EXPLICIT TRAINING PRACTICES FOR DEVELOPMENTALLY BASED BEHAVIORAL
INTERVENTIONS

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ABSTRACT

Effective implementation of behavior analytic practices for children with autism spectrum disorders (ASD) often requires explicit training. Although there is a need for more training in many human services fields, barriers such as costs and regulations may hinder the development of effective training practices (Larson et al., 2005). The absence of explicit training practices, particularly in naturalistic behavioral interventions (NDBIs) for children with ASD may lead to increased negative interactions with clients and their families (Jimenez-Gomez et al., 2019, Rose, 2020; Rohrer & Weiss, 2023; Rohrer et al., 2021; Taylor et al., 2019). Therefore, providers of NDBIs need to assess cheaper, yet effective ways of training providers to implement their practices. The purpose of this dissertation was to assess the current training practices and trends reported in evidence-based naturalistic interventions. Three interrelated, yet separate studies were conducted.

Chapter two is a scoping review of the reported training practices and strategies in NDBIs literature from 2000-2024. This review aimed to assess how providers are trained to implement evidence-based naturalistic interventions such as NDBIs. This study extends previous NDBI reviews as it adds pertinent information regarding training that may aid in the dissemination of NDBI practices.

Chapter three assessed a training package aimed at training providers to implement an NDBI known as reciprocal imitation training (RIT). Behavior technicians (BT) underwent a behavior skills training (BST) training protocol to increase implementation fidelity percentages. The results of this study indicated that BST was a cost effective and simple strategy that could be used to train BTs to implement RIT.

Chapter four assessed changes in children's spontaneous behaviors and responses to adult behavior following a change in adult PRIDE behaviors during a naturalistic intervention session. A reversal design was implemented to assess any change in child behaviors when an adult doubled the number of PRIDE behaviors expressed during a naturalistic teaching session. This study emulates a training study by expressing simulated "pre-training" and "post-training" frequencies of PRIDE behaviors, thus informing of the possible benefits of training providers to engage in higher levels of PRIDE behaviors. This study extends parent-child interaction therapy (PCIT) literature. Chapter five summarizes and integrates themes witnessed across studies including the use of BST components and the focus on parent training procedures observed in NDBI literature.

This dissertation is dedicated to my wife, Abbey.
Thank you for your sacrifices, love, and dedication to our family.

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I want to first acknowledge the sacrifice that my parents made to make sure I had the best possible education as a child. That sacrifice has opened doors for me that I never imagined. Next, I want to acknowledge my wife, Abbey. I cannot imagine a day without you. Lily, you are loved. I also would like to acknowledge the guidance and understanding that Josh has showed me since the day we met. His leadership has helped guide me in many ways. He has taught me lessons that will stay with me for life.

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LIST OF ABBREVIATIONS

ABA   Applied Behavior Analysis

ASD   Autism spectrum disorders

BCBA®   Board-Certified Behavior Analyst

BST   Behavior skills training

BT   Behavior Technician

CDI   Child-Directed Interaction

DTT   Discrete Trial Training

EA   Early Achievements

EIBI   Early Intensive Behavioral Intervention

ESDM   Early Start Denver Model

IT   Incidental Teaching

JASPER   Joint Attention, Symbolic Play, Engagement and Regulation

LEAP   Learning Experiences and Alternate Program

NDBI   Naturalistic Developmental Behavioral Intervention

PDI   Parent-Directed Interaction

ImPACT   Improving Parents As Communication Teachers

PRISMA   Preferred Reporting Items for Systematic reviews and Meta-Analyses

PRT   Pivotal response training

RIT   Reciprocal Imitation Training

SCERTS   Social Communication/Emotional Regulation/Transactional Support

CHAPTER 1:

EXPLICIT TRAINING PRACTICES FOR DEVELOPMENTALLY BASED

BEHAVIORAL INTERVENTIONS

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social, communication, and often educational outcomes as well as increased behavioral challenges (American Psychiatric Association, 2013). ASD often occurs with other comorbidities including genetic, neurological, or developmental disorders (Choi, Knight, Stein, & Coleman, 2020). ASD affects families and individuals from all racial, ethnic, and financial backgrounds. The Centers for Disease Control and Prevention (CDC) estimated that 1 in 36 children met the diagnostic criteria for ASD in 2020, a higher prevalence than the 1 in 68 children in the 2010 CDC survey (Maenner et al., 2023).

Due to ASD's comorbidities, costs for medical treatment and intensive behavioral therapy for those with ASD may be as high as four to six times greater than those without ASD, leading to financial hardship for many families (Choi, Knight, Stein, & Coleman, 2020). Changing laws and policies have risen to help access behavioral treatment to support the growing number of children with ASD (Mandell et al., 2016). Among these policies were insurance mandates requiring insurance companies cover intensive behavioral treatments for individuals with ASD. Prior to these mandates, insurance policies rarely covered the intensive treatments that individuals with ASD needed (Mandell et al., 2016). Currently, however, policies have mandated insurance coverage for intensive behavioral treatment across all 50 states and the District of Columbia (D.C). Although these state mandates differ across states in many ways (i.e., kind of services, number of hours), they have been critical in increasing utilization of ASD

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services that target a plethora of skills (Candon et al., 2018; Choi et al., 2020; Plavnick et al., 2020).

Individuals with ASD spend a considerable proportion of their lives interacting with human services providers. Human services for individuals with ASD may include speech-language pathology, occupational therapy, physical therapy, social work, and others. ASD is often diagnosed as early as 2-years old, and treatment may last throughout an individuals' entire life. The first step in treatment for children with ASD is often a form of early intensive behavior intervention therapy (EIBI). Children receiving EIBI often receive therapy that uses a 1:1 adult to child ratio, is implemented for 20-to-40 hrs per week and may last for up to 4 years of the child's life (Reichow et al., 2014). Due to the high incidence of comorbidities, individuals with ASD often continue to receive several in-home and in-school human services to aid in independent daily living and educational skill acquisition (McDonald et al., 2019; Wei et al., 2014). As such, it is imperative that behavioral service providers receive comprehensive training in both disciplinary and interpersonal therapeutic practices. Much like other fields, however, training in behavioral services is costly (Larson et al., 2005).

In 2012, the Association for Talent Development's (ATD) 2013 State of Industry Report detailed that organizations in the United States (U.S) spent over $164 billion on employee learning and training (Yang et al., 2020). The high expenditure of funds allocated for learning and training continues to highlight the critical nature of training. Allocating large amounts of funds on training is perhaps most important in human service fields where researchers continue to assess best practices for training providers. However, Larson and colleagues (2005) posit that training practices for human service providers are often driven by and written to meet minimal regulatory thresholds in order to limit costs. The focus on regulations may be problematic as

often regulations are written to assess the minimal training needs for providers in a field (Larson et al., 2005). Thus, Larson et al. (2005) argue that current training practices in human services are limited. Since human service providers often need more training than non-human service workers, it may be critical for the field to assess cheaper and simple, yet effective ways to train providers.

Applied Behavior Analysis

Applied behavior analysis (ABA) is a psycho-social intervention approach that utilizes the science of behaviorism to target issues of social importance (Fisher et al., 2021). Early intensive behavior intervention therapy, as described above, is one of the ABA services many children with ASD receive. A recent meta-analysis by Makrygianni and colleagues (2018) assessed the efficacy of applied behavior analysis for children with ASD. Similar to earlier meta-analyses (Reichow, 2012; Spreckley, & Boyd, 2009), Makrygianni et al., (2018) found that ABA was effective for improving communication skills, receptive and expressive language skills, and moderately improving the IQ scores of children with ASD.

Since 2010, the demand for Board Certified Behavior Analysts® (BCBAs®) has grown over 5,000% (Donnelly, 2022). The demand for BCBAs® is intuitive as it is in line with the increase in ASD diagnoses during the same period (Maenner et al., 2023). The increased demand for BCBAs® has been closely followed by an increase in individuals entering the field to become BCBAs®. Deochand et al., (2023) reports that the growth of BCBA® certifications has steadily increased during the years 1999-2019. The training process to become a BCBA® largely focuses on content knowledge and technical applications of ABA. BCBAs® are required to obtain a master's degree in a qualifying field (e.g., special education) and to obtain 1,500 practical

training hours working with clients and learning the technical responsibilities of the job (i.e., supervision).

The increase in ASD diagnoses and growth of ABA also led to a steep increase in demand for behavior technicians (BTs), who are the direct care providers in ABA and work under supervision of BCBAs®. Similar to the description of training practices for BCBAs®, training for BTs emerged from the same emphasis on technical precision of implementing protocols. BT training models often focus heavily on content knowledge and include increased expectations of implementation fidelity. The training process for ABA providers aligns with empirical findings, however, as accurate implementation of behavior analytic strategies has been shown to be an effective intervention approach for children with ASD for decades (Lovaas et al. 1965, Smith, 2001).

The focus on content knowledge and implementation fidelity aligns with the practices often used to implement ABA procedures. For example, discrete trial training (DTT) is a behavior analytic evidence-based practice often utilized in ABA settings to teach new skills to children with ASD (Smith, 2001). DTT utilizes a repetition of short, similar trials paired with reinforcement and prompting to teach a specific skill. Application of DTT is often meant to be completed at a quick pace and with high implementation fidelity. Despite the reported efficacy of DTT, there are some criticisms. A provider that is highly focused on the quick and accurate application of DTT may miss small changes in child affect or skip opportunities to interact with the child in a positive matter in hopes of increasing or maintaining their implementation fidelity scores. DTT has also been criticized for its association with low generalization of skills, lack of spontaneity in learned skills, and overall robotic nature of teaching (Schreibman et al., 2015; Schuck et al., 2021). One group of interventions that emerged to address these criticisms are

naturalistic developmental behavioral interventions (D'Agostino et al., 2023; Schuck et al., 2021).

Naturalistic Developmental Behavioral Interventions

Naturalistic Developmental Behavioral Interventions (NDBIs) are interventions based on behavioral principles and developmental sciences. In a comprehensive explanation of NDBIs, Schreibman and colleagues (2015) thoroughly introduced and explained NDBIs as evidence-based practices for teaching individuals diagnosed with autism spectrum disorders (ASD), particularly those in early childhood settings.

Core components of NDBIs fall into three categories: *nature of learning targets*, *nature of learning contexts*, and *the nature of development-enhancing strategies* (Schreibman et al, 2015). The learning targets of NDBIs are based on an approach known as the *developmental systems approach.* The developmental systems approach acknowledges the connections between different domains of learning such as motor ability, social, language, and play (e.g., Dawson et al. 2010; Landa et al. 2011). This approach posits that interventionists should focus on skills and knowledge that work as precursors for future learning across domains. This component often leads to NDBIs that target a variety of skills rather than one isolated skill. For example, the Early Start Denver Model (ESDM; Dawson et al., 2010; Waddington et al., 2016) is an NDBI that targets many skills for young children with ASD including joint attention, receptive communication, and imitation. Providers implementing ESDM often target skills thought pivotal for children to learn. For example, ESDM providers often aim to increase a child's imitative repertoire, as imitation is thought to lead to the acquisition of other skills (Waddington et al., 2016).

Another component of NDBIs is the idea that the context or environment that a child learns in must be meaningful to them. Schreibman and colleagues (2015) posit that the nature of learning contexts in NDBIs are based on meaningful social engagement. Providing a socially engaging environment for children promotes opportunities to learn about the social context in which children are in. The learning contexts in which children learn should aim to emphasize natural contingencies and encourage social engagement through high quality adult-child engagement and opportunities for the child to lead the engagement and choose the materials or activity. Enhancing child engagement may aid in creating a higher quality relationship between the child receiving the intervention and the adult administering it. NDBIs foster an environment where children are active participants in their learning, often encouraging spontaneous responding (D'Agostino et al., 2023) which may be critical for children with ASD to effectively learn new skills.

The last component of NDBIs is implementing behavioral strategies like modeling or prompting to enhance child skills development. The strategic combination of behavioral principles and developmental sciences in NDBIs suggests that NDBIs may be more difficult to train. Schreibman and colleagues (2015) do not explicitly mention steps to train providers to implement NDBIs. However, to effectively implement NDBIs, providers may need to explicitly express a variety of skills. For example, a provider that aims to utilize the developmental systems approach to target multiple skill domains (e.g., language, cognition, social) may need to express creativity in finding ways to target multiple skill domains within the context of a single play-based routine. To enhance the learning contexts of children, providers might also need to systematically use child-preferred activities as high-quality adult-child interactions are a critical component of creating a more engaged or motivating learning environment for the child

(Schreibman et al., 2015). Thus, providers utilizing NDBIs might need more training than those implementing more traditional teaching approaches such as DTT to effectively implement these interventions, suggesting a need for expensive, drawn-out training packages. This suggestion, however, may be premature, as cheaper, yet effective training approaches have been used in recent NDBI research.

Recently, Mrachko and colleagues (2023) utilized BST to train three therapeutic support staff (TSS) to implement Project ImPACT target skills. Project ImPACT is an NDBI that traditionally uses a parent-mediated intervention approach (e.g., Ingersoll & Wainer, 2013) where parents are trained in several skills (e.g., imitations, modeling language) to become teachers of social communication skills for their children with ASD. Mrachko and colleagues (2023) modified a parent-training protocol (see Ingersoll & Dvortcsak, 2010) and added live and written feedback to the protocol. Overall, their results suggest that BST can be utilized to train providers of NDBIs to reach mastery criteria of performance and although performance decreased slightly during maintenance probes, participants' level of performance remained above baseline levels. Mrachko and colleagues (2023) used a combination of in-vivo training, online modules, email feedback, and video feedback. This comprehensive training approach was meant to target workers in an in-home treatment environment where adult providers are often alone with clients, and support and materials might be more limited than in-clinic treatment. However, through the simple and inexpensive implementation of BST procedures, all three adult participants increased in their ability to implement Project ImPACT targets, and all three child participants' frequency of spontaneous communication increased, suggesting the efficacy of BST for training providers to implement NDBIs. More investigation is needed, however, on the use of BST for other NDBIs and in other environments (e.g., in-clinic).

Similar interventions such as parent-child interaction therapy may also benefit from research on training strategies. Parent-child interaction therapy (PCIT) is an evidence-based intervention that utilizes a two-stage approach to train parents to increase instances of PRIDE behaviors with their child while teaching new skills. PCIT introduces a Child-Directed Interaction (CDI) phase where parents are trained to increase PRIDE behaviors known as PRIDE behaviors while playing. During the Parent-Directed Interaction (PDI), parents are taught explicit behavior analytic skills (i.e., reinforcement implementation, error correction) to target child externalizing behaviors. PCIT posits that increasing the instances of PRIDE behaviors while simultaneously decreasing child externalizing behaviors will aid the relationship between the parent and child and decrease negative interactions.

Although PCIT is a parent-mediated intervention, researchers have begun to assess the possible feasibility of training non-parental providers to implement PRIDE behaviors. Jimenez-Gomez et al. (2019) trained direct care providers to increase PRIDE behaviors while working with clients. In their study, PRIDE behaviors were slightly adapted and referred to as positive interaction behaviors as the researchers wanted to also assess the extent to which negative interaction behaviors decreased. Jimenez-Gomez and colleagues utilized BST to explicitly train BTs to increase percentages of PRIDE behaviors while simultaneously decreasing percentages of negative interactions. Results from their investigation found that providers could be trained to increase the percentage of PRIDE behaviors with BST. Similar to Mrachko et al., (2023), this study expresses the efficacy of BST for training direct care providers of ABA to implement developmentally based interventions. It is important to note, however, that little is known about how increasing PRIDE behaviors affected child outcomes during Jimenez-Gomez et al.'s investigation as data was not reported.

Researchers and providers continue to assess and implement NDBIs and similar developmental procedures in their research and practice. Recent data continues to report the efficacy of NDBIs for skill acquisition in multiple skill domains (Sandbank et al., 2020; Tiede & Walton, 2019; Tupou, 2020). The efficacy of NDBIs combined with their ability to address some of the criticisms of behavior analytic interventions suggests additional research on these interventions is warranted. An important next step may be to assess what training methods are used for NDBIs. A secondary approach is to continue to systematically test the effective, yet simple approaches to training providers that are currently utilized in the field (i.e., BST). Lastly, it is imperative that the possible client outcomes associated with the use of these interventions are continuously assessed prior to training large numbers of providers (e.g., PRIDE behaviors).

The present dissertation will focus on exploring explicit training methods for developmentally based naturalistic interventions. As previously mentioned, behavior analytic literature is full of strategies for training practitioners to implement DTT and related skills, however, the literature base lacks the data to reasonably suggest a distinctive training model for practitioners to implement NDBIs and related interventions. Outside of a few articles utilizing and explicitly mentioning BST (Gianoumis, Seiverling, & Sturmey, 2012; Mrachko, Kaczmarek, Kostewicz, & Vostal, 2023), NDBI literature largely lacks explicit information on which techniques were utilized to train providers, leaving a large gap in the literature. A secondary focus of the present dissertation will be to assess how changes in adult behaviors may affect child behaviors during learning sessions.

The present dissertation follows the call for an 'alternative three-paper format' in MSU's Special Education PhD Handbook in which each chapter is a distinct research study within a thematically aligned dissertation. Accordingly, Chapter two consisted of a scoping review of the

current explicit training practices presented in NDBI literature since 2000. Chapter three presents strategies for practitioners to utilize while training others to implement NDBIs within their community-based clinics. Lastly, Chapter four investigated the outcomes of clients when the levels of PRIDE behaviors, a simple procedure that may be related to NDBIs, displayed by a provider are systematically manipulated.

Chapter two is a scoping review of the empirical literature regarding NDBIs from 2000-2024. The aim was to assess and organize the explicit training strategies utilized within the chosen research articles in hopes to better understand how researchers and practitioners are training others to implement NDBIs. The authors utilized the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) 2020 guidelines. Results indicated a clear tendency to use BST components and a tendency to train parental caregivers.

Chapter three empirically assessed BST as a feasible strategy for training providers to implement an NDBI known as reciprocal imitation training (RIT). Chapter three utilized a multiple probe design to systematically assess BT's implementation of RIT following a one-time BST training package. Results indicated that BST alone could effectively train BTs to implement RIT, with only one BT requiring a coaching additive. Chapter three assessed a training of NDBI in a clinical setting and adds to the nascent literature on training providers to implement NDBIs.

Chapter four evaluated the effect of PRIDE behaviors on client behavior by systematically manipulating the levels of PRIDE behaviors displayed by a provider and measuring its impact on the child's behavior. A reversal design was utilized. Results of the study found that when adult providers double their frequency of PRIDE behaviors during a naturalistic teaching session with a child with ASD, children may respond by noticeably increasing their spontaneous behaviors and increasing some of their responses to adult directions and uncontrived

imitative behaviors. Although no explicit training was implemented, this investigation replicated a pre-training/post-training experimental analysis by adjusting the frequency of PRIDE behaviors implemented in both phases in a noticeable enough manner that each phase may occasion different levels of child behaviors The changes in child behaviors during the high PRIDE behavior phase may give further credence to the need for strategies to train providers to implement these procedures.

Lastly, Chapter five outlines and discusses the themes and findings observed throughout and across chapters 2-4. These common themes include BST and BST components as a training approach and strategies for increasing non-parental providers training in developmentally-based interventions. Chapter five also highlights some common trends in NDBI training literature, including the settings in which training tends to occur.

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CHAPTER 2:

A SCOPING REVIEW OF TRAINING PRACTICES REPORTED IN EMPIRICAL INVESTIGATIONS OF NATURALISTIC DEVELOPMENTAL BEHAVIORAL INTERVENTIONS

Naturalistic developmental behavioral interventions (NDBIs) are interventions based on a combination of developmental sciences and behavior analytic techniques. Schreibman et al. (2015) report that NDBIs are effective for focused interventions of selected skills and package interventions that target multiple skills. The focused skills include but are not limited to imitation (RIT; Ingersoll, 2008; Ingersoll & Dvortcsak, 2006; Ingersoll and Schreibman, 2006), joint attention (JASPER; Kaale et al. 2012, 2014). Comprehensive packaged interventions include Social Communication/Emotional Regulation/Transactional Support (SCERTS; Prizant et al. 2003), Incidental Teaching (IT; McGee et al. 1999) pivotal response training (PRT; Koegel and Koegel 2006; Schreibman and Koegel, 2005) the Early Start Denver Model (ESDM; Dawson et al. 2010; Dawson et al. 2012), and Project ImPACT (Improving Parents As Communication Teachers; Ingersoll and Wainer 2013).

Naturalistic developmental behavioral interventions have been used and promoted by clinicians and educators to facilitate positive outcomes for children with autism spectrum disorders (ASD) (Schreibman et al., 2015). A recent meta-analysis of naturalistic interventions investigated the effects of NDBIs (Tiede. & Walton, 2019). Tiede and Walton found small positive effects for communication measures, marginal effects for joint attention and joint engagement measures, small but noticeable effects for reduction of ASD symptoms and increase in functional play, and large effects for social and cognitive measures. Similarly, a meta-analysis

of NDBIs by Tupou (2020) found noticeable positive effects for language, joint attention, cognitive development skills, and other skill domains.

Explicit training of practitioners is necessary for the effective implementation of all interventions (Fuller & Kaiser, 2020). Both providers and researchers may need to understand many aspects of the training process including the format of training, setting, title of trainee (e.g., who is receiving the training), or dosage when planning a particular intervention and corresponding training protocol. Thus, many reviews of behavior analytic training strategies have focused on several aspects of behavior analytic training. Some reviews have explored broad strategies such as the use of online or telehealth training protocols (Koldas, 2023; Tomlinson, Gore, & McGill, 2018; Unholz-Bowden, McComas, McMaster, Girtler, Kolb, & Shipchandler, 2020) or the use of evidence-based training protocols such as behavior skills training (BST) (Smith, Mattson, Aguilar, Pyle, & Higbee, 2024). Some reviews have explored potentially niche areas such as the use of tele-health delivered BST to train practitioners (Nylen, & King, 2024). Although individual NDBI studies have analyzed different strategies for training specific NDBIs (NLP: Gianoumis, Seiverling, & Sturmey, 2012; Project ImPACT: Mrachko, Kaczmarek, Kostewicz, & Vostal, 2023; RIT: Bravo & Schwartz, 2025), a more expansive review of the training strategies within the literature may be beneficial for practitioners and researchers to further integrate NDBIs into their practices and research.

Practitioners may need to understand current training practices used in published literature prior to effectively implementing these interventions on a wider scale. Researchers may need to understand training strategies prior to reliably replicating trainings to further assess the efficacy of interventions across differing contexts. Thus, a scoping review of NDBI training strategies and practices is critical in understanding the patterns observed in NDBI training

literature. Scoping reviews are reviews aimed at identifying and presenting the available evidence regarding a general topic within a field (Munn, Peters, Stern, Tufanaru, McArthur, & Aromataris, 2018). Scoping reviews may not provide a synthesized answer to a single research question and may instead provide a mapping of evidence that future researchers and practitioners may utilize when assessing the literature. O'Neill and Koudys (2024) conducted a recent scoping review of training strategies found in behavior analytic literature. O'Neill and Koudys (2024) explored the training strategies reported in single case studies aimed at reducing challenging behaviors displayed by children with ASD. Their review included 34 studies and found that around half of the included studies reported using BST or a combination of four BST components (e.g., instructions, modeling, rehearsal, feedback). This finding may offer critical information to practitioners and researchers interested in caregiver training for reducing challenging behaviors for children with ASD.

A similar scoping review is needed within the context of NDBIs. A better understanding of effective training practices could aid both practitioners and researchers in implementing and disseminating NDBI practices and research.

Purpose of the Current Scoping Review

We conducted a scoping review of training practices and strategies used within studies focused on NDBIs in clinic and community-based contexts. We first sought to identify the common training characteristics reported within and across each NDBI. Secondly, we sought to identify any common trends within and across NDBI training literature from 2000-2024.We asked the following research questions: (a)What training strategies and practices are currently reported in NDBI literature?; (b) Were chosen training strategies and practices similar across different types of NDBIs? And were chosen training strategies and practices similar across

different research methodologies? (c) What trends were observed across and within NDBI training literature?

METHOD

Inclusion and Exclusion Criteria

Studies were required to be published in a peer review journal in the English language. The study had to include the implementation of an NDBI (as described by Schreibman et al., 2015) to teach an individual with ASD. The study also needed to utilize a single case experimental design (e.g., multiple baseline, multiple probe) or group design (e.g., RCT, quasi-experimental). Studies were not excluded based on the quality of the design. The literature review focused on both NDBI intervention packages and focused interventions (e.g., RIT, ESDM), rather than brief behavior analytic strategies that are not intended to impact behavior beyond the immediate situation (e.g., choice making, positive reinforcement).

A study was excluded from the review if none of the individuals in the study had a diagnosis of autism spectrum disorder (ASD), if it was not an empirical investigation, if it utilized duplicate data or participants from another study, if it was retracted, if it was a review or meta-analysis, if it did not include an implementer, if no NDBI was implemented, or if it was a conference presentation. Studies focused solely on assessing adult implementation, training, or adult coaching were included if they met all other criteria.

Procedures

Search

The current investigation utilized the Preferred Reporting Items for Systematic reviews and Meta-Analyses Flow Chart (PRISMA) (Kahale et al., 2021) to track and report the decision-making process throughout the literature search. All studies were identified for inclusion in the

review using the following procedures. An electronic search was conducted by the first author on three databases: ProQuest (i.e., ERIC, PsycINFO, and PsycARTICLES), (i.e., Education Full Text), Web of Science, and Scopus (limited to Title-Abs-Key search) (D'Agostino et al, 2019). We used the following search terms: pivotal response training or pivotal response treatment or PRT or early start denver model or ESDM or reciprocal imitation training or RIT or joint attention symbolic play engagement and regulation or JASPER or milieu teaching or enhanced milieu teaching or EMT or project impact or natural environment teaching or naturalistic or SCERTS or Social Communication Emotional Regulation Transactional Support or LEAP or Learning Experiences Alternative Program AND (autism spectrum disorder or ASD or autism) AND (training or train or teaching or teach). All the articles included in the review were peer reviewed research articles written in the English language. After conducting the initial search, an ancestral search was conducted with the meta-analyses and systematic reviews found in the database search. Figure 2.1 depicts a PRISMA flowchart (Kahale et al., 2021) outlining the decisions made at each step. We imported all studies found within the databases to Covidence (https://www.covidence.org).

Initial Screening

Screening criteria, comprised of exclusion and inclusion criteria, were created on Covidence and used to initially screen the abstracts. If more information was needed to continue the screening, the full text of the article was screened using the same criteria. The first author screened 100% of the articles identified for eligibility. A secondary screener screened a randomly selected group of 50% of the studies. The average inter-rater reliability for screening was 96%. Table 2.1 displays the screening criteria used in this study.

Coding Procedures

Coding criteria were created in Covidence to obtain data that could answer the proposed research questions. Table 2.2 displays the coding questions used in this study. We coded the name of the NDBI, the study experimental methodology (single case experimental design, group experimental, mixed design), and the name of said design (e.g., multiple baseline design, randomized controlled trial). All studies that reported multiple research designs were coded as "mixed design". We then coded for the setting (i.e., school, clinic, home) and trainee occupation or position (i.e., therapist, researcher, caregiver). The setting was coded as "school" if researchers mention it occurred in a private or public school whereas the setting was coded as "clinic" if the researchers mentioned the intervention occurred in a publicly funded or privately funded clinical setting or hospital setting. If the setting was reported as "community" in the study, we coded it as "community" in this investigation. All studies that reported multiple settings were reported as "mixed setting". Studies that reported a setting as "home" were coded as home. We then coded for whether the study mentions training the implementer and if so, whether the training method was a known training method (e.g., behavior skills training; BST) or other training procedures (e.g., video modeling, feedback, instructions). We only coded for direct implementation. Thus, the focus of the training must have been directed towards the person working directly with the client. Training method descriptions were copied from each article into Covidence for accurate assessments. We then coded for the length of the training to assess for whether trainings were conducted as a one-time procedure or across multiple sessions and whether the training was conducted in a group, 1:1 environment, or a mixture of the two. Exact time for training (i.e., 3 weeks) were also coded. We coded explicitly what the authors reported. Thus, anything not directly reported in the study was coded as "not applicable" or "NA".

Inter-rater Reliability

A secondary coder coded 25% of all studies using Covidence. The first author trained the second coder to code. The first author and secondary coder went over step-by-step directions on how to code the articles using Covidence. After agreeing on coding criteria, coders then coded three studies similar to those included in the review. These three studies were all published prior to the included years of review (i.e.,1999) and were not included in the review. Following the coding, the first author and second coder met to discuss results. Coders reached >95% reliability prior to coding the rest of the studies. Any disagreements in coding during training were discussed before the second coder was approved to move forward with post-training coding. The first author coded 100% of the studies independently while the second coder coded 25% of the same articles. The results from both coders were compared using a point-by-point method (Cooper et al., 2007). The number of agreements per article were divided by the total number of disagreements plus agreements and multiplied by 100 to create a percentage of agreements. The average IRR was 94%.

Data Analysis

We utilized descriptive statistical analysis to further analyze each coded category.

Intervention Information

Intervention information collected included the name of the NDBI, the study experimental methodology, and the name of said research design (e.g., multiple baseline design, randomized controlled trial). Studies that reported implementing a combined NDBI (e.g., ESDM +PRT) were separated from the coding of the individual NDBIs that make up the combined intervention and reported as their own category.

Trainee Information and Setting

Trainee information collected included the title of the trainee. The setting for each study was coded as school, home or clinical. All settings noted as "university" were coded as "clinic" due to the research-oriented nature of university research and due to some articles reporting a "university clinic" setting.

Training Format

We coded whether training procedures were mentioned in the article and if so, what format was reported. We coded length of training in hours, weeks or months as "multiple sessions". We also coded the format of training if mentioned (e.g., online modules, in-vivo), and whether the study was conducted in a group, 1:1 setting, or a mix of the two.

Training Methodology

If an article mentioned training, we coded whether articles reported a specific training strategy (i.e., BST) or a combination of training strategies (i.e., modeling, feedback). We coded whether each article reported using a specific training strategy such as BST only if the authors specifically mentioned BST or another strategy. We also coded for the distinct training strategies found such as modeling, instructions, feedback, and rehearsal. Modeling was coded for the use of video models or in-vivo models. Instructions were coded for the use of written, verbal, or video instructions. Feedback was coded for the delivery of verbal, written, or video feedback. Rehearsal was coded for the implementer's opportunity to practice the skills. All variables were analyzed at the study level and not at the level of each participant.

Implementation Fidelity

We coded whether implementation fidelity was reported. Implementation fidelity was defined as the fidelity of the trainee. The trainee was defined as the individual being trained to

implement the intervention directly to the child. The level of implementation fidelity (i.e., 80%) was not coded for as that falls beyond the scope of this investigation.

RESULTS

Database Search

The database search produced 1,215 total articles, which narrowed to 608 after duplicates were removed. Following screening, 248 studies were assessed for eligibility and 160 studies were included in the review. No additional studies were found following an ancillary search of references and reviews (see Figure 2.1 for a PRISMA flow diagram).

Data Extraction

Intervention Information

A total of 160 studies were extracted. Interventions included Early Achievements (n=3), Project ImPACT/PI (n=17), Reciprocal Imitation Training/RIT (n=20), Early Start Denver Model/ ESDM (n=24), Pivotal Response Training/PRT (PRT; n=56), Incidental Teaching/IT (n=13), Learning Experiences and Alternate Program/LEAP (n=1), Enhanced Milieu Teaching/EMT (n=11), Joint Attention, Symbolic Play, Engagement and Regulation/ JASPER (n=9), ESDM+PRT (n=1), JASPER+EMT(n=4), and Social Communication, Emotional Regulation, Transactional Support/ SCERTS (n=1). Figure 2.2 offers a visual of all included studies.

Training Strategies

All 139 studies reporting training strategies were further analyzed. Two studies reported BST as their training strategy (1%). Twenty-four studies reported fidelity as a training strategy (17%). Forty-eight studies reported practice as a training strategy (35%). Forty-one studies reported instructions as training strategy (29%). Eighteen studies reported implementing

workshops (13%). Forty studies reported implementing manuals (29%). Twelve studies reported implementing modules or webinars (9%). Fifty-six reported coaching as a training strategy (40%). Fifty-four studies reported modeling (39%) with 11 studies explicitly reporting in-vivo models (20%) and 26 studies explicitly reporting video models (48%). Eighty-one studies reported some form of feedback (58%). Twenty-one studies reported role play as a training strategy (15%). Table 2.3 further analyzes the reported training strategies.

Trainee Information and Setting

A total of 159 studies (99%) reported the title of the trainee. One Early Achievements study did not report a title for a trainee (1%). Sixty-six studies reported trainees as caregivers (42%), 42 studies reported trainees as staff (26%), 22 studies reported trainees as teachers (14%), 19 studies reported trainees as researchers (12%), four studies reported trainees as graduate students (3%), three studies reported a mixture of trainees (2%), two studies reported trainees as siblings (1%), and one study reported the trainee as an adult with ASD (1%). Training setting was also coded. Amongst all studies, 41 studies reported the setting as a school (26%), 4 studies reported the setting as community (3%), 70 studies reported the setting as clinical (44%), 32 studies reported the setting as a home environment (20%), five studies did not report a setting (3%), and eight studies reported a mixture of one or more settings (5%).

Data for trainee title were also disaggregated by each NDBI (see Figure 2.3). One Early Achievements study reported the trainee as staff (33%), one as a teacher (33%), and one did not report the title of the trainee (33%). A total of 10 Project ImPACT studies reported the title of the trainee as caregivers (59%), four reported staff (24%), and three reported as researchers (17%). A total of seven Reciprocal Imitation Training studies reported trainees as caregivers (35%), nine as staff (45%), one as a teacher (5%), one as a researcher (5%), one as a sibling (5%), and one as

a mixture of trainees (5%). A total of 15 Early Start Denver Model studies reported trainees as caregivers (60%), six as staff (24%), two as teachers (8%), one as a researcher (4%), and one as a sibling (4%). A total of 22 Pivotal Response Training studies reported trainees as caregivers (39%), 15 reported as staff (27%), 10 reported as teachers (18%), four reported as researchers (7%), three as graduate students (5%), and two as a mixture of trainees (4%). Two Incidental Teaching studies reported trainees as caregivers (15%), five reported as teachers (38%), five as researchers (38%), and one as an adult with ASD (9%). One LEAP study reported trainees as staff (100%). Four Enhanced Milieu Teaching reported trainees as caregivers (36%), two studies reported staff (18%), one study reported a teacher (9%), three studies reported researchers (27%), and one study reported a graduate student (9%). JASPER studies reported two trainees as caregivers (29%), two as staff (29%), one as a teacher (13), and two as researchers (29%). One ESDM+PRT study reported trainees as caregivers (100%). Two JASPER+EMT studies reported trainees as caregivers (50%) and two studies reported staff (50%). One SCERTS study reported trainees as teachers (100%).

Figure 2.4 shows reported settings data broken down by NDBI. Early Achievements studies reported two settings as school (66%) and one setting as clinic (33%). Project ImPACT studies reported 11 settings as clinical (65%) three settings as home (18%), two settings were not reported (13), and one study reported a mix of more than one setting (6%). Reciprocal Imitation Training studies reported two settings as school (10%), 11 settings as clinical (55%), three settings as home (15%), two studies that did not report a setting (10%), and one study that reported a mix of more than one setting (5%). Early Start Denver Model studies reported two settings as school (8%), three settings as community (13%), 12 settings as clinical (50%), five settings as home (21%), one study that did not report a setting (4%), and two studies that

reported a mix of settings (8%). Pivotal Response Training reported 20 settings as home (36%), one setting as community, 21 settings as clinical (38%), nine settings as home (16%), two studies that did not report a setting (4%), and three studies that reported a mix of settings (5%). Incidental Teaching studies reported six settings as school (43%), five settings as clinical (38%), and two settings as home (15%). LEAP studies reported one setting as school (100%). Enhanced Milieu Teaching reported three settings as school (28%), four settings as clinical (36%), four settings as home (36%). JASPER studies reported five settings as home (62%), two settings as clinical (25%), and one study that reported a mix of settings (13%). The sole ESDM+PRT study reported one clinical setting (100%). JASPER+EMT studies reported two settings as clinical (50%) and two settings as home (50%). The sole SCERTS study reported one school setting (100%).

Training Format

Most studies reported explicit training format information (89%). Table 2.4 shows training format session lengths data broken down by NDBI. Early Achievements training averaged 4.3 hr (range, 3-7). Project ImPACT training averaged 16.3 weeks (range, 8-24). Reciprocal Imitation Training/RIT trainings averaged 7.4 weeks (range, 2-12). Early Start Denver Model trainings averaged 17 weeks (range, 10-26). Pivotal Response Training studies averaged 9.8 weeks (range, 1-25). Incidental Teaching studies trainings averaged 4.6 weeks (range, 1-24). LEAP reported one 23-day training completed over a 2-year period. Enhanced Milieu Teaching trainings averaged 42.5 min (range, 40-45) sessions over 12 weeks. JASPER trainings averaged 14.8 weeks (range, 1-24). SCERTS reported one training lasting three days. ESDM+PRT reported one 12-week training. JASPER+EMT reported one training lasting six months.

Figure 2.5 further analyzes training format lengths. Early Achievements studies reported three studies with multiple sessions of trainings (100%). Project ImPACT studies reported 15 trainings with multiple sessions (88%), one training of a single session (6%) and one training that did not specify session lengths (6%). RIT studies reported 10 trainings with multiple sessions (50%), nine trainings that did not specify a training length (75%), and one training of a single session (5%). Early Start Denver Model studies reported 16 trainings of multiple sessions (64%) and nine trainings that did not specify a training length (36%). Pivotal Response Training reported 41 trainings with multiple sessions (73%), 13 trainings that did not specify a length (23%), and two trainings of a single session (4%). Incidental Teaching studies reported six trainings with multiple sessions (46%), four trainings that did not specify a length (31%), and three trainings of a single session (23%). LEAP studies reported one training with multiple sessions (100%). Enhanced Milieu Teaching reported one training with multiple sessions (9%), nine trainings that did not specify a session (82%), and one training with a single session (9%). JASPER studies reported eight studies with multiple sessions (100%). ESDM+PRT reported one training of multiple sessions (100%). JASPER+EMT studies reported one training of multiple sessions (25%) and three studies that did not specify a training length (75%). SCERTS reported one training of multiple sessions (100%).

Figure 2.6 shows training format data broken down by NDBI. Early Achievements studies reported two group trainings (33%) and one mixed training (33%). Project ImPACT studies reported nine 1:1 training (53%), three group trainings (18%), and five mixed training studies (29). RIT studies reported six 1:1 training (30%), seven mixed trainings (35%), and seven studies without a specified training (35%). ESDM studies reported eight 1:1 trainings (32%), three group trainings (12%), four mixed trainings (16%), and 10 studies that did not specify a

training format (40%). Pivotal Response Training reported 24 one-to-one trainings. (43%), three group trainings (5%), 18 mixed trainings (32%), and 11 studies that did not specify a training format (20%). Incidental Teaching studies reported ten 1:1 training (77%), one mixed training (8%), and two studies that did not specify a training format (15%). LEAP studies reported one group training (100%). Enhanced Milieu Teaching reported four 1:1 trainings (36%), one mixed training (9%), and six studies that did not specify a training format (55%). JASPER studies reported two 1:1 trainings (25%), five group trainings (63%), and one mixed training (13%). ESDM+PRT reported one 1:1 training (100%). JASPER+EMT studies reported one 1:1 study (25%) and three studies that did not specify a training format (75%). SCERTS studies reported one mixed training (100%).

Study Research Design

Of the 160 studies, 85 (53%) reported a group design, 73 (46%) reported a single case design, and 2 (1%) reported a mixed design. All three Early Achievements studies reported a group design (100%). Project ImPACT studies reported 15 group studies (88%) and 2 single case studies (12%). Reciprocal Imitation Training studies reported seven group studies (35%), 12 single case studies (60%) and one mixed design study (5%). ESDM reported 17 group studies (68%), seven single case studies (28%), and one mixed design study (4%). Pivotal Response Training studies reported 29 group studies (52%) and 27 single case studies (48%). Incidental Teaching studies reported 13 single case studies (100%). LEAP reported one group study (100%). Enhanced Milieu Teaching reported one group design study (9%) and 10 single case studies (91%). JASPER reported eight group studies (100%). ESDM+PRT studies reported one single case study (100%). JASPER+EMT reported three group design studies (75%) and one single case design study (25%). SCERTS reported one group design study (100%).

Figure 2.7 outlines the study group designs. Forty-six out of 85 group studies (54%) were randomized controlled trials while 39 studies (46%) reported a non-randomized group design. Fifty-three out 73 single case studies (73%) reported a multiple baseline design while a multiple probe was reported 13 times (18%). Other single case designs (e.g., alternating treatment design) were reported 7 times (9%).

DISCUSSION

Naturalistic Developmental Behavioral Interventions have been categorized and described for 10 years (Schreibman et al., 2015). Since their categorization, many reviews and meta-analyses have been conducted to further analyze the efficacy of these studies (Tiede & Walton, 2019; Tupou, 2020). However, there is not much data about training approaches across NDBIs. The purpose of this scoping review was to display the training strategies and patterns reported in NDBI training literature since 2000 and to suggest ways in which NDBI interventionists may present their training strategies with more clarity to aide future interventionists and practitioners. This scoping review includes 160 studies published between January 1st, 2000, and December 31st, 2024.

Almost all studies reported explicit training strategies. The most common training strategy reported across all studies was feedback. Just over half of all studies reporting training strategies involved a feedback component. Although feedback is often implemented in many ways (i.e., corrective, positive, written, verbal), we only coded the word "feedback" as a training strategy. This general coding strategy was chosen as many studies reported the type of feedback (e.g., corrective), however, they failed to further explain what the steps to implementing corrective feedback entailed or give an example of said feedback. Findings indicate that coaching, modeling, instructions, and practice were also common with one-fourth to one-third of

all studies reporting these strategies. These findings are not surprising as modeling, practice, and feedback are some of the main components of BST and are common components of training protocols (O'Neill and Koudys, 2024). Interestingly, only two studies directly mentioned the use of BST as the format of their trainings. Similar to O'Neill and Koudys (2024) scoping review however, around one-third of all studies reported some combination of two or more BST components with some studies reporting all four components. Findings also indicate that studies that reported multiple training sessions often implemented some form of feedback component. Coaching strategies were not further analyzed as some studies reported a "coaching component" as a separate component to their other teaching strategies (i.e., instructions, feedback) while others described their entire training as "coaching" and then described the use of other training strategies within coaching sessions (i.e., instructions, feedback).

Overall, included studies were split almost evenly across single case and group design structures. Randomized controlled trials were almost even with non-randomized group trials. However, a vast majority of single case studies reported a multiple baseline design structure. The findings of the reported design structures indicate that across NDBI studies that mention training, the distribution of group and single case design structures is almost even. The skew towards multiple baseline design studies displayed in overall single case studies may indicate the need for longer baseline sessions when implementing NDBIs with a training component as multiple baseline studies tend to implement longer baseline sessions than multiple probe studies which were only reported in 18 studies.

Caregivers were the most reported trainee group. This finding differs from some DTT training reviews which found that staff such as clinicians were often the most reported (Briggs, Zohr, & Harvey, 2024; Leaf et al., 2019). These findings are not surprising, however, as a

common aspect of many NDBIs is caregiver implementation Schreibman et al., 2015). Well-researched NDBIs such as Project ImPACT, Pivotal Response Training and Early Start Denver Model have a strong history of caregiver implementation. Caregiver implemented interventions are often utilized to teach children with ASD due to the amount of time caregivers spend with the child and the opportunity for offering many learning opportunities across settings (van Noorden, Gardiner, & Waddington, 2024). Training caregivers may also prove to be more cost effective and time saving depending on the intervention (van Noorden, Gardiner, & Waddington, 2024). Often, there are less parents to train, thus less time and money may be utilized to implement parent training. Thus, interventions with higher numbers of caregiver training studies compared to other trainees such as Pivotal Response Training and Early Start Denver Model may suggest lower overall training needs (i.e., costs, time) than interventions such as JASPER, SCERTS, and EMT which reported lower numbers of caregiver trainings. Interestingly, interventions with the highest number of caregiver training also reported the highest numbers of manual usage while training. The implementation of a training manual may function as a buffer when training caregivers, which often have the least amount of clinical ABA experience. A manual may offer a more standardized training approach with more easily anticipated cost and time commitments, leading to a savings for some NDBIs.

"Staff" comprised of both clinical and school staff. Both school and clinical staff are often the direct providers of child behavior analytic programming in their respective environments. These groups were not separated for analysis due to the similar role of and the possibly similar level of training that often pertains to teaching and training lower-level staff such as behavior technicians (BTs) and paraprofessionals. Similar to studies that reported caregivers as trainees, studies reporting staff as trainees varied across NDBIs. Pivotal Response

Training, Early Start Denver, and Reciprocal Imitation Training studies reported the largest percentages of staff as trainees, suggesting a larger role of these interventions in school and clinical environments than others. Pivotal Response Training studies also reported almost half of the studies reporting trainees as teachers. Teacher training and professional development is a critical aspect to implementation of ABA strategies in schools (Kirkpatrick, Akers, & Rivera, 2019). The higher reports of teachers as trainees of PRT might suggest that sometimes PRT implementation may need the combination of teachers and staff to be effective in school environments. The variation of reported trainee titles across and within NDBIs further highlights the need for researchers to continue to report this information.

Almost half of all studies reported the setting as clinical. Clinical settings included hospitals, behavioral clinics, and university clinics. These three settings were coded the same way because these environments are known for higher standard research-based approaches to interventions, therefore, their grouping is justified. The next two most common settings were schools and the home environment which together make up almost the entirety of the other half of the study settings. Interestingly, NDBIs that tend to work primarily with caregivers such as PRT and ESDM did not report a majority of in-home trainings as one may expect. Instead, ESDM reported mainly in-clinic trainings while PRT reported an almost even plurality between in-home and in-clinic trainings. The setting in which training occurs may play a critical part in the efficacy of the training. These findings suggest that an in-clinic trainings may be beneficial when working with caregivers as they tend to have the least amount of clinical experience, thus, they may benefit from the more structured environment in a clinic than a less structured home environment. Other NDBIs such as Project ImPACT, RIT, and EMT also reported a majority of

in-clinic trainings, further suggesting the need for a structured environment while training across NDBIs.

Training lengths varied considerably. One NDBI reported an average training length of 4.3hrs, while another reported a training that took over 6 months to complete. Most NDBIs, however, reported training lengths that consisted of several weeks, with a range of 4.6 to 17 weeks. Notably, NDBIs known as packaged interventions (i.e., Project ImPACT, ESDM, PRT) reported longer training lengths than those considered focused interventions (i.e., RIT). This finding is expected as packaged interventions often utilize multiple training sessions and focus on a wider variety of both child skills and adult provider skills. Notably, no NDBI with multiple included studies reported a majority of single session training formats. These findings may suggest that NDBI intervention training may be difficult to complete in a single session regardless of whether the NDBI is considered a packaged intervention or focused intervention. These findings may also suggest that perhaps NDBI intervention training itself is not difficult, but the combination of developmental and behavioral strategies of NDBIs simply take more time to learn. These findings, however, should be analyzed with some caution as roughly one-fourth of all studies did not report the length of their training sessions.

Almost half of all studies reported a 1:1 training format while the rest of studies were split between a group training format, a mix of 1:1 and group training, or not specifying the grouping format of their study. Interestingly, the second largest reported training format was mixed training. Mixed trainings were coded as such when the study reported utilizing both a group training and a 1:1 training format. When combined, the studies reporting solely a 1:1 training and mixed trainings made up almost three-fourths of all studies (73%). Surprisingly, the grouping of training did not align with the research design of the study as one might expect.

NDBIs such as Project ImPACT, ESDM, and JASPER all reported a majority of group design studies, however, the majority of their trainings were not group trainings. Similarly, most NDBIs with majority single-case design studies (i.e., RIT, EMT) did not report 1:1 training format majority of the time. Only IT studies reported both a majority of single-case studies and 1:1 training format, aligning with the expected pattern. These findings once again highlight the possible need for more intensive training sessions when implementing an NDBI. One-to-one training formats may offer a more personalized experience than a group training format alone, leading to a quicker or more effective acquisition of skills. However, the combination of a 1:1 training with a group training format may create an even more robust training environment that offers both the benefits of individualization and the possible cost-effective nature of presenting to a large group. Interestingly, studies that reported a mixed training format often implemented the group training first followed by the 1:1 portion of the training. These findings suggest that trainers may have utilized the 1:1 sessions as a means for personalizing the often-general information presented in the group trainings. These findings also highlight the need for more intensive trainings (e.g., mixed training) even when the design of the study may suggest a simple 1:1 training or group training format.

Although these findings may be beneficial to researchers and practitioners interested in training in NDBIs, there are some limitations. The list of NDBIs presented in the scoping review are the most researched examples of NDBIs based on Schreibman et al., (2015). However, Schreibman and colleagues describe the list as inexhaustive. Thus, other interventions that combine developmental sciences and behavioral principles such as dialogic or shared book reading (Akemoglu, & Tomeny, 2021) and parent child interaction therapy (PCIT; McNeil, Hembree-Kigin, & Anhalt, 2010) may be considered NDBIs. Similarly, the search terms did not

include the terms "NDBIs " or "naturalistic developmental behavior interventions" as these terms would have widened the search significantly and this review was meant to focus on the specific interventions mentioned in Schreibman et al., (2015). The exclusion of these interventions may limit the scope of this review if researchers and practitioners consider these interventions as NDBIs and are interested in training providers to implement them. It is also crucial to note that this review limited the inclusion of NDBI studies to those that included the words "teaching", "training", or other variations of the two, in the abstract or full text. This limiting of the search procedures may have led to some studies not being included that may have been included otherwise, however, with the focus of this review consisting of training practices, this limiting step was justified.

The instances of unreported information were also a limitation. Similar to the scoping review of DTT training by Briggs, Zohr, & Harvey (2024), many studies failed to report some pertinent information. This study found that although only 18 studies did not report specific training strategies at all, many studies failed to report or specifically describe several training components. Several studies did not report the title of the trainee and the format of training both in the sense of trainee groupings and whether the training was a one-time training or multiple, ongoing sessions. Briggs, Zohr, & Harvey (2024) posit that future researchers should consider reporting more specific information regarding training because the missing information may play a critical role in finding the relationship between the training procedures and the individual that is trained. In both this review and Briggs and colleagues' review, many studies failed to report the educational level of trainees. Different types of trainees may have differing educational experiences and levels of expertise that play a role in the speed and efficacy of training a particular intervention. Due to the vast number of studies that did not report the levels of

experiences and education of trainees, however, these data were not included in this investigation.

This investigation reviewed NDBI training literature, identified themes across and within NDBIs, and discussed the possible benefits for clearer reporting of training components in future literature. The rise of NDBI research since their categorization in 2015 has led to many reviews of these practices. Training, however, has been a noticeably missing component in this research line. This review aimed to synthesize and summarize some of the pertinent themes surrounding training providers to implement NDBIs in hopes of informing both practitioners and researchers of ways to further advance the efficacy and dissemination of these practices.
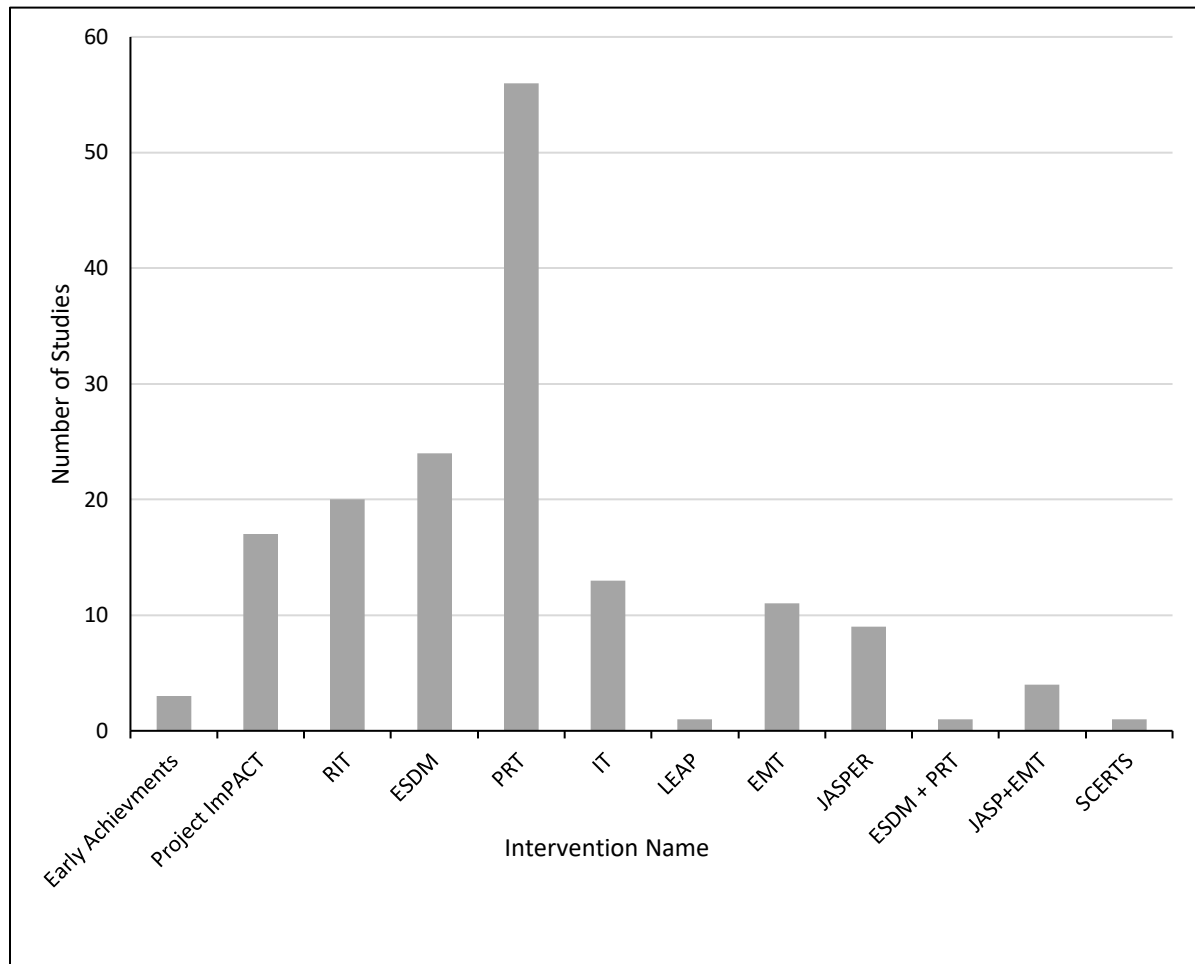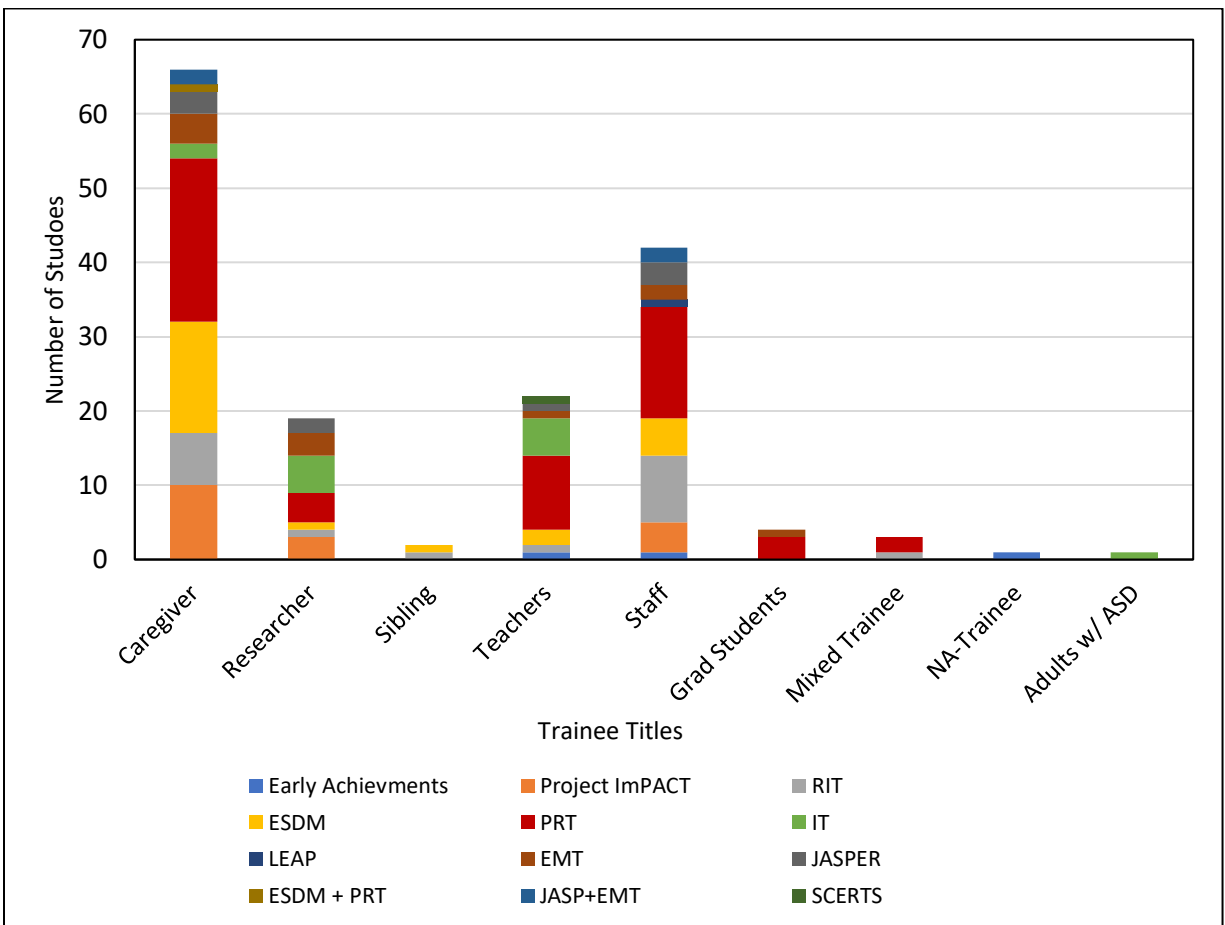
Figure 2.1.

PRISMA Flow Chart
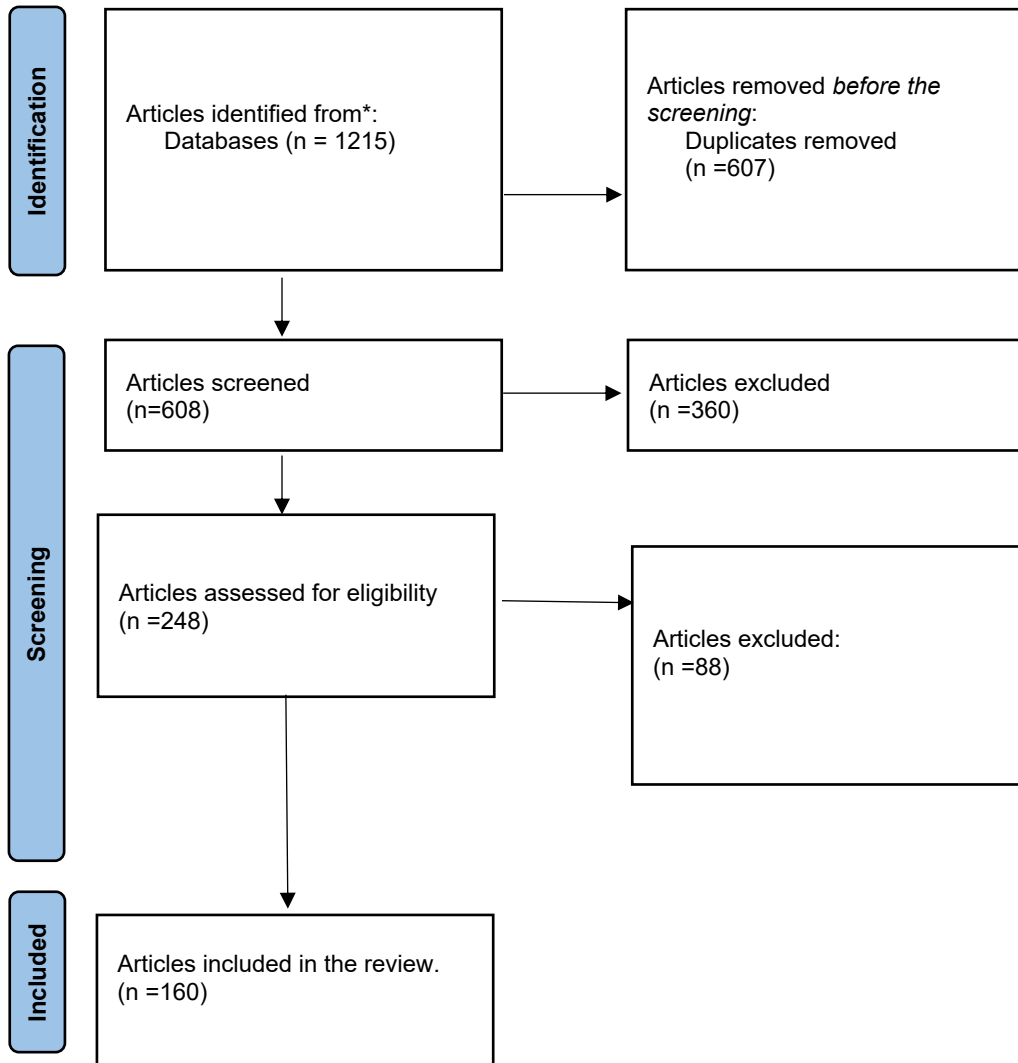
Figure 2.2.

NDBI Studies
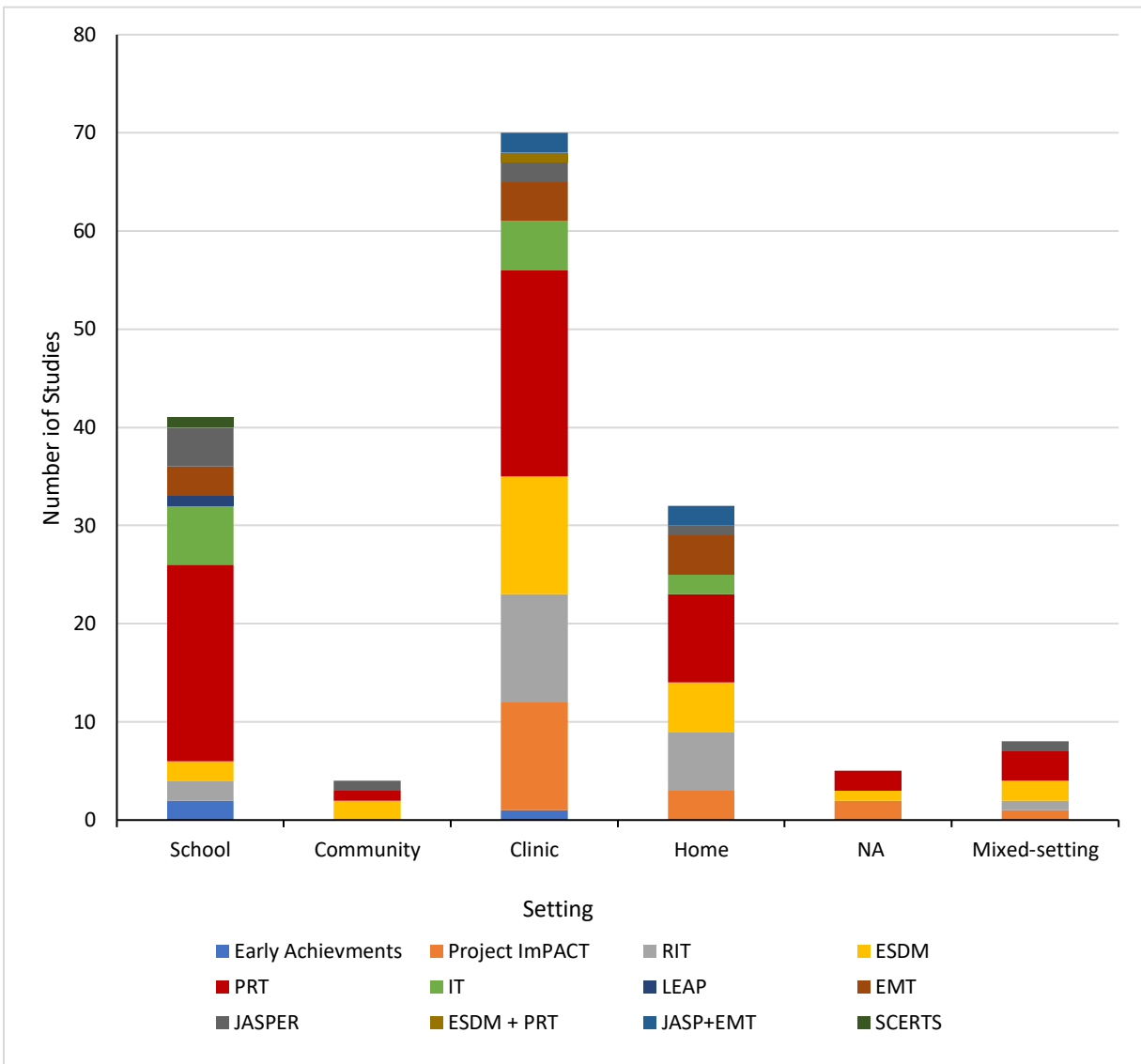
Figure 2.3

Titles of Trainee

Figure 2.4

Settings

Figure 2.5

Training Format
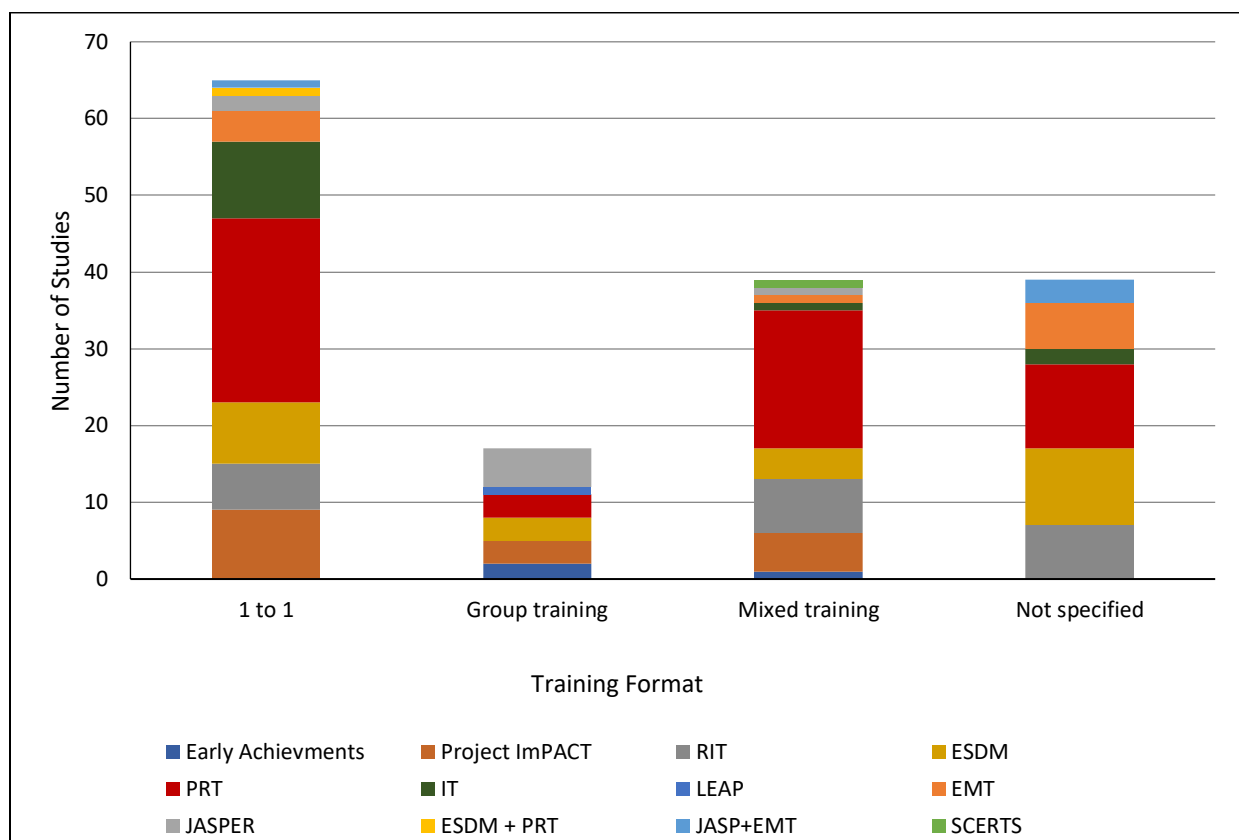
Figure 2.6

Training Length
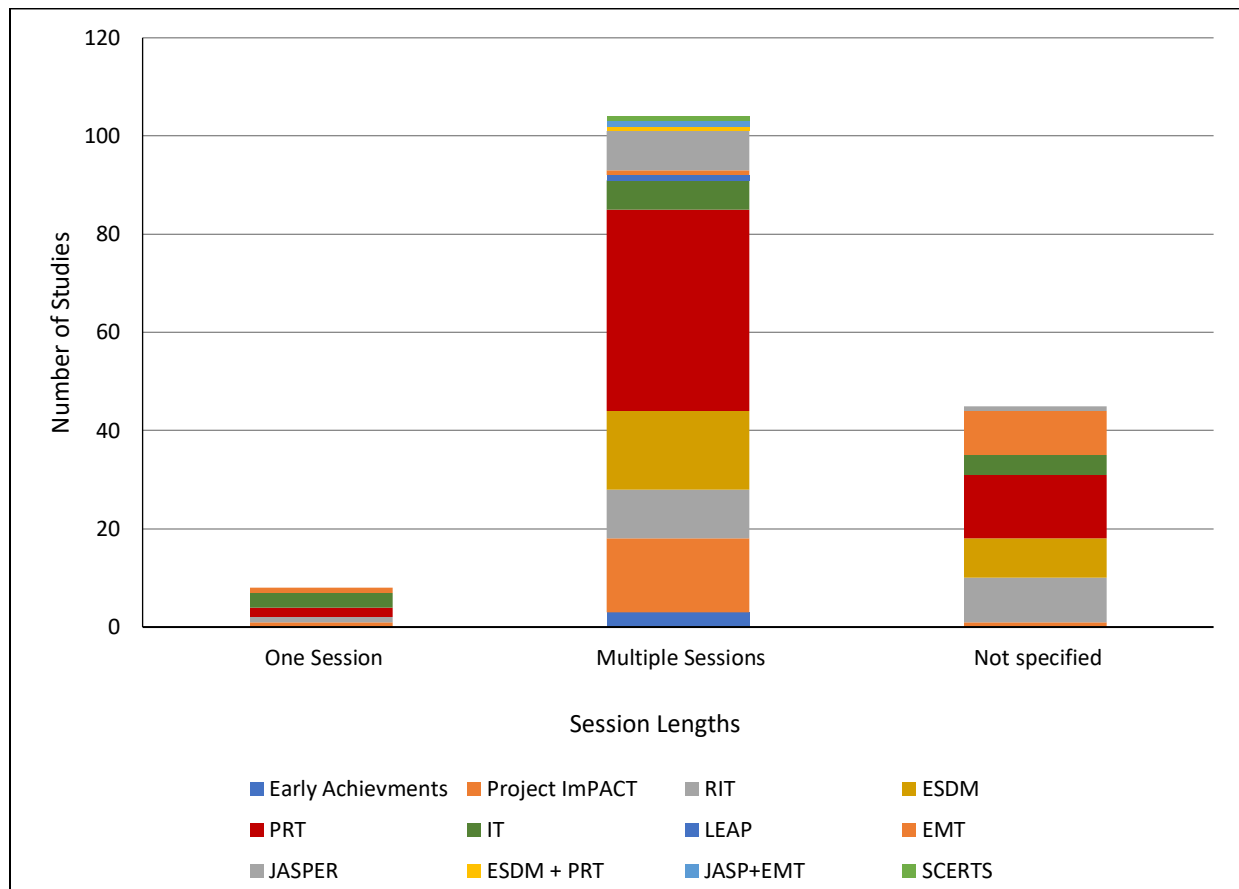
Figure 2.7.

Study Designs
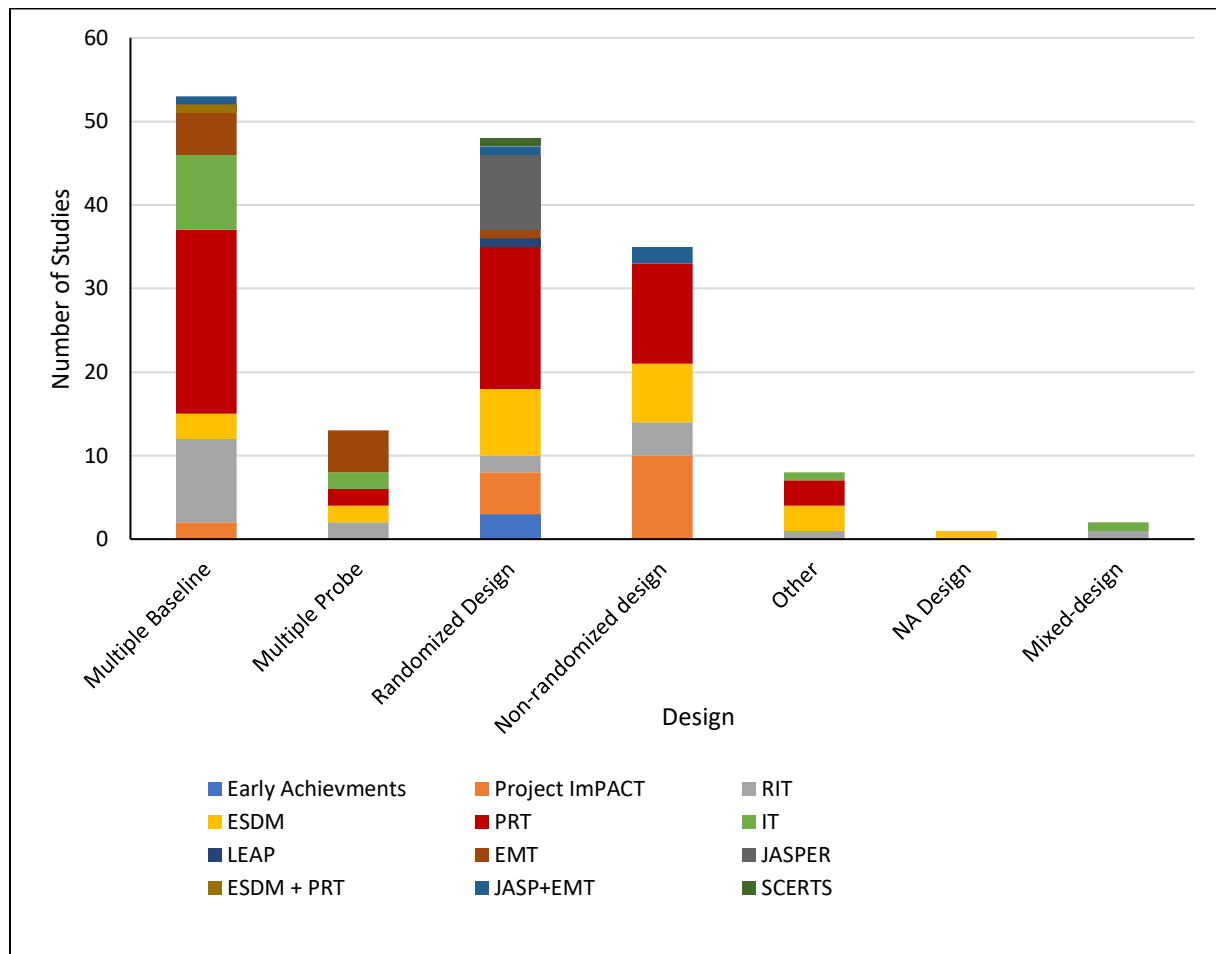
Table 2.1.

Screening Checklist

Section Information	Data collected
1. Article Identification	
Year	record collected data
2. Participant Characteristics	
ASD Diagnosis	record collected data
3. NDBI Implementation	
Name of NDBI	record collected data
4. **Training Mentioned**	
Yes or no?	record collected data

Table 2.2.

Codebook

Section Information	Data collected
1. NDBI Implementation	
Name of NDBI	record collected data
Trainee Title	record collected data
Setting where intervention is implemented	record collected data
2.Training Strategies	
Is training mentioned?	record collected data
Length of Training: 1 session, multiple sessions,	
Length of Training: time	record collected data
Training Format: group vs. 1:1 vs. mixed	record collected data
Copy and Paste of Training Strategies	record collected data
3. Study Methodology Characteristics	
Type of Design	record collected data
Name of Design	record collected data

Table 2.3.

Training Strategies

				Intervention								
	EA	PI	RIT	ESDM	PRT	IT	LEAP	EMT	JASPER	ESDM + PRT	JASP+ EMT	Total
Behavior skills training		1			1							2
Fidelity		2		8	11			1	1		1	24
Practice	1	3		12	21	4	1	2	2	1	1	48
Instructions	1	3	6	4	13	9	1	2	1	1		41
Workshops	3	3		3	4	1		2	1		1	18
Manual		6	4	9	20		1					40
Module/ Webinar		3	2	4	1	2						12
Coaching		7	6	14	16			4	7	1	1	56
Modeling	2	6	5	5	19	6	1	3	5	1	1	54
In-vivo model		2	1	1					5	1	1	11
video models	1	1	4	5	13		1	1				26
Feedback	2	9	9	6	35	11	1	2	5	1		81
Role Play	1	2	3	1	6	6		2				21
None			4	5	4	1		5			2	21

Table 2.4

Training Length of Interventions

Name of NDBI	Training Length
Early Achievements	4.3 hr (range, 3-7)
Project ImPACT	16.3 weeks (range,8-24)
RIT	7.4 weeks (range,2-12)
ESDM	17 weeks (range,10-26)
PRT	9.8 weeks (range, 1-25)
IT	4.6 weeks (range, 1-24)
LEAP	one 23-day training completed over a 2-year period
EMT	42.5 min (range, 40-45) sessions over 12 weeks
JASPER	14.8 weeks (range, 1-24)
ESDM + PRT	One 12-week training, 1hr per week
JASP+EMT	One 6-month training
SCERTS	One 3-day training

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CHAPTER 3:

USING BEHAVIORAL SKILLS TRAINING TO TEACH BEHAVIOR TECHNICIANS TO IMPLEMENT A MODIFIED RECIPROCAL IMITATION TRAINING INTERVENTION

Autism Spectrum Disorder (ASD) is a developmental disability that may affect one's educational outcomes and lead to a corresponding delay of social communicative skills (American Psychiatric Association, 2013). Imitation has been described as a pivotal skill for developing youth, as it aids in the development of other complex social and cognitive skills and is often delayed among children with ASD (Ingersoll and Gergans, 2007). Early literature on the development of imitation skills has found that children with ASD may lack imitative skills, leading to slower or non-development of other social communicative skills (Smith & Bryson, 1994). Children with ASD have been reported to have deficits in object imitation, gestural imitation, and vocal imitation (Ingersoll, 2008). ASD researchers have therefore focused on addressing these forms of imitative deficits (Ingersoll, 2008).

Traditional imitation training procedures in early intervention have relied on an approach known as discrete trail training (DTT) to teach imitative skills to children with ASD (Maurice, Green, & Luce, 1996). DTT emphasizes the use of a highly controlled, adult-led teaching environment where skills are broken down into smaller components and each component is taught separate from the next. The adult provider often chooses the targeted skill (i.e, putting hands on head) and behavior analytic strategies such as prompting and reinforcement are added to further aid the child in learning the targeted skills. Although this approach has been effective for decades in teaching new imitative skills (Baer, Peterson, & Sherman, 1967), the skills taught can be regimented and sometimes lack spontaneity and the more natural social-communicative use of

imitation often seen from neurotypical children (Ingersoll & Schreibman, 2006). One approach to teaching imitation to children with ASD that aims to address these underlying concerns is reciprocal imitation training (RIT).

Reciprocal imitation training (RIT; Ingersoll & Dvortcsak, 2006) is an imitation-based naturalistic developmental behavioral intervention (NDBI) which teaches individuals with ASD object and gesture imitation in naturalistic or play-based contexts. RIT calls for an adult provider and child client to both possess similar or identical play sets (e.g., doctor play sets) while the intervention is implemented. RIT offers a looser environment for learning than a DTT session by allowing the child to lead the session and embedding learning targets into play-based routines (Ingersoll & Schreibman, 2006). The looser environment combined with the child-led approach allows for the child's motivation to influence the session, often leading to quicker acquisition and better generalization of skills. This is noteworthy, as a main criticism of DTT-based skills teaching is the lack of skills generalization often observed after children have learned the targeted skill (Schreibman et al., 2015).

Ingersoll and Schreibman (2006) assessed RIT as an intervention to teach children with ASD how to imitate an adult while using an object. Children participated in the study for several weeks, and at the end, all participants showed large increases in their rate of object imitation and generalized these skills to novel materials, with novel adults, and in novel settings. In a similar study, Ingersoll and colleagues (2007) taught five children to imitate gestures using RIT. Overall, all children learned to imitate gestures. In addition to positive results for imitation, RIT also led to increases in other skill areas in both studies including pretend play, language, or joint attention, further demonstrating the benefit of RIT for early childhood development of children with ASD.

Due to the growing evidence of RIT's efficacy in teaching imitation, it is beneficial for researchers to focus on mechanisms for efficiently training direct care staff to administer RIT sessions. The vast majority of research on training RIT procedures is through parent-mediated intervention, wherein parents as implementers have shown improved implementation of trained skills, high maintenance. and generalization of skills (Ingersoll & Gergans, 2007). Ingersoll and Gergans (2007) trained three dyads of mothers of children with ASD paired with their children to implement RIT protocols. Ingersoll and Gergans implemented instructions, modeling, practice, and feedback to each adult participant to train the skills. All adult participants increased in their rate of implementing both gesture and object imitation procedures and adult implementation was paired with child gains in gesture and object imitation skills. Overall, the results of the study suggest that instructions, modeling, practice, and feedback were effective in training parental caregivers.

Penney and Schwartz (2019) implemented a group training followed by coaching sessions to train three parents to implement RIT with their children with ASD. Although one parent demonstrated an increase in RIT fidelity following the initial group training, more individualized coaching sessions were necessary for all three parents to reach mastery in implementation fidelity, suggesting that more extensive training procedures than the simple procedures of Ingersoll and Gergans (2007) may be necessary for some parental caregivers to reach mastery in RIT implementation.

Unlike parent participants in prior studies (Ingersoll & Gergens, 2007; Penney & Schwartz, 2019), clinicians may already have some baseline level of training that allows them to implement RIT following a simplistic training of instructions, modeling, practice, and feedback. However, there is a lack of research examining methods for teaching clinicians to implement RIT. Recently, .

Bravo & Schwartz (2025) trained four adult behavior technicians (BTs) to implement RIT. Training consisted of an adapted virtual workshop, video modeling, role play, feedback, and weekly coaching sessions. Bravo & Schwartz (2025) found that three BTs met RIT fidelity within the training condition, suggesting that some combination of the training strategies used may be effective for training some BTs to implement RIT. Both the results of Ingersoll and Gergans (2007) and Bravo & Schwartz (2025) align with behavior analytic literature which widely suggests that a combination of instructions, modeling, practice, and feedback, often in the form of behavior skills training (BST) is an effective training strategy for behavior analytic practices, suggesting that BST may be an area of investigation for training clinicians to implement RIT.

BST is an evidence-based training method that combines four main components of instructions, modeling, rehearsal, and feedback to teach new skills. BST has shown to be an effective tool for training parents (Buck, 2014; Dogan et al., 2017; Schaefer, & Andzik, 2021), adult clients (Morgan & Wine, 2018) and some teachers and clinicians (Andzik, et al., 2021; Gianoumis, et al, 2012; Ward-Horner & Sturmey, 2012). BST's four components can often be customized, offering trainers the opportunity to tailor the training for different trainees or even for different interventions (Kirkpatrick, Akers, & Rivera, 2019).

A meta-analysis conducted by Brock and colleagues (2017) reviewed literature regarding the training of practitioners working with individuals with disabilities and found that BST had a high association with improvement of implementation fidelity. This finding is not surprising as BST has been shown to be effective for DTT and similar procedures such as preference assessments and functional analyses (Jimenez-Gomez et al., 2019) and high implementation fidelity of direct care providers is often the target for training these procedures. A meta-analysis by Fingerhut and Moeyaeort (2022) found that BST procedures are also effective for maintaining

implementation fidelity scores, further expressing the efficacy of these procedures. A recent scoping review conducted by Briggs, Zohr, & Harvey (2024) reviewed empirical studies published from 1977-2021 that utilized a minimum of one BST component also found that the majority of these studies utilized the full BST when specifically implementing DTT procedures.

More recently, researchers have sought to extend BST to less structured interventions for individuals with ASD, such as various NDBIs. Gianoumis, Seiverling, & Sturmey (2012) trained three teacher assistants to implement natural language paradigm (NLP), an NDBI focused on increasing spontaneous and imitative utterances of children with ASD. Gianoumis and colleagues (2012) applied BST components and ultimately increased the correct implementation of NLP procedures for all three participants. More recently, Mrachko, Kaczmarek, Kostewicz, & Vostal (2023) utilized BST strategies to train an NDBI. Mrachko and colleagues (2023) implemented Project ImPACT, an adult training procedure that utilizes a multi-level approach to systematically train adult interventionists to implement naturalistic intervention strategies (Ingersoll & Wainer, 2013). All three therapeutic support staff met mastery criteria within nine sessions and two of the three staff maintained their learned skills following the completion of intervention. Although these two studies represent a small sample of NDBI literature, the combination of the findings from these two studies and the usage of BST components in Ingersoll and Gergans (2007) and Bravo & Schwartz (2025) suggest that the implementation of BST procedures may be an effective teaching strategy for non-parental providers to implement NDBIs such as RIT.

The current investigation aims to add to the limited research on the efficacy of BST for training providers (e.g., BTs) to implement RIT when working with children ASD. The current investigation administered BST training protocols to three BTs working with children with ASD.

The specific research question we sought to address was: To what extent does BST affect a BT's implementation fidelity of RIT?

METHOD

Participants

Three adult BTs participated in the study. Participants were chosen from an early intensive behavior intervention (EIBI) program that implemented applied behavior analysis (ABA) programming. Each adult worked for the program for at least 1 month. All participants received an initial one-week staff training on ongoing coaching from a clinic supervisor. Coaching included weekly one-on-one supervision sessions where supervisors would simultaneously supervise the client's ABA programming and the BT's ability to implement the programs. Additional coaching also included monthly group trainings where supervisors discussed behavior analytic procedures and protocols. All adult participants received initial training on implementing DTT imitation trials and some initial exposure to implementing naturalistic teaching strategies through their regular training as employees in the EIBI clinic. Participants, however, had not been explicitly trained to implement RIT.

Each adult participant delivered the RIT intervention to an assigned child throughout the study. The three child clients attended the same EIBI program where the previously identified adult participants were partnered as their direct care provider for at least part of the day. The child clients were between the ages of 2- to 5-years-old and admitted to the program based on an ASD diagnosis from a licensed psychologist outside of the program. Child clients were chosen based on a recommendation of their supervising Board-Certified Behavior Analyst ® (BCBA®)

Sara was a 21-year-old BT who had 6 months of experience providing ABA therapy. Sara received an undergraduate degree in Psychology prior to her employment at the behavioral

intervention clinic. Sara was paired with Angel, a 59-month-old girl who had been receiving ABA therapy for 24 months.

Alex was a 24-year-old BT who had 9 months of experience providing ABA therapy. Alex was in his first year of a master's degree program in applied behavior analysis and was paired with Patrick, a 48-month-old boy who had been receiving ABA therapy for 20 months prior to this study.

Elle was 21 years old and had 2 months of experience working as a BT. Elle was an undergraduate student working towards her degree in Psychology during this study. Elle was paired with Brad, a 60-month-old boy who had been receiving ABA services for 9 months prior to the start of this study.

Setting and Materials

Baseline and post-training observations were conducted within the EIBI classroom in a designated area. In the EIBI classroom, there were up to seven other children working 1:1 with seven other adult BTs. The designated area consisted of a 1 m by 1 m rug, the camera on a camera stand, and the chosen themed play sets. No other toys were present in the designated work area.

Themed toys sets were utilized to implement RIT. Nine different play sets with different themes were rotated randomly in groups of three during each play session. At the start of each play session, the child participant was instructed to choose between the three offered play sets. The themed toy sets included a fishing set, dentist toy set, tea party set, or a doctor play set. All sets included at least 10 items for the child and 10 identical or related items for the adult to promote multiple opportunities for imitating. The first author rotated the different play sets every

second session. Training presentations were created and presented on Microsoft PowerPoint®. A video camera was used to record 100% of the sessions.

Dependent Variable

The dependent variable was the fidelity of RIT implementation. A checklist based on the RIT implementation steps reported in previously published RIT studies (Ingersoll & Schreibman, 2006; Ingersoll et al., 2013) was slightly modified to measure BT implementation fidelity. Although RIT implementation steps were implemented as described in the manual, part of the RIT manual checklist's scoring mechanism was modified to adjust for the shorter session lengths in the current study (e.g., 5 min instead of 10 min sessions) and the requirement for BTs to offer an imitation opportunity every 30 seconds instead of every 1-2 mins as observed in the RIT manual. The first author utilized the checklist as a tool to measure RIT fidelity throughout all sessions. Each item on the checklist was scored as "correct" or "incorrect" in order to obtain a clear percentage of correct items. Any step found to be not applicable was scored as "N/A". Table 3.1 depicts each item on the RIT fidelity checklist modified for provider implementation. Fidelity was measured as the percentage of correct responses. The percentage of correct responses was calculated by dividing correct responses by the number of all responses and multiplying by 100%.

Experimental Design

A concurrent multiple probe across participants design (Gast & Ledford, 2014) was utilized to evaluate the effectiveness of the behavior skills training intervention for RIT implementation fidelity. A concurrent multiple probe design allowed for the first few sessions of the experiment to occur concurrently before moving into non-concurrent probe sessions. A multiple probe design was optimal because participants' RIT implementation was not expected

to increase without training, thus a strong assumption of stability during baseline was made (Horner & Baer, 1978). To minimize the gaps between observations, no more than three clinical treatment days passed without a session.

The first author implemented baseline probe sessions concurrently for all participants for at least the first three sessions. RIT training began for the first participant after stable responding was observed in the first participants' baseline data while continuing baseline probe sessions for the second and third participants. Once the first participant demonstrated stable responding in the post-training phase, the RIT training procedure was administered sequentially to each of the remaining participants. This process continued until all three participants reached the post-training phase for RIT implementation.

A one-time criterion of 90% implementation fidelity was established to indicate the procedures had been successfully acquired. If participants did not reach 90% within the first four sessions following training, coaching sessions were added to boost implementation fidelity. The four sessions allowed for a sufficient opportunity for participant data to begin improving prior to introducing more intensive training protocols. Once participants met the 90% criterion and demonstrated stable fidelity, they were moved to a maintenance phase in which implementation fidelity was probed once a week for four weeks.

Procedures

All sessions consisted of a 5 min observation of the adult implementing RIT. Adults were instructed to "teach (child name) to imitate in a naturalistic format". Once the instruction was given, the participant began the session with the child. After 5 min, the principal investigator instructed the participant that the session was complete. No further directions or coaching was

given. The procedures were the same for all participants prior to RIT training, after RIT training, and during maintenance.

BST Training

The principal investigator used the four components of BST (Mrachko, Kaczmarek, Kostewicz, & Vostal, 2023) to train BTs to implement RIT. The training consisted of a presentation mixed with modeling, rehearsal, and feedback. Each BST session was roughly 50 min.

Training began with a 15-min presentation of the definitions of NDBIs and explicit RIT implementation steps. Modeling followed the presentation, and the principal investigator recruited a child to aid in executing the modeling and practice component. The training child was one of the other children in the clinic that had demonstrated a generalized imitative repertoire within the RIT format. The training child knew all three adult participants and was trained to respond to adult instructions during an RIT session prior to starting this role. The training child was not included as a participant in the study. The training child functioned as the child participant during modeling and practice portions of the training session. During modeling, the training child was asked to play with the themed toy sets and respond to adult instructions while running an RIT session. For example, the principal investigator may have instructed the child to pretend to drink tea by stating "try this" while giving a model of the action. The principal investigator would repeat the instruction to "try this" while repeating the action up to three times or until the training child responded. If the child did not respond after three attempts, the principal investigator would prompt the child to do so. The principal investigator presented the training child with at least 10 separate trials with each opportunity occurring roughly every 30

sec. After 5 min, the principal investigator ended the modeling session and the training child was instructed to take a 5-min break.

Practice sessions immediately followed modeling and involved the adult participant implementing the modeled actions with the training child. During role play, the adult participant would ask the training child to "come play" with the themed toys sets and then the participant would implement the actions modeled for them previously by the principal investigator. The participant would instruct the child to "do this" or any similar instruction as they modeled an action for the child to complete. If the training child failed to complete the modeled action, the participant would repeat the direction and model up to three times before physically prompting the child. After 5 min, the principal investigator ended the role play session and the training child was again instructed to take a 5-min break.

Each adult participant experienced two modeling sessions and two practice sessions. Participant errors were addressed following the completion of each practice session through the delivery of constructive and positive feedback to the adult participant. No further BST training was given after the initial 50 min training session.

Coaching was administered for Elle, who was the only participant that failed to reach a 90% RIT fidelity criterion after four post-BST probes. Elle only received one coaching session that lasted for 15 min. During the coaching session, the principal investigator and the participant watched a recording of the participant's most recent RIT session. The principal investigator provided both positive and constructive feedback on the participant's performance in the video.

Interobserver Agreement

A point-by-point agreement formula was utilized to measure interobserver agreement (IOA). A trained second observer independently scored at least 33% of all sessions to establish

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IOA. All scored sessions were selected randomly. The training of the coder consisted of the principal investigator and second observer coding at least three intervention videos randomly selected across all participants and all phases together. Following the shared coding, the second observer independently coded videos until they reached 90% agreement with the principal investigator. Once the 90% agreement was reached, the second coder was authorized to begin independent coding. None of the chosen training videos were included in the final IOA calculation.

Mean agreement for Sara's fidelity of RIT implementation was 86% (range, 83-89%) in baseline, 86% (range, 80-92%) in post RIT training phase, and 87% (range, 85-89%) in the maintenance phase. Elle's mean agreement for fidelity of RIT was 86% (range, 83-92%) in baseline, 90% (range, 85-95%) in the post RIT training phase, and 85% (range, 82-88%) in the maintenance phase. Alex's mean agreement for fidelity of RIT was 81% (range, 80-82%) in baseline, 90% (range, 89-91%) in the post RIT training phase, and 86% (range, 86-89%) in the maintenance phase.

Procedural Fidelity

The principal investigator video recorded all RIT teaching sessions. A second observer scored the principal investigator's RIT training fidelity using the checklist found in Table 3.2. Procedural fidelity was collected for 33% of all training sessions. Data were collected on correct implementation of each component of training for RIT fidelity. Mean procedural fidelity was 100% for the RIT training sessions.

RESULTS

Figure 3.1 depicts adult participants' RIT fidelity. During baseline probes, Sara demonstrated a mean RIT fidelity of 70.8% (range, 61-81%). Following BST in RIT, Sara's

mean RIT fidelity was 78.8% (range, 68-90%). During this phase, Sara met the 90% RIT fidelity criterion during her fourth session following training. During maintenance, Sara demonstrated a mean RIT fidelity of 82.8% (range, 81-85%) and stayed above 80% fidelity throughout the remainder of the study.

Alex's mean RIT fidelity during baseline was 54.8% (range, 47-60%). Alex's mean fidelity following BST in RIT was 85.5 (range, 81-90%) and he reached the 90% criterion during the fourth session following training. Alex then demonstrated fidelity above 80% during maintenance with a mean fidelity of 89% (range, 81-98%).

Elle's mean RIT fidelity was 56.4% (range, 42-68%) during baseline probes. Elle's mean fidelity following BST in RIT was 76.7% (range, 68-90%) but she did not meet criterion for accurate implementation until coaching was provided following the fourth post-training session. After one coaching session was administered (See Figure 3.1), Elle reached 90% fidelity during her fifth post-training session and stayed above 80% fidelity for the remainder of the study. During maintenance, Elle's mean RIT fidelity was 85% (range, 81-90%).

DISCUSSION

The present investigation examined the feasibility of BST to increase RIT implementation fidelity of BTs during an intervention session with a young child with ASD. Following the initial training for RIT, all adult participants experienced an increase in RIT fidelity. Since two of the three adult participants did not require a coaching session to reach 90% fidelity, these results suggest that BST alone may be effective for teaching some BTs to implement RIT with high fidelity. The relatively simple and quick training necessary to implement BST makes it a prime choice for training behavior analytic practices. Results are consistent with prior studies showing BST is effective for training DTT (Anwar, Sutadi,&

Miranda, 2022; Dart, Radley, Furlow, & Murphy, 2017; Shin, Park, & Lee, 2021; Zheng, Albright, Mahoney, 2025). However, it is encouraging to find that BST could be effective for training a slightly more complex intervention procedure such as RIT.

One possible reason for the effectiveness of BST for improving RIT fidelity may be due to relatively high levels of baseline fidelity data. All three participants demonstrated a mean RIT fidelity above 50% (range, 54.8-70.8%) during baseline probes. These data suggest that participants may have received enough prior training or exposure to procedures similar to RIT, such as NET or imitation related DTT, that only a simple training was necessary to reach mastery criterion. These results may be important to consider in other contexts as providers with less regular training in imitation related DTT or NET procedures may need more extensive training to implement RIT.

Elle's need for a short 15-min coaching session to reach the 90% fidelity score for accurate RIT implementation suggests that not all BTS may reach implementation fidelity with just BST and that short coaching sessions may be necessary for some direct care providers. In Elle's case, she had only been employed as a BT for 2 months prior to her inclusion in the study. Perhaps her limited experience with DTT and NET procedures led to the need for a more intensive training than Alex and Sara who had been employed as BTs for 9 months and 6 months, respectively. However, it is important to note that the extra coaching in this case was a one-time 15-min session in which the principal investigator and Elle watched a recorded implementation session of Elle and her child partner. The investigator then provided corrective and positive feedback. Thus, even when adding coaching to BST, procedures remained relatively short and simple to implement.

All three adult participants maintained RIT fidelity above 80% after reaching the 90% criterion. These results are encouraging as the study included a 4-week maintenance period. The outcomes suggest that BST may be an effective tool for maintaining fidelity of RIT implementation for at least several weeks and are consistent with findings from the Fingerhut and Moeyaeort (2022) meta-analysis which showed that BST led to accurate implementation of DTT over an extended timeframe.

Overall, these results align with previous studies that have shown that BST may be effective in training NDBI implementation (NLP: Gianoumis, Seiverling, & Sturmey, 2012; Project ImPACT: Mrachko, Kaczmarek, Kostewicz, & Vostal, 2023, RIT: Bravo & Schwartz, 2025). Each study found that direct providers such as teacher assistants, therapeutic support staff, and BTs could be trained to effectively implement the chosen NDBI using BST procedures. The results of the current investigation also align with the findings in Ingersoll & Gergans (2007) where instructors were able to utilize instructions, modeling, rehearsal, and feedback to train providers to implement RIT with young children with ASD. Overall, it seems that BST and BST plus some coaching may be beneficial training strategies for training BTs to implement RIT procedures with fidelity.

Although findings were generally positive, there are a few limitations that warrant consideration. First, child-level data were not included in the present investigation. The omission of child-level data during this study leaves a question of whether and how increasing RIT fidelity with children with ASD impacts the child receiving the RIT intervention. However, Ingersoll and Gergans (2007) have demonstrated that the use of BST components for training parental caregivers to increase RIT fidelity not only increased the parents' ability to implement gesture and object imitation RIT skills, but also led to increases in child imitative skills once the adults

learned to implement RIT effectively. Thus, we may be able to hypothesize that the increase in the BT's RIT fidelity in this current study may have led to similar increases in child imitative skills as RIT is a known evidence-based practice for teaching imitative skills to children with ASD. Future researchers should explore whether training BTs to implement RIT through BST does change child imitative skills.

A second limitation of the study is the BT's inability to maintain 90% fidelity. All three participants reached the required one time 90% fidelity criterion, however, they were unable to sustain it for longer than one session. Although both Alex and Elle reached 90% fidelity or above at least one other time, Alex did not do so until the 4th session in the maintenance phase where he reached 90% fidelity and then increased to 100% one session later until eventually falling back down to 80% fidelity. Elle took four sessions after reaching the 90% fidelity to reach the same level before tapering back down to 80% and staying at that level for the remainder of the study. Although 80% fidelity may be considered an acceptable level of performance in some scenarios (Fingerhut & Moeyaeort, 2022), other interventions may require higher implementation fidelity (Mrachko, Kaczmarek, Kostewicz, & Vostal, 2023). Future researchers may consider adding a coaching component to BST training to help bolster the implementation fidelity and possibly maintain it at a higher level. Although this investigation did implement some coaching, only Elle received the coaching component, and it was implemented in a remedial manner rather than as a necessary component of the training package. It may also be of interest to researchers to see if coaching sessions lead to BTs reaching mastery at a faster rate.

Training providers is a critical component of behavior analytic practices, yet NDBI literature lacks vast empirical evidence for training strategies within the field. This investigation expands on the current literature on training non-parental providers to implement NDBIs through

a BST training package. This study specifically provides a framework for training providers to implement RIT with fidelity and to maintain above 80% fidelity.

TABLES AND FIGURES

Table 3.1

RIT Fidelity Checklist

| **IMITATE AND DESCRIBE** *(Consistently throughout the session)*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Imitate the child										
Face-to-face										
Describe the play										
IMITATION OPPORTUNITIES *(For each trial, whenever an action is modeled)*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Model an action										
Use a clear model										
Use a relevant model										
Provide opportunities to respond										
Wait Time between models										
Use Physical Guidance										
Praise the child										
GLOBAL RATING	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Balancing the RIT cycle										
Total Score										
Percentage Correct										

Note. Checklist modified from RIT Fidelity Manual. Changes: RIT sessions changed from 10 min to 5 min for study, BTs required to implement RIT opportunity every 30 seconds, "imitation opportunity" scored as "per opportunity, rather than using a 5-point score.

Table 3.2

RIT Training Checklist

Reciprocal Imitation Training Procedural Fidelity Checklist	
Date: *Participants:*	
For each step in the training, record "+" if researcher completes the step and a "-" if the step is not completed. If a step is not applicable, record "N/A".	
Training Step	Data:
1. Discusses the findings of Schreibman et al., (2015).	
2. Introduces Natural Environment Teaching (NET).	
3. Discusses the differences between naturalistic teaching and discrete trial teaching (DTT).	
4. Discusses the six aspects of naturalistic teaching.	
5. Introduces reciprocal imitation training (RIT).	
6. Watch videos of RIT implementation sessions.	
7. Models RIT with confederate child.	
8. *Presents an opportunity for adult participant to practice implementing RIT with the child confederate.*	
9. Offers trainee verbal feedback on performance.	
Percentage of procedural fidelity (total number of correct steps/ total number of steps x100)	*Percentage:*

Figure 3.1

RIT Training Fidelity
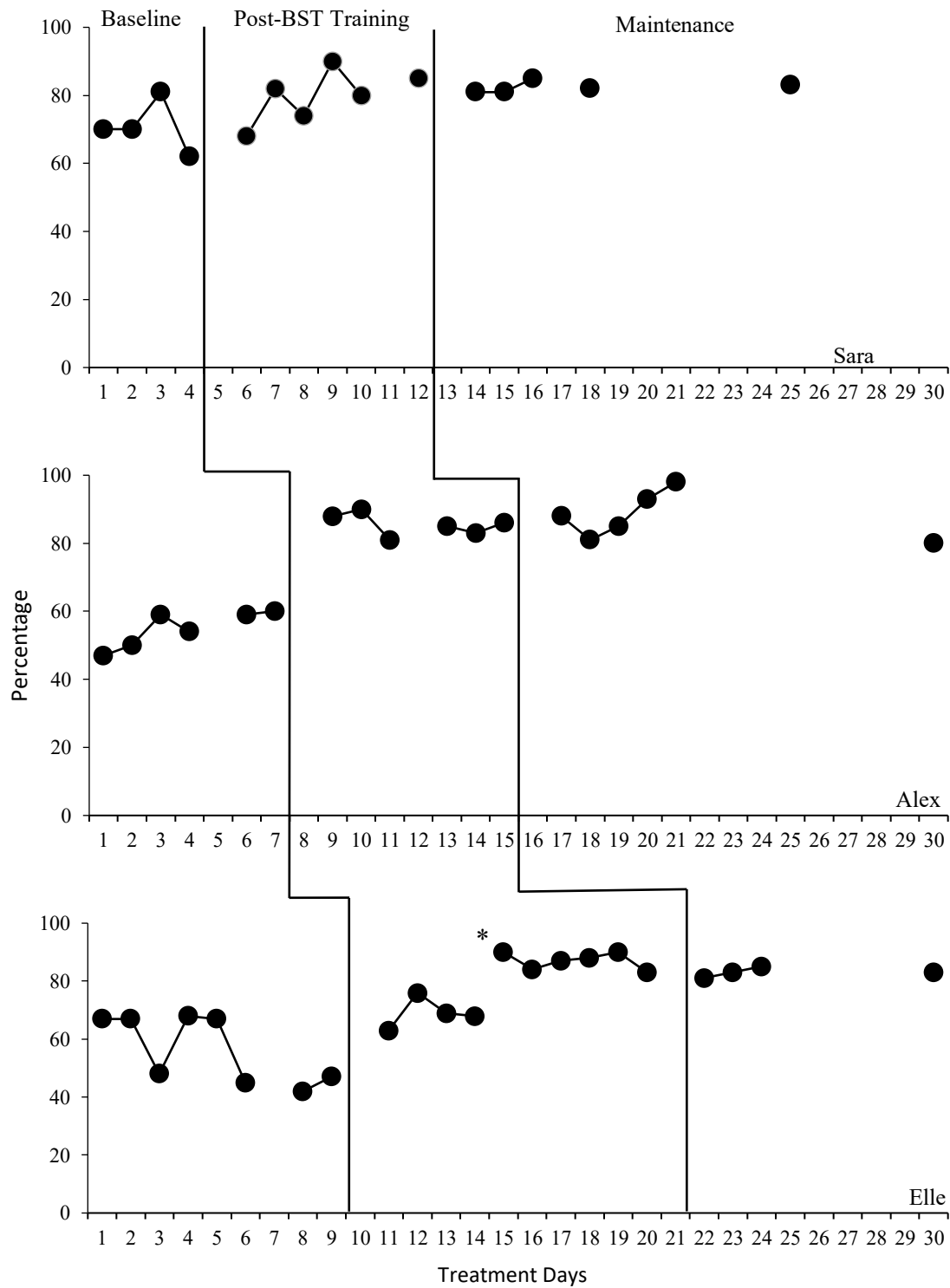
Note. The asterisk denotes the session in which Elle received extra coaching.

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CHAPTER 4:

AN ANALYSIS OF THE EFFECT OF PROVIDER PRIDE BEHAVIORS ON CHILD

BEHAVIORS

Autism spectrum disorder (ASD) is a developmental disability that is characterized by increased behavioral challenges and deficits in educational outcomes and acquisition of social and communicative skills (American Psychiatric Association, 2013). For decades, applied behavior analysis (ABA) has been recommended as an evidence-based approach for aiding individuals with ASD (Buchanan & Weiss, 2006; Lovaas, Baer, & Bijou, 1965; Slocum et al., 2014; Smith, 2001). ABA interventions have extensive evidence supporting positive outcomes when applied intensively to young children diagnosed with ASD (Gischlar et al., 2009; Wolf et al.,1963). Early intensive behavioral intervention therapy (EIBI) may begin at the age of 2 years old and continue for up to 4 years of the child's life (Reichow et al., 2014). Young children with ASD receiving EIBI services often spend up to 20-to-40 hrs per week interacting with adult providers (Reichow et al., 2014).

The rise in ASD diagnoses and efficacy of ABA has led to a subsequent increase in providers. The rapid rise in providers, however, may have negative impacts on the quality of services as documented in several recent studies describing negative interactions between clients and ABA providers (Rose, 2020; Rohrer & Weiss, 2023; Rohrer et al., 2021; Taylor et al., 2018).These concerns have not only been acknowledged in recent studies, many of them have also aimed to introduce training strategies to address the issues (Rohrer et al., 2021; Rohrer & Weiss, 2023). However, a common limitation of many studies that train providers is the absence of data regarding children's responses after staff are trained to change their interactions.

Research that examines the impact of changes in provider behavior on child behaviors could address these limitations.

Parent-Child Interaction Therapy (PCIT) has a long history of research examining interactions between caregivers and their children with ASD (McNeil et al., 1991). PCIT is an intervention that utilizes a manualized protocol to train parents of children with ASD to increase specific PRIDE behaviors while interacting with their children in their capacity as a provider of ASD services (Thomas et al., 2017). PCIT utilizes a two-stage process. The Child-Directed Interaction (CDI) phase teaches parents to strengthen the child-parent relationship by utilizing play skills and implementing PRIDE behaviors. The Parent-Directed Interaction (PDI) phase then teaches behavior analytic skills to parents to decrease parental stress and externalizing child behaviors or behaviors that may cause or increase stress or interfere with life functions. PCIT literature posits that externalizing behaviors occur due to the combination of child factors (e.g., difficult temperament, hyperactivity) and family factors (e.g., stressful life events, parental conflict) (Herschell et al., 2002). PCIT literature further posits that to lessen externalizing behaviors, the relationship between the child and the parents must be strengthened through the increase of positive interactive behaviors known as PRIDE behaviors (Herschell et al., 2002).

The PRIDE behaviors include: Praise, Reflect, Imitate, Describe, and Enthusiasm. Parents are taught to engage in the behavior "Praise" by emitting words of approval or affection toward the child, specifically when the child is engaging in pro-social or preferred behaviors. Parents can engage in the behavior "Reflect" by repeating a child's words and using opportunities to extend the child's vocalizations to be more appropriate. For example, if a child said, "I eated donots", the adult might respond by saying, "You did eat a sugar donut!" Parents can engage in the behavior "Imitate" by parallel playing near their child and deliberately

engaging in similar actions as their child. Parents are encouraged to use the behavior "Describe" by emitting descriptions of their child's behavior that specifically mention what the child is actively doing. Lastly, parents are taught to engage in "Enthusiasm" by displaying excitement using an animated voice and changing inflection. PDI behaviors are relatively simple to train. During PDI sessions, PCIT trainers often utilize simple training strategies such as short coaching sessions to teach parents to engage in these behaviors (McNeil &Hembree-Kigin, 2010). Overall, PDI and CDI strategies combine to give parents explicit tools for effectively teaching their children new skills while systematically increasing the positivity of the interactions between those parents and their children. Although used specifically for parents in the PCIT literature, the relative ease of training these skills may aid in disseminating them further to other providers such as BTs.

Currently, only one behavior analytic study examining the PCIT methodology with non-parental providers exists in the literature. Jimenez-Gomez, McGarry, Crochet, & Chong (2019) operationally defined the PRIDE Behaviors from the PCIT literature and used an adapted version of the CDI. Jimenez-Gomez et al., (2019) investigated the feasibility of behavior skills training (BST), an evidence-based training protocol, on increasing the percentages of PRIDE behaviors between a child with ASD and their providers during a naturalistic teaching session. Jimenez-Gomez & colleagues (2019) found that utilizing the components of BST (e.g., modeling, instructions, rehearsal, feedback) was effective for training three BTs to increase percentage of PRIDE behaviors while simultaneously decreasing percentage of negative interaction behaviors with children. Jimenez-Gomez and colleagues' (2019) found that all participants increased their percentage of PRIDE behaviors , maintained mastery level performance during a follow up, and generalized their skills to new clients.

Both Jimenez-Gomez et al.'s (2019) investigation and PCIT literature suggest CDI procedures can be beneficial to children, but both are limited in the extent to which they show an explicit change in child behaviors. Jimenez-Gomez et al.'s (2019) investigation aimed to train staff to increase percentages of PRIDE behaviors and did not report child outcome data. Excluding child outcome data may limit the ability to assess the overall effect of the PRIDE behaviors on child behaviors. A meta-analysis of PCIT literature by Thomas et al., (2017) found that PCIT procedures may be effective for decreasing child externalizing behaviors, increasing child compliance, and decreasing reported parental stress. However, the meta-analysis did not specifically describe the reported externalizing behaviors of the children or the behaviors reported to signify child compliance. Thus, additional research that explicitly documents changes in child behavior is needed to further understand the benefits of teaching staff to engage in higher rates of PRIDE behaviors adapted from the PRIDE behaviors.

Current Investigation

The current study sought to investigate whether systematically increasing the frequency of PRIDE behaviors had an impact on behavior of children with ASD. This investigation asked the following primary research question: 1) How does changing the frequency of PRIDE behaviors displayed by a provider during a naturalistic teaching session affect child behavior?

METHOD

Participants and Settings

Four participants were chosen from an early intensive behavioral program (EIBI). All participants received an ASD diagnosis from an independent licensed psychologist. All participants were children working on following single-step directions in a naturalistic play format as a targeted skill in the EIBI clinic. Single step directions are directions that only require

the child to complete one action to be correct. For example, if the principal investigator instructed the child to "stand up", the child only needed to straighten their knees and erect their body in an upright position to be considered a correct response. Participants had not mastered this skill before the start of the study. A board-certified behavior analyst (BCBA®) was consulted prior to including all child participants in the study. All participants attended the EIBI program for 6 h each day, 5 days per week. Due to the novel nature of this investigation, Beth was recruited first, and all the procedures were first administered to her to assess any unforeseen issues that may have arisen. All other participants experienced the conditions at the same time after Beth had completed the entire experiment.

All participants completed the clinic's imitation skills programming and demonstrated generalized imitative repertoires. Participants could generally imitate a vocal or gestural action when instructed. Participants had limited vocal repertoires. Three out of four participants were actively working on independently emitting appropriate vocal responses during a social play context. Beth was a 55-month-old Caucasian female. Beth had been in the EIBI program for 23 months at the start of the study. Ethan was a 48-month-old Hispanic male. Ethan had been in the EIBI program for 2.5 months at the onset of the experiment. Jackson was a 39-month old African American male and had been at the EIBI program for 7 months at the onset of the experiment. Andre was a 52-month-old Indian male. He had been at the EIBI program for 13 months at the onset of the experiment.

All sessions were conducted within the EIBI program. The program consisted of three clinical rooms, each containing eight children with ASD receiving programming from an adult BT. Each clinical room was a large room filled with eight small tables, each surrounded by two chairs. On one side of the room was a large semi-circle table with six chairs for children to

complete group activities. On the other side of the room there was a 2 m by 3 m rug that was designated a group play area. A 1 m by 1 m rug placed near the large semi-circle table was designated the experimental area. The experimental area was barren except for the experimental materials and any materials needed by the principal investigator for putative reinforcement (e.g., token board) and data collection. Experimental materials included sets of toys such as doctor and dentists play sets. Nine different play sets with different themes were rotated randomly in groups of two during each play session. At the start of each play session, the participant was instructed to choose between the two play sets. Each toy set includes up to 10 different toys that the child may engage with during the session. The first author rotated the different play sets every second session. A camera, camera stand, paper, and pen were used to video record each session and to take in-vivo data.

Dependent Variable

The primary dependent variable was child initiations. Child initiations were any attempt of the child to gain the attention of the adult either verbally or physically while the adult was not actively engaged with the child or if the adult is engaged with the child in one activity and the child initiates a new activity. An example may be a child saying "look!" while holding up a novel toy. The principal investigator required that three seconds passed between each instance of a child initiation behavior.

Data were also collected on child correct responses to following single-step directions and child uncontrived imitations. Child correct responses were defined as any unprompted attempt of the child to respond to a single- step direction given by the principal investigator within three seconds. An example would include any time that the child attempts to or fully straightens their legs into a standing position from a seated position within three seconds of the

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principal investigator directing them to "stand up". Uncontrived imitations were defined as any attempt of the child to imitate the adult's actions or words within 3 seconds (see Table 4.1). An "attempt" was defined as any time the child actively tried to engage in the same or similar actions or words as the adult. An action was counted as an "attempt" as long as the child completed part of the action. For example, if the adult grabbed and then held up a toy plane, the child would only need to complete part of the action (i.e., grab or hold up a toy plane) to be counted. Similarly, with uncontrived imitative words or phrases, the child was only required to say part of a phrase or word. For example, if the adult said, "I have a train!" and the child also said "train!", the use of a similar phrase or wording counted as an attempt.

The first author served as the primary provider working with each child during all sessions. Both child initiations and child uncontrived imitations were measured utilizing a frequency per session measuring system. Child correct responses to single-step directions were measured using a per opportunity measuring system. The principal investigator presented at least 10 opportunities for each child to correctly follow single step directions during each teaching session. Data were collected from video recordings of the first 5 min of each session. See Table 4.1 for definitions and examples of dependent variables.

Interobserver Agreement

A point-by-point agreement formula was used to measure interobserver agreement (IOA) for all dependent variables. A trained second observer independently scored at least 33% of all sessions to establish IOA. All scored sessions were selected randomly. The coder's training consisted of the principal investigator and second observer first reviewing a PowerPoint presentation that explained and defined the dependent variable. The second observer then coded a video that the principal investigator previously coded. The principal investigator compared

both sets of coding data and calculated an agreement percentage, then delivered feedback on the differences between the data and answered the secondary coder's questions regarding the definitions of the dependent variable. Once all questions were answered, the secondary coder then re-coded the video and the agreement percentage was collected once more. Following the initial training, the second observer independently coded videos until they reached a 90% agreement with the principal investigator and was then authorized to begin independent coding. None of the chosen training videos were included in the final IOA calculation. If the second observer's IOA fell below 80% at any time throughout the coding process, additional training was administered.

Mean agreement for Beth was 85% (range, 73-100%) for social initiations, 87% (range, 80-100%) for correct responses to following single step directions, and 82% (range, 50-100%) for uncontrived imitations. Mean agreement for Ethan was 83% (range, 66-100%) for social initiations, 88% (range, 71-100%) for correct responses to following single step directions, and 85% (range, 75-100%) for uncontrived imitations. Mean agreement for Jackson was 90% (range, 82-100%) for social initiations, 91% (range, 75-100%) for correct responses to following single step directions, and 88% (range, 80-100%) for uncontrived imitations. Mean agreement for Andre was 88% (range, 87-100%) for social initiations, 92% (range, 86-100%) for correct responses to following single step directions, and 93% (range, 80-100%) for uncontrived imitations.

Procedure

A reversal of treatment design (Gast & Ledford, 2014) was used to assess changes in child behaviors when changes in the number of adult PRIDE behaviors were systematically altered. A reversal of treatment design alternates between experimental conditions to assess

changes in behavior as a function of changes to conditions. In this study, the first condition was a low PRIDE behaviors (L-PB) environment in which the adult engaged in 20 PRIDE behaviors during the 5-min period. The second condition was a high PRIDE behavior (H-PB) environment in which the adult engaged in 40 PRIDE behaviors during the 5-min period. The number of PRIDE behaviors during each condition was based on a prior training investigation conducted by the first author. The first author specifically trained BTs to increase PRIDE behaviors and they found the average during baseline was approximately 20 PRIDE behaviors during a 5-min period and following training was approximately 40 PRIDE behaviors during the same period.

PRIDE behaviors included: Praise, Reflect, Imitate, Describe, and Enthusiasm. Table 4.2 provides further definitions and examples. The principal investigator used a hand operated tally counter during sessions to record PRIDE behaviors as they occurred to increase the likelihood of adhering to 20 or 40 in the corresponding condition. The experimenter clicked the counter each time he engaged in a PRIDE behavior, and the total was displayed on the device. The principal investigator also used a vibrating timer set to a 30 s schedule and delivered token reinforcement every 30 s to maintain consistency in delivery of conditioned reinforcers.

The L-PB and H-PB phases were procedurally identical. The principal investigator started all teaching sessions by calling the child over to the designated area and instructing them to come play. If the child refused to come to the designated area, the principal investigator immediately ended the session and tried again after 15 min had passed. If the child refused to come after the second attempt, the principal investigator ended the session for the day and tried again the following day. However, if the child came over to play, the principal investigator immediately acknowledged their willingness to come over and immediately began the session. The principal investigator had two different toy sets for the child to choose from and asked them

to "pick one". Once the child chose a set, the principal investigator said, "let's play" to the child as they began to complete a naturalistic play session. During the naturalistic play session, the principal investigator engaged with the child and provided an opportunity for the child to follow a single-step direction roughly every 30 s. After 5 min, the principal investigator ended the session.

Procedural Fidelity

The principal investigator videotaped all experimental sessions. A second observer blind to the condition scored the number of PRIDE behaviors emitted by the principal investigator during each session to ensure the interactions correspond to the required number for the low and high PRIDE behavior conditions. Procedural fidelity was collected for 38 sessions, which accounts for roughly 50% of all teaching sessions. The number of PRIDE behaviors displayed by the principal investigator in the video was compared to the number of PRIDE behaviors required for each condition. Mean procedural fidelity was 95%.

RESULTS

Child Initiations

Figure 4.1 depicts each participant's frequency of social initiations. During the first L-PB phase, Beth demonstrated a mean frequency of social initiations of 6.5 (range, 5-8). Following the first L-PB phase, Beth demonstrated an increased mean frequency of social initiations of 11.8 (range, 8-15) during the first H-PB phase. During the second L-PB phase, Beth's mean frequency of social initiations dropped to 6.3 (range, 6-7) before jumping back up to a mean of 13 (range, 11-15) social initiations during the second H-PB phase.

During the first L-PB phase, Ethan demonstrated a mean frequency of social initiations of 4 (range, 2-5). Following the first L-PB phase, Ethan demonstrated an increased mean

frequency of social initiations of 7.6 (range, 5-10) during the first H-PB phase. During the second L-PB phase, Ethan's mean frequency of social initiations dropped to 3.8 (range,3-5) before jumping back up to a mean of 6.4 (range, 5-8) social initiations during the second H-PB phase.

During the first L-PB phase, Jackson demonstrated a mean frequency of social initiations of 4.6 (range, 3-7). Following the first L-PB phase, Jackson demonstrated an increased mean frequency of social initiations of 8.8 (range, 7-11) during the first H-PB phase. During the second L-PB phase, Jackson's mean frequency of social initiations dropped to 3.6 (range, 1-6) before jumping back up to a mean of 9 (range, 8-10) social initiations during the second H-PB phase.

During the first L-PB phase, Andre demonstrated a mean frequency of social initiations of 5 (range, 3-7). Following the first L-PB phase, Andre demonstrated an increased mean frequency of social initiations of 11.2 (range, 8-14) during the first H-PB phase. During the second L-PB phase, Andre's mean frequency of social initiations dropped to 5.6 (range, 3-8) before jumping back up to a mean of 10 (range, 9-12) social initiations during the second H-PB phase.

Overall, each participant exhibited a mean increase in social initiations during the H-PB phases. The clear differences in the L-PB and H-PB conditions suggest a strong likelihood of a functional relation between the number of PRIDE behaviors by an adult provider and the social initiations of the child.

Correct Responses to Single-Step Directions

Figure 4.2 depicts each participant's correct responses to single-step directions. During the first L-PB phase, Beth demonstrated a mean percentage of 40% correct responses. Following

the first L-PB phase, Beth demonstrated an increased mean percentage of 46% correct responses during the first H-PB phase. During the second L-PB phase, Beth's mean percentage of correct responses increased to 53.3% correct responses and continued to increase to a mean percentage of 75% correct responses during the second H-PB phase.

During the first L-PB phase, Ethan demonstrated a mean percentage of 50% correct responses. Following the first L-PB phase, Ethan demonstrated an increased mean percentage of 62% correct responses during the first H-PB phase. During the second L-PB phase, Ethan's mean percentage of correct responses dropped to 46% correct responses before jumping back up to a mean percentage of 72% correct responses during the second H-PB phase.

During the first L-PB phase, Jackson demonstrated a mean percentage of 32% correct responses. Following the first L-PB phase, Jackson demonstrated an increased mean percentage of 56% correct responses during the first H-PB phase. During the second L-PB phase, Jackson's mean percentage of correct responses dropped slightly to 48% before jumping back up to a mean of 70% correct responses during the second H-PB phase.

During the first L-PB phase, Andre demonstrated a mean percentage of 34% correct responses. Following the first L-PB phase, Andre then demonstrated an increased mean percentage of 68% correct responses during the first H-PB phase. During the second L-PB phase, Andre's mean percentage of correct responses dropped to 44%. Andre's mean percentage of correct responses then jumped to 80% during the second H-PB phase.

Child Uncontrived Imitations

Figure 4.3 depicts each participant's frequency of uncontrived social imitations. During the first L-PB phase, Beth demonstrated a mean frequency of .5 social imitations (range,0-2). Following the first L-PB phase, Beth demonstrated an increased mean frequency of 1.75 social

imitations (range,0-3) during the first H-PB phase. During the second L-PB phase, Beth's mean frequency of uncontrived social imitations dropped to .33 (range,0-1) before jumping back up to a mean of 3.5 (range, 2-6) uncontrived social imitations during the second H-PB phase.

During the first L-PB phase, Ethan demonstrated a mean frequency of 1 (range,0-2) uncontrived social imitations. Following the first L-PB phase, Ethan demonstrated an increased mean frequency of 4.2 (range, 3-6) uncontrived social imitations during the first H-PB phase. During the second L-PB phase, Ethan's mean frequency dropped to 3 (range, 2-4) uncontrived social imitations before jumping back up to a mean of 6.4 (range, 5-8) uncontrived social imitations during the second H-PB phase.

During the first L-PB phase, Jackson demonstrated a mean frequency of 4.4 (range, 3-6) uncontrived social imitations. Following the first L-PB phase, Jackson demonstrated an increased mean frequency of 7.4 (range, 5-10) uncontrived social imitations during the first H-PB phase. During the second L-PB phase, Jackson's mean frequency of uncontrived social imitations dropped slightly to 6.2 (range,4-8) before jumping back up to a mean of 7.6 (range, 7-8) uncontrived social imitations during the second H-PB phase.

During the first L-PB phase, Andre demonstrated a mean frequency of 4.2 (range, 3-5) uncontrived social imitations. Following the first L-PB phase, Andre then demonstrated an increased mean frequency of uncontrived social imitations of 5.8 (range, 4-8) during the first H-PB phase. During the second L-PB phase, Andre's mean frequency of uncontrived social imitations dropped to 4 (range,1-6) before jumping back up to a mean of 6.6 (range, 5-7) uncontrived social imitations during the second H-PB phase.

DISCUSSION

The purpose of the current study was to examine the effects of changing adult PRIDE behaviors on the frequency of a child participant's social initiations, correct responses to single step directions, and uncontrived imitations. Results suggest that increasing the principal investigator's frequency of PRIDE behaviors may have led to prominent changes in social initiations. Although less prominent than social initiations, differences in some child participant data during the L-PB and H-PB phases for the correct responses to single step directions and uncontrived imitations were recorded, suggesting a possible functional relation between adult provider PRIDE behaviors and these dependent variables.

All four participants exhibited higher frequencies of social initiations during H-PB sessions than during L-PB sessions. These findings suggest that when adult providers increase their frequency of PRIDE behaviors during naturalistic teaching sessions, children may respond by increasing their frequency of social initiations. The increase in social initiations may be indicative of the child's preference of the procedures or increased PRIDE behaviors during H-PB sessions. The increased adult PRIDE behaviors during H-PB sessions may have also signaled to the child that some form of positive reinforcer was only available at this time or more available than during L-PB sessions. The participants may have paired the presence of a higher number of PRIDE behavior with the availability of said reinforcer, leading to an increased willingness to engage in social initiations. The exact positive reinforcer or reinforcers are unknown as the increase of PRIDE behaviors during H-PB sessions were not contingent on any preceding child behaviors. However, the correlative relationship between positive reinforcement and increasing child behaviors is a long-standing relationship (Jabeen et al., 2021; Premack, 1959; Skinner,

1958). The increase of social initiations during H-PB sessions followed by a decrease during L-PB sessions suggests that an unknown reinforcer must be more available during H-PB sessions.

Interestingly, the magnitude of the effect was inconsistent across participants. A visual analysis of Figure 4.1 shows that Beth, Jackson, and Andre exhibited more separation of data between the L-PB and H-PB phases than Ethan. More separation between the L-PB phases and H-PB phases suggests that the increase in adult PRIDE behaviors during H-PB phases may have a stronger effect on Beth, Jackson, and Andre's frequency of social initiations. The stronger effect may be an indication that the change in PRIDE behavior during H-PB may serve as a more potent indication for the availability of reinforcers for Beth, Andre, and Jackson than for Ethan who exhibited a smaller change in his frequency of social initiations. Since an increase in social initiations in H-PB sessions is still observed for Ethan, however, the data suggests that a less potent reinforcer may still be present during these sessions.

One possible explanation for the differences in social initiation data across participants may be the influence of the length of time that each client was enrolled in the program prior to the start of the study. Beth, Jackson, and Andre were each enrolled in the clinical program for a minimum of 7 months prior to the onset of the study, while Ethan had been enrolled for only 2.5 months. Due to the social nature of PRIDE behaviors, these behaviors may function as social attention which is regarded as a generalized conditioned reinforcer (Eby & Greer, 2017; Vollmer & Hackenberg, 2001). Generalized conditioned reinforcers are thought to be established through their constant pairing with other reinforcers (Skinner, 1953, Vollmer & Hackenberg, 2001). Essentially, as PRIDE behaviors were increased during H-PB sessions, children with longer learning histories that included social attention as a reinforcer may have been more likely to initiate social interactions. Ethan's brief time in the clinic prior to entering the study might have

limited the effect of social attention, thereby decreasing the number of initiations he demonstrated, relative to other participants, when PRIDE behaviors were higher.

Half of the child participants also exhibited moderate increases in percentages of correct responses to single-step directions during H-PB condition sessions. A visual analysis of Figure 3.2 shows a measurable difference in L-PB sessions and H-PB sessions for Ethan and Andre while data was visually inconclusive for Beth and Jackson. These findings are surprising as increasing child compliance is often the target of implementing PRIDE behaviors, however, only half of the participants exhibited a measurable increase in their percentages of correct responses (Thomas et al., 2017). The differences in magnitude of effect across participants may be due to several factors. Similar to the findings regarding social initiations, the increased frequency of PRIDE behaviors in H-PB sessions may serve as a signal to the child that some form of positive reinforcer was available for following single step directions. Perhaps Ethan and Andre perceived that reinforcement was available on a more potent schedule than for Beth and Jackson, leading to larger differences in data when PRIDE behaviors were doubled in H-PB sessions.

Secondly, Thomas et al., (2017) found that PCIT strategies have been effective for increasing child compliance behaviors, however, this review did not clarify or define the behaviors found in compliance. The vague definition of compliance behavior by Thomas et al., (2017) may suggest that perhaps other compliance behaviors were taking precedence for Beth and Jackson during the study. Beth and Jackson may have focused their efforts on behaviors such as making eye contact or sitting down and thus, their ability to follow other directions were diminished by possible competing behaviors. Also, the current investigation only included PRIDE behaviors and did not implement the full PCIT protocol. Perhaps the full implementation of the PCIT protocol is necessary for children to increase more complex compliance behaviors

such as following single step directions which may take more effort than simple behaviors such as making eye contact.

All four participants exhibited moderately higher frequencies of uncontrived imitations during H-PB condition sessions than during L-PB condition sessions. These findings suggest that when adult providers increase their frequency of PRIDE behaviors during naturalistic teaching sessions, children may respond by somewhat increasing their frequency of uncontrived imitations. Uncontrived imitations, however, are unique in that they may not fall under the compliance behaviors reported by Thomas et al., (2017) because they do not require a direct adult instruction to occur. On the other hand, uncontrived imitations are not considered initiations because they still require the adult to act first in some way. Thus, uncontrived imitations may be connected to a child's motivation almost entirely. For example, if an adult is actively playing with a train and they place the train on the track, the child might observe this action and choose to imitate. The imitation of this action is a response to the adult doing the same, however, the adult did not give a direct instruction to the child to imitate.

One possible explanation for uncontrived imitating may be that the increase in PRIDE behaviors during H-PB phase may somehow function as a discriminative stimulus for the child to imitate the adult independent of any direction to do so. The responses of engaging in uncontrived imitations may be stronger in H-PB phases due to the chances for a higher success rate for that behavior (Michael, 1980) as perceived by the child. For example, participants may choose to increase their uncontrived imitations during H-PB phases because the increase in adult PRIDE behaviors signals to the child that uncontrived imitations are more likely to garner some type of reinforcer such as adult social attention, similar to the other dependent variables. On the other hand, the presence of a particular reinforcer itself could also lead to an increase in the behavior,

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however, this reinforcer is unknown as the increase in PRIDE behaviors were not contingent on child behaviors. Consistent with data from both social initiations and correct responses to single-step directions, the effect is not the same across participants. A visual analysis of Figure 3 shows that Ethan and Andre exhibited more separation in data in L-PB phases and H-PB phases than Beth and Jackson. These results would once again suggest that PRIDE behaviors may be a more effective signal for the presence of reinforcement for some children than others.

The overall differences in correct responses to single-step directions and uncontrived imitations between L-PB sessions and H-PB sessions were not as obvious as the overall changes in social initiations, suggesting a stronger overall effect of PRIDE behaviors on child social initiations. This finding may be due to many factors. For example, the participants in this study were actively working on acquiring the skill of following single-step directions. Single-step directions are considered an early learner skill, as they are prerequisites for following multi-step directions. Thus, perhaps the children in the study exhibited a less frequent ability to socially respond to contrived single-step directions due to the skill not being present in the child's behavioral repertoire. Alternatively, each intervention session lasted for only 5 min. Given the short opportunity for all three behaviors to garner some reinforcer, children may have been focusing their efforts on increasing social initiations rather than either following single-step directions or exhibiting uncontrived imitation due to the less effortful nature of initiations. Perhaps the increased effort that it may have taken to respond to an adult lessened the child's motivation to engage in following single-step directions. For example, if the principal investigator held up a toy car and asked the child to say the color of the car, the child would have to engage in many steps prior to responding correctly. The child would need to look at the car, process the color, and then say the correct color. Whereas child initiations were not contingent

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on any prior adult directions, thus, could have taken less effort. Ultimately, the children may have chosen to allocate their time and effort towards emitting the less effortful response. This pattern may be true for uncontrived imitations as well. An uncontrived imitation still requires the child to observe an adult's actions or words prior to responding, thus, although they are not contrived, they still require more effort than a wholly independent initiation.

This study contributes to the literature on PCIT methodology by assessing the possible effects of introducing or increasing PRIDE behaviors based on the PRIDE behaviors while working with children with ASD. This investigation specifically extends the work of Jimenez-Gomez et al., (2019) by focusing its efforts on how providers or practitioners, rather than parents may implement PRIDE behaviors. This present investigation, however, aimed to change the frequency of PRIDE behaviors emitted by one adult rather training a group of practitioners in hopes of focusing its efforts on the changes in child behaviors rather than adult behaviors. These findings suggest that systematically increasing one's frequency of PRIDE behaviors while working with a child with ASD during a naturalistic session may lead to direct increases in child social initiations and some increases in following single-step directions and uncontrived imitations.

Although acquisition data across all three dependent variables were inconsistent across all participants, some notable patterns were observed. First, all four participants saw an increase in mean scores for all three variables when transitioning from L-PB phase to H-PB phase. These data suggest that overall, increasing PRIDE behaviors of adult participants affects many aspects of a child's behavior during the session. Next, all four participants exhibited their highest means for both correct responses to single step directions and uncontrived imitations during the second H-PB phase. Notably, Beth and Jackson exhibited their highest means for social initiations

during the second H-PB phase while Ethan and Andre exhibited their highest means for social initiations during the first H-PB phase. These data suggest that child social response behaviors may take longer to change when increasing PRIDE behaviors while a noticeable change in social initiations may be seen earlier in some children. A possible explanation for this may be that PRIDE behaviors may have functioned as a discriminative stimulus for Ethan and Andre much quicker than for Beth and Jackson. Overall, these patterns suggest that increasing an adult provider's PRIDE behaviors during naturalistic teaching sessions with children with ASD may lead to positive changes in several child behaviors.

The possible positive effects of increasing these child social behaviors combined with the relative speed at which children with ASD increased their social behaviors during this investigation suggests that it may be worth the effort to find ways to train providers to increase their PRIDE behaviors while working with children. Increasing the frequency or rate at which providers emit PRIDE behaviors while working with clients may have a noticeable impact on said client's initiation and some effect on following single step directions and uncontrived imitations. Clients that respond and initiate more often may acquire skills more quickly and utilize their time in therapy more effectively. These results highlight an area in which simple, effective, and inexpensive training strategies may lead to noticeable changes in child outcomes.

Currently, only Jimenez-Gomez and colleagues (2019) have published a training investigation where non-parental providers were trained to increase PRIDE behaviors. Jimenez-Gomez et al., (2019) utilized a BST package to investigate its efficacy, however, a further investigation into simpler or more cost-effective training strategies may be warranted. Although outcomes were generally positive, there are several limitations to the study that should be considered. First, the use of a single adult to implement the procedures limits the generalizability

of implementing PRIDE behaviors. The principal investigator was a trained provider with many years of working directly in a clinical format and four years of doctoral-level studies. Although this background aided in experimental control, the lack of an adult provider with a background more similar to BTs (i.e., undergraduate degree or student, 1-2 years clinical experience) may hinder the generalizability of these findings. The level of experience of a provider may directly affect that provider's ability to balance the implementation of PRIDE behaviors while simultaneously targeting a skills acquisition task (e.g., following single step directions) effectively. PRIDE behavior literature may benefit from future research that replicates these procedures across different adult implementers with differing years of experience or education levels.

Future research should assess new ways of investigating the long-term stability of these behaviors and their effect on child participants. One possible way may be to increase the length of each phase. Outside of Beth, most participants were exposed to four or five sessions per phase. During these sessions, the data for correct responses to single-step directions (See Figure 4.1) and uncontrived imitations (See Figure 4.3) often ended with increasing data points. Although, social initiations were the primary dependent variable, lengthening each session may have given the other two variables an opportunity to stabilize prior to moving phases, further demonstrating the effect of the PRIDE behaviors on the other dependent variables.

Table 4.1

Definitions and Examples of Child Behaviors

Behavior	Definition	Example
Social Initiations	Any attempt of the child to gain the attention of the adult either verbally or physically while the adult is not actively engaged with the child or if the adult is engaged with the child in one activity and the child initiates a new activity. 3 seconds must separate each initiation from the last	While the adult is taking data, the child states "Look at what I made!" While the adult is showing the child silly putty, the child picks up a train and says, "Look a train!"
Correct Responses to Single-Step Directions (Compliance)	Any unprompted attempt of the child to respond to a single- step direction given by the principal investigator within three seconds.	Adult tells the child to stand up and the child straightens both legs in a standing position.
Child Uncontrived Imitations	Any verbal or physical attempt of the child to imitate the adult's actions or words without being directed to do so. 3 seconds must separate each response from the last	The adult says "woooooosh!" while playing with a toy bird and the child says "wooosh!"

Table 4.2

Definitions and Examples of PRIDE Behaviors

Behaviors	Descriptions	Examples
Praise	Adult delivers verbal praise to the child as long as the child is not currently engaging in problem behavior or has not engaged in problem behavior for 3 seconds prior to the praise being delivered. Praise may be specific to what the child is doing or general.	Adult says, "Good job!", "Wow!" "That's cool!" "Look at you!" to the child
Reflect	Adult repeats some or all of what the child is verbally stating and extends the language of the child.	The child says, "a cow!" The adult replies "That's a big brown cow!"
Imitate	Adult imitates some or all the child's appropriate play actions. Including what the child does with just their body or while manipulating an object	The child rolls a ball. The adult then grabs a ball and rolls it too. The child chooses a toy, and the adult picks up a similar or identical toy If the child engaged in inappropriate actions such as placing a toy in their mouth, the adult will not imitate this action
Describe	Adult uses words to describe what the child is doing with just their body or when the child manipulates an object. Adult description must include the word "you"	The adult sees the child sitting down and says, you are sitting down! The adult sees the child push a ball and says, when you push the ball, it rolls!
Enthusiasm	Adult gives child a high five, pat on the back, pat on the head or hug. Adult can also give a thumbs up, claps during a time where the child is not engaging in problem behavior	Adult raises their hand and pats the child on the back

Note. 3 seconds must separate one identical instance from another for Praise and Describe.
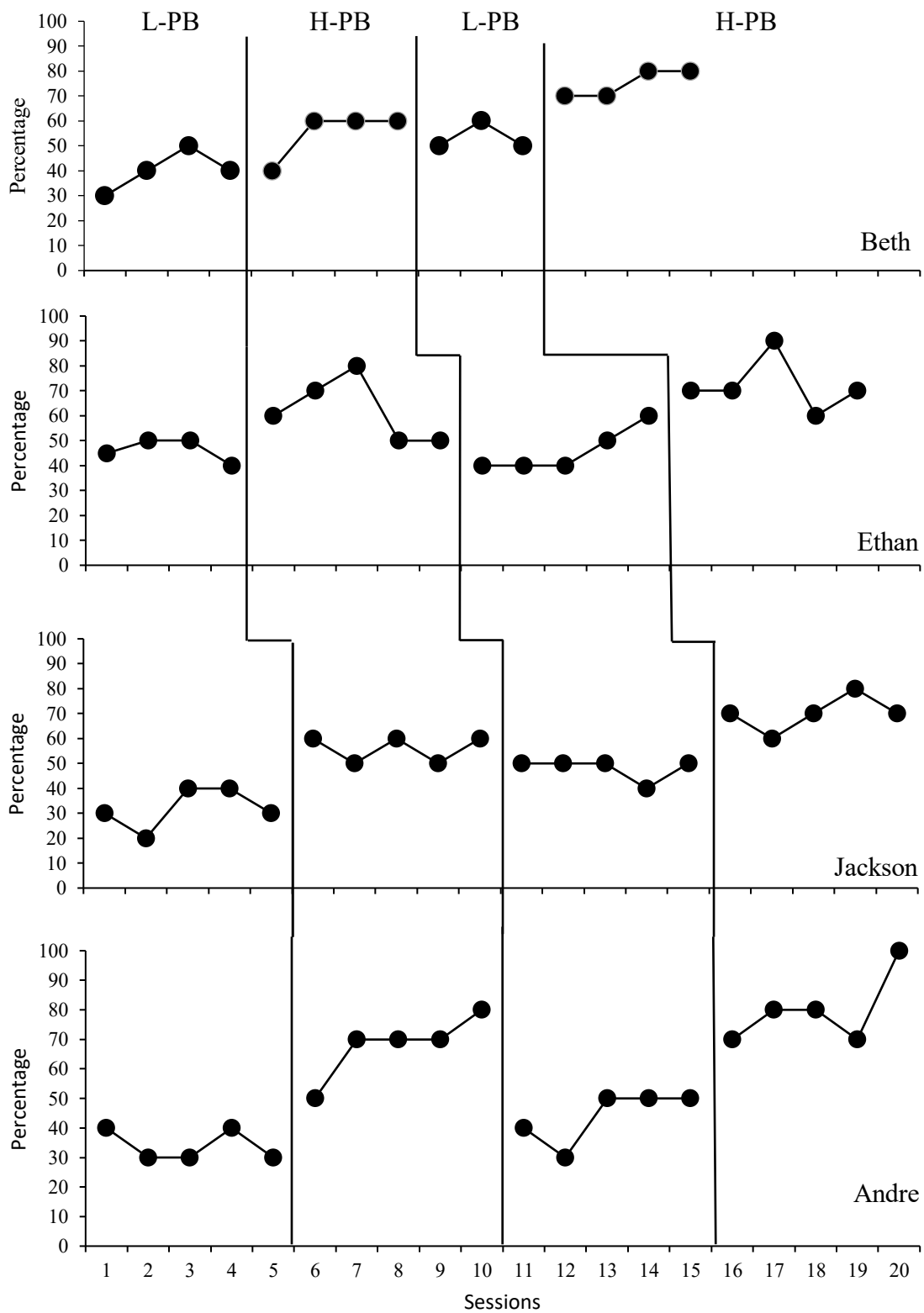
Figure 4.1

Child Social Initiations
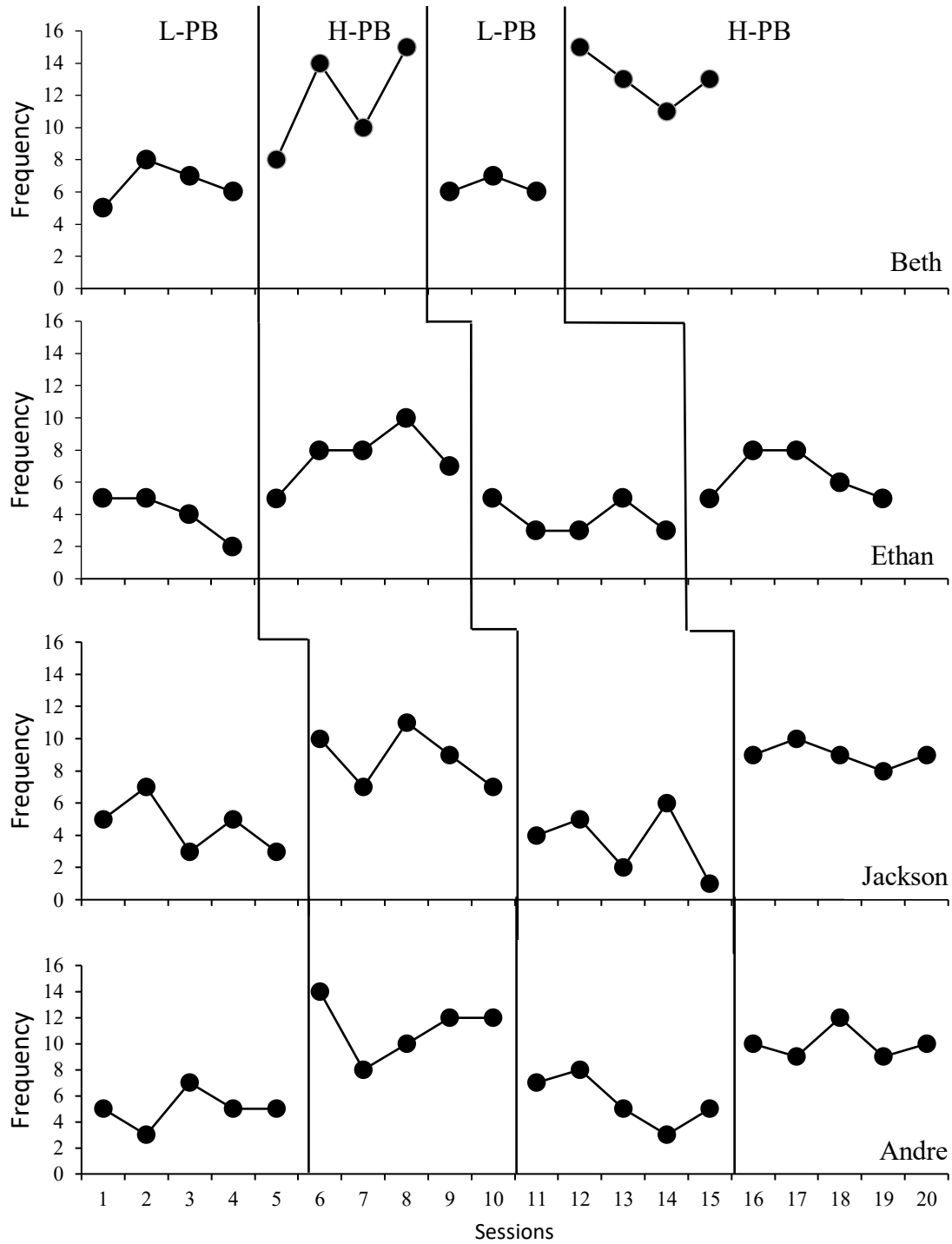
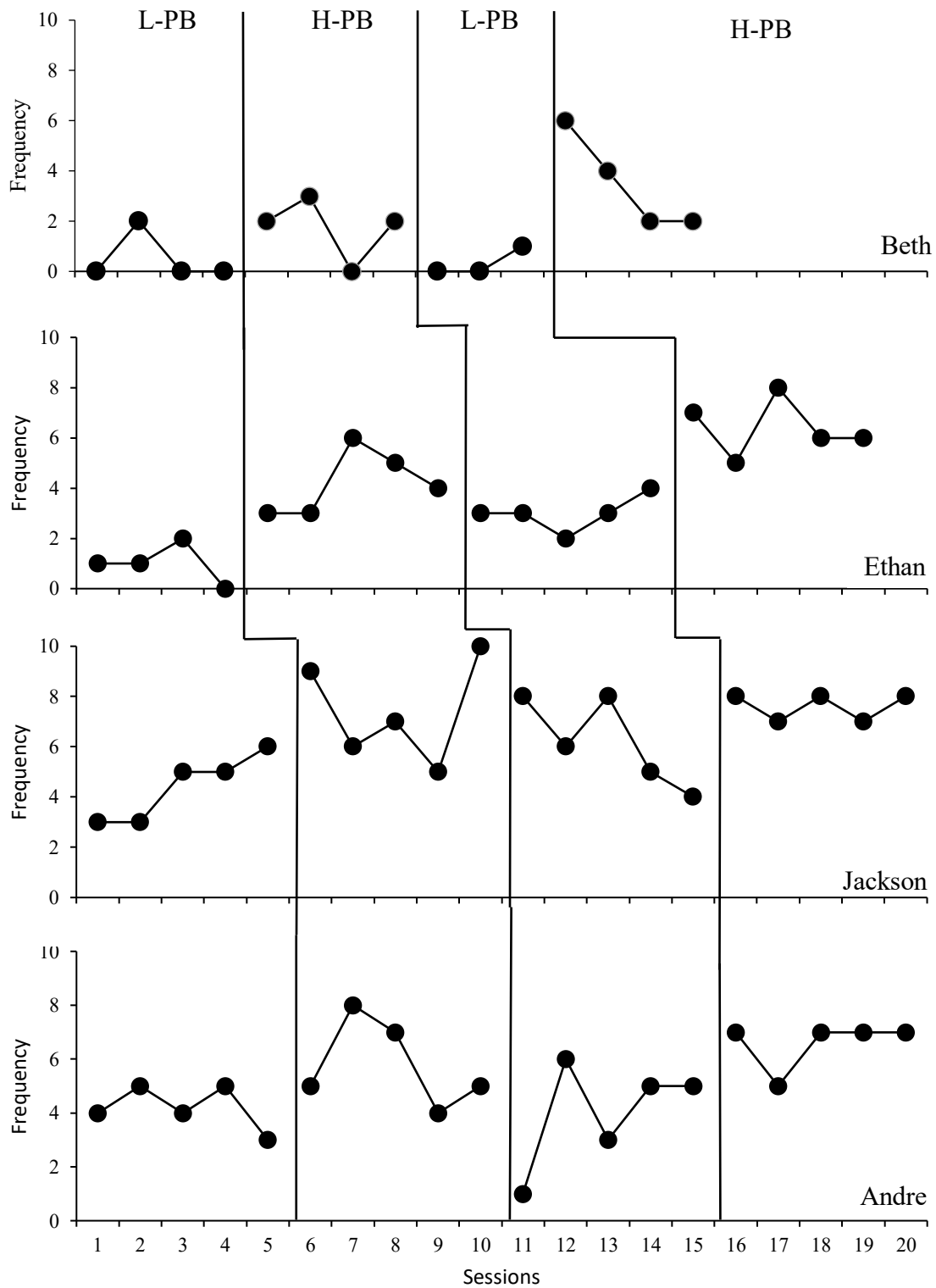*Note.* Child participants' social initiations data not collected concurrently.

Figure 4.2

Percentage of Correct Responses to Single-Step Directions (Compliance)

Figure 4.3

Child Uncontrived Imitations

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CHAPTER 5:

DISCUSSION

The present dissertation presented three studies that aimed to examine the currently reported training practices in NDBI literature while also investigating the possible utility of some of these practices. Chapter two was a scoping review of currently reported training practices in NDBI literature. The goal of the study was to better understand practices that may lead to effective NDBI implementation and to report any notable trends. Chapter three evaluated the efficacy of training BTs to implement RIT using a BST procedure. Lastly, Chapter four investigated the possible effects on child behaviors observed when an adult engaged in varied levels of PRIDE behaviors when working with a child with ASD (Jimenez-Gomez et al., 2019). The dissertation illustrates the need for more transparency in reporting training practices in NDBI research and the potential of BST as an effective training procedure for NDBIs. Additionally, the dissertation outlines the positive changes in child behaviors following a change in simple procedures such as increasing the PRIDE behaviors of ABA providers.

Applied behavior analysis providers may spend a considerable amount of time with clients. In ABA, direct care providers may spend up to 40 hours per week with clients (Reichow et al., 2014). The substantial amount of time with clients suggests that providers may have many interactions with clients. Some naturalistic interventions and strategies such as NDBIs have specifically targeted skills that focus on the quality of adult and child interactions. Some researchers have called for increased training in areas that target the quality of client-provider interactions (Rose, 2020; Rohrer & Weiss, 2023; Rohrer et al., 2021; Taylor et al., 2018).The focus on quality of child-adult interactions suggests that a well-trained provider may offer a plethora of learning opportunities and PRIDE behaviors with clients while providers with minimal training

may miss opportunities for skill acquisition or increase negative interactions with clients. Due to the critical need for having effective training practices in ABA implementation, continued investigation of the usage and efficacy of training strategies for interventions such as NDBIs and simple procedures such as PRIDE behavior is warranted.

The present dissertation addressed the lack of literature on training ABA providers in NDBIs in several important ways. The collective findings suggest three critical areas of consideration for researchers and practitioners delivering behavioral services to children with autism. First, there are a number of potential benefits of using BST to teach providers to use NDBIs. Second, research on NDBIs reveals parents or caregivers as the most common interventionist whereas many early intervention agencies employ BTs or paraprofessionals as providers. And finally, there may be some strategies, such as increasing PRIDE behaviors, that are simple to teach and offer opportunities for substantive changes in child behaviors that warrant additional investigation.

Behavior Skills Training

Behavior skills training has been shown to be effective for training more traditional ABA interventions and strategies such as implementing functional analyses, conducting preference assessments, and implementing DTT (Jimenez-Gomez et al., 2019). Briggs, Zohr, & Harvey (2024) conducted a recent scoping review of empirical ABA studies published from 1977-2021. Briggs and colleagues found that the combination of two or more BST components is common in ABA training literature. A recent scoping review of caregiver training studies by O'Neill and Koudys (2024) also found that majority of included studies reported some combination of BST components as their training approach, further emphasizing the use of BST components as a training mechanism for ABA procedures.

Similar to recent reviews (Briggs, Zohr, & Harvey, 2024, O'Neill & Koudys, 2024), a large proportion of studies in Chapter two reported some combination of two or more components of BST though only two studies explicitly reported the use of BST. Although both Briggs and colleagues and O'Neill and Koudy's focused on DTT procedures, Chapter two found that some components of BST were the most reported training strategies (i.e., feedback), suggesting that BST components may be effective in teaching more complex procedures such as NDBIs. The findings suggests that separate components of BST may be an effective training tool when only combined with one other component. Similarly, Ingersoll and Gergans (2007) utilized instructions, modeling, practice, and feedback to train adult caregivers to implement RIT with their children. Although Ingersoll and Gergans (2007) did not explicitly report BST as their training framework, their study implemented many components of BST, suggesting its efficacy as well. The findings from Ingersoll and colleagues further suggest that perhaps some NDBIs are already utilizing BST or BST related practices but not naming them as such.

BST has been utilized to train some NDBIs including Project ImPACT (Mrachko, Kaczmarek, Kostewicz, & Vostal, 2023) and natural language paradigm (NLP: Gianoumis, Seiverling, & Sturmey, 2012), suggesting its efficacy for training other NDBIs. In Chapter three, all four BTs demonstrated an increase in RIT fidelity following BST training with one participant needing a coaching session to reach mastery criterion. These results are similar to the findings of Bravo & Schwartz (2025) where coaching was a component of their training strategy. Their use of a coaching component, however, differed from the current investigation. Bravo & Schwartz (2025) implemented an ongoing bug-in-ear coaching component to their training protocol. Each BTs received a 10 min coaching session following a 10 min solo RIT implementation session. Three out of four BTs reached mastery criterion within the initial play condition. The current

investigation only implemented coaching sessions if participants failed to meet mastery criterion. Only one participant received a coaching session which consisted of a 15 min session where the participant watched a video of their RIT implementation and both positive and corrective feedback were implemented. This participant reached mastery immediately following the one coaching session, suggesting that the coaching aided in teaching the RIT skills. The results of these two studies suggest that BST may be an effective training strategy for RIT implementation, however, some providers may require an additional coaching component.

Researchers have described the customizability of BST procedures for training (Kirkpatrick, Akers, & Rivera, 2019). The findings from recent reviews (Briggs, Zohr, & Harvey, 2024, O'Neill & Koudys, 2024) and Chapter two also suggest that BST components are often customized to fit the intervention. The use of diverse combinations of BST components may offer an interesting outlet for future NDBI training investigations. NDBI literature may benefit from research that analyzes the efficacy of differing components of BST for training. Similar to the differing uses of coaching described by Bravo & Schwartz (2025) than in Chapter three of this dissertation, different implementation of instructions, modeling, practice, and feedback may lead to different levels of skill acquisition for trainees. Researchers are already aware of the efficacy of BST and NDBI training literature report the use of some BST components. Future researchers should assess ways in which BST components can be customized for the training of specific NDBIs. A component analysis of BST training in NDBIs may be one area of research that provides answers regarding which components of BST may be effective for training NDBIs.

Caregiver Training

The scoping review in Chapter two demonstrated the affinity for training studies in NDBIs to include caregivers as the main target for training. A trainee was defined as the person trained to

work directly with a child. Caregivers were defined as any adult family member responsible for the care of the child. Caregivers included grandparents, aunts, uncles, and adult cousins, but they were usually reported as the child's parents. These results were not surprising as caregiver implementation is a common element of NDBIs (Schreibman et al., 2015). Chapter two found that many NDBIs (i.e., Pivotal Response Training, Early Start Denver Model, Enhanced Milieu Teaching, Reciprocal Imitation Training) have extensive histories of parent-mediated research. Some NDBIs are specifically geared towards caregivers (e.g., Project ImPACT). The lack of NDBI literature focused on the training of non-parental providers may serve as worrisome as both the demand for clinical ABA services and ABA providers are rising (Donnelly, 2022, Maenner et al., 2023). Additionally, intervention effects for some ABA interventions were observed to be larger when interventions were implemented by providers (i.e., clinicians, researchers) as opposed to parents or school staff (Fuller and Kaiser, 2020).

Save for a recent investigation by Bravo & Schwartz (2025) and the findings in Chapter three, however, there is a lack of research examining methods for teaching clinicians to implement RIT. Bravo & Schwartz (2025) trained four adult BTs to implement RIT. Training consisted of an adapted virtual workshop, video modeling, role play, feedback, and weekly coaching sessions. Bravo & Schwartz (2025) found that three BTs met RIT fidelity within the training condition, suggesting that some combination of the training strategies used may be effective for training some BTs to implement RIT. Chapter three also found that BTs were relatively simple to train with only one BT needing a short coaching session to reach the targeted fidelity criterion for mastery.

There may be many untapped benefits to increasing the use of NDBIs with non-parental providers. Clinicians may receive some routine level of training that allows them to implement NDBIs following a more simplistic training while caregivers may need more extensive training

protocols (Ingersoll & Gergens, 2007; Penney & Schwartz, 2019). Practitioners may save on costs and time by training providers to implement NDBIs. Providers often receive routine training and supervision sessions and including an NDBI such as RIT may not require a large amount of funds or time to integrate into one's practice. Findings in Chapter two demonstrated that most training sessions of caregivers occurred in clinical environments. These results suggest clinical environments may offer a more effective environment for training NDBIs. These environments are often more controlled than school or home and may offer more resources for both the trainer and trainee. Providers in clinical environments (i.e., BTs) may already be placed in the most effective environment for learning NDBI implementation skills, further easing the process of training.

The steep rise in ASD diagnoses (Maenner et al., 2023) cannot be ignored. More children are requiring EIBI services every year (Maenner et al., 2023). With the field's knowledge about the efficacy of clinical provider implementation (Fuller and Kaiser, 2020) and the efficacy of NDBIs across many skill domains (Schreibman et al., 2015; Tiede. & Walton, 2019; Tupou, 2020), it may be due time for NDBIs to be utilized across more clinical environments. Future NDBI research may benefit from a push to include more clinicians in the implementation and dissemination of NDBI literature.

PRIDE behaviors

Chapter four aimed to justify the suggestion for more training in naturalistic interventions and strategies, by showing the possible benefits in terms of changes in child behavior. Results indicated a positive correlation of child behaviors and adult behaviors, meaning the child participants immediately and consistently increased and decreased their levels of initiation behaviors as the adult increased or decreased their levels of PRIDE behaviors. These results are

important because they suggest that a simple procedure such as increasing specific PRIDE behaviors may lead to an increase in child initiations, which are behaviors that are often paired with high levels of child engagement, which is an important component of NDBIs and other naturalistic interventions (D'Agostino et al., 2023, Schreibman et al., 2015).

Chapter four results showed that positive changes in child behaviors may not always align with simply implementing an intervention with high fidelity. Although high levels of fidelity are important for some naturalistic interventions (Mrachko et al., 2023), PRIDE behaviors can be increased in isolation or in combination with fidelity of specific interventions. During the study described in Chapter four, the adult interventionist implemented the naturalistic intervention with fidelity during both L-PB and H-PB sessions. However, positive changes in child behaviors were mostly observed during H-PB phases. Children engaged in higher frequencies of spontaneous social initiations when the adult doubled their PRIDE behaviors. Thus, social initiations were not contingent on high fidelity of the intervention. These results suggest that there may be important aspects of working with children that implementation fidelity alone may not encompass.

The simplicity and time saving nature of implementing PRIDE behaviors may be a critical finding. The average amount of time reported for training NDBIs found in Chapter two ranged from a couple hours to multiple weeks comprised of many sessions of training. PRIDE behaviors may offer a time-saving area of where adult providers can change their behaviors outside of implementation fidelity and lead to positive changes in children. Although Chapter four did not implement a training, Jimenez-Gomez and colleagues (2019) showed that BTs can be trained to implement PRIDE behaviors following a short BST training. Chapter three also showcased the little time it may take to train using BST as most BTs were able to effectively implement RIT after only one training session. With knowledge that RIT procedures are more complex than

implementing PRIDE behaviors, it is reasonable to assume that BTs would only need a short training to implement PRIDE behaviors as well.

Many researchers have called for changes in how clinicians interact with providers (Rohrer & Weiss, 2023; Rohrer et al., 2021; Taylor et al., 2018) and PRIDE behaviors may offer a simple, yet effective way of doing so. Chapter four showcased the relative ease of which PRIDE behaviors may be changed. The adult interventionist simply used a hand-held counter to assure that the number of PRIDE behaviors implemented were correct. The steps to train a clinician to understand the behaviors and to ensure their high usage with a hand-held clicker are far outweighed by the potential benefits of implementing these behaviors Clinicians with little time or resources may be able to train providers to implement PRIDE behaviors, leading to reasonable positive change in child behaviors. Clinics often implement routine trainings and PRIDE behaviors may offer an opportunity for clinicians to quickly and easily target the disposition of providers, rather than focusing solely on skills-based implementation fidelity.

Conclusion

The present dissertation provides support for training interventions in naturalistic interventions and strategies. Chapter two outlined the many trends found in NDBI studies that included a training component. Chapter two displayed the uneven distribution of training strategies across NDBIs, showcasing the need for some NDBI literature (i.e., Early Achievements) to continue to assess procedures for training their practices while others (i.e., PRT) have provided efficient examples. Chapter two also displayed the prevalent use of BST procedures within NDBI studies, further suggesting the efficacy of BST as a behavior analytic training approach.

The results of Chapter three combined with findings in Chapter two, add further credence to BST's efficacy. Future research should continue to assess BST as a means for training adults to

implement NDBIs. These studies have important implications for future research as many reviews have found NDBIs to be effective in training new skills, thus, finding new training strategies may help disseminate these effective practices to new populations. Chapter four concluded by showing the possible beneficial effects to child behaviors that may be observed if an adult was trained to implement developmentally based naturalistic strategies. Results indicated that child initiations increased for all child participants while other behaviors increased for some children. Developmentally based natural interventions show promise as a possible direction for not just increasing the skills of children with ASD, but perhaps even increasing the quality of the interactions between children with ASD and adult providers. Thus, more research on the best strategies for training these interventions is warranted.

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