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Coaching Student Clinicians and Parents to Use Naturalistic Communication Techniques for Children with Signs of Autism

Erin M. Gallegos

Erin Gallegos

Candidate

Speech and Hearing Sciences

Department

This thesis is approved, and it is acceptable in quality and form for publication:

Approved by the Thesis Committee:

Cindy Gevarter, Ph.D. BCBA-D, Chairperson

Cathy Binger, Ph.D., CCC-SLP

Mary Hartley, M.S., CCC-SLP

COACHING STUDENT CLINICIANS AND PARENTS TO USE NATURALISTIC COMMUNICATION TECHNIQUES FOR CHILDREN WITH SIGNS OF AUTISM

by

ERIN GALLEGOS

B.A., ENGLISH, UNIVERSITY OF NEW MEXICO, 2012

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ABSTRACT

In this study, researchers implemented a short-term cascading coaching program focusing on naturalistic developmental behavioral interventions (NDBIs) with three participant triads consisting of a graduate student clinician, a minimally verbal child with autism spectrum disorder (ASD) or signs of ASD, and the child's parent. The efficacy of several short-term instruction sessions, in-session coaching, and student clinician parent coaching was evaluated using a multiple baseline across interventionists design. The primary dependent variables were clinician and parent use of elicitation techniques, including creating communication temptations and prompting, and response techniques, including reinforcing child communication and using vocal models. Following targeting coaching, all three triads increased use of elicitation and response techniques for both parents and clinicians, though results for some triads were variable. Implications for successful use of NDBI strategies with student clinicians and parents and the short-term implementation of cascading coaching models for under-resourced or rural families are discussed.

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Introduction

Autism spectrum disorder (ASD) is a developmental disorder characterized by social communication deficits and the presence of restrictive and repetitive behaviors or interests, affecting 1 in 44 children (American Psychiatric Association, 2013; Maenner et al., 2021). Most children with ASD have difficulties using verbal and nonverbal communication in social contexts, and approximately 25–35% of children with ASD may be considered minimally vocal (Kasari et al., 2013; Rose et al., 2016). Children described as minimally vocal are those who use a small inventory of spoken words or phrases in communicative contexts (Kasari et al., 2013). Although the exact number of words varies, the vocabulary size of minimally vocal children is typically between 0–25 words (Kasari et al., 2013).

Children with ASD who have limited use of vocal words may also have difficulties with prelinguistic communication (Shumway & Wetherby, 2009). Prelinguistic behaviors, which include gestures (e.g., pointing), eye gaze, and early vocalizations (i.e., not yet words) indicate a shift to intentional communication. Although prelinguistic acts are not yet symbolic (i.e., are not concrete symbols that represent a specific referents), they are used for engaging in social interactions, sharing in joint attention activities, and indicating wants and needs (Paul et al., 2018; Shumway & Wetherby, 2009). In comparison with peers, children with ASD ages 18–24 months may show more limited use of prelinguistic forms to initiate communication (Shumway & Wetherby, 2009). The quality of communicative acts and the number of communicative exchanges may also differ for this population (Romeo et al., 2018; Shumway & Wetherby, 2009). For example, children with ASD may use prelinguistic behaviors that do not have a clear function or rely on atypical forms of communication (Shumway & Wetherby, 2009).

In response to limited clear communication initiations, communication partners and their children with ASD may not engage in high frequency and varied social communication exchanges in home and community environments (Dubin & Lieberman-Betz, 2020; Romeo et al., 2018). Research indicates that the number of communication opportunities parents provide to children, the quality and quantity of parental language input, and parental responses to communication attempts, can influence children's overall language development (Cartmill et al., 2013; Hirsh-Pasek et al., 2015; Rowe, 2012; Swanson et al., 2019; Romeo et al., 2018). For instance, Romeo et al., (2018) found that more conversational turns between children and adults led to more robust activation in language-related brain areas in young children aged 4–6. Additionally, Venker et al. (2015) found that adult use of telegraphic language (e.g., omission of determiners, adjectives, grammatical morphemes) during communication turns correlated to lower language abilities for young children with ASD one year later when compared to parental use of grammatically complete utterances.

One approach for improving children's early communication skills that can include a focus on increasing child communication turns and providing high quality parental input is naturalistic developmental behavioral intervention or NDBI (Dubin & Lieberman-Betz, 2020; Gevarter, Najar, et al., 2021; Schreibman et al., 2015). NDBI focuses on the integration of intervention components derived from behaviorist and social interactionist theories into the natural environment (e.g., home, school) in everyday routines, such as mealtime and play (Dubin & Lieberman-Betz, 2020). Recent research has shown that components of NDBI techniques, such as following the child's lead, utilizing existing routines and natural reinforcers, applying systematic prompts and time delay, and using environmental arrangements to support communication, can lead to increased use of

prelinguistic communication behaviors and manual signs for children with ASD (Dubin & Lieberman-Betz, 2020; Gevarter, Najar, et al., 2021). It is important to note, however, that the relative naturalness of an NDBI approach can change based on factors such as the communication partner (e.g., parents are more natural partners than clinicians), environment (e.g., home is a more natural location than a clinic room), and level of adult control (e.g., adults contriving opportunities to communicate is less natural than incidentally capturing child-led opportunities).

Environmental arrangements can be used to create communication temptations (i.e., opportunities presented by a communication partner to elicit communication from the child), which should increase a child's use of communicative turns (Paul et al., 2018; Schreibman et al., 2015). Examples of communication temptations include placing preferred items or activities out of reach, giving only a few pieces of a preferred item to child, or interrupting an existing routine (Paul et al., 2018; Schreibman et al., 2015). For example, if a child's favorite food is fruit snacks, a parent or caregiver can place the fruit snacks on top of the refrigerator. If the child initiates a communicative turn (e.g., pointing, vocalizing, signing FOOD), their parent or caregiver can provide them with the fruit snacks. This technique can encourage parent-child engagement and utilizes natural reinforcement (Koegel et al., 2009; Paul et al., 2018; Schreibman et al., 2015). A recent study also showed that when parents integrated more communication temptations into existing routines, children with ASD showed an increase in their use of prelinguistic behaviors and manual signs (Gevarter, Najar, et al., 2021).

Some NDBI techniques, like creating communication temptations, focus on eliciting communication from the child. Following the creation of a communication temptation, NDBI

techniques such as providing wait time and prompting new communication behaviors can further elicit communication from the child (Minjarez et al., 2020). Additionally, because communication temptations are embedded into naturalistic routines (Dubin & Lieberman-Betz, 2020), such activities can also incorporate the circumscribed interests of children with ASD. Circumscribed interests include items/activities/themes with which a child with ASD shows intense interest (Kryzak & Jones, 2014). Several studies have found evidence that using circumscribed interests can increase motivation to communicate when integrated with NDBI strategies (Kryzak & Jones, 2014; Vismara & Lyons, 2007). Once a communication temptation is created and target communication is elicited, NDBI strategies emphasize timely and appropriate responding from the adult (Schreibman et al., 2020). Appropriate responding when using NBDI strategies involves the use of natural reinforcement that is provided immediately following the communication act and directly connected to the act (Schreibman et al., 2020). Additionally, pairing a child's communication with a spoken model that maps language to the child's actions, adds new information, or increases grammatical complexity can foster increased communication skills and maximize the communication turn (Minjarez et al., 2020). In a study by Gevarter, Najar, et al. (2021), for example, parents integrated both elicitation and response techniques to increase their children's communication by creating communication temptations, prompting targeted communication responses, delivering natural reinforcement, and providing language input by using speech to model words associated with prelinguistic responses.

While spoken language can be mapped onto a child's prelinguistic communication turns, it can also be mapped onto alternative forms of symbolic communication, such as manual signs. Prior research supports the use of manual signs to foster functional

communication for minimally vocal children with ASD (Nam et al, 2018). Like prelinguistic gestures, manual signs do not require any external equipment outside of the body and can be used to introduce specific words (Beukelman & Light, 2020). Additionally, physical prompts and modeling can be used to facilitate sign use during communication opportunities. Manual sign systems, typically focusing on several signs relevant to the child, are often introduced in early intervention programs for children with developmental disabilities before aided AAC forms are introduced or may continue to be the primary communication mode (Beukelman & Light, 2020).

Because NDBI strategies focus heavily on naturalistic routines, successful implementation of NDBI should involve typical early communication partners such as caregivers/parents (Dubin & Lieberman-Betz, 2020). Some NDBI studies have included partner-instruction in which parents are taught to use the aforementioned techniques, such as following the child's lead, providing natural reinforcement, creating communication temptations, modeling, and prompting (Gevarter, Najar, et al., 2021; Kasari, Lawton, et al., 2014; Shire et al., 2018; Wetherby et al., 2014). Different approaches are available to teach communication strategies and techniques to parents and caregivers. For example, parents might be provided with professionally led group instruction in face-to-face or online contexts where treatment information is provided to them in an instructional format, or they may be coached in a clinical environment where they try out treatment techniques in a hands-on format (Kasari, Lawton, et al., 2014).

Behavioral Skills Training (BST) is an instruction model derived from applied behavior analysis that includes (a) describing techniques, (b) modeling, (c) rehearsing and role playing, and (d) providing feedback (Miltenberger, 2011). BST has been shown to be

successful in instructing parents to implement a variety of evidence-based treatments for their children with ASD (Schaefer & Andzik, 2021). Sharing components of BST, coaching models embed parent instruction into intervention sessions in which the child is present. Specific models of coaching, such as Family Guided Routines Based Intervention (FGRBI; Woods et al., 2004) and Project IMPACT (Ingersoll & Wainer, 2013), have developed structured curriculums but have many shared elements. Common components of coaching include (a) discussing priorities, preferences, and routines with caregivers; (b) observing existing caregiver-child interactions; (c) providing parents with direct instruction and modeling of techniques using a variety of modalities (e.g., print, video, verbal, visual); (d) providing opportunities for caregivers to practice techniques with children and providing feedback; (e) engaging in reflection and discussion; and (f) fading of coaching (Friedman et al., 2012; Wetherby et al., 2014). In one study, Kasari, Lawton, et al. (2014) compared the impact of a coaching approach (teaching caregivers to model, prompt, expand play, and use developmentally appropriate language with the child) to caregiver educational sessions (small group instruction on intervention strategies and techniques without the child present). Results indicated that the coaching model (in comparison to group instruction) led to greater gains in prelinguistic communication for the children of the caregivers (Kasari, Lawton et al., 2014).

Although evidence about the importance of including parents in communication interventions is robust, according to a recent meta-analysis, interventions implemented by both caregivers and interventionists rather than caregivers alone have a greater positive effect on overall language outcomes (Sandback et al., 2020). However, in a rural state like New Mexico, services from highly trained clinicians, such as speech language pathologists (SLPs)

and board certified behavior analysts (BCBAs), to implement collaborative parent/caregiver coaching can be difficult to access due to provider shortages (Gevarter, Najar, et al., 2021). To address these concerns, recent research has explored models in which a highly trained clinician provides short-term instruction or coaching to less experienced clinicians who work with parents on a more regular basis (Gevarter, Najar, et al., 2021; Meadan et al., 2020). In one study, BST was first used to teach communication intervention techniques to both parents and early intervention providers working with young minimally vocal children with diagnoses or signs of ASD (Gevarter, Najar, et al., 2021). The trained clinician then provided coaching to parents and early intervention providers for two sessions before fading this support. Early intervention providers continued to coach parents for additional sessions before this support was faded as well. Results indicated increases in both caregiver use of communication temptations and child targeted communication responses (Gevarter, Najar, et al., 2021). In another study, Meadan et al. (2020) utilized a cascading coaching model. A highly knowledgeable clinician instructed early interventionists/generalists in methods for delivering parent-coaching via telehealth. The study found that early intervention providers improved their caregiver-coaching practices following the intervention. This study did not, however, specifically focus on children with ASD.

Although providing instruction to practicing clinicians is important in increasing the number of professionals with expertise in the use of parent coaching approaches and NDBI techniques, graduate instruction programs must also ensure that student clinicians have ample opportunities to implement these techniques and receive feedback. A small evidence-base has examined the role of student practitioners in NDBI implementation (Dubin & Lieberman-Betz, 2020). In a randomized control trial conducted by Ingersoll (2012), undergraduate and

graduate clinicians implemented a prelinguistic intervention targeting initiation of joint attention after direct instruction, modeling, and feedback was provided to them by a highly trained clinician. Fidelity for the student clinicians was high and children in the treatment group made significant gains in initiating joint attention. Student clinicians were not, however, provided instruction on coaching parents (Ingersoll, 2012). In a study by Kasari et al. (2010), graduate students were instructed by the lead researcher to coach parents in the use of naturalistic intervention techniques for their minimally vocal toddlers with ASD. Results indicated that when caregivers implemented techniques with fidelity, joint attention responses increased (Kasari et al., 2010). These studies provide evidence that instruction from a highly trained clinician can lead to high quality intervention implementation and coaching from more novice clinicians.

The current study sought to assess the effectiveness of a brief four-week cascading coaching model involving a highly trained researcher (i.e., lead instructor), graduate-level special education and speech-language pathology student clinicians, parents, and young children with diagnoses or signs of ASD. Using BST and coaching models, the lead instructor first instructed student clinicians in the use of naturalistic elicitation and response techniques. Elicitation techniques included (a) using targeted communication opportunities provided to children during preferred activities, (b) waiting for communication responses, and (c) prompting communication as needed. Response techniques included reinforcing communicative acts with natural consequences and providing grammatically complete models of language. Following additional instruction in the use of coaching approaches, student clinicians then coached parents to implement the elicitation and response techniques. Although the NDBI techniques described above have been shown to be effective when used

regularly and in high dosages (Dubin & Lieberman-Betz, 2020), the effectiveness of short-term, low-intensity approaches are important to explore in rural and under-resourced states (Gevarter, Najar, et al., 2021). For instance, in New Mexico, due to high turnover of early interventionists/generalists at the state level and limited access to highly trained professionals, families may not be getting regular access to the high-quality services they need (Office of Special Education Programs, 2021). Providing brief but effective instruction to parents who can implement these techniques on a regular basis could increase access to consistent, evidence-based intervention techniques for children with ASD. Additionally, by teaching student clinicians to both use naturalistic intervention approaches and coach parents in these techniques, this study has the potential to improve ASD intervention research-to-practice gaps. Early intervention providers in New Mexico have, for example, demonstrated knowledge gaps in their understanding of naturalistic intervention approaches while also reporting the need for more instruction in working with parents (Gevarter et al., 2022).

The primary research question focused on whether a brief cascading coaching model (involving BST, researcher-led coaching for student-clinicians, and student-led coaching for parents) led to an increase in student clinician and parent use of naturalistic (a) elicitation techniques and (b) response techniques. Additional descriptive measures focused on fidelity of coaching, and parent and student clinician views on the social validity of the coaching model/intervention techniques. Researchers did not examine variables related to child use of prelinguistic communicative forms, as these questions will be addressed in a companion study.

Methods

Participants

Participants in this study initially included four triads that each consisted of (a) a child with a diagnosis of/or signs of ASD, (b) a participating child's parent, and (c) a student clinician. One triad was dropped from this study after the parent and child stopped attending sessions due to child illness. As this triad did not move past the baseline stage, we excluded participant information from this analysis. Child participants met the following criteria: (a) were between 2.5–4 years old, (b) had an independent diagnosis of ASD or were on a wait list for a diagnostic assessment, (c) were confirmed to have at least mild-to-moderate symptoms of ASD on the Childhood Autism Rating Scale Second Edition (CARS-2; Schopler et al., 2010), and (d) were considered minimally vocal based on parent report of spoken words (i.e., fewer than 25 words; Kasari et al., 2013; Rose et al., 2016). Because of long wait times for ASD diagnosis in New Mexico, this study broadened inclusion criteria to children who presented with mild to moderate signs of ASD (CARS-2 score greater than 30) but did not yet have a formal diagnosis. The CARS-2 has been shown to be a reliable and valid measure that correlates with other ASD severity measures (Reszka et al., 2014). Child and parent participants were recruited via outreach to local early intervention, speech therapy, and applied behavior analysis providers, as well as parent Facebook groups.

The student clinicians who implemented the trickle-down caregiver coaching model were participating in a summer clinical rotation/course that was part of the Project SCENES training grant program at the University of New Mexico (Gevarter, 2021–2025). The student clinicians who completed the study included two special education graduate students and one speech-language pathology graduate student. Student clinicians and parents both completed

an informed consent process approved by the University Intuitional Review Board. The director of the grant program, who is a board-certified behavior analyst at the doctoral level (BCBA-D) and an associate professor in speech and hearing sciences, served as the lead instructor who provided instruction to the student clinicians.

Table 1 illustrates demographic information for the adult participants (i.e., parents and student clinicians and Table 2 illustrates demographic and assessment information for the three child participants). Pseudonyms were assigned for all participants. Ethnicity and education level was reported by adult participants. All parents identified as female and Hispanic. Student clinicians identified as female and Caucasian, Hispanic, or African American and Pacific Islander. All student clinicians and parents spoke English as their primary language. All three of the child participants were between 2;4 and 2;8 years-old and Hispanic. One of the three (Michelle) was identified as female and the other two were male. Vince and Michelle were both waitlisted for a formal ASD diagnosis and demonstrated mild-to-moderate ASD symptoms based on the CARS-2 (Schopler et al., 2010). Garrett had a formal ASD diagnosis and demonstrated severe ASD symptoms based on the CARS-2 (Schopler et al., 2010). Scores from the Vineland Adaptive Behavior Scales 3rd Edition Interview Form (VABS-III; Sparrow et al., 2016) which were used to gauge overall receptive and expressive communication abilities, are included. Summaries from the Communication Matrix (Rowland, 2011), which were used to assess the types of prelinguistic communication behaviors the child participants were currently using, are also included.

Table 1

Adult Participant Characteristics

	Age	Ethnicity and gender	Education	Job or Degree Program
Triad 1				
Elaine (Garrett's mother)	25;3	Hispanic female	Some college	Stay-at-home parent
Linda (Garrett's clinician;	45;3	Caucasian female	Master's degree in progress	Special education graduate student and special education teacher
Triad 2				
Katherine (Vince's mother)	41;7	Hispanic female	Bachelor's degree in progress	Data scientist
Paula (Vince's clinician)	22;11	Hispanic female	Master's degree in progress	Special education graduate student
Triad 3				
Karen (Michelle's mother)	29;10	Hispanic female	Associate's degree	Stay-at-home parent
Tina (Michelle's clinician)	22;5	African American and Pacific Islander female	Master's degree in progress	Speech-language pathology graduate student

Table 2

Child Participant Characteristics

	Age	Ethnicity and gender	Diagnostic status	CARS-2 score	VABS-III age equivalent and standard score	Communication Matrix summary
Garrett (Triad 1)	2;4	Hispanic male	ASD diagnosis	43.5 (severe ASD symptoms)	Receptive: 0;9 Expressive: 0;8 Standard score: 36 CI (95%): 30–42	Level III (unconventional gestures) and Level IV (conventional gestures) with some emerging Level V (abstract symbols – words)
Vince (Triad 2)	2;6	Hispanic male	Waitlist for diagnostic assessment	32.5 (mild-to-moderate ASD symptoms)	Receptive: 1;4 Expressive:0;0 Standard score: 51 CI (95%): 45–57	Level IV (conventional gestures) and Level V (abstract symbols – signs)
Michelle (Triad 3)	2;8	Hispanic female	Waitlist for diagnostic assessment	34.5 (mild-to-moderate ASD symptoms)	Receptive: 1;5 Expressive: 1;3 Standard score: 69 CI (95%): 63–75	Level IV (conventional gestures) and Level V (abstract symbols – signs and words)

Materials and Setting

Materials in this study included instructional visual supports, video models of intervention and coaching methods, a coaching checklist, and preferred toys and activities specific to each child participant. Ten-dollar Amazon gift cards were used as participant incentives. Several visual supports to aid in instruction/coaching were used. First, a visual aid for parents and student clinicians outlining techniques taught during coaching sessions was provided (see Figure 1). The visual aid, which was adapted from Gevarter, Najar, et al. (2021), emphasized techniques for eliciting and responding to communication (i.e., create, wait, prompt, respond, describe). Second, an individualized activity planner (see Figure 2 for example) outlining targeted communication temptations, amount of wait time, type of prompts, potential child responses, how to reinforce the child response, and potential grammatically complete spoken models was created for each child.

Figure 1

Visual Aid for Caregivers Including All NDBI Techniques

Figure 2

Example Activity Planner

Target Temptation	**"Create:" Activities/ Routines**	**Types of Responses**	**"Wait:" Wait Time**	**"Prompt"**	**"Respond" & "Describe"**
Giving choices	Water toys Pretend food Vehicles	Reach or point	≥ 3s	Model reach or point Provide physical guidance as needed	Respond: give child requested item selected Describe: *You chose the blue car!*
Items requiring assistance	Balloons Spray bottle Closed containers Shaving cream	Hand item to the adult	≥3s	Adult holds out hand Provide physical guidance as needed	Respond: help child access the item (e.g., open container, blow up balloon) Describe: *You asked for help!*
Start and stop routines	Tickles Bouncing on ball Riding a rocking horse	Sign for MORE, say *go*	≥3s	Model sign or *go* Provide physical guidance as needed for sign	Respond: continue routine that was stopped Describe: *You want more tickles!*

Video models initially created for the Gevarter, Najar, et al. (2021) study were used to show examples of intervention and coaching techniques during BST sessions with student clinicians. The intervention techniques video included models and descriptions of different communication temptations (e.g., using items that require assistance, starting and stopping routines, placing items out of reach), waiting, and prompting (e.g., graduated physical assistance or modeling). The video also provided models and descriptions of how to appropriately respond to the child by completing an action or providing an item while also pairing a spoken model with the child's communication act. The coaching video included models of how parent coaching was used to teach parents the specific techniques outlined in the intervention video. Coaching methods demonstrated included modeling, providing assistance (e.g., help with prompting and gathering preferred items), and giving feedback.

A coaching checklist was provided for graduate student clinicians implementing parent coaching (see Figures 3 and 4). It emphasized the coaching steps that included (a) introducing/modeling elicitation and response techniques, (b) jointly filling out the activity planner, (c) asking for questions from parents, (d) observing parent/child interactions while providing assistance and feedback, and (e) providing follow-up feedback and discussion.

Preferred materials/activities (e.g., toys, sensory items, art activities) that were used in sessions were identified using the Reinforcer Assessment for Individuals with Severe Disability (RAISD; Fisher et al., 1996). This parent interview assessment tool has been used to establish preferred stimuli for young children with ASD in recent communication intervention research (Barry et al., 2018; Mandel et al., 2022). After preferred items were established, two unique and targeted sets of materials were created for each child—one set of materials for the child to use in the student clinician sessions and one for the child to use in

the parent sessions. Triad 1 materials included activities/items such as a spray bottle, balloons, bouncy balls, popper toys, and music toys. Triad 2 materials included a water table, water beads, bubbles, balloons, books, and a variety of vehicle-related items, including vehicle stickers, and large and small toy vehicles (trains, busses, cars). Triad 3 materials included a water bin, water toys, trampoline, magnatiles, dinosaur toys, and a variety of different puzzles. Materials were similar for parent and student clinician sessions, but each set of materials included novel toys and activities (e.g., vehicle stickers were only available during parent sessions for Triad 2) with some consistent items throughout sessions (e.g., water bin was available for both parent and student clinician sessions for Triad 3).

Figure 3

Coaching Checklist Sessions 1–3

Sessions 1–3:

- ☐ Introduce and model one communication temptation and techniques needed to complete communication turn
- ☐ Fill in activity planner jointly
- ☐ Visual aid available
- ☐ Ask for questions

All sessions:

- ☐ 12-minute play session
- ☐ Variety of child's preferred items available
- ☐ Used verbal cues and assistance as needed

Provide Feedback (at least 2 skills):

- ☐ Create
- ☐ Wait
- ☐ Prompt
- ☐ Respond
- ☐ Describe

Figure 4

Coaching Checklist Sessions 4–6

Sessions 4–6:

- ☐ Activity planner available
- ☐ Visual aid available
- ☐ Ask for questions
- ☐ Model techniques if needed

All sessions:

- ☐ 12-minute play session
- ☐ Variety of child's preferred items available
- ☐ Used verbal cues and assistance as needed

Provide Feedback (at least 2 skills):

- ☐ Create
- ☐ Wait
- ☐ Prompt
- ☐ Respond
- ☐ Describe

All sessions took place in clinic rooms of a university speech-language pathology clinic. The clinic rooms had a small table with 2–3 chairs. Preferred toys and activities were placed in clinic rooms prior to a session, but some items remained inside a bag at the start of a session so the parent or clinician could slowly introduce or offer different items.

The researchers (i.e., lead researcher and student researcher) used the following commercially available assessments: (a) the Childhood Autism Rating Scale Second Edition (CARS-2; Schopler et al., 2010), (b) the Communication Matrix (Rowland, 2011), and (c) the Vineland Adaptive Behavior Scales Interview From 3rd Edition (VABS-III; Sparrow et al., 2016). The CARS-2 was used to confirm participant ASD symptoms and level of severity. The Communication Matrix was used to determine the existing communication skills of the participants. The Communication Matrix is a broadly used tool that evaluates the function, form, and intentions of expressive communication skills from a developmental perspective (Rowland, 2011). The communication sections of the VABS-III, which has strong internal validity and internal consistency, were used to further evaluate participant expressive and receptive language abilities (Pepperdine & McCrimmon, 2018).

Dependent Variables

The primary dependent variables assessed across adult participants (i.e., both the student clinicians and parents) were the use of targeted (a) elicitation techniques and (b) response techniques. Elicitation techniques included using a targeted communication temptation, waiting at least 3 seconds for an independent initiation from the child, and prompting (model or physical guidance) if no independent initiation occurred. Verbal cues or questions (e.g., *Do you need help? Which one do you want?*) were not considered prompts. In order to maintain the naturalness of the parent/clinician-child interaction, these types of cues

were not discouraged and were considered by the researchers to be natural cues. Prior naturalistic interventions have categorized verbal cues and questions as such (Gevarter, Groll, et al., 2021). Response techniques included reinforcing the communication turn from the child with natural consequences (e.g., giving items or completing actions that were requested) and pairing that reinforcement with a grammatically complete spoken model of the child's communication turn (e.g., *you asked for more tickles*). A response from the parent or student clinician that would not be considered acceptable would be unrelated to the communication act or grammatically incomplete, such as *wow, ball!*

Target communication temptations were chosen based on initial baseline sessions. Table 3 provides descriptions of potential communication temptations that could have been selected. This list of temptations was adapted from Minjarez et al. (2020). Using this table, the lead researcher and student researcher reviewed baseline interactions between parents/clinicians and child participants and selected communication temptations that were not frequently being used by the parents/clinicians (e.g., no more than three instances across two or more sessions) and were appropriate for the chosen activities and/or routines. These infrequently used temptations were chosen so student clinicians and parents could expand the type of communicative functions that the child was currently using (e.g., if a child was primarily initiating communication to request items during baseline, the temptation of offering non-preferred items could be introduced during intervention to teach the communicative function of rejecting). It was possible for parent and student clinician targeted communication temptations to be different for the same child.

Table 3

Possible Communication Temptations

Communication Temptation	Definition
Giving choices	Offering at least two items so the child must make a choice between the items to obtain one
Withholding access to items (items or activities in sight, out of reach, or adult holding item)	Storing items/setting up activities where the child can see the items/activities but cannot access them (includes when adult has access to item)
Interrupting routines, actions, or activities	Pausing during a routine so the child is required to communicate before the routine continues
Items/activities requiring assistance	Setting up activities or situations in which the child needs to ask for assistance to access the item/activity
Inadequate portions/providing a few pieces/or withholding necessary parts	Providing a few pieces or parts of an item so the child has to communicate to access more pieces or additional items needed for activity (e.g., give paper but not paint)
Giving wrong item	Giving the child the wrong piece of a toy or item
Intentional ignoring	Ignoring the child on purpose to teach the child how to get adult attention
Offering non-preferred item/activity or action	Setting up situations with non-desired items, activities, or actions, in order to practice rejecting
Silly situations/playing the naïve adult	Setting up routines that are intentionally silly or interrupting routines in a silly manner
Using carrier phrases	Using phrases such as "ready, set, ____" or "one, two, ____" to encourage communication during play routines
Asking questions	Asking a question in which the child can respond with gestures or signs (e.g., where's the cat?)
Taking turns	Taking a turn with an item or activity and waiting to give the child an opportunity to take a turn with the same item/activity

Data Collection and Analysis

All sessions were videorecorded, and coders used a data collection sheet to document the components of the primary dependent variables. The student researcher served as the primary coder. When parents/clinicians presented a communication temptation, the coder recorded the following: (a) if it was a target temptation, (b) if 3s of wait time occurred (if needed), (c) if the parent provided a prompt following 3s (if needed), (d) if the parent/clinician appropriately reinforced the child's communication act (e.g., provided requested toy), and (e) if the parent/clinician provided a grammatically complete and relevant spoken model. If steps a–c were recorded as being correctly implemented, the coder marked that elicitation techniques had been correctly used for that opportunity. If steps d and e were recorded as being correctly implemented, the coder marked that response techniques had been used appropriately.

Interobserver Agreement (IOA)

For each adult participant (i.e., student clinicians and parents), 33% of sessions across each phase were randomly selected to be evaluated for IOA. A second independent observer coded the sessions selected for IOA using the same data collection sheets as the primary coder. An IOA score for each session was calculated by dividing the number of agreements by the total amount of disagreements + agreements across both elicitation and response technique variables Average IOA for Triad 1 was 95.89% (range 80–100%) for student clinician sessions and was 94.87% (range 86–100%) for parent sessions. Average IOA for Triad 2 was 98.63% (range 83–100%) for student clinician sessions and 97.79% (range 86–100%) for parent sessions. Average IOA for Triad 3 was 96.10% (range 91–100%) for student clinician sessions and 97.09% (range 85–100%) for Triad 3 parent sessions.

Research Design

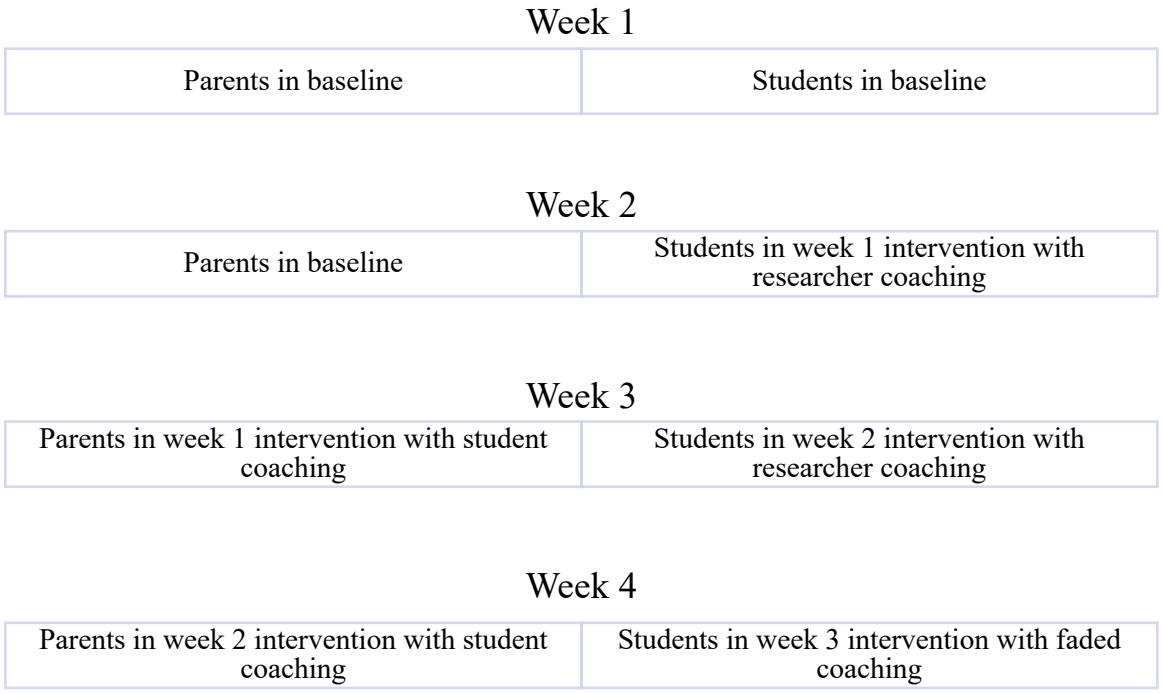
A multiple-baseline across-participants (i.e., parents and student clinicians) design was implemented for Triads 1 and 2, but due to child participant absences during baseline, Triad 3 used a multiple probe design (Gast et al., 2014). Research sessions took place three days a week during a four-week summer clinic for children with ASD. Research sessions with the parent, child, and student clinician, who provided parent coaching, occurred in small clinic rooms at the start of the 2.5-hour clinic session. The child and student clinician then both took part in a group-based naturalistic clinic modeled to emulate a preschool classroom. At least one hour after the research session that included the parent, student clinicians and the child participants completed another research session in one of the small clinic rooms with coaching from the lead instructor. While research sessions could be up to 30 minutes in length during intervention (to include time for joint-planning, discussion, and feedback) the observational portion of the session during which the student clinician or parent played and interacted with the child (i.e., portion used to code dependent variables) were 12 minutes in length.

Researchers planned for baseline sessions with the parent/child/clinician and child/clinician alone to take place during week 1 of the summer clinic (sessions 1–3). Although in this design it is recommended to continue baseline until stable data patterns have been established (Cooper et al., 2019) due to the short duration of this study, a predetermined number of baseline sessions was selected. Given the focus on selecting communication temptations that occurred at low rates during baseline, the researchers did anticipate relatively stable data. During sessions 4–6 (week 2), intervention that involved the lead instructor coaching the student clinicians to use communication techniques during

sessions without the parent present was introduced. During this same time, sessions in which the parent was the primary communication partner continued to remain in baseline. Lead instructor coaching with student clinicians continued during sessions 7–9 (week 3), with no new techniques introduced. At the same time, if student intervention sessions during sessions 4–6 showed a higher level of completed targeted opportunities compared to baseline for at least two sessions, then graduate clinicians began introducing parents to new communication techniques via coaching during sessions 7–9 (week 3). This criterion was added as it is recommended that intervention is not introduced across a second set of participants until an effect of the intervention is demonstrated with the first set of participants (Cooper et al., 2019) For the final week of sessions (sessions 10–12) student clinician-led intervention sessions without any researcher coaching and parent intervention sessions with student coaching continued.

Figure 5

Research Design Timeline



Not all sessions were completed for all triads due to participant illness and restrictions related to the Covid-19 pandemic. Triad 1 completed all scheduled baseline sessions for the student clinician (three sessions) and the parent (six sessions). The student clinician completed seven intervention sessions, including one session without lead instructor coaching. The parent participated in four intervention sessions with student clinician coaching. Triad 2 completed all baseline and intervention sessions with both the parent and student clinician, including fading of lead instructor coaching. Triad 3 completed two baseline sessions with the student clinician and four baseline sessions with the parent. The student clinician completed four intervention sessions with lead instructor coaching, and the parent completed four intervention sessions with student clinician coaching.

Procedures

Screening

Researchers used parent interviews to administer the CARS-2 (Schopler et al., 2010) and the communication sections of the VABS-III Interview Form (Sparrow et al., 2016). If the child had at least mild-moderate ASD symptoms based on the CARS-2 (score of 30+), fewer than 25 words based on the VABS-III, and the parent was available to participate in the study, an approved informed consent process was conducted. Parent interviews using the RAISD (Fisher et al., 1996) were then conducted to determine preferred items, activities, and social-sensory routines. Finally, parent interviews with the Communication Matrix (Rowland, 2011) were completed to identify the child participants' current use of prelinguistic communication acts (i.e., forms and functions).

Baseline

During baseline sessions, parents and student clinicians were instructed to try to engage the child with the preferred items, activities, or social sensory routines that were selected based on RAISD responses. Different materials/activities were available in the parent sessions versus the student clinician sessions to prevent satiation (see Materials for details). Once the child approached or showed interest in an item, activity, or routine, the 12-minute observation began.

Target selection

After baseline videos were collected, the lead researcher and student researcher watched initial baseline videos and recorded what types of communication temptations (see Table 3) that were currently being used. Three communication temptation types that were used infrequently by the parents and student clinicians and were appropriate for the child's

interests and activities were selected as targets. Data from the Communication Matrix and child behaviors seen in the recorded baseline sessions were also used to brainstorm possible ways in which the child might respond to communication temptations (e.g., by pointing or using manual sign). The possible responses were further refined with student/parent input during initial coaching sessions (see Instruction and Coaching section). Table 4 describes the targeted temptations and examples of child communicative responses selected for each child.

Table 4

Child-Specific Targets

	Adult target temptations	Example child responses
Garrett's clinician targets	Give choices	Reach or point
	Items requiring assistance	Hand item to adult
	Inadequate portions	Reach or point
Garrett's parent targets	Give choices	Reach or point
	Items requiring assistance	Hand item to adult
	Start and stop a routine	Say *go* or sign MORE
Vince's clinician targets	Giving choices	Point or sign for specific item
	Items that require assistance	Sign OPEN or HELP
	Taking a turn	Sign MY TURN or specific sign for item
Vince's parent targets	Giving choices	Point or sign for specific item
	Silly situations/playful obstruction	Sign OFF
	Taking a turn	Sign MY TURN or specific sign for item
Michelle's clinician targets	Giving choices	Point or specific sign for item
	Inadequate portions	Specific signs for item (e.g., PUZZLE, WATER, BLOCK) or sign MORE
	Offering non-preferred items	Shake head 'no,' push away items
Michelle's parent targets	Giving choices	Point or specific sign for item
	Inadequate portions	Specific signs for item (e.g., PUZZLE, WATER, BLOCK) or sign MORE
	Offering non-preferred items	Shake head 'no,' push item away

Instruction and Coaching

Group Instruction for Students in Intervention Methods. Student clinician group intervention instruction sessions took place during a university course associated with the summer clinic. Group instruction sessions took approximately 1 hour. The instruction session utilized a BST model which includes describing, modeling, rehearsing/role-playing, and providing feedback (Miltenberger, 2011). For this study, instruction occurred for the following techniques: (a) creating a communication temptation, (b) waiting at least 3s for the child to respond with an appropriate communicative act, (c) prompting a gesture or sign via model or graduated physical guidance, (d) naturally reinforcing the independent or prompted communication act, and (e) providing a grammatically complete spoken model of the child's communication act. Graduated physical guidance entails introducing physical prompts as needed to assist a child in completing a task (Akmanoglu et al., 2014). Parents and clinicians were taught to use prompts as appropriate to the context for the child, behavior being taught, and prior mastery of the skill (e.g., graduated physical guidance was used to teach new skills and modeling was used to prompt previously observed skills). The activity planner, adapted from Gevarter, Najar, et al. (2021), describing the selected communication temptations was also used (see Figure 2 for example). Modeling of techniques was provided via both in-person demonstration and video models (see Materials). Roleplay with feedback occurred in small groups.

Researcher-Led Coaching Sessions of Students. In-session student clinician coaching was provided by the lead instructor (a certified BCBA-D with 15+ years' experience) following initial baseline sessions and after the group instruction session. Sessions were approximately 20–30 minutes in length, with the play session with the child

lasting 12 minutes. For the first three coaching sessions, during the first 5–10 minutes, the lead instructor introduced a new target communication temptation and modeled how to use it with the child. The lead instructor and student clinician then jointly collaborated to fill out the activity planner (see Figure 2 for example). First the lead instructor and student clinician brainstormed possible activities in which the temptation could be used (e.g., with bubbles, balloons). The lead instructor then discussed the purposes of waiting at least 3s prior to prompting a response and described conditions when they may want to wait longer. Next, the lead instructor and student clinician discussed the possible communication behaviors that a child might use in response to the communication temptations (e.g., pointing to an object, signing OPEN), and what communicative acts the student clinician would prompt if the child made no response. After that, the lead instructor and student clinician discussed options for prompting (e.g., when to use modeling versus graduated guidance) and reviewed how to naturally reinforce responses. Finally, the lead instructor provided examples of grammatically complete spoken models that could be used following a child response (e.g., "you want to open it"). A visual aid (see Figure 1) illustrating the general skills that were required to complete a targeted communication opportunity (i.e., create, wait, prompt, respond, describe) was also reviewed and displayed on the wall of each clinic room during all intervention sessions. Following this introduction, the student clinician ran the 12-minute play session with the child participant. The lead instructor was present during the session to give verbal cues and assist as needed (e.g., help with prompting the child or gathering materials needed for communication temptations). During the final 5 minutes of the session, the lead instructor provided feedback on at least two of the skills related to elicitation or response techniques (e.g., use of wait time and spoken models) observed or not observed

during the session and answered any questions from the student clinician. A coaching checklist was used to ensure coaching fidelity (see Figure 3).

During the next three coaching sessions, no new communication temptations were introduced, but the lead instructor had the visual aid and activity planner available. Student clinicians were encouraged to ask questions and skills were modeled as needed in the first 5–10 minutes of the session. Following the review, the student clinician conducted the 12-minute play session. The lead instructor was available to provide assistance and verbal cues. During the final 5 minutes, feedback was given on at least two skills and the lead instructor answered any questions from the student clinician. If a child was available for all 12 possible sessions, then during the last three sessions in which the student clinician worked with the child, coaching was faded and the student clinician ran their sessions independently but still had access to the visual aid and activity planner.

Group Instruction for Students in How to Coach Parents. Group instruction for student clinician-led parent coaching took place during the university course associated with the summer clinic and took approximately 1 hour. The skills that were taught to the students during this session were the same coaching steps the lead instructor applied when coaching students in the intervention methods session. These steps are listed in the coaching checklists (see Figures 3 and 4). The lead instructor used the BST model (i.e., describing, modeling, rehearsing/role-playing, and providing feedback) to instruct student clinicians on how to coach parents. Instructions were provided via in-person modeling/demonstration and video models (see Materials section for video descriptions). Student clinicians role played coaching steps in groups and received feedback from the lead instructor.

Student-Led Coaching Sessions of Parents. In-session parent coaching was provided by student clinicians following initial baseline sessions and after the group instruction session on coaching. Procedures were identical to researcher-led coaching, except student clinicians performed the coaching role. For example, for the first three coaching sessions, the student clinician modeled a new target communication temptation and collaborated on the creation of the activity planner (see Figure 2 for example). The student clinician reviewed the visual aid (see Figure 1) displayed in the clinic room, and the parent then ran the 12-minute play session with their child. The student clinician was present during the session to give verbal cues and assist as needed and provided feedback after the play session. Student clinicians then continued coaching for the remaining three sessions for those who completed all phases of the instruction model, but no new communication temptations were introduced.

Treatment Fidelity

Group Instruction Fidelity

A checklist outlining the steps of BST was used to assess group instruction fidelity for the lead instructor. A trained independent observer (the student researcher) checked off whether the lead instructor completed all BST steps during the two group instruction sessions. Lead instructor coaching fidelity was 100% across both group instruction sessions.

Coaching Fidelity

A coaching checklist (see Figures 3 and 4) was used to track coaching fidelity for the lead instructor and student clinicians during the coaching phase. Some items on the checklist were scored as either 1 or 0, indicating whether a step was completed or not completed (e.g., was the activity planner made available to the parent or was it not). Others had a rating scale

from 0–2 and allowed for partial credit. For example, when scoring if spoken cues and assistance were provided as needed, a 1 would be awarded if intermittent spoken cues were provided and a 2 would be awarded if sufficient spoken cues and assistance were provided. Fidelity checks were completed using the same videos coded for IOA (i.e., 33% of randomly selected sessions). A trained independent observer (a first-year graduate student in the Speech and Hearing Sciences department) used the coaching checklist to mark off which techniques were used during coaching sessions and assigned values for level of completion for both the lead instructor and the student clinicians. Coaching fidelity data is reported in the results section.

Data Analysis

The two primary dependent variables were graphed for each session in the baseline and intervention phases for both parents and student clinicians. Visual analysis and the Tau-U effect size measure were used to analyze the results of the study. Based on the visual analysis methods identified by Kratchowill et al. (2013), differences in trend, level, variability, and immediacy of effect were examined. Tau-U, a non-overlap method, was chosen because it controls for positive baseline trends, accounts for change in level and trend between phases, and is compatible with visual analysis (Brossart et al., 2013; Rakap, 2015).

Tau-U scores are calculated by combining within-intervention phase trends and percentage of non-overlapping data points between phases, while controlling for positive baseline trends (Parker et al., 2011). A statistical package is required to complete these calculations and the researchers used the web-based software package developed by Vannest et al. (2016) which can be found at http://singlecaseresearch.org/calculators/tau-u.

First, researchers concluded whether to correct for baseline trends by calculating Tau for baseline using the online Tau-U calculator (Vannest et al., 2016). If baseline value was greater than 0.20, a correction was performed (Wolfe et al., 2019). After correcting for baseline, researchers calculated Tau-U for each parent-led and student clinician-led dataset. Researchers then used the Tau-U and standard error values to determine the overall effect size and confidence interval (CI) for each dataset (i.e., parent-led sessions and student clinician-led sessions). A 90% CI was used, and effect size was determined based the following parameters defined by Vannest & Ninci (2015), where 0.20 and below indicated a "small" effect, 0.20–0.60 indicated a "moderate" effect, 0.60–0.80 indicated a "large" effect, and 0.80 and above indicated a "very large" effect.

Social Validity Survey

The researchers created a social validity survey for both the parents and the student clinicians. The student clinician survey consisted of eight open-ended questions and two Likert scale questions focused on the positive and negative aspects of both the intervention methods instruction sessions and parent coaching. The parent survey consisted of six open-ended questions and two Likert scale questions focused on the positive and negative aspects of the coaching model as well as their child's communication progress over the course of the study.

Questions were developed to address parent and student clinician views of what went well and what could be improved in future studies, as well as the real-world applicability of the targeted intervention techniques. Although Likert-type scales can be used for data interpretation and to obtain a more objective picture of subjective information (Wolf, 1978), they are often limited in gleaning meaningful anecdotal information from participants.

Therefore, a combination of open-ended questions and Likert scale questions were included in the survey to get a more holistic picture of participant experience (Leko, 2014). Example questions included "Which elements of the training were most useful (e.g., in-session cueing, feedback)?" and "On a scale of 1-3, how likely are you to use the intervention methods in class or sessions with your students/clients?" with wording modified for the scale to apply to parents implementing techniques at home with their child. See appendices A and B for a copy of the surveys.

Results

Findings across all three triads demonstrated experimental control with an immediate effect and no overlap in data points from baseline to intervention for both primary dependent variables. However, differences among triads were apparent in terms of the level of increase, variability, and trend.

Primary Dependent Variables

Figures 6–8 show the elicitation and response technique use for both student clinician-led and parent-led sessions across phases. Results were interpreted using visual analysis and Tau-U effect size measure.

Triad 1

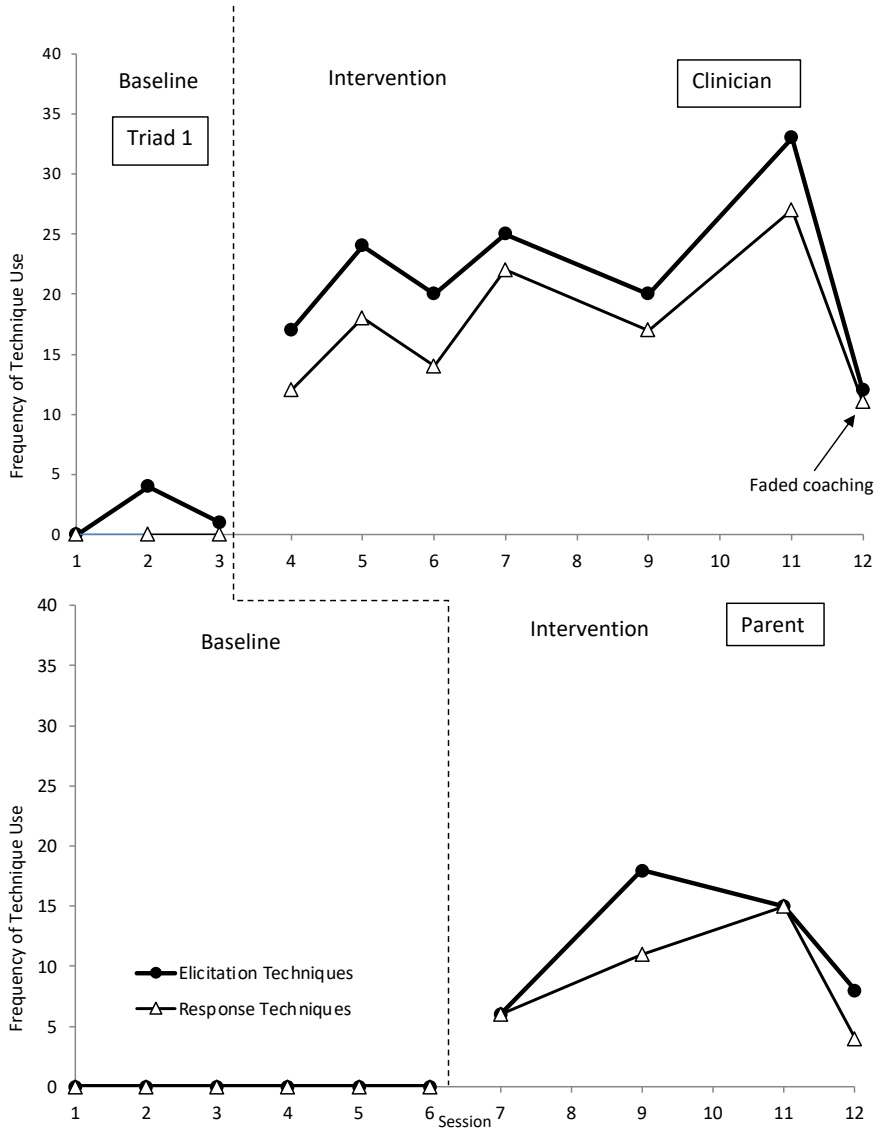
Triad 1 showed an immediate increase in level from baseline to intervention for elicitation and response techniques for both the parent- and clinician-led sessions. The Tau-U scores for the clinician's use of techniques was 1.0 (CI = 0.69–1.31) for elicitation techniques and 1.0 (CI = 0.69–1.31) for response techniques. For parent-led sessions, the Tau-U score was 1.0 (CI = 0.64–1.36) for elicitation techniques, and 1.0 (CI = 0.64–1.36) for response techniques. Tau-U scores across clinician- and parent-led interventions indicated very large effects.

Baseline was stable for both targeted elicitation and response techniques during the parent sessions. Baseline for targeted student clinician response techniques was stable across sessions but was more variable for targeted elicitation techniques, with an increase from session 1 to session 2 (from 0 to 4 instances) and a decrease from session 2 to session 3 (from 4 instances to 1 instance). During intervention, student clinician data demonstrated a neutral trend with some variability throughout most of intervention. Following a brief increase in

technique use on session 11, a slight decline was observed for elicitation and response techniques in the final intervention session when coaching was faded; however, all intervention data points were above baseline levels. Intervention data for the parent sessions showed high variability (8–18 elicitation techniques and 4–15 response techniques per session), with increases during the second and third intervention sessions for both elicitation and response techniques and a decline in the final intervention session. Again, however, all data points remained above baseline levels. The child participant, Garrett, showed lower levels of engagement with materials during both the parent- and clinician-led final sessions, which may have contributed to the decline as it was difficult to engage him in a communication temptation. Across both adult participants, the correct use of elicitation techniques was slightly higher than response techniques, primarily due to instances in which the student clinician and parent did not use a grammatically complete spoken model (see Figure 6).

Figure 6

Triad 1 Number of Targeted Elicitation and Response Techniques



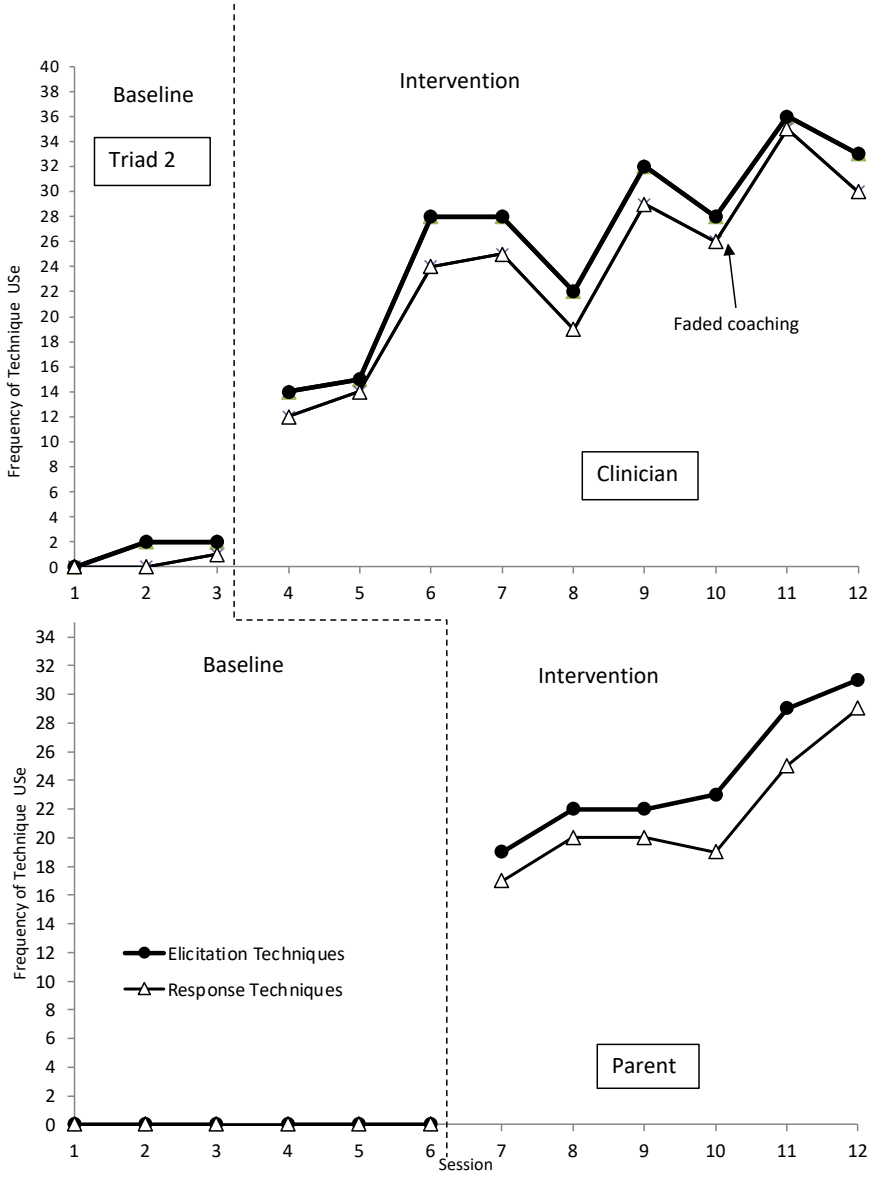
Triad 2

Triad 2 demonstrated an immediate increase in level from baseline to intervention for both elicitation and response techniques across student clinician and parent sessions. The Tau-U score for student clinician technique use was 1 (CI= 0.66–1.34) for elicitation techniques and 0.93 (CI = 0.66–1.22) for response techniques. For parent-led elicitation techniques, the Tau-U score was 1 (CI = 0.57–1.43) and response techniques was 1 (CI = 0.57–1.43). Tau-U scores across student clinician- and parent-led interventions indicated very large effects.

Baseline was stable across student clinician and parent sessions, with a slight increase from 0–1 for student clinician-led response techniques. Triad 2's student clinician and parent demonstrated a gradual upward trend for both dependent variables when intervention was introduced (with response technique use slightly below elicitation technique use due to instances in which a grammatically complete spoken model was not used). The student clinician maintained the increasing trend following faded lead instructor coaching. Student clinician intervention data sets ranged from 14–36 elicitation techniques and 12–35 response techniques per session. Parent intervention data sets ranged from 19–31 elicitation techniques and 17–29 response techniques per session (see Figure 7).

Figure 7

Triad 2 Number of Targeted Elicitation and Response Techniques



Triad 3

Triad 3 also showed an immediate increase in level from baseline to intervention for both elicitation and response techniques across student clinician and parent sessions The Tau-U score for student clinician technique use was 0.88 (CI = 0.86–0.89) for elicitation techniques and 1 (CI = 0.89–1.11) for response techniques. For parent use of elicitation techniques, the Tau-U score was 1 (CI = 0.71–1.29) and response techniques was 1 (CI = 0.71–1.29). Tau-U scores across student clinician- and parent-led interventions indicated very large effects.

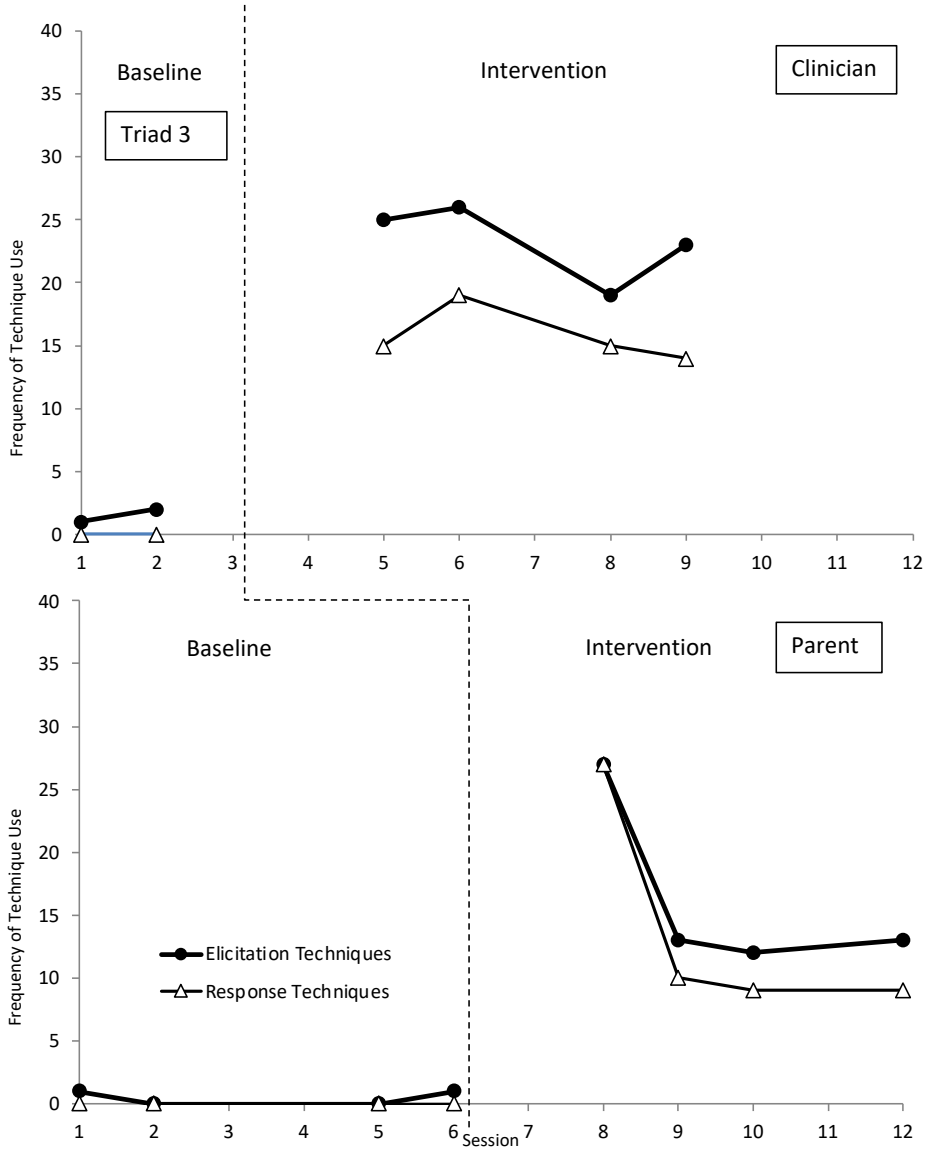
Baseline data for the Triad 3 parent was stable (0-1 targeted elicitation technique used across sessions and no targeted response techniques). Due to absences, Triad 3 only completed two baseline sessions with the student clinician alone. Although the student clinician's targeted elicitation technique use increased slightly from session 1 to session 2 of baseline (from 1 to 2 instances), a much larger and immediate increase in level from baseline to intervention was observed for both elicitation and response techniques. Similarly, parent-led sessions demonstrated an increase in level from baseline to intervention across both dependent variables.

Despite the increase in level during intervention, neither the student clinician nor parent data showed increasing trends during the intervention phase. Student clinician sessions showed a relatively neutral trend during the majority of intervention sessions with a gradual declining trend for response techniques in the final two sessions. Parent elicitation and response techniques showed a downward trend from the first to second intervention session which leveled out for the remaining three sessions. The decline in elicitation and response techniques in parent and clinician sessions may have been impacted by reported illness for

the child participant, Michelle, and observed satiation with session materials. For instance, during later sessions the parent and clinician often abandoned attempted temptations (e.g., did not wait or prompt) after Michelle showed disinterest in the opportunity. Elicitation technique use rates were slightly higher than response technique use due to instances when a grammatically complete spoken model was not used (see Figure 8).

Figure 8

Triad 3 Number of Targeted Elicitation and Response Techniques



Coaching Fidelity

Average lead instructor coaching fidelity was 97.5% (ranged 90–100) for Triad 1 and was 100% for Triads 2 and 3. Average student clinician coaching fidelity was 100% across all clinicians.

Social Validity

On average on the 3-point scale (with 1 being gestures and/or vocalizations have decreased, 2 being gestures and/or vocalizations have stayed the same, and 3 being gestures and/or vocalizations have increased), all three parents rated their children's use of gestures and/or vocalization as a 3 (has improved). When asked about their likelihood of using the techniques themselves on the 3-point scale (with 1 being will not use the communication techniques, 2 being will use the communication techniques sometimes, and 3 being will use the communication techniques regularly), all three parents rated their use of techniques as a 3. All three student clinicians rated their likelihood of using the intervention methods as a 3. When asked about their level of comfort with providing parent coaching on a 3-point scale (with 1 being not comfortable at all, 2 being somewhat comfortable, and 3 being completely comfortable), two student clinicians rated their level of comfort as a 3 and one clinician rated their comfort level as a 2. All parents and student clinicians described improvements in their child participants' communication skills. For example, Triad 2's parent, Katherine, stated that her child, Vince's, "sign vocab(ulary) has increased" and that Vince "has shown delight in engagement with peers." Student clinicians all described improvement in parent engagement/use of techniques throughout the study. For example, Triad 3's student clinician, Tina, stated that "the parent really began using the strategies and eliciting a large amount of language from [the child] in comparison to the beginning of the study."

All parents and one student clinician stated that modeling was the most useful element of the coaching model, with one student clinician and one parent also sharing that in-session cueing/feedback was helpful. As an improvement for future iterations of this model, one parent suggested allowing the parents to observe the sessions with the lead instructor, student clinician, and child as well as having a larger back-up room for child participants who show aversion to the small clinic rooms. Student clinicians provided several suggestions for improvement for future studies, such as more time to practice the techniques before implementing them with parents and being involved in the meetings with the parents before the start of the study to gather information about the child. Noted challenges for parents included knowing when to change or fade prompts/models and not knowing what to do during baseline sessions. Challenges for student clinicians included child behavior challenges, child aversion to the size of the small clinic room, and general nervousness during the first several sessions.

Discussion

A brief cascading coaching model that involved short BST sessions, researcher-led coaching for student clinicians, and student-led coaching for parents led to increased use of targeted elicitation and response techniques for all parents and student clinicians with consistent and significant improvements noted in all cases. Although more long-term systematically applied parent coaching programs such as FGRBI (Woods et al., 2004) and Project ImPACT (Ingersoll & Wainer, 2013) have a strong research base, this study's short-term instruction model also had very large effects on parent and clinician behaviors for all triads and variables (based upon Tau-U). These results align with similar studies showing that parents can implement NDBI strategies with high fidelity after receiving coaching from clinicians who were provided instruction by researchers (Gevarter, Najar, et al., 2021; Kasari et al., 2010).

Despite the large effect sizes, it is important to note that visual analysis revealed different patterns in the trends, variability, and levels of responding of adult participants. For instance, although both the student clinician and parent from Triad 2 demonstrated increasing trends in their use of elicitation and response techniques, the use of techniques varied more from session-to-session for both student clinicians and parents in Triads 1 and 3. Due to illnesses and the abundance of caution taken during the COVID-19 pandemic, absences were frequent, specifically for Triad 3. These instances of illness affected the consistency of the coaching. Decreases or variability in student clinician and parent responding may also have been impacted by factors related to child participants' motivation or interest in engaging in play. For example, later sessions for Triad 1 showed notable variability, as the child participant, Garrett, began showing signs of aversion to entering the small clinic room after

having spent time in the larger preschool room. Differences in child engagement also seemed to be affected by time of day. For example, child participants in Triads 1 and 3 who participated in the morning sessions (Garrett and Michelle respectively) showed more signs of fatigue/tiredness than the child participant in Triad 2 (Vince) who participated in the afternoon session. As Garrett (the youngest participant) began showing increased signs of tiredness with his mother, we moved his parent coaching session several hours later (i.e., from 8 am to 11 am) starting with intervention session 2. Although this seemed to improve engagement and willingness to participate, Garrett still showed signs of fatigue following his illness-related absences. This type of pattern is to be expected for very young children.

Parent-led and student clinician-led sessions also showed differences in child engagement efforts that impacted the use of elicitation and response techniques.Whereas student clinicians often tried to reengage children when they showed signs of tiredness or agitation during intervention (e.g., offering choices of different toys/activities or modeling a different way to play with something), parents tended to focus on providing physical comfort to their children (e.g., holding them in their laps) during these moments rather than using elicitation techniques. Although this may have led to lower use of elicitation and response techniques for parents, providing comfort is also an appropriate response for parents of young children within a dual role in this setting (i.e., serving as parent as well as interventionist). Additionally, even though student clinicians appeared more likely than parents to vary play items or try to reengage children when they showed signs of disinterest, some level of material satiation across both parent and clinician sessions was evident for Triads 1 and 3 during the final week of sessions.

Clinical Implications

The short-term cascading coaching model has important implications for graduate clinician instruction programs and community agencies providing services to families of children with ASD. First, the fact that the researcher-led coaching focused on a number of straightforward steps (i.e., create, wait, prompt, respond, describe) likely impacted the increased use of targeted NDBI techniques amongst student clinicians in a relatively short time period. This supports prior research that communication partner instruction is effective when an intervention approach that has clear, sequential, and predictable steps is used (Kent-Walsh et al., 2015).

Students were also able to implement parent coaching steps (e.g., modeling, providing feedback) with high fidelity after receiving researcher-led modeling of the coaching process during their own intervention sessions and two short instructional sessions (using BST) on the NDBI techniques and coaching methods. High fidelity of intervention by student clinicians has previously been demonstrated in a study with a relatively brief instructional session consisting of a didactic training and feedback from a highly trained clinician (Ingersoll, 2012). Given that these types of adjunctive and functional instruction sessions with a hands-on component translate into high fidelity service delivery for novice clinicians, clinical programs should consider integrating them into clinical instruction. Although long-term maintenance outcomes and generalization of skills after faded coaching were not addressed in this study, the fact that all student clinicians and parents reported that they plan to use these techniques regularly at home or in their clinical practices, further validates the utility of incorporating such experiences into graduate clinical programs.

Findings from this also study have implications for reducing barriers to accessing services in under-resourced or rural communities. In states like New Mexico, where shortages of highly trained masters level providers (e.g., SLPs, BCBAs, special educators) who are available to provide direct services to families statewide are common, community agencies can consider using masters level therapists as capacity builders who can provided short-term instruction and coaching to less experienced or specialized clinicians (Gevarter, Najar, et al., 2021). Adjusting the role of highly trained providers can help community agencies reach more clients in rural locations while still providing quality intervention. Results from this study indicate that brief instruction and coaching support from a highly trained clinician can lead to increases in bachelors-level clinician and parent use of targeted NDBI techniques. Recent research has shown that both parent and clinician involvement in interventions can lead to better language outcomes (Sandback et al., 2020). Instructing novice clinicians/generalists who can consistently implement interventions with parents can help to combat provider shortages in states with large rural populations and lead to better language outcomes for children who may have not previously had regular access to services. Community agencies can also consider using highly trained clinicians to provide periodic follow-up instruction on additional techniques over time to further increase the skill base of more novice providers.

Limitations and Future Research

Although very large effects were observed across dependent variables in all three triads, there are several limitations of the current study. First, although parents and student clinicians increased their use of targeted elicitation and response techniques, the researchers specifically focused on teaching parents and student clinicians to use communication

temptations that were not observed at high rates during baseline. Although this allowed researchers to focus on teaching unmastered skills and establish relatively stable baselines in a set, short period of time, it may limit understanding of parental/student use of communication temptations without instruction. Future research should examine parent and clinician baseline rates of different communication temptation types to determine if some are more likely to be used than others, or if there are differences amongst parents and clinicians.

Additionally, although the study focused on embedding communication opportunities into child preferred play activities and involved natural communication partners (parents), other factors limited the relative naturalness of the intervention. For instance, sessions were conducted in clinic rooms rather than home settings, and clinicians and parents utilized materials that were not part of the child participants' home environments. This fact may have contributed to material satiation observed with Garrett and Michelle, and signs of aversiveness to the clinic rooms that was observed with Garrett. It may also negatively impact generalization to home contexts, which was not assessed in the current study. On the other hand, this limitation relates to a real-world challenge, as it is often not practical for all interventions for young children to be done face-to-face in home environments. In future studies completed in clinical settings, completing intermittent informal preference assessments to gauge interest in the provided materials or to conduct generalization probes in home contexts may be advantageous. Assessing preference for room size before beginning intervention also may be necessary. Additionally, using telehealth could increase the naturalness of intervention sessions, as parents could conduct in-home sessions with familiar materials. Prior cascading coaching research has shown positive results in increasing parent use of communication temptations via telehealth coaching (Gevarter, Najar, et al., 2021).

Another important factor to consider in relationship to the naturalness of this study is whether it promoted joint play engagement and social interactions between the children and adults. Although not a dependent variable in this study, prioritizing joint engagement is an important aspect of NDBIs (Tiede & Walton, 2019). Anecdotally, the researchers observed that in some instances, maintaining engagement appeared to become secondary to the goal of eliciting child communication acts for both student clinicians and parents. In Triad 2 (the triad with greatest increases in elicitation and response techniques), Vince's clinician Paula often introduced sequential communication temptations without allowing Vince sufficient time between opportunities to engage with items or activities requested. For example, Paula offered Vince multiple sequential opportunities to choose ocean animals to place in a water table without encouraging him to play with each animal he chose. In these instances, social interaction and joint engagement became more limited, as Paula missed opportunities to join in Vince's play (e.g., playing side by side with another ocean animal in the water table after he made a choice). In contrast to these examples, a highly socially engaging temptation frequently used by Garrett's clinician Linda (Triad 1) was a request assistance temptation in which she would give Garrett a water spray bottle he could not use on his own. After Garrett handed the spray bottle back to her to request assistance, Linda immediately sprayed Garrett with the water (a highly preferred activity). In these instances, there was a high level of social interaction (e.g., Garrett would look at Linda, smile, and laugh after being sprayed). Recent research supports the fact that although caregiver-directed communication techniques (similar to the methods used in this study) can lead to increased frequency of joint interactions, using more engagement-focused/child-directed techniques (e.g., limiting prompting of desired communication and treating all child actions as meaningful) can

increase the length of joint interactions (Jones et al., 2022). Future research should consider incorporating explicit instruction in joint engagement for both parents and student clinicians. Feedback on joint engagement could also be provided during coaching sessions. Additionally, establishing a criterion for use of elicitation techniques may be helpful in balancing play with creating opportunities. Prior research suggests eliciting between one and two communicative turns per minute is appropriate and natural for early language learners and is effective in increasing target behaviors (Wetherby et al., 1988; Hamberger et al., 2022; Coogle et al., 2015)

In addition to not measuring joint engagement, several other relevant variables were not included in this study. Although not explicitly reported in the current study, preliminary findings (to be discussed in future research) on child outcomes indicate that all child participants increased their use of communication responses that occurred following targeted communication temptations. This is consistent with findings that increased adult engagement and use of communication temptations correlates to increased communication turns for young children with ASD (Gevarter, Najar, et al., 2021; Swanson et al., 2019). These findings may also have been impacted by the fact that this study focused on increasing skills using communication forms the child participants already had in their repertoire and allowed for multimodal communication to be reinforced (e.g., gestures, signs, and vocalizations). For example, as Vince's and Michelle's parents both reported (via the Communication Matrix) that their children more often used manual signs and gestures than natural speech to communicate, during the joint planning process the lead instructor, student clinicians, and parents decided to focus on communicative responses involving manual signs and gestures. Although new or infrequently used manual signs and gestures (e.g., PUZZLE or Michelle

and OFF for Vince), were introduced during intervention, explicit attempts to prompt natural speech were not utilized. Focusing on existing communication forms was prioritized because of the short duration of the study and the requirements for teaching brand new skills. For example, because two of three participants already had several signs within their repertoire, teaching additional signs rather than introducing aided AAC forms was prioritized. Future research could consider implementing the instructional steps of this study in instructing parents to teach their child new communication forms.

The short-term nature of the study also impacted the decision not to focus on teaching parents and clinicians more advanced skills such as fading prompts or verbal cues. Although parents and student clinicians did appropriately use wait time before delivering prompts, in some cases, student clinicians or parents did overly rely on verbal cues or questions such as *Do you want to open it?* Child responses following these cues may be considered less spontaneous, despite prior research categorizing verbal hints and questions as natural cues (Gevarter, Groll, et al., 2021). Future research could consider exploring the efficacy of this short-term cascading coaching model in teaching clinicians and parents to use more advanced skills, such as fading prompts/cues or eliciting new communication forms.

Variables related to faded coaching and independent implementation of elicitation and response techniques also need to be more comprehensively addressed in future research. Due to absences, data for student clinician use of techniques after lead instructor coaching was faded was only available for the intended three sessions for Triad 2 and for one session for Triad 1. Although the student clinician for Triad 2, Paula, was able to maintain frequency of technique use with faded coaching, this effect needs to be replicated. Further, the time constraints of this study did not allow for examinations of faded parent coaching. Variables

related to qualitative differences in lead instructor versus student clinician coaching should also be explored in future research as they were not examined in this study. For instance, although both the lead instructor and student clinicians had high procedural implementation scores for the use of coaching methods, the implementation fidelity checklist did not examine differences in the amount, quality, or focus of feedback (e.g., constructive vs positive) provided by the lead instructor (a doctorate-level clinician) and the student clinicians. For example, fidelity required providing feedback on only two skills, and while student clinicians met that requirement when coaching parents, they may have not provided adequate feedback in comparison to the lead instructor. Such differences may have affected the frequency of parent-implemented elicitation and response techniques, which was lower than student clinician technique use.

Finally, the results of this study should be generalized with caution due to a small sample size and monolingual English-speaking participants. Replication is required to assess effectiveness for bilingual families or families that speak languages other than English. Shortages of bilingual providers in early intervention is a prevalent issue and future studies should examine whether brief cascading coaching models for bilingual providers lead to increased parent engagement for non-English speaking families.

Conclusions

This small-scale study provides support for a short-term cascading model (focusing on instruction in NDBI methods and in-session coaching) for increasing student clinician and parent use of communication techniques with young children with ASD or signs of ASD. Student clinicians were also able to implement evidence-based coaching techniques in parent sessions with high fidelity following two short instructional sessions and researcher-led

coaching. The methods used in this study could be applied to graduate education programs, rural communities, or under-resourced communities who may not have access to highly experienced providers on a regular basis. Further research should be completed to ensure generalization across a more diverse range of populations and outcomes.

References

Akmanoglu, N., Yanardag, M., & Batu, E. S. (2014). Comparing video modeling and graduated guidance together and video modeling alone for teaching role playing skills to children with autism. *Education and Training in Autism and Developmental Disabilities*, *49*(1), 17–31.

American Psychiatric Association. (2013). *What is autism spectrum disorder?* Retrieved December 21, 2021, from https://www.psychiatry.org/patients-families/autism/what-is-autism-spectrum-disorder

Barry, L., Holloway, J., & Gunning, C. (2018). An investigation of the effects of a parent delivered stimulus-stimulus pairing intervention on vocalizations of two children with autism spectrum disorder. *The Analysis of Verbal Behavior*, *35*(1), 57–73. https://doi.org/10.1007/s40616-018-0094-1

Beukelman, D. R., & Light, J. C. (2020). *Augmentative & alternative communication: Supporting children and adults with complex communication needs* (5th ed.). Paul H. Brookes Publishing Co., Inc.

Brossart, D. F., Vannest, K. J., Davis, J. L., & Patience, M. A. (2014). Incorporating nonoverlap indices with visual analysis for quantifying intervention effectiveness in single-case experimental designs. *Neuropsychological Rehabilitation*, *24*(3-4), 464–491. https://doi.org/10.1080/09602011.2013.868361

Cartmill, E. A., Armstrong, B. F., Gleitman, L. R., GoldinMeadow, S., Medina, T. N., & Trueswell, J. C. (2013). Quality of early parent input predicts child vocabulary 3 years later. *Proceedings of the National Academy of Sciences*, *110*(28), 11278–11283. https://doi.org/10.1073/pnas.1309518110

Coogle C. G., Rahn N. L., Ottley J. R. (2015). Pre-service teacher use of communication strategies upon receiving immediate feedback. *Early Childhood Research Quarterly*, 32, 105–115. https://doi.org/10.1016/j.ecresq.2015.03.003

Cooper, J. O., Heron, T. E., & Heward, W. L. (2019). *Applied behavior analysis* (3rd ed). Pearson Education.

Dubin, A. H., & Lieberman-Betz, R. G. (2020). Naturalistic interventions to improve prelinguistic communication for children with autism spectrum disorder: A systematic review. *Review Journal of Autism and Developmental Disorders*, *7*(2), 151–167. https://doi.org/10.1007/s40489-019-00184-9

Fisher, W.W. Piazza, C.C., Bowman, L.G., & Amari, A. (1996). Integrating caregiver report with a systematic choice assessment. *American Journal on Mental Retardation*, *101*, 15-25.

Friedman, M., Woods, J., & Salisbury, C. (2012). Caregiver coaching strategies for early intervention providers. *Infants and Young Children*, *25*(1), 62–82. https://doi.org/10.1097/iyc.0b013e31823d8f12

Gast, D. L., Lloyd, B. P., & Ledford, J. R. (2014). Multiple baseline and multiple probe designs. In *Single case research methodology* (pp. 251-296). Routledge.

Gevarter, C. (Program Manager). (2021–2025). *Project SCENES (Social communication: Collaborating early with naturalistic, evidence-based supports)* (Project No. H325K200073) [Grant]. US Department of Education Office of Special Education Programs. https://sites.google.com/view/projectscenes/home

Gevarter, C., Groll, M., Stone, E., & Medina Najar, A. (2021). A parent-implemented embedded AAC intervention for teaching navigational requests and other

communicative functions to children with autism spectrum disorder. *Augmentative and Alternative Communication*, *37*(3), 180–193. https://doi.org/10.1080/07434618.2021.1946846

Gevarter, C., Najar, A. M., Flake, J., Tapia-Alvidrez, F., & Lucero, A. (2021). Naturalistic communication training for early intervention providers and Latinx parents of children with signs of autism. *Journal of Developmental & Physical Disabilities*, *34*(1), 147–169. https://doi.org/10.1007/s10882-021-09794-w

Gevarter, C., Siciliano, M. G., & Stone, E. (2022). Early interventionists' knowledge of evidence-based practices for autism. *Focus on Autism and Other Developmental Disabilities*, *37*(4), 203–214. https://doi.org/10.1177/10883576221099895

Hamberger, R. J., Evmenova, A. S., Coogle, C. G., & Regan, K. S. (2022). Parent coaching in natural communication opportunities through bug-in-ear technology. *Topics in Early Childhood Special Education*, *42*(3), 234–245. https://doi.org/10.1177/02711214221119031

Hirsh-Pasek, K., Adamson, L. B., Bakeman, R., Owen, M. T., Golinkoff, R. M., Pace, A., Yust, P. K., & Suma, K. (2015). The contribution of early communication quality to low-income children's language success. *Psychological Science*, *26*(7), 1071–1083. https://doi.org/10.1177/0956797615581493

Ingersoll, B. (2012). Brief report: Effect of a focused imitation intervention on social functioning in children with autism. *Journal of Autism & Developmental Disorders*, *42*(8), 1768–1773. https://doi-org.libproxy.unm.edu/10.1007/s10803-011-1423-6

Ingersoll, B., & Wainer, A. (2013). Initial efficacy of Project IMPACT: A parent-mediated social communication intervention for young children with ASD. *Journal of Autism*

and Developmental Disorders, *43*(12), 2943–2952. https://doi.org/10.1007/s10803-013-1840-9

Jones, M., Sone, B., Grauzer, J., Sudec, L., Kaat, A. J., & Roberts, M. (2022). Active ingredients of caregiver-mediated naturalistic developmental behavioral interventions (NDBIs) for autistic toddlers: A randomized clinical trial. (Unpublished Manuscript). https://doi.org/10.31234/osf.io/9vygf

Kasari, C., Brady, N., Lord, C., & Tager-Flusberg, H. (2013). Assessing the minimally verbal school-aged child with autism spectrum disorder. *Autism Research*, *6*(6), 479–493. https://doi.org/10.1002/aur.1334

Kasari, C., Gulsrud, A. C., Wong, C., Kwon, S., & Locke, J. (2010). Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. *Journal of Autism and Developmental Disorders*, *40*(9), 1045–1056. https://doi.org/10.1007/s10803-010-0955-5

Kasari, C., Lawton, K., Shih, W., Barker, T. V., Landa, R., Lord, C., Orlich, F., King, B., Wetherby, A., & Senturk, D. (2014). Caregiver-mediated intervention for low-resourced preschoolers with autism: An RCT. *Pediatrics*, *134*(1). https://doi.org/10.1542/peds.2013-3229

Kent-Walsh, J., Murza, K. A., Malani, M. D., & Binger, C. (2015). Effects of communication partner instruction on the communication of individuals using AAC: A meta-analysis. *AAC: Augmentative & Alternative Communication*, *31*(4), 271–284. https://doi-org.libproxy.unm.edu/10.3109/07434618.2015.1052153

Koegel, R. L., Vernon, T. W., & Koegel, L. K. (2009). Improving social initiations in young children with autism using reinforcers with embedded social interactions. *Journal of*

Autism and Developmental Disorders, *39*(9), 1240–1251. https://doi.org/10.1007/s10803-009-0732-5

Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2013). Single-case intervention research design standards. *Remedial and Special Education*, *34*(1), 26–38.

Kryzak, L. A., & Jones, E. A. (2014). The effect of prompts within embedded circumscribed interests to teach initiating joint attention in children with autism spectrum disorders. *Journal of Developmental and Physical Disabilities*, *27*(3), 265–284. https://doi.org/10.1007/s10882-014-9414-0

Leko, M. M. (2014). The value of qualitative methods in social validity research. *Remedial and Special Education*, *35*(5), 275–286. https://doi.org/10.1177/0741932514524002

Maenner M.J., Shaw K.A., Bakian A.V. (2021). Prevalence and characteristics of autism spectrum disorder among children aged 8 years — autism and developmental disabilities monitoring network, 11 Sites, United States, 2018. *MMWR Surveillance Summaries*, *70*(11), 1–16. http://dx.doi.org/10.15585/mmwr.ss7011a1

Mandel, N. R., Cividini-Motta, C., & Schram, J. (2022). An evaluation of the impact of stimulus mode on acquisition, maintenance, and generalization of tacts of actions. *Behavioral Interventions*, *37*(1), 5–18. https://doi.org/10.1002/bin.1792

Meadan, H., Chung, M. Y., Sands, M. M., & Snodgrass, M. R. (2020). The cascading coaching model for supporting service providers, caregivers, and children. *The Journal of Special Education*, *54*(2), 113–125. https://doi.org/10.1177/0022466919884070

Miltenberger, R. G. (2011). *Behavior modification: Principles and procedures* (5th ed.). Cengage Learning.

Minjarez, M. B., Earl, R. K., Bruinsma, Y., & Donaldson, A. L. (2020). Targeting communication skills. In Y. Bruinsma, M.B. Minjarez, L. Schreibman, & A.C. Stahmer (Eds.), *Naturalistic developmental behavioral interventions for autism spectrum disorder* (1st ed., pp. 237–277). Paul H. Brookes Publishing Co.

Nam, S., Kim, J., Sparks, S. (2018). An overview of review studies on effectiveness of major AAC systems for individuals with developmental disabilities including autism. *The Journal of Special Education Apprenticeship*, *7*(2), Article 6.

Office of Special Education Programs (2021). *NM Part C FFY 2019 state performance plan /annual performance report*. Retrieved January 6, 2022, from https://sites.ed.gov/idea/idea-files/2021-spp-apr-and-state-determination-letters-part-c-new-mexico/

Parker, R. I., Vannest, K. J., Davis, J. L., & Sauber, S. B. (2011). Combining nonoverlap and trend for single-case research: Tau-u. *Behavior Therapy*, *42*(2), 284–299. https://doi.org/10.1016/j.beth.2010.08.006

Paul, R., Norbury, C., & Gosse, C. (2018). *Language disorders from infancy through adolescence: Listening, speaking, reading, writing, and communicating* (5th ed.). Elsevier.

Pepperdine, C. R., & McCrimmon, A. W. (2018). Test review: Vineland adaptive behavior scales, third edition (Vineland-3) by Sparrow, S. S., Cicchetti, D. V., and Saulnier, *C. A. Canadian Journal of School Psychology*, *33*(2), 157–163. https://doi.org/10.1177/0829573517733845

Rakap, S. (2015). Effect sizes as result interpretation aids in single-subject experimental research: Description and application of four nonoverlap methods. *British Journal of Special Education*, *42*(1), 11–33. https://doi.org/10.1111/1467-8578.12091

Reszka, S. S., Boyd, B. A., McBee, M., Hume, K. A., & Odom, S. L. (2014). Brief report: Concurrent validity of autism symptom severity measures. *Journal of Autism and Developmental Disorders*, *44*(2), 466–470. https://doi.org/10.1007/s10803-013-1879-7

Romeo, R. R., Leonard, J. A., Robinson, S. T., West, M. R., Mackey, A. P., Rowe, M. L., & Gabrieli, J. D. (2018). Beyond the 30-million-word gap: Children's conversational exposure is associated with language-related brain function. *Psychological Science*, *29*(5), 700–710. https://doi.org/10.1177/0956797617742725

Rose, V., Trembath, D., Keen, D., & Paynter, J. (2016). The proportion of minimally verbal children with autism spectrum disorder in a community-based early intervention programme. *Journal of Intellectual Disability Research*, *60*(5), 464–477. https://doi.org/10.1111/jir.12284

Rowe, M. L. (2012). A longitudinal investigation of the role of quantity and quality of child-directed speech vocabulary development. *Child Development*, *83*(5), 1762–1774. https://doi-org.libproxy.unm.edu/10.1111/j.1467-8624.2012.01805.x

Rowland, C. (2011). Using the communication matrix to assess expressive skills in early communicators. *Communication Disorders Quarterly*, *32*(3), 190–201. https://doi.org/10.1177/1525740110394651

Sandbank, M., Bottema-Beutel, K., Crowley, S., Cassidy, M., Feldman, J. I., Canihuante, M., & Woynaroski, T. (2020). Intervention effects on language in children with autism: A

project aim meta-analysis. *Journal of Speech, Language, and Hearing Research*, *63*(5), 1537–1560. https://doi.org/10.1044/2020_jslhr-19-00167

Schaefer, J. M., & Andzik, N. R. (2021). Evaluating behavioral skills training as an evidence-based practice when training parents to intervene with their children. *Behavior Modification*, *45*(6), 887–910. https://doi-org.libproxy.unm.edu/10.1177/0145445520923996

Schopler, E., Reichle, R. J., and Renner, B. R. (2010). Childhood autism rating scale (2nd ed.). Los Angeles, CA. *Western Psychological Services*.

Schreibman, L., Dawson, G., Stahmer, A. C., Landa, R., Rogers, S. J., McGee, G. G., et al. (2015). Naturalistic developmental behavioral interventions: Empirically validated treatments for autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*(8), 2411–2428. https://doi.org/10.1007/s10803-015-2407-8

Schreibman, L., Jobin, A. B., Dawson, G. (2020). Understanding NDBI. In Y. Bruinsma, M.B. Minjarez, L. Schreibman, & A.C. Stahmer (Eds.), *Naturalistic developmental behavioral interventions for autism spectrum disorder* (1st ed., pp. 3–20). Paul H. Brookes Publishing Co.

Shire, S. Y., Shih, W., & Kasari, C. (2018). Brief report: Caregiver strategy implementation—advancing spoken communication in children who are minimally verbal. *Journal of Autism and Developmental Disorders*, *48*(4), 1228–1234. https://doi.org/10.1007/s10803-017-3454-0

Shumway, S., & Wetherby, A. M. (2009). Communicative acts of children with autism spectrum disorders in the second year of life. *Journal of Speech, Language, and*

Hearing Research, *52*(5), 1139–1156. https://doi.org/10.1044/1092-4388(2009/07-0280)

Sparrow, S. S., Cicchetti, D. V., and Saulnier, C. A. (2016). Vineland adaptive behavior scales, (3rd ed.) Pearson.

Swanson, M. R., Donovan, K., Paterson, S., Wolff, J. J., Parish-Morris, J., Meera, S. S., Watson, L. R., Estes, A. M., Marrus, N., Elison, J. T., Shen, M. D., McNeilly, H. B., MacIntyre, L., Zwaigenbaum, L., St. John, T., Botteron, K., Dager, S., & Piven, J. (2019). Early language exposure supports later language skills in infants with and without autism. *Autism Research*, *12*(12), 1784–1795. https://doi.org/10.1002/aur.2163

Tiede, G., & Walton, K. M. (2019). Meta-analysis of naturalistic developmental behavioral interventions for young children with autism spectrum disorder. *Autism*, *23*(8), 2080–2095. https://doi.org/10.1177/1362361319836371

Vannest, K. J., & Ninci, J. (2015). Evaluating intervention effects in single-case research designs. *Journal of Counseling & Development, 93*(4), 403–411. https://doi-org.libproxy.unm.edu/10.1002/jcad.12038

Vannest, K.J., Parker, R.I., Gonen, O., & Adiguzel, T. (2016). Single Case Research: web based calculators for SCR analysis. (Version 2.0) [Web-based application]. College Station, TX: Texas A&M University. Available from singlecaseresearch.org.

Venker, C. E., Bolt, D. M., Meyer, A., Sindberg, H., Weismer, S. E., & Tager-Flusberg, H. (2015). Parent telegraphic speech use and spoken language in preschoolers with ASD. *Journal of Speech, Language & Hearing Research*, *58*(6), 1733–1746. https://doi-org.libproxy.unm.edu/10.1044/2015_JSLHR-L-14-0291.

Vismara, L. A., & Lyons, G. L. (2007). Using perseverative interests to elicit joint attention behaviors in young children with autism. *Journal of Positive Behavior Interventions*, *9*(4), 214–228. https://doi.org/10.1177/10983007070090040401

Wetherby, A. M., Cain, D. H., Yonclas, D. G., & Walker, V. G. (1988). Analysis of intentional communication of normal children from the prelinguistic to the Multiword stage. *Journal of Speech, Language, and Hearing Research*, *31*(2), 240–252. https://doi.org/10.1044/jshr.3102.240

Wetherby, A. M., Guthrie, W., Woods, J., Schatschneider, C., Holland, R. D., Morgan, L., & Lord, C. (2014). Parent-implemented social intervention for toddlers with autism: An RCT. *Pediatrics*, *134*(6), 1084–1093. https://doi.org/10.1542/peds.2014-0757

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis*, *11*(2), 203–214. doi:10.1901/jaba.1978.11-203

Wolfe, K., Pound, S., McCammon, M. N., Chezan, L. C., & Drasgow, E. (2019). A systematic review of interventions to promote varied social-communication behavior in individuals with autism spectrum disorder. *Behavior Modification*, *43*(6), 790–818. https://doi-org.libproxy.unm.edu/10.1177/0145445519859803

Woods, J., Kashinath, S., & Goldstein, H. (2004). Effects of embedding caregiver-implemented teaching strategies in daily routines on children's communication outcomes. *Journal of Early Intervention*, *26*(3), 175-193.

Appendix A

Student Clinician Social Validity Survey

1. Which elements of the training/coaching on intervention methods were most useful (e.g., group role play, in-session cueing)?
2. Which elements of the training/coaching in intervention methods were not as useful?
3. What elements of the training in parent coaching methods were most useful (e.g., video models)?
4. Which elements of the training on parent coaching methods were not useful?
5. What challenges did you experience (if any)?
6. Provide suggestions for improvement. (e.g., areas you would have liked more in-depth training on)?
7. Describe any improvements you saw in the child's communication and engagement since the beginning of the study.
8. Describe any improvements in parent engagement/use of techniques since the beginning of the study.
9. On a scale of 1-3, how likely are you to use the intervention methods in class or sessions with your students/clients?

    1 – will not use intervention methods

    2 – will implement intervention methods with some children sometimes

    3 – will implement these methods regularly

10. On a scale of 1-3, how comfortable do you feel providing parent coaching?

    1 – not comfortable at all

    2 – somewhat comfortable

    3 – completely comfortable

Appendix B

Parent Social Validity Survey

1. Which elements of the training were most useful (e.g., modeling, feedback)?
2. Which elements of the training were not useful?
3. What challenges did you experience (if any)?
4. Provide suggestions for improvement. (e.g., areas you would have liked more in-depth training on)?
5. On a scale of 1-5, how much has your child's use of gestures and/or vocalizations to communicate preferences for activities/items/attention changed since the beginning of the study?

    1 – use of gestures and/or vocalizations has decreased

    2 – use of gestures and/or vocalizations has stayed the same

    3 – use of gestures and/or vocalizations has improved

6. Describe improvements you saw in your child's communication and engagement since the beginning of the study.
7. On a scale of 1-3, how likely are you to use the communication techniques with your child?

    1 – will not use the communication techniques

    2 – will use the communication techniques sometimes

    3 – will use the communication techniques regularly

8. Describe which techniques you are most likely to use with your child at home and/or in the community (if any)?