (ESDM) and Pivotal Response Training (PRT). Particularly, ESDM has been the subject of the largest clinical trials, and offers some of the most convincing evidence for the efficacy of NDBI interventions. Results have consistently been positive, with notable gains in cognitive and communication measures (Smith et al. 2010; Dawson et al. 2010; Rogers et al. 2012). In their randomized controlled trial (n=48), Dawson and fellow authors found significantly better results for toddlers in the ESDM group on measures of adaptive functioning and remittance of core ASD symptoms. Indeed, as compared to controls, after two years of active intervention those in the ESDM group were more likely to move from a diagnosis of autism to a diagnosis of PPD-NOS (Dawson et al. 2010). Gains in adaptive behavior, intellectual functioning and symptom severity were maintained during a prospective follow-up two years later (Estes et al. 2015).

Apart from ESDM, Pivotal Response Training is likely the next most widely recognized NDBI model, and a number of studies have consistently supported its efficacy (Mohammadzaheri, Koegel, Rezaee, & Rafiee 2014; Smith, Flanagan, Garon & Bryson 2015; Gengoux et al. 2015). Additionally, both ESDM and PRT have commercially available manuals, which is likely a crucial factor in their success. Many other NDBI
models exist, and have also garnered empirical support (Kasari et al. 2014; Ingersoll, Lewis & Kroman 2007; Yoder & Stone 2006).

Presently, two multisite randomized controlled trials are underway comparing the efficacy of DTT against NDBI models (clinical trials.gov Identifier: NCT01751698 & Identifier: NCT01018407). The ICAN (Interventions for Communication in Autism Network) study aims to compare the efficacy of the two intervention models, whereas the AIM-ASD (Adaptive Intervention for Minimally-Verbal Students with Autism Spectrum Disorder) study utilizes a multi-stage, adaptive randomization design to determine whether non-responders have greater success in a “blended” intervention model (a combination of NDBI and DTT). Forthcoming outcomes from these trials will likely greatly impact the field of ASD intervention research.

Translational Research: Community Members as Implementers

In addition to spurring the implementation of head-to-head trials, the relatively recent proliferation of NDBI models and supporting research has encouraged a line of translational research. Specifically, many researchers in the field are focusing on translating efficacious NDBI interventions into programs that can be implemented by stakeholders (namely parents and teachers) in community settings. Parent training studies, and more recently teacher training studies, aim to encourage sustainability and widespread dissemination in this way, thus minimizing resource intensity. These groups are good candidates for training, as both spend large amounts of time with target children, and therefore have the potential to greatly impact their development. Further, all NDBI models are unified in their emphasis on naturally occurring contexts (Schreibman et al.)
2015), thus making implementation in community settings a natural extension of successes in more controlled settings.

Teacher and parent training studies have generally reported good outcomes on unstructured, video-coded primary measures (including social engagement and social communication), but weaker findings on standardized measures (Goods, Change & Kasari 2012; Kaale, Sponheim & Smith 2012; Lawton & Kasari 2012; Kasari, Gulsrud, Paparella, Hellemann, & Berry 2015) and mixed results in terms of maintenance at follow-up (Kaale, Fagerland, Martinsen & Smith 2014; Kasari et al. 2014).

NDBI in Preschool Settings

Specifically regarding preschool settings, substantial barriers remain to widespread adoption of evidence-based practices. Recent research has indicated that teachers do not use evidence-based practices, or will modify them in unsupported ways (Stahmer, Collings & Palinkas 2005). Further, teachers report time, staffing and funding issues as barriers to implementing evidence-based practices (Maras, Splett, Reinke, Stormont & Herman 2014). These findings could be indicative of a bad fit between evidence-based practices in their present form (1:1 with a trained clinician) and the constraints of community-based settings. In light of this, there is a clear need for more research aimed at adapting evidence-based practices into formats that are feasible in community settings (Dingfelder & Mandell 2011).

In one study with positive findings, teachers were trained to implement an NDBI curriculum. However intervention took place one-on-one in a separate room, thus calling into question feasibility in classroom settings, where individualized instruction may be limited (Kaale et al. 2012). Conversely, in another study NDBI intervention was
successfully administered in a group setting by teachers. However, teachers in the
treatment group underwent such an extensive fidelity and certification program that it
may be reasonable to wonder whether they can truly be considered community
implementers, as opposed to trained research staff (Vivanti et al. 2014). At the very least,
it is questionable whether such rigorous fidelity standards can be implemented in
widespread community settings. These studies represent good intermediary attempts at
community implementation, but highlight the need for future research that integrates
both community-based settings and feasible stakeholder implementation.

In perhaps the most convincing research effort in terms of procedurally feasible
preschool implementation, Kasari and Lawton trained teachers to implement an NDBI
program in their preschool classrooms (2012). Curriculum targets were taught for one
hour each week for six weeks, and even at this modest dosage, target children initiated
more communication and spent more time engaged in classroom activities. This study is
encouraging to the field of preschool implementation, and future studies should focus on
replicating and expanding upon these targets. Shortcomings of this study include
emphasis on play–based strategies, which may not generalize to other classroom routines,
as well as utilization of materials, namely toys, purchased by study grants and not found
in the classroom. A second iteration of this study focused on using materials found in the
classroom, as well as integrating intervention efforts into an existing center-based
classroom routine (Chang et al. 2016). Findings for social communication and staff
fidelity were generally positive and maintained over time. However, the staff to child
ratio was substantially higher than might be expected in typical preschool classrooms
(1:2).
Implementation Fidelity

One concern regarding translational studies is preservation of implementation fidelity. In one recent study, teachers were trained in one of three different evidence-based curricula in order to examine procedural fidelity (Stahmer, Rieth & Connell 2015). It was found that procedural fidelity for Pivotal Response Training, an NDBI intervention, was significantly lower than either of the other two interventions (Discrete Trials Training and Functional Routines Training). Researchers hypothesized that the well-manualized and clear procedural information of DTT may have promoted mastery for teachers (Stahmer et al. 2015). Contrastingly, Pivotal Response Training emphasizes use of clinical judgment and a less scripted, more spontaneous format. According to the authors of this study, this may have been more challenging for teacher-implementers. Finally, the authors also speculated that several of the components of Pivotal Response Training may have been a poor match for classroom formats, and thus were ignored by teachers. These findings highlight the need for research that adapts the evidence-based practices of NDBI interventions into manualized, context-sensitive formats.

Although the findings discussed above are concerning, it is important to note that implementation fidelity for community members is not expected to match that of trained clinicians (Lawton & Kasari 2012). Therefore, even though most studies report good parent/teacher fidelity to intervention procedures, they are not measured against the same standards as professionals (particularly given the relatively small training dosage of most studies), and thus intervention quality will generally be lower.
The Present Study

Treatment interventions in their present form, as implemented 1:1 with a trained professional, are not sustainable in terms of resource intensity, nor are they suitable for the contexts in which the majority of young children with ASD currently receive services. Further, there is evidence to suggest that even when NDBI strategies are presented, teachers may struggle with the less-prescriptive format and clinical judgment involved for implementation (Stahmer et al. 2015). Despite these roadblocks, stakeholders, including teachers and parents, have expressed interest in interventions that focus on social communication (Iadarola et al. 2015). For this reason, future research must focus on adapting presently existing models into formats that meet the needs of teachers and work well in classroom settings.

Using a multiple baseline, teacher-training model, the present study attempted to advance this goal in several ways. First, classroom teachers were targeted as intervention implementers as opposed to research staff, who withdraw at the conclusion of the study. Targeting this population could lead to increased sustainability of intervention practices, as well as better outcomes for students over time.

Second, the intervention was not only sensitive to, but specifically tailored for classroom activities. Preexisting classroom routines were identified, and NDBI targets were mapped onto them, thus encouraging a better fit between intervention format and preschool settings. Finally, all curriculum procedures and materials were manualized with the intent of encouraging procedural fidelity, as well as making the curriculum exportable into other community settings. Staff members were assessed regarding procedural fidelity to determine intervention feasibility in community settings.
Additionally, measured child outcomes included changes in quality and quantity of communication targets as well as quality of classroom engagement.
Chapter 2: Methods

Design

A multiple baseline design across three staff/target child dyads was used to examine the efficacy of an 8-week NDBI-based staff training intervention in The Nisonger Center’s Early Childhood Education Center. Baseline data was collected to measure how the target child and staff member were presently interacting prior to the onset of training. Baseline length ranged from two to five weeks. From a research perspective, varying baseline length in this way is done in part to demonstrate that change is dependent on the onset of training, and is not an artifact of the baseline length itself, or any other temporally sensitive variable (e.g., staff and children becoming more comfortable with filming, dyads building rapport over time). In this way, one can more carefully isolate their variable of interest (the effect of intervention). Dyad one received a two week baseline, dyad two received a three week baseline, and dyad three received a five week baseline. In clinical usages, baseline data collection continues until a stable, consistent pattern emerges. However for this research study this was not feasible (due to time constraints and exceptionally heterogeneous baselines. Further, it may not be the best choice from an empirical perspective. Specifically, to begin to build causal arguments from multiple-baseline data, baselines must vary for the reasons discussed above. From a research perspective, it may be beneficial to make these decisions a-priori maintain impartiality and proper control.
Active intervention start dates were staggered by at least one week. Baseline data collection consisted of weekly ten minute videos from two separate preschool contexts that were to be the focus of intervention, as well as at least one generalization probe video of a different classroom context, meant to serve as a probe for generalization of strategies. Participating staff members were instructed to attempt to be within camera frame with the target child and interact as they typically would. It was also reiterated that they should feel free to step away to manage other classroom responsibilities as necessary.

Following baseline data collection, each participating classroom staff member was scheduled to receive eight weeks of active intervention. Each dyad began active intervention in the unstructured context only (outdoor gross motor play). Following four weeks of scheduled instruction specific to the unstructured context, dyads began instruction specific to a structured context.

Staff and child absences, and breaks to the academic calendar led to durations of active intervention longer than the intended 8 weeks. However, dosage was held fairly consistent across dyads, with all completing >80% of scheduled sessions. Weekly ten minute video clips were collected to capture changes in implementation fidelity, rate of child communication, and child social engagement in classroom activities. As in baseline, video clips were taken twice weekly during active intervention (once in each of the two targeted contexts). Approximately once every other week, an additional ten minute video clip was taken in a non-targeted classroom context to probe generalization. Follow-up data was scheduled to be collected at one month intervals for the three months following the end of active intervention, as allowed by scheduling. For dyads one and
two, staff turnover and changes in classroom assignment made follow-up data collection impossible.

Participants

Recruitment

One student/staff dyad was identified in each of three classrooms of the Nisonger Center’s early childhood education program, which serves approximately 50 children ages 1-5 with developmental delays/disabilities.

Target Staff Members

Target classroom staff were recruited based on willingness to participate in the study, amount of contact with target child, and feasibility of intervention implementation (given existing schedules and responsibilities). Since classroom teachers have many competing responsibilities, recruitment efforts were extended to other classroom staff members. Specifically, teacher aides often spend large amounts of one-on-one time with students, but usually have the least amount of training. Therefore, the present study attempted to recruit from this population. However, high rates of turnover and scheduling challenges limited the recruitment sample to classroom teachers.

Target Students

Target students were identified based on a previous diagnosis of ASD, as reported by parents to classroom teachers. To further verify the presence of an Autism Spectrum Disorder, inclusion was contingent upon the results of the Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2), administered by a licensed psychologist or by the lead author under the supervision of a licensed psychologist.
Inclusion Criteria for Target Children.  
The following inclusion criteria were used to determine study eligibility:

1. Male or female presently enrolled in the Nisonger Center’s early childhood program.  
   No explicit age cut-offs were used. However, recruitment out of the Nisonger  
   Center’s toddler and preschool classrooms constricted the age range of participants to  
   18 months to 5 years.

2. DSM-5 diagnosis of *Autism Spectrum Disorder* per parent report and as supported by  
   an administration of the *Autism Diagnostic Observation Schedule*-2, administered  
   under the supervision of a licensed psychologist.

3. Expressive language delay (score at least one SD below the mean) as indicated by the  
   Mullen Scales of Early Learning.

*Screening Procedures*

Target Children

Recruitment flyers were sent home to parents by classroom teachers in the backpacks  
of potentially eligible children. If parents returned the flyers indicating interest, they  
were contacted by phone and screened for interest in study participation and fit with  
inclusion criteria. Next, an in-person meeting was scheduled to provide further details  
about the study, obtain consent and perform a confirmatory ADOS-2 administration.  
Other intake assessments were completed at this time or during breaks in the child’s  
regular preschool day if more convenient for parents.

Target Staff Members
All classroom staff were informed of the goals of the study, and eligible participants were identified based on interest, level of contact with target children and feasibility of intervention procedures given their preexisting schedules. One potential concern was that staff might feel pressure to participate, given the Nisonger Center’s affiliation with both the early intervention program and study investigators. Efforts were made to ensure that staff members understood their participation was voluntary and that willingness to participate had no effect on job performance.

**Scheduling and Attrition**

After obtaining IRB approval, recruitment began in the summer of 2016. Data collection began in August of 2016, and concluded in March of 2017. In the case of all three dyads, significant disruptions and delays were experienced to the original baseline and intervention schedules. Sessions and data collection points frequently needed to be postponed and rescheduled due to breaks in the school’s academic calendar, as well as staff and child absences. For dyad one, one in-class session was unable to be rescheduled. Intervention was completed in ten weeks. For dyad two, two in-class sessions were missed and unable to be rescheduled due to child transitioning to preschool. Active intervention lasted nine weeks. For dyad three, all sessions were completed. However, significant disruptions, including winter holidays and planned and unplanned school absences significantly extended intervention duration (19 weeks). No didactic instruction sessions were missed for any dyad. While duration varied, dosage was held relatively constant. All dyads received >80% of the originally scheduled dosage.
Although the intervention schedule needed to be extended or abbreviated dependent on scheduling challenges, all recruited participants completed the study. However, barriers to study participation, particularly for target children, may have affected the sample. Specifically, reliable transportation to the Nisonger center to complete intake assessments, ability to communicate regularly with classroom staff, and ability to enlist the help of a translator when necessary, limited recruitment efforts to a subset of eligible children.

**Target Child Measures**

The following assessments were completed at baseline for the purposes of subject characterization:


The ADOS-2 is a valid and reliable tool for diagnosing ASD (Hus & Lord 2014). Based on chronological age and language level, the target child in dyad one participated in an administration of the Toddler Module, while children in dyads two and three received Module One. Both modules of the ADOS-2 are semi-structured, play-based assessments of social-communicative skills and behaviors designed to assist in the diagnosis of ASD.

2. *Mullen Scales of Early Learning (MSEL)*

The MSEL is a structured developmental assessment designed for children ages birth to 68 months (Mullen 1995). The visual reception, fine motor, expressive language, and receptive language scales were administered to each child prior to beginning the baseline period. To participate, children needed to demonstrate an expressive language delay (scores at least one SD below the mean) as expressive communication is one major focus of the intervention. In addition, previous research suggests that children with ASD
functioning at a higher intellectual level tend to respond more favorably to intervention. Given the possible moderating effects of global intellectual functioning, scores on all four major domains of the MSEL will be reported to support future meta-analytic efforts. The MSEL was administered by the lead author under the supervision of a licensed psychologist. All participating children evidenced developmental delays, with all Early Learning Composite scores falling in the Very Low range. For the purposes of this study, participating children needed to have an expressive language delay; all scores for Expressive Language fell in the Very Low range.

3. Early Social Communication Scales

The Early Social Communication Scales (ESCS) was used to characterize baseline levels of social communication including joint attention, gaze-shifting and shared enjoyment. The ESCS is a semi-structured play-based assessment that features specific presses for social and behavioral communication targets. The examiner presents a series of toys to the child, many of which they will need to request help to activate. The examiner also sets up several opportunities for shared enjoyment and reciprocal social interaction. The assessment takes 15 to 25 minutes, and is most appropriate for toddlers and preschool-age children. Previous research has supported the use of the ESCS as a valid and reliable measure of social communication (Mundy, Ungerer & Sherman 1986; Mundy et al. 2007). Results of this assessment were used to gauge communicative level for intervention planning. They were also used to qualitatively characterize the sample for dissemination efforts. Finally, the ESCS is commonly administered as a part of treatment studies for NDBI interventions. Therefore, the present study will collect this data for future qualitative reviews and meta-analytic efforts. The ESCS was administered
by the lead author and coded for initiating and responding to joint attention by an undergraduate research assistant trained to reliability (kappa > .7 on three consecutive training videos).

4. Demographics Questionnaire

One caregiver for each participant completed a demographics questionnaire (see Appendix I).

Target Staff Measures
At baseline, target staff members completed a form regarding demographic information including education level and years of experience working with students with ASD. They also completed a questionnaire regarding their comfort working with students with ASD (see appendix J). Since this study was a pilot with the forward-looking intention of informing future research efforts, qualitative feedback regarding feasibility and acceptability was collected from participating staff members (see appendix I for the questionnaire used). Additionally, a questionnaire containing Likert scale ratings and open-ended questions regarding comfort working with students with ASD was administered pre and post treatment to qualitatively assess for change (appendix J).

Dyad characterization

Dyad one

01 was a male aged 31 months at the beginning of the study who had an existing diagnosis of ASD. His MSEL Early Learning Composite standard score was a 54, falling in the Very Low range. His Expressive Language T-score of 32 was the highest of the three participants, but also fell in the Very Low range. 01 used single words and occasional phrases to communicate. He rarely used gestures. 01 was administered
Module One of the ADOS-2, and his calibrated severity score was a five. His score fell in the moderate range of ASD-related symptoms. On the ESCS, 01 used words to request, and asked for help by giving the examiner objects. When the examiner pointed to pictures around the room and in a book, 01 sometimes visually followed her points, but did not do so consistently. 01 also shared enjoyment by holding toys up and showing them to the examiner and his mother, as well as directing smiling facial expressions at them. 01’s classroom was a toddler, inclusion classroom with approximately 50% typically developing peers, and 50% children with disabilities. He attended this classroom two days per week for 2.5 hours per session. Approximately 6 to 14 children were present daily with two to three staff members. Dyad one’s staff member was a lead classroom teacher with a graduate degree and eight years of experience working with students with ASD.

Dyad two

02 was a male aged 38 months at the beginning of the study who had an existing diagnosis of ASD. His MSEL Early Learning Composite standard score was a 50, falling in the Very Low range. His Expressive Language T-score of 20 also fell in the Very Low range. He infrequently used directed communication but did use occasional single words. He participated in Module One of the ADOS-2, and his calibrated severity score was an eight. His score fell in the severe range of ASD-related symptoms. On the ESCS, 02 was not able to request help or access to toys held out of reach using either gestures or verbal communication, frequently trying to grab the toys himself. 02 responded to and enjoyed social interaction initiated by the examiner (singing tickle games). However, he did not spontaneously initiate social interaction in this setting on his own. 02’s classroom was a
preschool, inclusion classroom with a ratio of ten typically developing children to four
children with disabilities. He attended this classroom four days per week for 2.5 hours
per session for special education services. Approximately 10 to 14 children were present
daily with two to five staff members. Dyad two’s staff member was a lead classroom
teacher with a bachelor’s degree and three years of experience with children with ASD.
Dyad three

03 was a male aged 23 months at the beginning of the study who had an existing
diagnosis of ASD at the start of the study. His MSEL Early Learning Composite
standard score was a 67, falling in the Very Low range. His Expressive Language T-
score was a 25 and also fell in the Very Low range. He used gestures, a handful of signs,
and vocalizations to communicate. He was administered the Toddler Module of the
ADOS-2, and his calibrated severity score was a six. His score fell in the moderate to
high concern range. On the ESCS, 03 did not consistently respond to the joint attention
bids of the examiner, and was not able to request help when needed (e.g., open a jar with
toys inside). 03’s classroom was a toddler, inclusion classroom with a ratio of 10
typically developing children to four children with disabilities. He attended this
classroom three days per week for child care and early intervention programming, and
was often accompanied by an Applied Behavior Analysis aide during his time in the
classroom. Approximately 10 to 14 children were present daily with two to three staff
members. Dyad three’s staff member was a lead classroom teacher with a bachelor’s
degree and one year of experience working with students with ASD.
Target Child Demographics

Children in the study were racially diverse (one Caucasian, one Asian, one African-American). Average household income was relatively high ($81,000-$130,000) for all three participants.

Intervention Procedures

Overview

Naturalistic, Developmental Behavioral interventions (NDBIs) are characterized by emphasis on behavioral and developmental principles, naturally occurring contexts and contingencies, and shared control between the interventionist and student (Schreibman et al. 2015). NDBI can be seen as an emerging in response to the limited generalization to naturally occurring contexts that characterizes some highly structured ABA curriculums, as well as to the lack of structure and behavioral control that may limit the efficacy of strictly developmental interventions. In its present form, NDBI combines elements of both methods into interventions targeting social communication in naturally occurring contexts using behavioral principles.

Curriculum

Several NDBI manuals were reviewed for convergent themes, and these were adapted to fit within classroom routines: JASPER (Joint Attention, Symbolic Play, Engagement and Regulation), PRT (Pivotal Response Training), ImPACT (Improving Parents as Communication Teachers), RIT (Reciprocal Imitation Training), ESDM (Early Start Denver Model), and SCERTS (Social Communication and Emotional Regulation Transactional Support) (Kasari 2012; Koegel & Koegel 2012; Ingersoll & Dvortcsak...
This intervention did not espouse one specific NDBI model, but adapted key features from several manualized models. Setting the precedent for this, leading researchers in the field have noted the utility in considering NDBI techniques holistically and the need for the dissemination of evidence-based practices as general principles, rather than specifically branded interventions (Schreibman et al. 2015; Rogers & Vismara 2008). Importantly, this should not be done at the expense of keeping practices well characterized and manualized.

For this study, key components adapted from NDBI interventions included identification of developmentally appropriate verbal and nonverbal communication targets, setting up opportunities for communication during daily routines, getting and maintaining child attention using exaggerated affect, and using least to most prompting sequences to teach communication targets. See appendix C for an annotated list of NDBI strategies that were integrated when creating the classroom communication intervention. Strategies from these efficacious interventions were then mapped onto pre-existing classroom routines and packaged in a clearly delineated, exportable fashion with the intention of optimizing both feasibility for classroom staff and outcomes for students. See appendix D for full curricula that were used in this study.

During active intervention, each participating staff member received four didactic instructional sessions (approximately 40 minutes), two in the beginning of active intervention, one at the midpoint and one at the conclusion. For each of the eight weeks, dyads also received one in vivo coaching session during targeted contexts (approximately 20 minutes). Often, NDBI principles are taught in a serial fashion over the course of
many weeks. Then in the final weeks of training, they are integrated into applied settings. However, in an effort to streamline the curriculum and expedite learning into a timeframe that might be feasible in community sessions, strategies were introduced simultaneously in applied formats, as applicable to the identified contexts. See appendix E for session guidelines. It is hypothesized that teaching the curriculum in a more abridged, integrated and applied manner will minimize the intensity of resources necessary to make a clinically significant difference.

Targeted Classroom Contexts

Two classroom contexts were targeted for each staff/student dyad: one structured and one unstructured. For structured contexts, staff members chose between a “snack/lunch time” curriculum and a “story time” curriculum, depending on what best met their needs and the needs of the child. Staff members also chose one unstructured curriculum: either “free play” or “outdoor/gross motor play.” All three dyads chose outdoor/gross motor for their unstructured context. Dyads one and three chose snack/lunch time for their structured context, while dyad two chose story time. All dyads began with instruction related only to the unstructured context, and then progressed to instruction in the structured context approximately halfway through treatment.

Overview of Instruction Schedule

Historically, NDBI parent and teacher training programs focus on one constituent concept per week over the course of treatment (e.g., environmental arrangement, modeling developmental appropriate language, etc.). Focusing concepts discretely over time may facilitate a more nuanced understanding of the intervention. However, this approach often leaves only a session or two at the end to address concepts in a complete,
integrated manner. Further, application to other, untargeted daily routines is often covered briefly in a single session. The instructional approach in the present study was novel in that it presented intervention concepts in an integrated fashion early on in treatment, with the intention focusing on increased coaching in applied settings throughout intervention to make the most of this minimal intensity design and aid generalization. Appendix E contains the intervention schedule and additional information regarding specific content covered each week.

**Outcome Measures**

Videotaped data was collected twice weekly during both baseline and intervention phases: once in the targeted structured context (e.g., snack, book reading) and once in the targeted unstructured context (e.g., free play, motor time). Videotaped data was collected primarily by undergraduate research assistants. Occasionally (approximately a dozen times), the lead author (who also served as the interventionist) collected video-taped data, when made necessary by scheduling conflicts. Approximately, every other week, a videotaped generalization probe was collected in a non-targeted context. Contexts for the generalization probes were largely determined by scheduling limitations, and were collected during activities such as free play, songs and stories, sensory table, and arts and crafts. Additionally, videotaped follow-up data was collected at one month intervals following the conclusion of active intervention for dyad one. Scheduling and transitioning of children to new classrooms or programs precluded the collection of follow-up data for dyads two and three. Each video was approximately 10 minutes long. All primary outcome measures (as detailed below) were scored from these videotapes.
Implementation Fidelity

Many NDBI fidelity measures use Likert scale ratings from one to five on several broad domains. Rating videos holistically in this manner relies heavily on clinical expertise, and many introduce subjectivity. Since videos were to be rated by undergraduate research assistants, it was thought that using a more fine-grained approach would make coding more objective and accurate for relatively inexperienced raters.

Intervals of two minutes were coded for each of the nine intervention components (0% for not present/poorly implemented, 50% for somewhat present/sometimes appropriately implemented and 100% for present and appropriately implemented). These ratings for each two minute interval were then averaged across three broad domains (encouraging engagement, building routines, and language). The fourth domain, prompting for communication, was coded in an event driven manner. Each prompt for communication was rated either as a yes (100%) or no (0%) for each of the four components under this domain. Finally, each of the four domains was averaged for a final fidelity score. See appendix F for additional coding details.

Implementation fidelity was coded using pencil and paper by blinded undergraduate research assistants with previous experience implementing an NDBI intervention who were also trained by the lead author in this model.

Communication

Communication data was coded continuously from video clips using Mangold INTERACT software (Mangold 2017). Children’s use of communication was coded for overall rate of communicative bids (e.g., gestures, vocalizations, words per codeable
minute of video), and communicative intent (goal directed behavioral requesting versus social/shared enjoyment). See appendix G for communication coding details. Communication was coded by a blinded undergraduate research assistant trained by the lead author.

*Engagement States*

Engagement states were coded continuously from video clips using Mangold INTERACT software (Mangold 2017). An adaptation of the coding scheme detailed in Adamson and Bakeman (2004) was used (see appendix H for complete coding details). Data was interpreted by examining percent time spent jointly engaged (with another person, or with another person and objects/toys). Engagement state data was coded by the lead author and a trained undergraduate research assistant.

*Qualitative Feedback*

Since this study was a pilot with the forward-looking intention of informing future research efforts, qualitative feedback regarding feasibility and acceptability was collected from participating staff members (see appendix I for the questionnaire used). Additionally, a questionnaire containing Likert scale ratings and open-ended questions regarding comfort working with students with ASD was administered pre and post treatment to qualitatively assess for change.

*Analyses*

Data was graphed and visually analyzed to look for patterns of change from baseline to active intervention (Kazdin 2011) across the three primary outcome measures: engagement state, communication targets and implementation fidelity. To further characterize change on these measures, a points exceeding the median (PEM) analysis
was also used and interpreted. A guideline of PEM ≥.70 was used to characterize effectiveness, as suggested by Ma (2006). Finally, feasibility and acceptability feedback from staff participants was collected and is qualitatively discussed.

Study Aims and Hypotheses

Primary Aim One

The primary aim of this study is to determine whether classroom staff are able to reach fidelity to NDBI practices after an 8-week didactic and consultation program that streamlines information into a practical, integrated format accompanied by supporting materials.

Hypothesis

Lower levels of procedural fidelity will be observed during baseline, with scores improving throughout active intervention. Implementation fidelity for the structured and unstructured context will improve independently with the onset of teaching in each specific context. Staff will achieve levels of fidelity ≥80% at the conclusion of intervention.

Primary Aim Two

The second primary aim of the study is to use qualitative feedback from participating staff members regarding feasibility and acceptability to inform future research efforts. Feedback will be evaluated with an eye for whether the proposed intervention is satisfactory and acceptable for staff, beneficial to students, and reasonable to incorporate into their preexisting classroom routine. This feedback will be pivotal for future revisions to the intervention to improve feasibility and acceptability, as well as future dissemination efforts.
Secondary Aim One

A secondary study aim is to examine whether target child communication bids increase in frequency and quality as a result of active intervention. Since conclusions about long-term improvements in child outcomes are not supported by this pilot study design, this measure may be best thought of as a secondary measure of implementation fidelity and feasibility. More specifically, setting up opportunities and prompting for communication are central aims of this intervention. If staff are able to implement these strategies to fidelity, increased rates of communication will be elicited from target children. This may further signal that the intervention is feasible in classroom settings. Increases in socially motivated communication and goal oriented communication will be examined separately in an exploratory fashion to see if consistent patterns of change emerge.

Hypothesis

During active intervention, communication bids by target children will increase in frequency, relative to baseline scores, as indicated by graphical representation of data over time. It is hypothesized that communication rate for the unstructured and structured context will improve independently with the onset of teaching in each specific context.

Secondary Aim Two

The next secondary aim of this study is to determine whether improvement in classroom social engagement can be observed with minimal intervention dosage and resource intensity. Specifically, improvement will be defined as increased time spent jointly engaged. Like secondary aim one, since conclusions about long-term
improvements in child outcomes are not supported by this pilot study design, this measure may also be best thought of as a secondary measure of implementation fidelity and feasibility. More specifically, improving engagement is a central aim of this intervention, and if staff are able to use strategies effectively to improve child engagement, it may signal that intervention strategies are feasible in the classroom environment.

Hypothesis

Visual inspection of classroom engagement data is predicted to reflect greater time spent jointly engaged during active intervention as compared to baseline. It is hypothesized that joint engagement for the unstructured and structured context will improve independently with the onset of teaching in each specific context.
Results

Reliability Analyses
For communication and fidelity of implementation, 25% of videos were independently coded by the lead author and a trained research assistant to examine inter-rater reliability. Two way random, absolute agreement intra-class correlation coefficients were used to probe agreement. Implementation fidelity had an overall ICC of .78. Total communicative utterances had an ICC of .88. Broken out by function, joint attention communicative bids had an ICC of .91 and behavioral requesting communicative bids had an ICC of .86. The lead author was the primary coder for the engagement states data, and a blinded undergraduate research assistant served as the reliability coder. The ICC for joint engagement was .86.

Video-Coded Outcomes

For each of the three video coded outcome measures, two baseline medians were calculated for each dyad to reflect the staggered nature of onset of teaching in the unstructured and structured context. The unstructured context baseline was calculated for data points collected prior to the onset of coaching in context one, which was outdoor/gross motor play for all dyads. The “structured” baseline was calculated using data prior to the onset of teaching in context two, which was snack/lunchtime for dyads one and three, and songs/story time for dyad two.
Dyad one

Dyad one began with high levels of baseline fidelity (unstructured and structured median of 88%), and thus the fidelity measure was not sensitive to change in the unstructured context (PEM=20%). Although the points exceeding the median analysis looked promising for the structured context (PEM=100%), the magnitude of change was slight, and given that only two treatment data points were collected, results were unconvincing.

Dyad two

Relative to the other dyads, dyad two had moderate to low levels of fidelity at baseline (unstructured context median of 78% and structured context median of 75%), and some marginal evidence of positive change was detected in the unstructured context (PEM=64%), and more consistent positive change in the structured context (PEM=80%).

Dyad three

Dyad three had the lowest level of baseline fidelity (unstructured median of 63% and structured context median of 68%), and the greatest positive change was observed (unstructured PEM=100% and structured PEM=100%). It was hypothesized that fidelity in the second context would not improve significantly until the onset of specific teaching in that classroom activity. However, visual inspection of the data show that overall, onset of teaching in the unstructured context also saw an increase in fidelity in the structured context, where explicit teaching had not yet taken place. Follow-up data appeared consistent with treatment rates of fidelity at one month. At two and three months, fidelity
dropped back down closer to baseline levels in the unstructured context. Scheduling challenges related to staffing shortages made collecting follow-up data at the two and three month time points impossible in the structured context.

Conclusions
The fidelity coding scheme may have suffered from a general lack of sensitivity, particularly for dyad one. For dyads two and three, there was evidence in at least one teaching context of fidelity improvement. For dyad three (who showed improvement in both contexts), this improvement began with the onset of teaching in context one. Generalization probes (activities that were neither context one or two) also appeared to trend with onset of instruction and overall rates of fidelity.

Communication (figure 2)

Dyad one
Dyad one had the highest baseline rates of communication, median of 1.4 and 1.2 communicative bids per codeable minute, in the unstructured and structured context, respectively. While a points exceeding the median analysis did not clearly indicate positive change (PEM=60%), visual inspection revealed a positive overall trend in data points in the unstructured context. For this dyad clear, interpretable change was likely limited by an unstable baseline and relatively few data points. However, an increase in communication in the structured context was visually clear (PEM=100%). In contrast with the other dyads, improvements in this second teaching context for dyad one appeared to hinge on the onset of specific teaching in that classroom routine.

Dyad two
For dyad two, significant improvements in rate of communication were observed for both the unstructured context (PEM=82%) and the structured context (PEM=80%).
As with the fidelity results, improvement in the second (structured) teaching context occurred concurrently with onset of teaching in the first (unstructured) context. In both contexts, baseline rate of communication (communicative bids per minute) was relatively low (unstructured median of .3 and structured median of .15), with a decreasing baseline in the unstructured context. Prior to the onset of teaching in context one, baseline points in context two were all centered near zero bids per minute. Although visual inspection supports clear and consistent improvement in both contexts, significant heterogeneity persists throughout treatment.

Dyad three
Dyad three evidenced consistent increases in rate of communication in the unstructured context. The trend is visually clear, and supported by a points exceeding the median analysis (PEM=86%). While a points exceeding the median analysis indicated positive change in the structured context as well (PEM=75%), the heterogeneity of communication rate in both baseline and treatment made patterns visually unclear, and ultimately unconvincing. Follow-up data generally indicated decreases relative to treatment rates of communication.

Behavioral requesting and joint attention
Increases in socially motivated communication (joint attention) and goal directed communication (behavioral requesting), were also examined to probe whether increases in one function over the other drove changes from baseline to treatment, as well as if structured versus unstructured contexts facilitated improvements in different communicative functions. However no consistent patterns emerged (see figures 4 and 5).
Conclusions
Overall, the communication coding scheme data appeared more sensitive to change than the fidelity data, with all dyads evidencing clear improvements in at least one context. However, which context dyads were most successful in (structured or unstructured) was not consistent. Unlike the fidelity data, generalization probe points did not trend with other increases observed throughout treatment.

Engagement (figure 3)

Dyad one
For dyad one, no clear change in percent time spent jointly engaged was evident in the unstructured context (PEM=40%). As with the communication data however, joint engagement in the structured context steeply increased with the onset of teaching in that specific context (PEM=100%). Supporting this interpretation, baseline rates of joint engagement in the structured context appeared visually stable and relatively low (median of 9%). After the onset of teaching in the structured context, rates sharply improved.

Dyad two
For dyad two, baseline time spent jointly engaged was significantly higher (19%) in the unstructured context relative to the structured context (5%). As with communication, significant improvements in time spent jointly engaged were observed in the unstructured context (PEM=91%). The baseline heterogeneity in the structured context for this dyad made trends less clear. However, visual inspection revealed that half of baseline data points were near zero, and that some evidence of increases in time spent engaged in the structured context began with teaching in the unstructured context, and appeared more consistent with the onset of teaching in the structured context (PEM=80%).
Dyad three

Dyad three’s baseline joint engagement rate was somewhat higher during the unstructured context (12%) than the structured context (6%). Dyad three evidenced consistent increases in rate of joint engagement in the unstructured context (PEM=86%). While points exceeding the median analysis indicated positive change in the structured context as well (PEM=100%), the relatively small magnitude of this change made a convincing trend difficult to see. As with the communication outcomes, follow-up data generally indicated a return to baseline rates of joint engagement.

Conclusions

For all three dyads, trends in engagement data were relatively consistent with trends in the communication data, with all dyads evidencing improvement, although this improvement is differentially supported by context. Also like the communication data, generalization probes of untaught contexts evidenced no improvement throughout treatment.

Staff Qualitative Feedback

Feasibility and Acceptability

On a five point Likert scale, all staff members rated items related to acceptability as a four or a five, indicating that they agreed or strongly agreed that the intervention was appropriate and helpful. Also on a five point Likert scale, all staff members rated items related to feasibility as either a four or a five, indicating that they generally thought that implementing strategies was feasible within their classrooms. Staff members also responded to open ended questions regarding barriers to implementation in the classroom, and what changes they would make, if any, to intervention procedures. While staff members reported some barriers, such as short-staffing limiting the amount of time they
could work with the students, overall barriers were regarded as minimal. Some suggested changes included wanting to make the curriculum available to classroom assistants, and to include curriculums for center-based activities. All teachers provided written feedback about which components of the interventions they found most useful, and reported “strongly agreeing” that they would implement intervention strategies in the future (see appendix I for full results from this questionnaire).

Comfort Working with Students with ASD

Participating staff members also filled out a five point Likert scale questionnaire pre- and post-intervention about their comfort and ability to work with students with ASD (e.g., “I have strategies for encouraging communication for students with ASD,” “I am able to encourage classroom engagement for students with ASD”). Both pre and post intervention onset, teacher one rated herself as a five out of five, indicating the highest level of competence, on nearly all items. However, both teachers from dyads two and three rated themselves, on average, one point higher on the majority of items post intervention (see appendix J for full results from this questionnaire).
Discussion

Overall, evidence from qualitative and quantitative measures suggested that a modular, classroom-based NDBI intervention may be feasible and acceptable for intervention in toddler/preschool classrooms. However, different contexts were more successful for different dyads, with some appearing to respond better to intervention in structured contexts and others evidencing more change in unstructured contexts. Additionally, significant heterogeneity in both baseline and treatment phases was evident. Although barriers to implementation were encountered (e.g., scheduling limitations and teachers’ competing responsibilities) staff qualitative feedback was generally positive. Regarding feasibility, significant challenges (e.g., participant recruitment, school closures, participant absences) made study efforts more lengthy and time intensive than originally prescribed. This outcome is not unusual for community-based research projects, and suggests that future efforts should account for this in funding, scheduling and timeline estimation.

Video Coded Outcomes

Fidelity of Implementation

While fidelity improved somewhat for dyad two and markedly for dyad three, dyad one showed no change. Overall, implementation fidelity was not as sensitive to change as the other two measures: rate of child communication and improvements in classroom engagement. Several factors may have limited the sensitivity of this measure.
Specifically, baseline fidelity was negatively associated with points exceeding the median (PEM). Dyad one, with the highest rate of baseline fidelity evidenced the least amount of change. While dyads two and three, with moderate and relatively low baseline fidelity, evidenced relatively more improvement and marked improvement, respectively. This pattern suggests that high baseline fidelity may have resulted in a constricted range of scores which limited sensitivity to change, particularly for dyad one. This interpretation is also supported by examining teacher experience and education. The teacher in dyad one had a graduate degree, eight years of experience working with children with ASD, and previous experience with NDBI models. The participating teacher in dyad two had a bachelor’s degree and three years of experience with children with ASD. Finally, the teacher in dyad three, who registered the greatest change, had the least amount of experience and training, with one year of experience working with children with ASD and a bachelor’s degree. This pattern may indicate problems with the sensitivity of the measure. However, it may also suggest that this intervention is more appropriate for paraprofessionals or staff with more limited training and experience at baseline.

Another factor that may have limited sensitivity is that fidelity was the relative inexperience of the raters. While all three coding schemes were developed to be as objective as possible, the implementation fidelity coding scheme in particular necessarily required more clinical expertise. While both raters had experience implementing NDBI interventions in one-on-one research settings, how these interventions should look in different classroom settings may have been a challenging conceptual leap. This may have limited their ability to reliably code more advanced or subtle changes to implementation fidelity, further limiting the sensitivity of the measure.
Finally, the fidelity coding scheme was developed by the lead author for the purposes of this study, and it is possible that the measure itself was not sensitive enough to change. Presently, rigorous efforts are underway in other research groups to develop and pilot an NDBI fidelity measure that does not ascribe to any one model (Frost & Ingersoll, study in progress). Future research efforts should continue to explore this issue.

One issue that the translational nature of this project introduced was how to account for the environment when scoring fidelity. Specifically, often competing classroom demands hindered high quality implementation in the way it is traditionally defined in research settings (e.g., behavioral management of multiple children necessitating teachers sitting behind target children, competing attentional demands forcing teachers to end prompting sequences prematurely). The present study scored situations such as these generously, with the intention of focusing on teacher behavior rather than the challenges introduced by the environment. While there was value in focusing on this, the significant challenges introduced by the environment are not reflected in the data. This may have been useful information to gather systematically for a pilot feasibility study. Future research efforts should carefully consider at the outset what information they wish to capture with an implementation fidelity measure.

In general, clinical impressions of improvement dovetail more with the communication and engagement states data than the fidelity data. For example for dyad one, significant changes were implemented to improve quality of engagement during the structured context. Improvements as a result of these changes are well-reflected in the
communication and engagement coding schemes, but do not register change on the fidelity coding scheme; the same applies to both contexts for dyad two.

*Communication Rate and Engagement States*

For the purposes of this pilot feasibility study, the communication and engagement data are best thought of as secondary measures of fidelity. If teachers are able to use strategies to increase engagement at acceptable levels of fidelity, child engagement level should increase. Similarly, if teachers are able to effectively prompt for and encourage communication, child communicative bids should increase. In this way, increases in child behavior as measured by these coding schemes are best interpreted as direct functions of teacher behavior.

Unlike the fidelity coding scheme, the communication and engagement coding schemes are more objective, require less clinical expertise, and were not developed specifically for this study, but were based strongly off of existing measures which, while not norm-referenced, have been well-standardized and shown to be sensitive to change. Perhaps as a consequence of this, more subtle patterns emerged. Further, trends in communication rate and engagement state data followed the same general patterns. This is logically consistent, as joint engagement with another person is a prerequisite for effective, directed communication. In turn, observing the two move together is a good validity check for the two coding schemes, which were developed and coded independently.

For both joint engagement and communication rate, dyad two evidenced consistent changes across structured and unstructured contexts. However, for dyad one these variables only increased in the structured context. Conversely, dyad three’s
communication rate only increased convincingly in the unstructured context. Overall, these trends are consistent with clinical impressions from both the trainer and target staff members, and suggest that intervention strategies were differentially successful according to treatment context and dyad.

Specifically, the target staff member in dyad one was already using the majority of the intervention principles in an effective manner, particularly in the unstructured context. Although the trainer tried to address this by focusing on more sophisticated child skills (e.g., prompting for phrases instead of single words) and the target staff member was positive and receptive, ultimately, relatively few changes were likely made to staff and child behavior in this context. Additionally, in addition to having the shortest baseline, dyad one missed many data collection time points due to scheduled school breaks and inconsistent child attendance. Consequently, this may have made consistent patterns challenging to see in the unstructured context. In the structured context however, significant changes were made and are convincing in spite of the relative lack of data. During baseline in the structured context, the target child generally was not interested in eating during this time and spent the duration of mealtime unengaged and/or requesting to leave the space. With the onset of teaching context two, the interventionist and the target staff member worked on different engagement strategies (e.g., modeling play acts, pretending to feed toys, social imitation) to increase social interaction in this context. Unlike the unstructured context, both the interventionist and the staff member noted that these changes were successful and significantly altered behavior during this time. These impressions were supported by the steep increase in communication rate with the onset of teaching context two.
For dyad three, consistent changes were present in communication rate and time spent jointly engaged for the unstructured context, but not for the structured context. In the structured (mealtime) context, both the staff member and the interventionist noted challenges with intervening during this time. In particular, during this time of day, fewer staff members were typically present, and the teacher to child ratio was often significantly lower. In addition, the target teacher had many competing responsibilities, such as prepping meals for children and managing challenging behaviors. Given this, lack of consistent change in the context may be best attributed to variability in the target staff member’s ability to focus on the intervention and the target child. Contrastingly, during the unstructured classroom routine (outdoor/gross motor play), more adults were typically present, and classroom responsibilities were less demanding. This may be why improvement in communication rate was more consistent in this context.

Dyad two displayed increases in communication rate and time spent jointly engaged across both contexts that began with the initial onset of teaching in context one. The magnitude of this increase was substantial, (baseline medians of .3 and .155, and final treatment data points at 3.6 and 2.5). While the overall positive trend is striking and convincing, heterogeneity was noted throughout treatment (with some treatment phase data points still occasionally dropping down to zero). Clinical impressions noted by the interventionist suggest that, as with dyad three, significant day to day fluctuations in staff to child ratio may account for some of this variability. Specifically during the structured context (story time), sometimes the typically developing peers were present, and story time was done in a larger group. Other times, the typically developing peers were elsewhere, and story time was conducted with just one to three other children. In
addition to variability introduced by the classroom setting, much variability can likely simply by attributed to daily fluctuations in target child setting variables (e.g., present mood, present physical comfort level, amount of daily stress experienced prior to intervention time).

Generalization

While generalization probes for the fidelity data generally trended with overall increases in rate of fidelity, this was not the case for the joint engagement and communication rate data. Visual inspection indicates no consistent patterns on these variables, as well as a relative lack of positive change. While the fact that improvements in the structured context with the onset of teaching in the unstructured context were frequently observed across measures seems to argue that target staff members were able to generalize intervention strategies, this relative lack of change in the generalization probe videos seem to argue against this conclusion. It may be the case that being filmed consistently in the structured context while learning strategies tailored for the unstructured context may have encouraged teachers to actively think about how best to apply learned principles to this classroom routine, and in turn, more effectively implement the strategies.

Long-term sustainability, once research staff support withdraws, continues to be a challenge for community-based research projects. Follow-up data, collected for dyad three at one month intervals, generally indicates that results were not consistently maintained over time. Since follow-up data could only be collected for one dyad, conclusions about the long-term viability of this intervention model are premature.
However, future research projects should continue to consider sustainability in the design and planning phases.

Discussion of Qualitative Feedback

In general, feedback for feasibility, acceptability, and staff-reported improvement in working with students with ASD was positive, with minimal noted barriers. Regarding acceptability and perception of improvement, staff were asked to respond to the open-ended question: “Did this intervention improve your ability to interact with students with ASD? How so?” In response to this question, staff members identified specific areas of improvement. Feedback included:

While only working with one student this intervention has taught me skills that I will be able to carry out & use with all students in the classroom! I think the level of prompting that we used is an important skill I will carry away with me because it is something you can individualize for the child you are working with, some kids may need a full physical prompt while others may be able to skip that step completely. This study has helped me be more aware of exactly what I’m doing during lunch time and gave me good ideas of how to get the students to have conversation at the table (Teacher three).

[One helpful strategy was] the use of pointing to get a “correct” response when not talking. Also exaggerating the emotion helped not only the student but others that I work with daily… I will take the interventions and apply them to other students! Thanks!(Teacher two).

[The intervention] also helped me with focusing on one-on-one interactions while still being able to facilitate activities within my centers (Teacher one). When asked what could be changed to make the intervention more effective, one teacher reported: “I think this would have been a better opportunity for the assistant teacher in my classroom. Assistant teachers don’t always get the trainings the leads do so I think it would be very beneficial” (Teacher one). This intervention was initially developed with the aim of targeting teacher aides in classrooms; thus, this observation
from one teacher (who had the highest baseline fidelity) supports the use of this curriculum with paraprofessionals. Another suggested change was to “make the interventions during center time” (Teacher two). The four intervention curriculums did not specifically address centers (small group activities where students rotate among sensory play, “blocks and trucks”, “pretend play” stations). However, the “Free Play” curriculum, which was not selected as an implementation context by any of the teachers, may be adaptable to these classroom contexts.

Future Directions

As pilot study, the central goal of this research effort was to inform future research efforts, particularly in regard to minimal intensity, community-based models. Specifically, several practical and clinical recommendations emerged.

Clinical Recommendations

This training model was novel in that it “front-loaded” the didactic instruction of intervention components and presented them in a relatively integrated manner. Clinical impressions and staff feedback were generally positive. From a theoretical perspective, this model is designed with the intention of leaving more clinical time throughout treatment available for practice and coaching of the complete model (rather than presenting constituent pieces individually over the course of weeks, with relatively little time to practice the intervention in its complete form). Additionally, in a short-term (8-10 week) intervention model, this approach may make more sense, as it prioritizes in vivo
practicing of the model in its complete form, which may aid comprehension and long-term sustainability.

Additionally, focusing on teaching in a variety of specific applied contexts, rather than presenting general principles, may be particularly important for community-based preschool settings, where classroom routines introduce great variability in staff attentional resources and child behavior. To combat this, front loading didactic material, and dedicating more time to practicing the complete intervention as it applies to specific classroom routines may promote better generalization across classroom routines, and consequently better sustainability and long-term outcomes. Outcomes from the communication and engagement state coding schemes generally support differential staff and child behavior in different preschool contexts, and future research may benefit from continuing to explore the efficacy of this model.

In particular, all of the teachers who participated in this pilot study chose outdoor/gross motor play over free play with toys in classroom settings (which would have been the more obvious choice for NDBI interventions). It is unclear whether this preference would generalize to other preschool teachers and classrooms. However, this context specifically may be worth continued examination.

Practical recommendations for research

Community-based research for young children with ASD comes with many unique challenges that need to be considered at the outset of larger research efforts. Preschool settings in particular introduce even more specific challenges. Considerations for future research efforts are outlined below.
Accessing target staff members

In this small feasibility pilot, significant barriers related to recruiting staff members were encountered. In particular, although staff were generally interested in receiving more training for working with students with ASD, high staff turnover hampered some recruitment efforts. Specifically, this limited the availability of paraprofessionals, and was part of the reason why participating staff members were all classroom teachers. Future research efforts focusing on paraprofessionals should be aware of how staff turnover may affect recruitment and dropout, and should adjust their timeline accordingly.

Accessing target children

Some barriers were encountered related to recruiting target children. Specifically, contacting eligible families and scheduling intake visits may be more challenging in community settings than in research centers. Specifically, transportation to the Nisonger Center was a barrier for some families. Ideally, future community-based projects should plan to travel to family homes and work to make evening and weekend visits possible.

Scheduling challenges

Participating staff members often had variable schedules that changed on relatively short notice. Scheduling time for the didactic, out-of-class sessions, was challenging, and required the research team to be flexible and available on short notice. In larger scale studies that operate outside of university centers, achieving this level of flexibility may be more challenging.

Another scheduling challenge specific to this particular model, which focused on staff/child dyads was that both participants needed to be present for classroom coaching.
and data collection to occur. In this way, missed sessions due to illness and other absences were functionally doubled. Further, school vacations and closures further stretched out the intervention timeline. In turn, this caused what was meant to be an eight week intervention to take an average of twelve weeks per child. Future research projects should account for this in their timelines, as well as in terms of capturing change in their outcome measures.

Measuring Outcomes

Across all dyads and outcome measures, significant heterogeneity was observed from day to day. This point is particularly well-illustrated in the communication graphs. Specifically, the target child in dyad two displayed consistent improvement in communication rate that was striking in magnitude, but still had data points that dipped down to near zero during active intervention. Similarly, baseline data points for all three outcome measures often evidenced significant heterogeneity. Larger scale group designs, which traditionally use comparisons between two data collection time points (entry and exit) could be negatively affected by these day to day fluctuations. Solutions to this issue might include increasing power by having a significantly larger number of participants to account for the relatively low signal to noise ratio that will be introduced by this heterogeneity. This of course, would require more funding and staffing resources. Other solutions may include using more fine-grained measurement procedures (relative to comparisons between entry and exit) to capture more signal in the data. Particularly for studies with short term designs, collecting data at multiple time points throughout treatment (rather than once pre and post) may help limit outlier effects.
In addition to this day to day heterogeneity, there was also variance introduced by different teaching contexts. Specifically, two of three dyads also evidenced differential improvement according to teaching context. Clinical impressions and staff feedback generally attributed this to factors such as lower versus higher staff to child ratios and increased demands on staff members. Future studies may benefit from examining the effect of staff to child ratio more systematically for potential moderating effects. Although community-based studies implemented at a one to one ratio are a good step in the right direction (Chang et al. 2016) it is unlikely that results will replicate in classrooms with higher ratios.

While collecting video-coded data was possible for this small scale pilot, this method may not be feasibility in larger scale studies. In particular, getting video permissions for the majority of children in classrooms, combined with the time-intensive process of video-coding outcomes may pose significant barriers. Live-coding outcomes may be a better alternative. Although, live coding, without videos to reference and review, will make solving issues related to measurement reliability and sensitivity even more critical. A recently developed measure which can be live coded aims to capture change in social communication in children with ASD may be a good fit for future research efforts (Grzadzinski et al. 2017). Although, it’s translational utility in community settings remains untested.

Limitations

As a pilot study using a multiple-baseline design, certain limitations are inherent to the methods used. Specifically, causal attributions regarding outcome measures are
tenuous and more rigorous designs using random assignment are needed to build these arguments. Relatedly, with a relatively small number of participants, generalization of findings to other children and community contexts are not supported.

Overall, the fidelity measure may have suffered from a lack of sensitivity. Whether this was due to relatively inexperienced raters, high staff baselines resulting in constricted range, or problems with the measure itself was unclear. While the fidelity and communication coding schemes were blind-coded by individuals not involved in data collection or intervention, engagement states data were coded primarily by the first author, who functioned as the interventionist for this study. While reliability with a blinded rater was good (ICC=.85), this data are less well-controlled than the other two schemes. Similarly, while research assistants blind to treatment timeline did the majority of the videotaping, the first author sometimes stepped in to assist with filming when scheduling necessitated it. In particular, the majority of dyad three’s baseline was filmed by the first author. This could have elicited differential behaviors from participants and introduced bias in the data.

Another limitation of the present study is the presence of missing data points, particularly for dyad one. Specifically, missed sessions and data collection points were unable to be made-up, as he was leaving the program for preschool at the conclusion of the study. As a result, he only had two treatment data collection points for context two. At the outset of this project, the intention was to collect follow-up data at one month intervals for three months to probe sustainability. Due to staff turnover and classroom changes, this was only possible for dyad three. Therefore, conclusions about long-term sustainability are not supported.
Conclusions

Conducting research in community settings continues to introduce additional issues related to feasibility, effective implementation, and sensitive measurement of outcomes. However, conducting this translational research is paramount to affecting real, positive changes for stakeholders. Indeed, few would agree that these barriers are sufficient reason to halt community-based research efforts. Instead, researchers should focus on considering what necessary methodological and clinical changes need to be made to both affect and measure true change in community settings. Accounting for heterogeneity in outcomes may be particularly important for translational research. Often, past studies address this by calls for increased sample sizes. Alternatively, using measures that capture change over multiple data collection time points throughout the course of treatment (rather than one pre and one post measurement) may increase signal to noise in a more efficient manner. This may be a better option, as community-based studies are already costly projects. Indeed, funding may be better spent covering the increased costs of missed sessions, mileage, travel time for personnel, and more challenging recruitment efforts that come with the territory of community-based studies.

Overall, this minimal intensity model shows promise regarding feasibility and acceptability in community settings. Fidelity data, while less sensitive than ideal, showed some evidence of change for dyads two and three. The engagement and communication results also indicate evidence of positive change, although the success of intervention efforts appeared to vary among teaching contexts. Finally, and arguably most
importantly, stakeholder feedback regarding acceptability and feasibility was positive, and supported this training model as a viable option to explore in future research projects.
References


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### Appendix A: Target Child Characterization

**Table 1**

**Target Child Characterization**

<table>
<thead>
<tr>
<th></th>
<th>01</th>
<th>02</th>
<th>03</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age in months</strong></td>
<td>31</td>
<td>38</td>
<td>23</td>
</tr>
<tr>
<td>ADOS-2 CSS&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>MSEL&lt;sup&gt;b&lt;/sup&gt; Early Learning Composite (m=100)</td>
<td>54</td>
<td>50</td>
<td>67</td>
</tr>
<tr>
<td>MSEL Visual Reception (m=50)</td>
<td>22</td>
<td>20</td>
<td>38</td>
</tr>
<tr>
<td>MSEL Fine Motor (m=50)</td>
<td>21</td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>MSEL Receptive Language (m=50)</td>
<td>20</td>
<td>20</td>
<td>47</td>
</tr>
<tr>
<td>MSEL Expressive Language (m=50)</td>
<td>32</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>ESCS IJA Frequency&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>ESCS RJA % Response&lt;sup&gt;d&lt;/sup&gt;</td>
<td>71%</td>
<td>43%</td>
<td>92%</td>
</tr>
<tr>
<td>ESCS IBR Frequency&lt;sup&gt;e&lt;/sup&gt;</td>
<td>0</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

<sup>a</sup> Autism Diagnostic Observation Schedule, Edition Two, calibrated severity scores (0-10)

<sup>b</sup> Mullen Scales of Early Learning. Composite scores have a mean of 100 and a standard deviation of 15. Subscale scores have a mean of 50 and a standard deviation of 10.

<sup>c</sup> Early Social Communication Scales Initiating Joint Attention.

<sup>d</sup> Percent correct response to joint attention.

<sup>e</sup> Initiating behavioral requests.
Appendix B: Video Coded Outcomes

Figure 1. Rate of teacher fidelity expressed as a percentage at baseline (BL), after the onset of teaching in the unstructured context, and after the onset of teaching in the structured context. Dyad three has follow-up data (FO) taken at one month intervals.
Figure 2. Frequency of communicative bids per codeable minute at baseline (BL), after the onset of teaching in the unstructured context, and after the onset of teaching in the structured context. Dyad three has follow-up (FO) data taken at one month intervals.
Figure 3. Rate of joint engagement (engaged with either a person or a person and objects) at baseline (BL), after the onset of teaching in the unstructured context, and after the onset of teaching in the structured context. Dyad three has follow-up (FO) data taken at one month intervals.
Figure 4. Rate of behavioral requesting communicative bids per codeable minute at baseline (BL), after the onset of teaching in the unstructured context, and after the onset of teaching in the structured context. Dyad three has follow-up (FO) data taken at one month intervals.
Figure 5. Rate joint attention bids (socially motivated communication) per codeable minute at baseline (BL), after the onset of teaching in the unstructured context, and after the onset of teaching in the structured context. Dyad three has follow-up (FO) data taken at one month intervals.
Appendix C: Index of Curriculum Content: Pulled from Six Accessible NDBI Manuals

I. Identifying Communication Targets
   a. Determine baseline verbal and nonverbal strategies (SCERTS 26,100; ESDM 81; ESDM 156; PRT 192, 152; JASPER 24)
   b. Identify developmentally appropriate verbal and nonverbal target (SCERTS 26,100; ESDM 81; ESDM 170; JASPER)

II. Environmental Arrangement
   a. Minimizing distractions/appropriate toy choices (SCERTS 86; ESDM 103, 129; 187; IMPACT 71, 72; JASPER 27)
   b. Within sight but out of reach (ESDM 106; IMPACT 126)
   c. Control Pieces (ESDM 106; IMPACT 126)
   d. Classroom routines as opportunities for communication (ESDM 115, 125, 204; PRT 192; IMPACT 72; RIT 14)
   e. Redirecting attention/moving materials (ESDM 199; JASPER 38,)

III. Engagement States
   a. Hierarchy of Engagement (ESDM 104, 110,113;ESDM 106; ESDM 148; RIT 11; JASPER)
   b. Behavioral Functions
      1. Joint attention (SCERTS 87; ESDM 109,113, 154; IMPACT 79, 100; JASPER 5, 13, 43)
      2. Behavioral Requesting (SCERTS 160; ESDM 165; JASPER 13)

IV. Building routines
   a. Identify play and/or other classroom routines that can be targeted (SCERTS 30,4; ESDM 107, 108, 188; RIT 10,11; JASPER 33)
   b. Steps in routine, possible expansions (JASPER 35; RIT 10; ESDM 146; IMPACT 100)
   c. Routines as opportunities for communication(RIT 14; IMPACT 71; PRT 12, 149; JASPER 33; SCERTS 4, 12; ESDM 22)
   d. Following Child’s Lead (SCERTS 27,41; ESDM 102; IMPACT 71, 75, 84; RIT 4, 11; JASPER 5, 29)
   e. Choosing good times to probe for communication (SCERTS 29; ESDM 103; IMPACT 100, 144; JASPER 43, 48)
   f. Balancing imitating and modeling (SCERTS 27; ESDM 106; ESDM 107; ESDM 136; IMPACT 85, 96; RIT 4; JASPER 30)

V. Getting and Maintaining Attention
a. Animation (SCERTS 27, 29; ESDM 106, 159; IMPACT 90; RIT 4; JASPER 40)
b. Sitting in front of child (SCERTS 29; ESDM 104; IMPACT 78; RIT 4; JASPER 27, 41)
c. Getting on their level (SCERTS 29; ESDM 104; JASPER 41)
d. Thinking about structure (seating options, making the space smaller, another person, communication supports (SCERTS 35; ESDM 129; IMPACT 73)

VI. Communication
a. Imitate and model target-level language (SCERTS 31; PRT 149; IMPACT 99; RIT 4, 6; JASPER 52)
b. Talking less/responding more (SCERTS 27; ESDM 156; PRT 150; IMPACT 108, 120; JASPER 50)
c. Commenting language and responding/ fewer questions (SCERTS 27, 31; ESDM 105; IMPACT 108; RIT 7; JASPER 32, 50, 51)
d. Imitate and model target-level gestures (ESDM 141, 142; IMPACT 86, 100, 148; RIT 11; JASPER 47, 52)
e. Child perspective language (SCERTS 32; JASPER 52)
f. Verbal turn-taking (SCERTS 34; ESDM 144; PRT 149; IMPACT 115; RIT 6; JASPER 51)
g. Expand Language (SCERTS 30; ESDM 139, 22; IMPACT 96; RIT 6; JASPER 53)

VII. Prompting for Communication
a. Least to most prompting (RIT 8; SCERTS 13; JASPER 37; IMPACT 142; ESDM 21)
b. Access contingent on communication (PRT 144; ESDM 21)
c. Open-ended question (IMPACT 151; JASPER 46, 48)
d. Time-Delays
   i. Choices (ESDM 103; PRT 143; JASPER 30, 48)
   ii. Withholding materials (ESDM 106; PRT 194; IMPACT 108, 126)
   iii. Pause in routine/waiting expectantly/ Playful obstruction (PRT 194; IMPACT 92, 106, 108, 120; JASPER 50)
   iv. Asking for help
e. Prompting Hierarchy (Least to Most IMPACT 139; RIT 7; JASPER 32, 37; Three prompt rule IMPACT 141, RIT 7, Require prompted response 142)
f. Asking good questions: open ended, choices (IMPACT 160, 174; JASPER 46, 48)
g. Social praise/ reinforcing attempts (ESDM 129; PRT 143; IMPACT 142; RIT 4, 7)
h. Planned ignoring of inappropriate communication (ESDM 120,122; IMPACT 80; JASPER 53)

VIII. Facilitating Peer Engagement (PRT 194)
a. Drawing peers close (SCERTS 30)
b. Verbal and nonverbal prompting (SCERTS 30; PRT 194)

Manual References


Social Communication:

Play Centers
Encourage better engagement

Make eye-contact

Eye-contact is a struggle for some kids with autism, and encouraging increased eye-contact can help promote awareness of other people and in turn, more social interactions with others.

Make a consistent effort to be in front of and at eye-level with the child

This might take some effort, since they are so small and active! Kids with autism may naturally orient away from you, or it may feel natural for you to be behind them to support them. When possible, try to maximize the amount of time you spend in front of them to catch eye-contact and facial expressions.

Use an excited tone of voice

Act as though you are really interested and excited by what the child is interested in. Even if it is a really simple action, use high affect (excited tones) in your voice and act like it is super interesting! This will help the child notice that you are interested in what they are interested in and facilitate engagement.

Build a play routine

Step 1: Imitate what they are doing

Watch to see how the child likes to interact with the toy, and then imitate their actions, even if it seems silly and is not what you would expect.

Make sure to play with the child, rather than just watching.

Step 2: Model new play actions

If the child looks like they aren’t certain what to do next with the toys, model an option within their line of vision to give them an idea.

Keep a few toy choices out so the child can incorporate new toys into their routine

Ideas: If the child is playing with trains and train track, have some toy people, other vehicles, or blocks out to see if they might want to put people in the trains, use cars and trains on the track, or build houses along the train track.
<table>
<thead>
<tr>
<th>Child</th>
<th>Play Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very limited play skills</td>
<td>Start with simple social games you and the child can do together</td>
</tr>
<tr>
<td></td>
<td>- Singing songs</td>
</tr>
<tr>
<td></td>
<td>- Playing tickle games</td>
</tr>
<tr>
<td></td>
<td>- Peek-a-boo games</td>
</tr>
<tr>
<td></td>
<td>- See if you can use a &quot;ready&quot; &quot;set&quot; &quot;go&quot; sequence to get them engaged</td>
</tr>
<tr>
<td>Repeating the same play action over and over</td>
<td>Model an option within their line of vision to give them a new idea.</td>
</tr>
<tr>
<td></td>
<td>For example:</td>
</tr>
<tr>
<td></td>
<td>If they are driving a vehicle around, but don’t seem sure what else to do</td>
</tr>
<tr>
<td></td>
<td>with the bus, put a person inside or make the bus crash.</td>
</tr>
<tr>
<td></td>
<td>Keep trying new things!</td>
</tr>
<tr>
<td>Child is not interested in the toys</td>
<td>The child might be unsure how to play, try modeling a few different play actions</td>
</tr>
<tr>
<td></td>
<td>Or, use the “simple social games” described above</td>
</tr>
<tr>
<td>Child is playing well and is ready for the next steps</td>
<td>Keep building on their play with new play models! Try to make your play routine as long and diverse as possible! This will help the child hear the greatest variety of language</td>
</tr>
</tbody>
</table>

**Map on language**

**Comment on what they are doing**

Narrate their play using comments such as "we are putting the children to sleep" or "the bus drives fast". Avoid questions and directions. This will help facilitate spontaneous communication and social skills.

**Use target level language**

For kids who are using zero to single word utterances, focusing on nouns might be helpful (i.e. "block" or "eyes"). For kids who are not using any words, make sure to praise any attempts you hear, new sounds you hear and vocalizations paired with eye-contact.

**Expand their language:**

Add one or two words to anything you hear them say. If the child is preverbal, respond with a similar sounding word to any vocalization they make.

<table>
<thead>
<tr>
<th>Child says:</th>
<th>You respond:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;buh&quot;</td>
<td>Shape sound into a word like &quot;bus&quot; or &quot;bye&quot;</td>
</tr>
<tr>
<td>&quot;crash&quot;</td>
<td>&quot;The cars crashed&quot; or &quot;crash into the blocks&quot;</td>
</tr>
<tr>
<td>&quot;go sleep&quot;</td>
<td>&quot;We are going to sleep&quot; or &quot;put the children to sleep&quot;</td>
</tr>
<tr>
<td>&quot;He is hungry&quot;</td>
<td>Make a related comment &quot;Let’s eat lunch&quot;</td>
</tr>
</tbody>
</table>
Prompt for language

Once child is engaged with you, look for opportunities to prompt for language.

**Less support: Time delay ideas**

- **Pause in the routine:** Examples: Pausing before putting your piece in the potato head, stopping abruptly when singing to see if they can fill in the word, holding your block right above a block tower to see if they will use words to tell you to build it.

- **Withhold Access:** Example: If you are building with blocks, leave the last few in a box they cannot open, or hold them in your hands to see if they can request more.

- **Hold up two choices:** Hold up two options without saying anything, or you can label the choices if you think they might need more support (i.e. “do you want the triangle or the square?”)

**More support: Time delay ideas**

- Make your time delay “big” and exaggerated (with a gasp or excited facial expression) so that they notice it.

**More support: Prompts**

- **Offer a choice:** If you are withholding access some of the toys, you could say, “more or all done?” This way, the child knows what their choices are.

- **Verbal Model:** If you have a clear idea of what they want and think they need more support to be successful, say just one option: “block” or “I want the block.” Pause and wait for them to repeat you.

- **Physical Prompt (point or other gesture):** If the child is preverbal or is refusing to talk, prompt for a point. Have the child point to what they want.

- **Sign language:** If signing for “more” or “go” is something that you think would be useful for the child or something you are working on, you could hand-over-hand prompt these actions.

**ALWAYS finish a prompting sequence once you start**
Social Communication:
Outdoor/Gross Motor Play
Encourage better engagement

Use an excited tone of voice
Start by being really interested and excited by what the child is interested in. Even if it is a really simple action that the child is interested in, use high affect in your voice and excitement to act like it is super exciting! This will help the child notice that you are interested in what they are interested in and facilitate engagement.

Make eye-contact. Be in front of and at eye-level with the child.
This might take some effort! Some kids with autism may struggle with eye-contact and may naturally orient away from you, or it may feel natural for you to be behind them to support them. When possible maximize the amount of time you spend in front of them to catch eye-contact and facial expressions. Encouraging increased eye-contact can help promote awareness of other people and in turn, more social interactions with others.

Arrange the environment

Requesting help

Since a lot of the toys and activities in this environment require assistance, this is a great setting to prompt for requesting help (swings, slides, carts, balls etc.)
Try to note which options in the environment require your help for the child to engage in and that might be motivating for that child, and incorporate them into your play.

Build a routine

Follow child’s lead and imitate their play:
Try to find your role in their play instead of just watching:

Your role can be the same:

Take your turn sliding down a slide, pushing a cart or doing another activity

Or your role can be different:

Have pushing them on a swing be your role
Have filling their cart with balls be your role
Try to find an active way to participate in their play
Children who have few play skills/difficulty engaging:

**Start with simple social games:**
- Singing songs
- Play “chase” games or hiding games
- Playing tickle games
- Peek-a-boo games.
- See if you can use a “ready” “set” “go” sequence, and then hold back saying “go” during a familiar routine such as sliding or swinging to see if they can fill in the blank.

**Map on language**

Comment on what they are doing using target level language.

Use language you think the child could imitate (single words, short phrases etc.). If they are not yet talking, use single words.

Imitate their play acts and use commenting language (not questions):

- Children with phrases and sentences: “We are sliding” or “We are throwing the ball”
- One-word target children: “Slide” or “ball”.

<table>
<thead>
<tr>
<th>Child says:</th>
<th>You respond:</th>
</tr>
</thead>
<tbody>
<tr>
<td>“buh”</td>
<td>Shape sound into a word like “bus” or “bye”</td>
</tr>
<tr>
<td>“slide”</td>
<td>“We are sliding” or “down the slide”</td>
</tr>
<tr>
<td>“go swing”</td>
<td>“I want to go swing”</td>
</tr>
<tr>
<td>“I want the ball”</td>
<td>Make a related comment “Let’s throw the ball”</td>
</tr>
</tbody>
</table>

Children who engage well during gross motor/outdoor time:

**Try to add new, creative steps:**

Adding steps will create a longer interaction and opportunities for a variety of language:

- Taking turns pushing the cart, pushing peers in the cart, pushing stuffed animals etc.
- Adding imaginary elements such as driving to the park/school and then driving home again, picking up/dropping off friends/toys from school
- Playing a game such as “the ground is lava” and you need to get from one side of the space to the other without touching the ground.
- Doing obstacle courses

If you hear good communication or a good attempt respond with a language expansion:

It is fine to use natural sounding grammar for your expansions.

For kids who have more sophisticated language (i.e. speaking in phrases with 2 or more words) it might be more natural to sometimes respond with a related comment. For example, if the child says “boy goes to sleep”, you could say “the boy is tired”.
Prompt for language

Once child is engaged with you, look for opportunities to prompt for language:

Less support: Time delay options

Pause in the routine: If child is engaged in a routine like chasing or hide and seek: pause in the routine, and wait expectantly for the child to use target level communication to encourage you to continue playing.

Or

Asking for help: Since a lot of activities in this environment require assistance, if you notice their interest in an activity, get down on their level in front of them, make-eye contact and wait expectantly.

Or

Withhold Access: Hold the child's swing still or block them from sliding down a slide and wait for communication that they would like to continue.

More supportive prompts

A lot of the strategies that are used to facilitate engagement (pausing in routines, withholding access) transition nicely into a communication prompt.

If after you have paused in a routine/withheld access or noticed that the child is engaged enough to tolerate a language prompt, move down the prompting hierarchy into more direct prompts.

Only prompt occasionally, and when the child is really motivated. If the child is struggling to engage, do not feel like you need to prompt for language.

ALWAYS finish a prompting sequence once you start.

### Prompts

- **Offer a choice:** If you are withholding access to a swing or slide, you could say, "go or all done?" This way, the child knows what their choices are.
- **Verbal Model:** If you have a clear idea of what they want and think they need more support to be successful, say just one option: "go" or "I want to swing".
- **Physical Prompt (point or other gesture):** If the child is preverbal or is refusing to talk, prompt for a point. Have the child point to what they want (swing, slide, you for help).
- **Sign language:** If signing for "more" or "go" is something that you think would be useful for the child or something you are working on, you could hand-over-hand prompt these actions.
Social Communication
Snack Time/Lunch
Pick communication targets

**Verbal:** This more structured opportunity might be a good time to focus on behavioral requesting skills. How is the child currently communicating his/her needs and wants? What might be a good next level for them?

**Nonverbal:** How are they using gesture to request? Snack could be a great time to work on 1. **pointing to request.** If the child is already a good pointer for requesting, you could work on 2. **social pointing** or 3. **holding something up to share something cool (showing).** If the child is already really good at these types of gestures, you could work on 4. **other gestures** such as rubbing your stomach to indicate "yummy" food.

Encourage better engagement

**Sit across from the child**

Since children are seated for snack time, this is a good time to promote eye-contact, social engagement and shared enjoyment. Try to sit across from the child with your face at their eye-level. When they make eye-contact with you, smile and make an excited comment to reinforce social engagement.

**Use high affect & conversational tone**

Mealtimes will continue to be a social experience for children throughout school and their lives. Try to encourage social engagement during this time by commenting in a conversational tone about what is going on during snack time.

**Building a routine**

**Imitate what they are doing**

Snack already has clear steps, so this will involve trying to participate with them in what they are doing.

**Routine building ideas**

- If feeding a doll or puppet can be part of the snack time routine, adding steps to that action such as giving the doll something to eat, wiping his/her mouth or having the doll wash her hands too.

- To imitate and "participate" a little bit more in the snack time routine, you can pretend to drink from a cup or water bottle.
If the child enjoys a play action with the food, like having the goldfish swim, you could add steps like having the goldfish jump out of the bowl and into their mouth, or walk across the table.

Focus on getting the child to more independently participate in all preexisting part of the routine (washing hands, eating, cleaning up) could count as routine expansions.

*** Some of these strategies may be too disruptive to the snack routine, and it is at your discretion which ones work best for your classroom***

Map on language

Use target level language, or language that the child could potentially repeat. Also try to use child centered language, or pronouns from either the child's perspective or shared perspective (we) so that when the child repeats you it makes sense.

For example, instead of "you are eating snack" say:

- "We are eating"
- "We eat"
- "Eat"

Expand their language:

Add one or two words to anything you hear them say. If the child is preverbal, respond with a similar sounding word to any vocalization they make.

<table>
<thead>
<tr>
<th>Child says:</th>
<th>You respond:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;mmm&quot;</td>
<td>Shape sound into a word like &quot;more&quot;</td>
</tr>
<tr>
<td>&quot;snack&quot;</td>
<td>&quot;Yummy snack&quot; or &quot;Snack tastes good&quot;</td>
</tr>
<tr>
<td>&quot;all done&quot;</td>
<td>&quot;We are all done&quot; or &quot;snack is all done&quot;</td>
</tr>
<tr>
<td>&quot;I want more&quot;</td>
<td>Make a related comment &quot;I am still hungry&quot; or &quot;Let's get more goldfish&quot;</td>
</tr>
</tbody>
</table>

Peer engagement

Feel free to let peers take place in exercise such as commenting on what they are eating, playing, and pointing exercises.

Peer participation could be a good way to encourage the target child's engagement.

You could recruit other children to help by saying, "We are helping James learn to point, can you show him how to point to XXX?" Or "Tell James what you are eating, and then we will tell you what we are eating!"

However, if peer involvement becomes distracting to learning opportunities for the child it may be appropriate to try some strategies to control it. Some things that might work could be:

- "Nice job pointing/doing that, now it's James' turn."
Prompt for communication

**Less support: Time delay options**

- Withhold access. Only give the child a small amount of snack at once, and then wait for them to request more. Also “wait expectantly, when the child wants more water, help opening a container, etc.
- Pause in routine. Look for an opportunity to pause right before something expected happens; helping child out of chair, pouring more water, bringing over the bucket for dishes, and see if the child will communicate to encourage you to continue
- Offer a choice. Hold up two options for snack (with or without labeling) and wait to see if the child will point and/or use words to request. Even if you know what the child wants “play dumb” to encourage communication

**More support**

**More supportive prompts**

**Prompting for pointing**
- What is the child’s present pointing level?
- 1. No pointing
- 2. Reaching but without point hand shape
- 3. Proximal pointing (pointing with contact with object, tapping the picture with finger)
- 4. Distal pointing (pointing at something out of reach, no contact with the object)

Once you get a feel for where the child is at with pointing, encourage them to use this skill frequently, and then begin prompting for the next level

- **Pointing hierarchy (Least to Most)**
  1. Model your own point - model point in their line of vision with an exaggerated movement and verbal phrase (i.e. “there’s the dog”) to capture their attention. Then, pause again to see if they point.
  2. Tap elbow/ lift elbow - give a “partial physical prompt” to help them understand what is expected. Pair the physical prompt with a phrase such as “where is the dog”, to underscore the expectation.
  3. Full physical prompt - if the child has no pointing/reaching or has not responded to less intrusive prompts

**Prompting for words**

- **Verbal Model**
  After you have used a time delay and the child does not respond with the target word, verbally model the word(s) yourself and then continue to wait expectantly
- **Physical prompt for a point**
  If the child does not respond after one or two presses for a verbal target, drop down and begin prompting for a point.
Social Communication:

Storytime
Encourage better engagement

Sit in front of the child
Since story time often takes place in a circle, sitting in front of the child (as we would usually do), might not always be the best choice. If the child engages well with peers and instructors during this time, sitting next to or behind the child may be better. However, if engagement is challenging in this environment, or the routine is too overwhelming, it might be better to modify the activity so that the child can just focus on you.

Build a play routine
Similar to the play routines for play centers/outdoor/gross motor play, you want to try to engage in a play routine with as many different parts and opportunities for interaction as possible. Since story time will already have a routine structured into it, try to look for opportunities to layer in additional play on communication opportunities:

Imitating body actions
Since Storytime routines sometimes involve singing songs with actions (clapping etc.) this could be a great time to work on imitation.

Model the actions “big and exaggerated” with eye-contact right in front of the child to encourage them to notice the action and respond. If they do not imitate, move through the prompting hierarchy.

Imitating play actions
Look in the books planned for story time and think about what types of actions are going on (trains driving, animals walking, eating, sleeping, etc.).

Try to find small toys that match the figures and actions in the book. When the class gets to that part in the story, model that action with an appropriate language level phrase (“the train drives”). Encourage the child to imitate your model, and prompt imitation if necessary.

Pointing to pictures in book/on the wall
Look at the stories that your classroom is planning on reading in the coming weeks. Print out large pictures that match objects in the story, and hang them around the space.

When you get to the part in the story that references the picture, pause and ask the child “Where is the apple?” and wait to see if the child will point to the picture (if not, move through the prompting for pointing hierarchy). Pictures around the room will help the child work on pointing at things that are far away to share with others. However, if you do not have pictures printed out and hung around the room, you can have the child practice pointing to objects in the book itself.
Pausing in story reading/song singing

Since a familiar story or song will have repetitive words, this could be an opportunity to pause in the familiar story to promote engagement and prompt for language. Pause during a familiar phrase and make exaggerated eye-contact (cheerleader face) with the child to see if they will complete it.

Map on target level language

Simple and repetitive

Try to adapt the story or song to use target level language for the child. Many stories/songs may already have language that goes with them that is appropriate for other children in the classroom, but is above the child’s current level.

During story time, look for key words (nouns/verbs) to emphasize that are closer to their target language level.

For example, in the very hungry caterpillar, when the text in the book says:

“On Monday he ate through one apple, but he was still hungry” simplify and say:

“Caterpillar eats the apple”

Or

“Eat the apple”

Or

“Eat”

Expand their language:

Add one or two words to anything you hear them say. If the child is preverbal, respond with a similar sounding word to any vocalization they make.

<table>
<thead>
<tr>
<th>Child says:</th>
<th>You respond:</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Bubb”</td>
<td>“bear”</td>
</tr>
<tr>
<td>“Caterpillar”</td>
<td>“Caterpillar’s hungry”</td>
</tr>
<tr>
<td>“Open the book”</td>
<td>“Open the book and look inside”</td>
</tr>
<tr>
<td>“Turn the page please”</td>
<td>Make a related comment like “What happens next?” or “Let’s keep reading”</td>
</tr>
</tbody>
</table>

Peer Engagement

Feel free to let peers take place in exercise such as pointing, imitating play, and imitation body movements. Peer participation could be a good way to encourage the target child’s engagement.

You could recruit other children to help by saying, “We are helping James learn to point, can you show him how to point to XOX?” Or “Show James how we clap!”

However, if peer involvement become distracting to learning opportunities for the child it may be appropriate to try some strategies to control it. Some things that might work could be:

“Nice job pointing/doin that, now it’s James’ turn.”
Prompt for communication

Less support:

Time delay ideas

Pause before turning the page to prompt for either a word: "Turn page" or a gesture (pointing to request turning the page)

When you get to the part in the story that references the picture, pause and ask the child "Where is the XXX?" and wait to see if the child will point to the picture

More supportive prompts

Prompting for pointing
What is the child's present pointing level?
1. No pointing
2. Reaching but without point hand shape
3. Proximal pointing (pointing with contact with object, tapping the picture with finger)
4. Distal pointing (pointing at something out of reach, no contact with the object)

Once you get a feel for where the child is at with pointing, encourage them to use this skill frequently, and then begin prompting for the next level

Pointing hierarchy (Least to Most)
1. Model your own point - model point right in their line of vision with an exaggerated movement and verbal phrase (i.e. "there's the dog") to capture their attention. Then, pause again to see if they point.
2. Tap elbow/lift elbow - give a "partial physical prompt" to help them understand what is expected. Pair the physical prompt with a phrase such as "where is the dog", to underscore the expectation.
3. Full physical prompt - if the child has no pointing/reaching or has not responded to less intrusive prompts

Prompting for words
1. Verbal Model
   After you have paused either to turn a page, or paused in a familiar, repetitive phrase, if the child does not respond with the target word, verbally model the word(s) yourself and then continue to wait expectantly
2. Physical prompt for a point
   If the child does not respond after one or two presses for a verbal target, drop down and begin prompting for a point.
Appendix E: Intervention Schedule and Session Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Session Type</th>
<th>Duration</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Didactic Instruction</td>
<td>45</td>
<td>Overview of NDBI Principles</td>
</tr>
<tr>
<td>1</td>
<td>Classroom Observation</td>
<td>20</td>
<td>Observe classroom contexts 1 and 2</td>
</tr>
<tr>
<td>2</td>
<td>Didactic Instruction</td>
<td>45</td>
<td>Develop and review intervention plan for context 1</td>
</tr>
<tr>
<td>2</td>
<td>Live coaching/modeling</td>
<td>20</td>
<td>Model intervention plan for context 1</td>
</tr>
<tr>
<td>3</td>
<td>Live coaching/modeling</td>
<td>20</td>
<td>Coaching/modeling context 1</td>
</tr>
<tr>
<td>4</td>
<td>Live coaching/modeling</td>
<td>20</td>
<td>Trouble shooting/adapting context 1</td>
</tr>
<tr>
<td>4</td>
<td>Didactic Instruction</td>
<td>45</td>
<td>Develop plan/future target skills for context 1; introduce plan for context 2</td>
</tr>
<tr>
<td>5</td>
<td>Live coaching/modeling</td>
<td>20</td>
<td>Model intervention plan for context 2</td>
</tr>
<tr>
<td>6</td>
<td>Live coaching/modeling</td>
<td>20</td>
<td>Coaching/modeling for target contexts 2</td>
</tr>
<tr>
<td>7</td>
<td>Live coaching/modeling</td>
<td>20</td>
<td>Troubleshooting, adapting context 2</td>
</tr>
<tr>
<td>8</td>
<td>Live coaching/modeling</td>
<td>20</td>
<td>Additional week of coaching/modeling for either context 1 or 2 (at discretion of teacher)</td>
</tr>
<tr>
<td>8</td>
<td>Didactic Instruction</td>
<td>45</td>
<td>Review and wrap-up, discuss future target skills and long-term plan for contexts 1 and 2</td>
</tr>
</tbody>
</table>
Didactic Session One

- Reintroduction/ Overview of intervention components
  - Introduction
  - Goals of study
  - Study components
  - Scheduling
- Qualitative discussion of child in present child care settings
  - Degree child is typically engaged in activities
  - How child communicates (verbal/ nonverbal initiations/responses)
  - Child strengths
  - Preferred versus non-preferred activities
  - Play and engagement skills
  - Behavioral challenges
  - Teacher goals for child
- Selecting unstructured context and structured context
  - Child considerations (what will be most beneficial for child)
  - Teacher considerations (when will be most feasible for teacher to work with child)
  - Interventionist considerations (when interventionist available)
- Introducing and discussing packet for context one
  - Review general principles of NDBI intervention
  - Go over strategies generally for context one: encouraging engagement, building routines, using appropriate language, prompting communication

Classroom observation of child in context one

- Observe present classroom routine
- Observe child participation and language
- Observe teacher role with respect to feasibility of intervention techniques

Didactic Session Two

- Discussion of child in context one
  - Current level of engagement/interest in activities in context one
  - How child usually behaves in context one
  - How child usually communicates in context one
- Discussion of principles from packet as they apply specifically to child
- Review general principles of NDBI intervention as they relate to child
- Go over strategies specifically for child for context one: encouraging engagement, building routines, using appropriate language, prompting communication
- Identify communication goals for child (verbal and nonverbal)
- Identify what level of language is best to use with child
- Identify what level of prompting support child will need to be successful
- Discuss and troubleshoot potential issues

**Classroom Coaching Session One: Context One**

- Model intervention strategies and at least one prompting sequence
- Coach and support teacher in intervention and prompting strategies
- Troubleshoot and discuss problems as they arise

**Classroom Coaching Session Two: Context One**

- Observe and coach teacher through intervention and prompting strategies
- Model if needed
- Troubleshoot and discuss problems as they arise

**Classroom Coaching Session Three: Context One**

- Observe and coach teacher through intervention and prompting strategies
- Model if needed
- Troubleshoot and discuss problems as they arise

**Didactic Session Three**

- Discussion of progress in context two
  - Discussion of examples of child’s best and new communication skills
  - Discussion of child responses to prompting
- Discussion of teacher ability to implement strategies in terms of feasibility
- Trouble-shooting problems and barriers to implementation for context one
- Discussion of child functioning in context two
  - Current level of engagement/interest in activities in context two
  - How child usually behaves in context two
  - How child usually communicates in context two
- Introduction of context two packet and strategies
- Discussion of principles from packet as they apply specifically to child
  - Review general principles of NDBI intervention as they relate to child
Go over strategies specifically for child for context one: encouraging engagement, building routines, using appropriate language, prompting communication

- Identify communication goals for child (verbal and nonverbal)
- Identify what level of language is best to use with child
- Identify what level of prompting support child will need to be successful

- Discuss and troubleshoot potential issues

Classroom Coaching Session Four: Context Two

- Model intervention strategies and at least one prompting sequence
- Coach and support teacher in intervention and prompting strategies
- Troubleshoot and discuss problems as they arise

Classroom Coaching Session Five: Context Two

- Observe and coach teacher through intervention and prompting strategies
- Model if needed
- Troubleshoot and discuss problems as they arise

Classroom Coaching Session Six: Context Two

- Observe and coach teacher through intervention and prompting strategies
- Model if needed
- Troubleshoot and discuss problems as they arise

Classroom Coaching Session Seven: Context one or two

- Observe and coach in context one or two (at discretion of teacher)
- Troubleshoot and discuss problems as they arise

Didactic Session Four

- Discussion of progress across contexts one and two
  - Discussion of examples of child’s best and new communication skills
  - Discussion of child responses to prompting
- Discussion of teacher ability to implement strategies in terms of feasibility
- Discussion of child responses to prompting
- Trouble-shooting problems and barriers to implementation
- Identifying and planning for next developmental steps
Appendix F: Fidelity Coding Scheme

Encouraging Engagement:

- **Affect**
  - High animation is used to attract and maintain attention
  - Expressive directed facial expressions are used to attract and maintain attention

- **Sits in front of child/Eye-level**
  - Eye-level—teacher should be at level of child’s height
  - Sits in front of child—teacher should be positioned in front of child to allow for eye-contact
  - If teacher at eye-level but not sitting in front of child (or vice versa) = (+/-)
  - If activity structure necessitates teacher sitting behind child, code (+) if teacher makes regular efforts (e.g. once every 30 seconds to recruit attention of child

- **Environment clean with choices**
  - Enough objects in the environment to facilitate choice making (unless structure of classroom routines necessitates participation in specific activities.
  - Code (-) if competing classroom demands distract target child and teacher so that intervention goals are not able to be implemented (e.g., other children crying loudly)

Building Routines:

- **Imitates and follows child’s lead**
  - Implementer should actively participate in play that is of interest to child
  - Teacher and child can have different roles in shared play (+)
    - Ex: child going down slide and teacher catches child at bottom
    - Ex: teacher pushing child on swing
  - Commenting on what the child is doing but not actively imitating or participating in play (or vice versa) = (+/-)
  - Telling child that he/she is doing something wrong = (-)

- **Models new actions**
  - If child well engaged in play, then teacher doesn’t need to model new actions (+)
• New actions are modeled preferably with the toy child is already interested in (+)
• If child is not engaged with any toys, modeling with a variety of toys is good (+)
• If model is not related to child’s current play or interests (+/-)

Language:
➢ **Target level language**
  • Teacher uses appropriate language level for the child to understand and possibly repeat (+)
➢ **Expands child’s language**
  • Teacher should expand child’s language every time child speaks/vocalizes OR gestures to teacher with eye-contact (+)
  • If child doesn’t vocalize OR gesture with eye-contact = N/A
  • Child says something and then teacher repeats the utterance and adds one word to what the child says (i.e. only occurs after child’s initial language attempt) (+)
  • Teacher can also expand language by making related comments (ex: child says “go to sleep” teacher says “we are tired”). (+)
  • Child gestures while making eye-contact with teacher and teacher acknowledges/reinforces child’s attempted communication (+)
  • Child vocalizes/gestures and teacher responds with question (+)
    ▪ Note: give (-) under commenting language
  • If the child frequently speaks/vocalizes and the teacher does not acknowledge the utterance (-)

➢ **Commenting language**
  • Narration on the activity going on (+)
  • Questions & commands (unless needed to ensure compliance and safety) = (-)
  • Commenting frequency
    ▪ Consistent, natural commenting with pauses (+)
    ▪ No commenting (-)
    ▪ Non-stop commenting such that child could not take a natural communication turn (-)
➢ **Prompt frequency**
  • Scale rates if necessary for video length

<table>
<thead>
<tr>
<th>Not Applicable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
</table>

91
• Prompts directed towards other children count
• Exceeding acceptable number of prompts (12) should only occur if all
  prompts are directed to the same child

Prompting Communication:
*looking at verbal communication only
(Any part of prompting sequence not related to communication is not coded for this
intervention)

➢ Least to most prompting
  • Moves through prompting hierarchy from least to most support (+)
  • Teacher can use same prompt in hierarchy more than once (+)
  • Teacher can skip steps in hierarchy as long as move top → bottom direction (+)

➢ Prompts when child is engaged/motivated
  • Prompts for communication only when child is engaged

➢ Socially reinforces attempt
  • Praise, gives child indication that he/she is correct and did a good job

➢ Follows through complete sequence
  • Once a question is asked/ prompt is given, teacher should persist until
    expectation is met
  • For verbal prompts, may “drop down” to prompts for points to complete
    sequence

➢ Appropriate support
  • Initial prompt appropriate for child’s level of communication (+)

Determining Final Scores for each 2-minute interval:

<table>
<thead>
<tr>
<th>Notes</th>
<th>Overall Final Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ + + -</td>
<td>+</td>
</tr>
<tr>
<td>+ + -</td>
<td>+/-</td>
</tr>
<tr>
<td>+ + + - -</td>
<td>+/-</td>
</tr>
</tbody>
</table>

Same rules apply to opposite situation, i.e. more (-) than (+)
Appendix G: Communication Coding Scheme

**Communication Coding Schema:** For each 10 minute video clip, one target skill in each domain will be identified. That targeted skill, or any higher level skill, will be coded. Skills below the target skill sequentially will not be coded.

*time stamp at beginning of utterance

**Codeable Versus Not Codeable**

- If you are unsure if the child spoke- need to be certain of an utterance. If uncertain, do not code. Criteria for coding:
  1. NEED TO HEAR A SOUND AND need to be certain either from the reaction of the partner, or content of speech that it was the target child who made that sound/vocalization
  2. Otherwise, do not code
  3. If you see their mouth moving, but do not actually hear anything do not code-even if partner reacts
  4. Do not code if not directed at a person
  5. Need to be sure vocalization was not another child, if unsure, don’t code
- If you listen more than three times and are certain about any of these criteria, do not code

**Directed vs. Undirected**

Code all communication that appears to be directed to another person (peer or adult).

Directed communication is defined as:

- A verbal or nonverbal initiation or response that appears to be directed to another person (peer or adult). Count as directed to another person if:
1. There is another person close enough to hear/see the communication OR the child is seeking another person to direct communication to (e.g., walking around looking for a teacher, looking around for a teacher, etc.).
2. AND
3. The communication is related to current activity (e.g., labeling an object the child is playing with, asking for things that are out of reach, asking to be all done, etc.) OR
4. If the communication is not related to the current activity, the child MUST be using strategies to actively recruit another person’s attention (e.g., eye contact, gesture, physical contact, holding up/showing an item, etc.)

Once you identify that a communication has occurred, decide whether the communication is verbal or nonverbal. If a verbal and a nonverbal communication occur simultaneously, both will be coded.

- **Verbal communication includes:**
  1. Any vocalization or verbalization (whether or not it is a true word, or just a sound, phrase, sentence, etc.). If the child repeats the same word multiple times in a row (e.g., go, go, go!) it should only be coded once and as a single-word utterance. In order to be coded as separate communications, there must be at least 1 second between vocalizations. Continuous singing counts as only one communication instance unless there is a pause of at least 5 seconds or there is an intervening conversational turn with another partner (e.g., turn taking between student and teacher). The same rules for singing also apply to counting.
  2. Signs (sign language) count as verbal. These include “more” (putting fingers on two hands together), “help” (putting fist to palm), “go” (arms in a rolling motion), “my turn” (hand to chest), “all done” (both hands from center of body out and down to sides) or other identifiable sign language. Approximations of these signs also count as long as they are identifiable as the sign. Note: GESTURES that are not specific signs will be coded as nonverbal.
  3. Use of assistive communication devices including PECS (Picture Exchange Communication System), an AAC device (electronic communication system), or other alternative communication system will be coded as verbal communication. An instance of alternative communication includes activating the device (electronic), pointing to a card or handing a card to someone. Just picking up the card is not enough to count it as a communication.
Communication using a device or PECS may or may not be combined with a vocalization. If the child uses a device along with a verbal communication, this should only be coded once (as a single communication). Code whichever is more sophisticated (e.g., if a vocal approximation accompanies a clear sign, code the clear sign, since it counts as one word).

4. Crying, screaming, whining, and laughing should NOT be coded as a directed communication.

- **Nonverbal communication includes:**
  1. Hand gestures such as pointing or any other meaningful gesture (that is NOT a sign) including conventional gestures (e.g., waving bye, blowing kiss, clapping, gesturing “come here”)
  2. Do not include pushing objects away
  3. Signs generally should count as one word (even if it is a sign associated with a two word phrase such as “all done” or “my turn.”). Signs could be counted as two words if the child uses two signs together (e.g., more, eat). If a child talks and sign at the same time, code only the highest level communication (e.g., if they sign more while saying “more snack”, code two words rather than one word (for the sign).
  4. Full prompted gestures do not count. Partially prompted (elbow tap, verbal prompt “wave goodbye”) do count as communication
  5. Hand as tool does not count

- **Examples of Descriptive/Instrumental Joint attention gestures:**
  1. Motioning for someone to come closer (social intent)
  2. Waving hello or goodbye
  3. Clapping to encourage a friend (needs to have social intent, not just clapping to self as a self-stimulatory behavior
  4. Tapping toys in environments to show them to others
  5. Examples of Descriptive/Instrumental Behavioral Requesting gestures:
  6. Proximal reaching/Tapping seat of the swing to indicate wanting help getting on
  7. Pantomimimg twisting a lid off to indicate wanting help opening something
  8. Pointing versus Reaching:
  9. Pointing using index finger- everything else (pointing w/thumb) etc. us coded as a reach (e.g. thumb, pinkie, using and object)
  10. Reaching
     - Proximal (not touching the object)
     - If they don’t touch object -> code reaching
     - Distal reaching coded as descriptive gesture
• **Specific Situations**
  1. **Singing**: continuous singing utterance counts as one three word phrase (e.g. “a, b, c, d, e…”) counts as one three word phrase
  2. **Repeating a word multiple times**: same word repeated is coded as a one-word utterance (e.g. “go, go, go” and “bye-bye”)
  3. **Talking/singing to self**: not coded
  4. **Unclear speech**: if you can understand what they are trying to say (closer than just making the first sound), babble with mostly accurate sounds -> code as word/multiple words as relevant

Once you have identified an instance of verbal or nonverbal communication, decide if the intent of the communication is to request or for joint attention.

• **Behavioral Requesting**: communication has a clear goal-oriented motivation OR motivation is not clear, but the intent of the communication is clearly not social

• **Joint Attention**: motivation of communication is to share enjoyment, comment on activities with no goal-oriented motivation, or to engage in social interaction/initiate social interaction.

• **Deciding between JA and BR**
  
  **1. Pivotal Criteria**: Is something being withheld, or is the child clearly requesting something?

• **Other Considerations**
  1. When in motivation is not clear, but communication is appropriate to context and appears directed (there is another person around that could hear, talking about toys in front of them), code down: (BR)
  2. If the teacher is blocking or withholding something and child talks to get access, code BR.
3. Spontaneous comments when teacher does not appear to be withholding anything, code JA (e.g. “go”)
4. Scripting about a tv show/song that is not present, talking to self when no one else is paying attention/ about something not relevant to the situation
5. Self-stimulatory, repetitive vocalizations that have no functional purpose should not be coded
6. Note: children with ASD often do not pair communication with eye contact, and lack of eye contact does not mean communication was not directed

Matrix of Possible Codes

<table>
<thead>
<tr>
<th>Behavioral Request</th>
<th>Verbal</th>
<th>Nonverbal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Directed vocalization/Word approximation</td>
<td>1) Reaching (pointing without hand shape)</td>
<td></td>
</tr>
<tr>
<td>2) Single Words and signs</td>
<td>2) Giving to request help</td>
<td></td>
</tr>
<tr>
<td>3) Two word requests</td>
<td>3) Pointing to request</td>
<td></td>
</tr>
<tr>
<td>4) Three words or more for requesting</td>
<td>4) Descriptive/Instrumental gestures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5) Showing to request</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Joint Attention</th>
<th>Verbal</th>
<th>Nonverbal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Directed Vocalization/Word approximation</td>
<td>1) Reaching (pointing without hand shape)</td>
<td></td>
</tr>
<tr>
<td>2) Single word comments</td>
<td>2) Giving to share</td>
<td></td>
</tr>
<tr>
<td>3) Two word comments</td>
<td>3) Pointing to share enjoyment</td>
<td></td>
</tr>
<tr>
<td>4) Three word comments or more</td>
<td>4) Descriptive/instrumental gesture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5) Showing/holding object up to share enjoyment</td>
<td></td>
</tr>
</tbody>
</table>
Appendix H: Engagement Coding Scheme

Engagement States Coding Scheme

0) Not Codeable:

- **Code whenever child is off**-camera for 3 seconds or more (even if you can hear them)
- You need to see the child (but not necessarily the play partner)
- Child is off camera when:
  - Entire body is not visible
  - Brief instances of extremities on camera
  - Brief intermittent visibility of small portions of body (e.g. through play structures)
  - Cannot see face, also cannot see what they are engaged in (e.g. can only see feet and cannot see what their attentional focus is)
- Child is on-camera when:
  - Child is off camera for less than three seconds
  - Can clearly see child’s face
  - Cannot see their face/back is to camera, but can see hands/what they are engaged in

1) **Unengaged**- Target child is not focused on any identifiable person or object.

- Pacing through the room
- Staring not clearly focused on activity/other child
- Requesting to leave space/ Actually leaving space
- Engaging in verbal, visual or sensory self-stimulation
- Just holding object not interacting with it
- Transitioning/Walking and moving around
2) **On looking**- child is actively watching activities of other students or teachers. Eyes are directed at another activity.

- Tracking activity/movement of a person (not clearly staring at an object, e.g. iPhone/iPad)
- Another person is involved that we need to see or hear
- Watching a teacher model a new activity/play
- **Staring at IPAD-> Object engaged**
- **Watching other children/teacher -> On looking**

3) **Object Engaged**- Child is engaged with an object (looking at it, holding it or interacting with it) but is not engaged with another person. This code may include instances where other children and adults are proximal to the target child as well as attempting to engage the target child, but the target child is not receptive to their overtures and not demonstrating awareness or reciprocity in the interaction (not making eye-contact, not shifting gaze between person and object, back towards individual).

- Playing with an object in conventional ways (rolling a car, feeding a doll)
- Playing with an object in nonconventional ways (stacking toy food, putting toys in a bucket and then dumping them out)
- **Staring at IPAD during story time**
- Visually inspecting an object, sensory play (feeling an object).
- When play partner/teacher is visibly/prominently holding an object of interest, and it is not clear which the child is visually tracking, code down (object engaged).

4) **Person Engaged**- Participating in group activities or partnered activities with other(s) that do not involve objects such as singing songs, clapping games. Target child must demonstrate active interaction with another person during this time (also referencing an object, such as the IPad, code joint engaged). For example, just sitting with the group during story time is not enough to count. Target child must also be demonstrating engagement though any of the following: eye-contact, social smiling, body language including prompting partner to continue the interaction, orientation towards partner, actively participating in joint activity.

- Participating in group activities that do involve objects (story time, play centers, gross motor, playground)
- Engaging in one on one interaction with partner (playing a game/singing a song with partner, talking to a partner)
• Possibly engaging in activities like tickling, songs, clapping, and peek-a-boo

5) **Supported/Passive Joint Engagement**- Target Child is engaged with both an object and a person at the same time. Indicators of joint engagement (as opposed to object or person alone). Will include any of the following

- Gaze shifts between person and object (child is clearly integrating both person and object in play/activity at once, not just periods of one or other)
- Communication with partner during play with object
- Prompting partner to participate/continue participation in engagement with object
- Requesting access to an object/Gifting or Bringing object
- Pausing so partner can take turn/Waiting
- Following object directions from a person/teacher like how to play with object
- Following points to objects
- Full hand over hand prompting does NOT count
- Relevant communication about play or activity (during or after)
- Overall still pursuing child’s own interest
Appendix I: Feasibility and Acceptability Questionnaire

01

Check the box under the response that best matches your own response to the question.

1) There is adequate time in my day to implement strategies.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
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2) The program fits well with my other classroom responsibilities

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3) The program works well with the structure of the classroom (works with the classroom schedule and routines).

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4) The intervention curriculum was appropriate for my knowledge level (not too hard or too easy).

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5) I was able to learn the strategies well over the course of intervention training.

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6) I sometimes found the intervention components to be confusing.

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7) I was not always sure how to perform the intervention.

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8) I did not find the intervention helpful for my student.

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9) I plan to continue using the strategies I learned in this intervention.

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Your unique experiences with the program are important to ensuring that research efforts best match your needs. Your feedback about this program is greatly appreciated.

11) How well did the intervention work with the classroom routine/your other classroom responsibilities?

It worked very well I just wish the child was staying longer to see the effects/outcomes of the intervention.

12) How would you change the program to make it work better for your classroom?

I wouldn’t really change it, I just wish circumstance would have permitted for myself to see the child longer in the intervention before he aged out.

02

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11) How well did the intervention work with the classroom routine/your other classroom responsibilities?

They worked well. We were able to fit the interventions around classroom and student needs.

12) How would you change the program to make it work better for your classroom?

Make the interventions during center time in our daily classroom.

03

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1) There is adequate time in my day to implement strategies.

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Your unique experiences with the program are important to ensuring that research efforts best match your needs. Your feedback about this program is greatly appreciated.

11) How well did the intervention work with the classroom routine/your other classroom responsibilities?
It was hard because we were working with a part time kid with an inconsistent schedule who was receiving other supports overall. I had a good experience. I was overwhelmed sometimes when we did not have our full staff and I had to pay attention to one child during the video taping, but it worked out!

The intervention is great b/c it is things you can use w/ all students in the class – filming not always easy depending on staffing

12) How would you change the program to make it work better for your classroom
Appendix J: Comfort Working with Students with ASD Questionnaire

1) I feel confident working with students with ASD.

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2) I feel that I can provide therapeutic care for children with ASD.

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<th>Strongly Disagree</th>
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3) I am able to encourage classroom engagement for students with ASD.

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4) I have strategies for encouraging communication for students with ASD.

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109
5) I feel overwhelmed when working with students with ASD.

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<tr>
<th>Always</th>
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6) I know how to provide an enriching classroom environment for students with ASD.

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<thead>
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<th>Strongly Disagree</th>
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7) I struggle to engage/play with students with ASD.

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8) I feel discouraged when working with students with ASD.

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9) Did this intervention improve your ability to interact with students with ASD? How so?

I think that I was already doing a lot of these strategies in my classroom already but I think it was a great refresher. It also helped me with focusing on one on one interaction while still being able to facilitate activities within my centers.
10) Please provide any additional thoughts/experiences related to the impact this intervention had on you and/or your students.

I think this would have been a better opportunity for the assistant teacher in my classroom. Assistant teachers don’t always get the trainings the leads do so I think it would be very beneficial.

02

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| Time One | Time Two |

2) I feel that I can provide therapeutic care for children with ASD.

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<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<td>Time One</td>
<td>Time Two</td>
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</table>

7) I struggle to engage/play with students with ASD.

<table>
<thead>
<tr>
<th>Always</th>
<th>Sometimes</th>
<th>Occasionally</th>
<th>Rarely</th>
<th>Never</th>
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<tbody>
<tr>
<td>Time One</td>
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</table>

8) I feel discouraged when working with students with ASD.

<table>
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9) Did this intervention improve your ability to interact with students with ASD? How so?

Yes, the use of pointing to get a “correct” response when not talking. Also exaggerating the emotion helped not only the student but others that I work with daily.

10) Please provide any additional thoughts/experiences related to the impact this intervention had on you and/or your students.
I will take the interventions and apply them to other students! Thanks!

03

1) I feel confident working with students with ASD.

<table>
<thead>
<tr>
<th></th>
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<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
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2) I feel that I can provide therapeutic care for children with ASD.

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<th>Agree</th>
<th>Strongly Agree</th>
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3) I am able to encourage classroom engagement for students with ASD.

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<th>Agree</th>
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4) I have strategies for encouraging communication for students with ASD.

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5) I feel overwhelmed when working with students with ASD.

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</table>
6) I know how to provide an enriching classroom environment for students with ASD.

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9) Did this intervention improve your ability to interact with students with ASD? How so?

While only working with one student this intervention has taught me skills that I will be able to carry out & use with all students in the classroom! I think the level of prompting that we used is an import skill I will carry away with me because it is something you can individualize for the child you are working with, some kids may need a full physical prompt while others may be able to skip that step completely. This study has helped me be more aware of exactly what I’m doing during lunch time and gave me good ideas of how to get the students to have conversation at the table and I can model eating/using utensils.
10) Please provide any additional thoughts/experiences related to the impact this intervention had on you and/or your students.

I thought Gabby was very accommodating to us & the class. It was hard because we were working with a part time kid with an inconsistent schedule who was receiving other supports overall. I had a good experience. I was overwhelmed sometimes when we did not have our full staff and I had to pay attention to one child during the video taping, but it worked out!
Appendix K: Demographics Questionnaire

Target Children and Families

Person Completing the Form: __________________________________________________________

Your Relationship to the Child: _______________________             Today’s Date: _____________

Child’s Name: ______________________________________________________________________

Date of Birth: _______________            Gender :         Male          Female

Child’s Ethnicity: Hispanic/Latino          Not Hispanic/Latino

Child’s Race (check all that apply):

☐ American Indian/Alaskan Native
☐ Asian
☐ Native Hawaiian or Other Pacific Islander
☐ Black or African American
☐ White
☐ More Than One Race
☐ Other: __________________________________________

Current Diagnoses (check all that apply):

☐ Autism, Autistic Disorder, or Autism Spectrum Disorder (ASD)
☐ Epilepsy or seizure disorder
☐ Genetic disorder (please specify) _____________________________________________
☐ Attention-Deficit/Hyperactivity Disorder (ADHD)
☐ Behavioral disorder (e.g., conduct disorder, oppositional defiant disorder)

Please list any other developmental, genetic, mental health, or behavioral diagnoses the child has received:
Please list any medications the child is currently taking:

1. 
2. 
3. 
4. 

__________________________________________

1. 
2. 
3. 
4. 

__________________________________________
Please indicate services that your child currently receives:

- Early Intervention/Help Me Grow
  - Amount of time per week: ____________________
- School-based/preschool special education services
  - Location or Provider: _______________________
  - Amount of time per week: ____________________
- Speech Therapy
  - Location or Provider: _______________________
  - Amount of time per week: ____________________
- Occupational Therapy
  - Location or Provider: _______________________
  - Amount of time per week: ____________________
- Physical Therapy
  - Location or Provider: _______________________
  - Amount of time per week: ____________________
- Applied Behavior Analysis (ABA) Services
  - Location or Provider: _______________________
  - Amount of time per week: ____________________
- Psychological/mental health services
  - Location or Provider: _______________________
  - Amount of time per week: ____________________
- Other services not listed above
  - Location or Provider: _______________________
  - Amount of time per week: ____________________

Approximate yearly income for the child’s family (before taxes)?

- Less than $20,000
- $21,000-$35,000
- $36,000-$50,000
- $51,000-$65,000
- $66,000-$80,000
- $81,000-$100,000
- $101,000-$130,000
- $131,000-$160,000
- Over $160,000

Mother/Mother Figure’s Highest Level of Education

- Some high school
- Alternative high school diploma
- High School graduate/GED
- Some college/vocational school
- Associate’s degree or certificate
- Bachelor’s degree
Target Staff Members

Your name: ____________________________________________________________

Your position at the ECE: _______________________             Today’s Date: ________________

Date of Birth: _________________

Gender: Male    Female

Ethnicity: Hispanic/Latino    Not Hispanic/Latino

Race (check all that apply):

- American Indian/Alaskan Native
- Asian
- Native Hawaiian or Other Pacific Islander
- Black or African American
- White
- More Than One Race
- Other: __________________________

Level of education:

- Some high school
- Alternative high school diploma
- High School graduate/GED
- Some college/vocational school
- Associate’s degree or certificate
- Bachelor’s degree
- Graduate degree

List your highest degree earned and any other relevant training/certifications
1.______________________________________________________________________
2.______________________________________________________________________
3.______________________________________________________________________

Years of experience with children with ASD: ___
Years of experience with children with other developmental disabilities: ____
Years of experience with typically developing children: ___