Speech-Language Pathology Interventions and Ingredients that Support Social Communication and Language of Preschoolers with Autism

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Abstract

One of the best predictors of long-term outcomes for autistic children is development of language and social communication skills. Therefore, it’s not surprising that speech and language therapy is one of the most frequently accessed interventions for children with suspected or diagnosed autism. From a public health and family well-being perspective, identifying effective social communication interventions and better understanding the specific components that contribute to their effectiveness is critical. However, there is a lack of clarity about the most effective interventions. This dissertation addressed this important topic through three studies.

Study 1 examined the literature on interventions provided by speech-language pathologists (SLPs) to autistic preschool children through a scoping review. Findings indicated that current research captures the versatility of SLPs’ roles in supporting autistic children, and has markedly increased over the past decade. However, research with strong methodological rigor that captures the complex and individualized nature of interventions is needed, as are studies aligned with community practice.

Study 2 systematically reviewed and critically appraised research evaluating one type of intervention used by SLPs – developmental social pragmatic (DSP) interventions. Results revealed that DSP interventions positively impact autistic children’s social communication, but evidence for impact on children’s language was inconsistent.

Study 3 focused on better understanding one support built into DSP interventions and other programs – environmental modification – by exploring the relationship between children’s unstructured (symbolic and gross-motor) play environments and their social communication behaviours using linear mixed effect models. Results revealed that young autistic children were more likely to socially attend to caregivers in gross motor play and to
focus their attention solely on objects during symbolic play. This study confirmed the importance of continued research focused on understanding the impact of unstructured play environments on children’s social attention and communication.

Together, this dissertation contributes to a broader understanding of SLP-delivered interventions for preschoolers with autism, begins the work of examining how specific ingredients included within early interventions might interact with social communication behaviours, and provides suggestions for future lines of inquiry.

**Keywords:** Autism, Speech-Language Pathology, Social Communication, Language, Social Attention, Intervention, Therapy, Children, Preschool, Play, Systematic Review, Scoping Review
Summary for Lay Audience

This thesis aims to enhance our understanding of intervention programs offered by speech-language pathologists (SLPs) to children with autism. One of the best predictors of long-term outcomes for children with autism is development of language. Therefore, it is not surprising that speech-language pathology services are one of the most frequently sought-after services after children receive a diagnosis of autism. Three studies were conducted to better understand therapies offered by SLPs, their effectiveness, and specific ingredients within these interventions that might play an important role in supporting autistic children and their families. The first study involved searching all research published between 1980-2019 that investigated SLP-delivered therapies provided to preschool autistic children. This was done to identify how much research has been conducted, what types of therapies have been researched and to provide guidance for what kind of research needs to be done in the future. The second study evaluated the quality of the research on one particular type of therapy often use by SLPs when working with young children with autism. The third study investigated how symbolic and gross motor play environments impacted autistic children’s attention to their caregivers and their toys, how much they used language, and the complexity of the language they used. Together these studies contribute to a broader understanding of SLP-delivered therapies for preschoolers with autism and provide suggestions for future research.
Co-Authorship Statement

This dissertation is composed of original work conducted by me in fulfilment of a PhD under the supervision of Dr. Janis Oram Cardy, from the School of Communication Disorders at University of Western Ontario. No part of this dissertation has been submitted for any other degree or diploma.

This thesis includes three original papers presented in chapters 2, 3, and 4, one of which has been published in a peer-reviewed journal and another that has been submitted for publication. Publishers have granted permission to include the articles in this dissertation. All three studies were designed and conducted by me along with collaborators. Co-author contributions have been clearly outlined below. My primary supervisor, Dr. Janis Oram Cardy, provided input into the design, analysis, and interpretation of results and editing of all chapters in this dissertation.


Author Contributions: Amanda Binns: Conceptualization (Lead), Investigation (Equal), Methodology (Lead), Supervision (Lead), Writing - review & editing (Lead). Allison Andres: Conceptualization (Supporting), Investigation (Equal), Project administration (Supporting); Review & editing (Supporting). Rachael Smyth: Conceptualization (Supporting), Methodology (Supporting), Investigation (Supporting), Review & editing (Supporting), Formal analysis (Supporting). Joyce Lam: Investigation (Equal), Project administration (Supporting); Review & editing (Supporting). Janis Oram Cardy: Funding acquisition (Lead), Resources (Lead), Conceptualization (Supporting); Methodology (Supporting); Writing - review & editing (Supporting).

*Author Contributions:* Amanda Binns: Conceptualization (Lead), Investigation (Lead), Methodology (Lead), Supervision (Lead), Formal Analysis (Lead), Writing - review & editing (Lead). Janis Oram Cardy: Resources (Lead); Conceptualization (Supporting); Methodology (Supporting), Investigation (Supporting), Writing - review & editing (Supporting).

Chapter 4: Unpublished manuscript

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Chapter 1: Introduction

In this first chapter, I introduce the research problem and articulate the rationale for selecting the topic of preschool autism interventions for my dissertation. Then, to provide context for my research topic, I present an overview of autism, and broadly discuss supports and interventions for autistic children and their families. Finally, I outline the three studies included within this dissertation.

1.1 Research Problem

Speech and language therapy is one of the most frequently accessed early interventions for children with suspected or diagnosed autism (Denne et al., 2018; Salomone et al., 2016; Volden et al., 2015). This is not surprising given that parents consistently identify both the communication and social domains as treatment priorities for their children with autism (Pituch et al., 2011). Additionally, language and social communication skills are among the most important contributors to long-term outcomes in children with autism (Tidmarsh & Volkmar, 2003). Therefore, identifying and implementing effective supports to improve these capacities in autistic children is essential for enhancing quality of life for both children and their parents. However, this is not an easy task. Autistic children present with complex and highly heterogenous profiles (Masi et al., 2017), making it illogical to think that a single intervention, or even a specific set of interventions, is likely to support all individuals with autism. Speech-language pathologists (SLPs) are in a prime position to support children with autism as they receive diversified trainings and can provide therapy to support a range of different skill development areas. However, we (as SLPs) need to better understand how to identify, select, and deliver these interventions to this heterogeneous population of children. In order to do this, we need a more complete
understanding of SLP-delivered interventions, their effectiveness, and the specific supports built into the interventions that might act as mechanisms for positive change. The primary purpose of my doctoral research was to enhance our understanding of intervention programs offered by SLPs to children with autism and to contribute to our knowledge about how to best support their social communication and language development.

1.2 Topic Selection

As a SLP who practiced for seven years before pursuing a doctoral degree, I have worked extensively with young children with autism and their families. My front-line clinical experiences led me to reflect critically on what it means to provide good treatment, for both the child and the family. These clinical experiences also exposed clinical practice challenges and gaps in the current knowledge. For example, there was (and remains) insufficient evidence to support the interventions that SLPs use within their clinical practice, and there is little information guiding SLPs’ decisions in selecting interventions specifically suited for the specific needs of each client and their family. Both my curiosity and desire to generate knowledge that could have the potential to positively impact SLPs’ clinical service delivery, and the lives of autistic children and their families, motivated me to focus on examining preschool autism interventions for my dissertation.

1.3 Autism Overview

In this section, I provide context for this dissertation by reviewing research and clinical literature relevant to preschool social communication interventions for autistic children. I begin by considering the language used throughout this dissertation to describe autism. Subsequently, I consider the prevalence of autism and explore the criteria and
processes used to identify autism in children. Finally, I discuss the heterogeneity of autism and consider the implications on the broader context of social communication. I draw on the literature to develop the rationale for the work in this dissertation, illustrating the importance of better understanding and contributing to the literature on social communication interventions for preschool children with autism.

1.3.1 A Word About Terminology

Within this document, I use a mixture of terminology when referring to autism and individuals identified as autistic. This is because autism is thought of as “both a medical condition that gives rise to disability and an example of human variation that is characterised by neurological and cognitive differences” (Lai et al., 2020). Autism is thought to be a condition when an individual’s autistic traits do not cause impairment for that person. However, when a person’s autistic traits lead to distress or dysfunction for that person, autism is thought of as a disorder. Many autistic adults have expressed frustration with the use of medical- and deficit-focused terminology referring to autism as a disorder (see Kenny et al., 2016). They have advocated for use of language that represents autism as a human variation - Autism Spectrum Condition (ASC) - and identity-first language (e.g., autistic, or autistic person; Fletcher-Watson et al., 2017; Fletcher-Watson & Happe, 2019). Other autistic adults have voiced a preference for person-first language (e.g., child with autism), which was part of the disability rights agenda and is required by many academic journals. For these reasons, I minimize the use of medical and deficit focused terminology and use a combination of person-first and identity-first language in this dissertation.
1.3.2 Prevalence

Understanding the prevalence of autism is crucial for diagnostic and intervention service planning and funding allocation. Autism is estimated to affect over 1% of children globally (Baio et al., 2018) and 1 in 66 children in Canada (Public Health Agency of Canada, 2018). Males are diagnosed with autism four times more frequently than females (Baio et al., 2018; Guthrie et al., 2013). However, there is growing recognition that females often present with more subtle signs of autism than boys (Lai et al., 2015; Loomes et al., 2017). Because of this, it appears that females who meet diagnostic criteria for an ASC are at disproportionate risk of not receiving a diagnosis compared to their male counterparts (Loomes et al., 2017). As this disparity becomes more widely recognized and accounted for within the diagnostic process, we may see a narrowing of the male-to-female ratio in autism diagnoses in the future.

1.3.3 Diagnostic Criteria

“Diagnosis should be more than just a label, ideally, it’s about families working with an expert team to understand the individual and make a plan for their future support needs.” (Fletcher-Watson & Happe, 2019, pp. 61).

Autistic individuals have a range of abilities and talents, and many people with autism achieve independence, develop lasting relationships, obtain higher education degrees, and work in competitive jobs (Fletcher-Watson & Happe, 2019; Marriage et al., 2009; Gentles et al., 2020). However, autistic persons and their families are also faced with very real challenges. Autism is a life-long neurodevelopmental condition arising from an interaction of genetic and environmental factors (Tick et al., 2016). As defined by the fifth edition of the Diagnostic and Statistical Manual (DSM-5; American Psychiatric Association, 2013), autism spectrum disorder is a diagnostic
category that includes two core symptom domains: persistent social communication atypicalities and the presence of repetitive behavior patterns or restricted range of interests. Expression of characteristics within the core symptom domains and impact on daily functioning is highly variable across individuals. Although the diagnosis of autism does not always occur in childhood, presence of the core characteristics (social communication challenges and repetitive behaviours) from early development must be documented and must not be better explained by an intellectual disability or global developmental delay.

1.3.3.1 Core Feature: Social Communication

In order to receive a diagnosis of autism, the DSM-5 (American Psychiatric Association, 2013) specifies that atypicalities in social communication across three areas must be present. The three areas are: social emotional reciprocity (e.g., difficulties in engaging in two-way back and forth communication exchanges, verbally and non-verbally as in joint attention), non-verbal communication (e.g., difficulties using and integrating gestures, affective facial expressions or social referencing when communicating with others), and relationships (e.g., difficulties adjusting behavior to suit context, or challenges developing and maintaining friendships).

1.3.3.2 Core Feature: Repetitive Behaviours

Repetitive behaviours are assessed across four areas within the DSM-5. In order to receive a diagnosis of autism, the person must present with at least two of the following four classifications: stereotyped or repetitive motor movements, use of objects, or speech (e.g., use of scripted language or repeatedly lining up objects); insistence on sameness (e.g., extreme distress with seemingly small changes, or difficulty with transitions, or rigid rituals etc.); highly restricted interests (e.g., strong
attachment to seemingly unusual item, or perseverative interests such as interest in train schedules); and hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment (e.g., using peripheral vision to watch spinning items, or adverse reaction to specific visual, auditory, or tactile input).

### 1.3.3.3 Language Considerations

While not specific to autism, many children with autism also have a language impairment (Levy et al., 2010; Kim et al., 2014). This is not surprising, with neurocognitive research suggesting language and social communication processes as distinct yet intertwined systems (e.g., Willems & Varley, 2010). Indicators of differences in children’s language use (pragmatics) are captured within the DSM-5 descriptions of the core social communication atypicalities. However, differences in language form (morphology and syntax) and content (semantics) are not accounted for within the core diagnostic criteria for autism. Instead, they are viewed as “factors that influence clinical symptoms of ASD rather than defining the ASD diagnosis” (American Speech and Hearing Association, 2012; pp. 11). Currently, language disorders are thought to be a condition that co-occurs with autism, rather than a trait of autism itself. This has not been biologically validated and is a current topic of debate (Mody & Belliveau, 2013). Even though language impairment is not a core characteristic of autism, for young children later diagnosed with autism, late onset of early language milestones is among the first concerns most commonly reported by parents (Matheis et al., 2017). For this reason, it is not surprising that SLPs are one of the most frequently accessed interventionists after children receive an autism diagnosis (Denne et al., 2018; Salomone et al., 2016; Volden et al., 2015).
1.3.4 Diagnostic Process

The process of diagnosing autism has evolved significantly since the mid-twentieth century, when doctors simply assigned diagnoses to patients (Fischer, 2012). Today, the recommended process of diagnosing young children with autism is more comprehensive and inclusive of the person receiving the diagnosis and their caregivers. This includes (a) interviewing parents and other caregivers to gather a complete developmental, medical and education/early intervention history; (b) reviewing records (e.g., medical, speech-language and occupational therapy assessments, educator observations); and (c) using standardized protocols to guide clinical observations (ideally across different contexts; Brian et al., 2019; Chawarska et al., 2008). Within Canada, physicians and psychologists primarily diagnose autism. SLPs may be part of a diagnostic team, however, it is not within the SLPs’ scope of practice to diagnose autism.

A number of tools are available for diagnosing autism in children. Today, the most widely used standardized assessment for diagnosing autism is the Autism Diagnostic Schedule – second edition (ADOS-2; Lord et al., 2012). It is considered to be a gold standard diagnostic tool because of its high rates of sensitivity and specificity (Kamp-Becker et al., 2018) and it includes a toddler version, which allows for diagnosis in children as young as 12 months (Lord et al., 2012).

1.3.4.1 Early Identification

In recent years, there has been a rapid increase in the number of young children referred for diagnostic evaluation of autism (Chawarska et al., 2008; Shaw et al., 2020). The increase in early referrals for autism diagnosis is likely due to a number of factors including the development of reliable diagnostic tools, the rise in public
awareness of the early signs of autism, and ongoing monitoring of infants who have genetic predisposition to autism (Johnson et al., 2007). The impetus for early identification is also driven by recognition that early diagnosis of autism allows for earlier access to supports and interventions for children and their families.

Currently, the mean age of diagnosis is 4 to 5 years of age (Daniels & Mandell, 2014; Salomone et al., 2016), despite accumulating evidence supporting the reliable diagnosis of autism as early as 18 months in some children (Ozonoff et al., 2015; Zwaigenbaum et al., 2016). For children from racial or ethnic minority groups, and children living in remote or rural communities, diagnosis is likely to be later than peers in the general population (Mandell et al., 2002; 2005). Similarly, children with better verbal language skills are likely to be diagnosed later (Solomone et al., 2016), and females (who are more likely than males to present with subtle symptoms of autism) are often diagnosed later than males (Begeer et al., 2013). Delays in identification of autism for these groups of children may have significant clinical implications with respect to referral to early intervention programs and access to supports.

1.3.5 Heterogeneity

Another factor of importance is the considerable heterogeneity among people diagnosed with autism (Wing & Gould, 1979; Masi et al., 2017). The idea that autism is heterogeneous was first brought forth in 1979 by Wing and Gould. Specific areas of strength and impairment can vary widely across individuals, as can the severity of the impairments. Some autistic individuals remain minimally communicative even after receiving intensive supports, while others attain language abilities similar to same-aged peers (Tager-Flusberg & Kasari, 2013; Tek et al., 2014). Autistic individuals’
intellectual abilities can also span from profoundly impaired to abilities that are superior to neuro-typical peers (Munson et al., 2008). This variability across strengths and skill levels can pose challenges for diagnosis of autism and for the development and selection of effective interventions. For example, it has been proposed that tools used to diagnose autism might not be sensitive to subtle symptoms often presented by females. Similarly, if there is a great deal of variability in skill development areas, one-size-fits-all autism interventions are unlikely to be the most efficient way of supporting this population.

1.4 Supports and Interventions for Autistic Children and Their Families

This section broadly explores the topic of preschool interventions for children with autism. I begin by considering the language used throughout this dissertation to describe the supports provided to autistic children. Subsequently, I review the importance of providing intervention at a young age and discuss three components commonly incorporated within interventions for young autistic children.

1.4.1 A Note on Terminology

The idea that autistic people require intervention or treatment has become controversial. This is because use of the terms treatment or intervention can be interpreted to imply that supports are being used in attempt to “cure” or “normalize” the autistic child (Fletcher-Watson et al., 2017). It is important to articulate that this is not my intended meaning. The goals of therapy are to enhance or amplify children’s skills to support them to experience the world as fully as possible, and to decrease barriers that impede their learning and well-being. Recognizing and respecting the views of autistic advocates, I have attempted to adopt use of the term supports in this dissertation where possible, however, the terms treatment and intervention are also
used. This is because, regardless of a child’s diagnosis, a primary role of SLPs is to deliver treatment and interventions to children who present with challenges in the domains of speech, language, and communication development. When SLPs are searching for information to inform their clinical practice, terms such as therapy and intervention are likely to be used. Therefore, in order to ensure this research aligns with the services SLPs deliver, and is easily searchable within databases, I have included these terms within my work.

1.4.2 The Importance of Providing Supports as Early as Possible

With a growing emphasis on early diagnosis of autism comes a need for interventions designed to support young children and their families. It is widely believed that providing supports at the earliest age possible capitalizes on the brain’s neuroplasticity and period rapid of growth that occurs in children at a young age (e.g. Dawson, 2008; Sullivan, et al., 2014; Wallace & Rogers, 2010). We know that autistic children who receive intervention at younger ages make greater gains than those who enter programs at older ages (Harris & Handleman, 2000; Sheinkopf & Siegel, 1998). Research has also shown that the ways autistic children interact with their environment when they are young can impact neurodevelopment, potentially yielding effects that extend beyond childhood (see Sullivan et al., 2014).

Many intervention programs have been developed to support young children with autism and their families. Most of the research on these programs has been conducted with preschool-aged children, although recently there has been an increase in research examining interventions specifically developed for use with infants and toddlers with suspected or diagnosed autism (e.g., Brian et al., 2017; Green et al., 2017; Wetherby et al., 2014). Given the heterogeneity of autism, it is advantageous to
have a diversity of program options, but it also makes it difficult for clinicians and families to select the best fit for their child and family as a whole. Each program may support unique skill development areas and evolve from different theoretical models of child development, but despite theoretical differences, there are likely to also be common elements shared across these programs.

Generally speaking, the elements shared across intervention programs for young autistic children are thought to include: (a) parent involvement, (b) individualization of the treatment program to fit each child’s developmental profile, and (c) a focus on using natural environments so as to include a range of integrated learning targets (Sullivan et al., 2014; Wallace & Rogers, 2010). These key elements constitute recurring themes throughout this dissertation, and thus warrant a brief introduction here.

1.4.3 Parent Involvement

Parents play a prominent role in their children’s social communication development (Hart & Risley, 1995; Smith, Landry, & Swank, 2000; Tamis-LeMonda et al., 2001). Therefore, involving families within early intervention is considered best practice (Zwaigenbaum et al., 2019). A variety of terms are used across the literature to capture the inclusion of parents within intervention processes (e.g., parent coaching, parent training, parent-mediated interventions, parent support groups, reviewing therapy progress with parents; Bearss et al., 2015). Each of these terms reflects a qualitatively different approach to how parents are included within the interventions. Nonetheless, interventions that include parent involvement principally focus on building caregivers’ capacity to support their child within the context of their everyday activities and routines. They are considered triadic treatment models where (a)
clinicians use direct coaching, reflective practice, and/or teaching to help parents learn communication facilitation strategies, (b) parents learn strategies during sessions, and (c) the child receives intervention directly from their parent during sessions and in-home. Interventions that include parents within the therapeutic process are thought to align with the transactional theory of development, which considers the bidirectional nature of child development (Sammeroff, 2000).

1.4.4 Individualization of Treatment Programs

As was previously mentioned in section 1.3.5, the vast heterogeneity of autism requires personalized interventions (Massi et al., 2017). Autistic children’s response to treatment can be variable, with some children making substantial gains, and others seeing only modest gains (Howlin & Charman, 2011). However, we know little about the factors related to children’s variability in treatment response (Kilner & Dudley, 2020; Sherer & Schreibman, 2005). This leaves caregivers with little guidance for how to pick services and programs tailored to their child’s needs, and clinicians with little evidence for selecting supports tailored to each child’s individual differences. Furthermore, for young children, interventions need to be tailored not only to each child, but also to their family’s strengths and areas of challenge. Thus, it seems our pursuit of identifying effective interventions is relative, and consideration of how to identify and align the right supports with the right child and family profile needs to be further explored.

1.4.5 Use of Natural Environments/Integrated Learning Targets

The importance of embedding opportunities for language learning within social interactions has been documented in typical development (Kuhl et al., 2003) and in children with various challenges (e.g., Smyke et al., 2009). Interventions that embed
learning within children’s real-world interactions and daily routines are thought to promote cross-domain integration of skill development (Schribeman et al., 2015) and generalization of skill acquisition (Kashinath et al., 2006). At a biological level, it is thought that children’s neural connections are strengthened through social interactions with familiar caregivers, and repeated experiences within their social and physical worlds (Carter et al., 2005). For young children, one essential natural environment is their play environment. For this reason, many interventions that embed their programs within young children’s everyday interactions are referred to as play-based interventions. The concept of embedding intervention within children’s daily routines and play aligns with both ecological systems and transactional theories of development, as they promote integrated learning within bi-directional social interactions (Bronfenbrenner, 1979; Sameroff, 2000).

### 1.5 Objectives

With speech-language pathology services among the most frequently accessed early interventions after children receive an autism diagnosis (Denne et al., 2018; Salomone et al., 2016; Volden et al., 2015), research focused on understanding SLP-delivered interventions is imperative. The overarching purpose of the research in this dissertation was to enhance our understanding of intervention programs offered by SLPs to children with autism, and to contribute to the research considering how to best support social communication and language of children with autism. The next three chapters continue the discussion introduced within this chapter, through: examining the extent, range, and nature of research on interventions provided by SLPs to autistic preschoolers (Chapter 2); systematically reviewing the research on one type of intervention commonly used by SLPs (Chapter 3); and, finally, examining the impact one support strategy
(environmental modification) may have on children’s social communication (Chapter 3). These are described in further detail below.

The first study, described in Chapter 2, used a scoping review methodology to look broadly at the state of research in the field of speech-language pathology and preschool autism interventions. We examined the extent of research conducted within the field, identified the range of skill development areas targeted within the research, and explored characteristics of the interventions.

The second study, described in Chapter 3, was a systematic review of one treatment option available to young children with suspected or diagnosed autism for supporting their social communication and language skills, namely, developmental social pragmatic interventions. We examined the impact of developmental social pragmatic interventions in supporting (a) foundational social communication and language skills of preschool children with autism spectrum disorder and (b) caregiver interaction style. Additionally, we reviewed results exploring mediators and potential factors influencing children’s response to developmental social pragmatic interventions.

The third study, described in Chapter 4, used data collected from a previous research study conducted at York University (where I worked as a research SLP) to retrospectively examine the impact of the play environment on preschool autistic children’s social communication and language skills, to explore the impact of one key ingredient used in preschool autism programs. As a member of the group that collaborated on the York University MEHRIT research study (Casenhiser et al., 2013; 2015), I was granted access to videotapes collected as a part of this study for retrospective analysis in my dissertation work.
Collectively, these three studies aimed to contribute to a broader understanding of SLP-delivered interventions for preschoolers with autism, and to begin the work of examining how specific ingredients included within in early interventions might interact with social communication behaviours.
References


Chapter 2
Looking Back and Moving Forward: A Scoping Review of Research on Preschool Autism Interventions in the Field of Speech-Language Pathology

2.1 Introduction

Variations or challenges in social communication and social interactions are core behavioural features of autism spectrum disorder (ASD) or autism spectrum conditions, referred to here as autism (American Psychological Association, 2013; Fletcher & Watson, 2019). The extent and range of communication and social interaction challenges often faced by autistic individuals varies from person to person and the degree of these difficulties can impact long-term outcomes and overall quality of life (Tidmarsh & Volkmar, 2003). Some autistic individuals achieve independent living, develop lasting relationships, obtain higher education degrees, and work in competitive jobs. However, many do not and for these individuals, their social and communication challenges can negatively impact community involvement, health, and overall quality of life (Marriage et al., 2009; Gentles et al., 2020).

There is evidence to support better outcomes for children with autism who receive early intervention (e.g., Beaudoin et al., 2014; Hampton & Kaiser, 2016), and one of the best predictors of long-term outcomes in individuals with autism is functional use of language and social communication skills by 5-6 years of age (Szatmari et al., 1989; Taylor & Seltzer, 2011; Tidmarsh & Volkmar, 2003). Therefore, it is not surprising that speech-language pathology services are the most frequently accessed interventions after children receive an autism diagnosis (Denne et al., 2018; Jabery et al., 2014; Salomone et al., 2016; Volden et al., 2015) and that parents of autistic children have
consistently identified communication and social domains as treatment priorities for their children (Pituch et al., 2011). Thus, from a public health and family well-being perspective, services from speech-language pathologists (SLPs) are an especially critical component of efforts to support autistic children and their families and research focused on understanding the services provided by SLPs is imperative.

The aim of this article is to look broadly at the state of research in the field of speech-language pathology and preschool autism interventions, in order to reveal the types of intervention studies that could be used to address and inform the practices of SLPs, and to identify knowledge gaps. Many reviews have evaluated the efficacy of interventions that aim to support autistic children’s communication and language development (e.g., Hampton & Kaiser, 2016; Smith & Iadarola, 2015; Wetherby & Woods, 2008; Sandbank et al., 2020). However, isolating the studies that examined interventions delivered (at least in part) by SLPs was not the focus of these reviews. Identifying and examining research that represents the roles served by SLPs within preschool autism intervention delivery can be used to identify research gaps in the field so they can be addressed in future research and, ultimately, be used to strengthen clinical practice and policy development related to the services provided by SLPs.

2.1.1 A Note on SLP Interventions and Programs

Autism is thought of as both a “medical condition that gives rise to disability… and an example of human variation that is characterised by neurological and cognitive differences” (Lai et al., 2020, pp. 4). Because of this, the idea that autistic people require intervention or treatment has become controversial. This is because use of the terms treatment or intervention can be interpreted to imply that autism itself is something that needs to be “treated” or “cured”. SLP services do not aim to “cure” or “treat” autism;
instead their intervention services focus on enhancing the wellbeing of both the autistic child and their family through supporting communication development and alleviating distress that a child or caregiver might be experiencing due to breakdowns in communication.

SLPs receive specialized training in how to support a range of skill development areas such as use of augmentative communication, speech production, language comprehension, language use, social communication, play, and feeding and swallowing. This variety is echoed in reports examining the intervention practices of SLPs working with autistic preschoolers in real-world settings (Hsieh et al., 2018; Gillon et al., 2017). The diversified training and breadth of SLPs’ scope of practice enhances their ability to tailor the selection of treatment goals and strategies to each individual child, which is imperative given the heterogeneity of autism. However, the wide range of treatment options available to SLPs and interest in providing flexible individualized intervention programs also poses challenges, making it difficult to select the single or combination of evidence-based early interventions(s) that are ‘just right’ for a given individual with autism.

2.1.2 The Current Study

To gain a comprehensive understanding of the state of research on preschool autism interventions provided by SLPs, this review aimed to answer the broad question: What is the extent, range, and nature of the research conducted on preschool autism interventions delivered at least in part by SLPs? In answering this question, we would be able to map the existing literature base on SLP interventions provided to preschool children with autism, provide insight into the types of intervention characteristics used across research studies, identify research gaps and needs, highlight pathways for future
research and policy development, and inform future funding initiatives and resource allocation.

We elected to focus on preschool aged children because of the important role that early intervention plays in autistic children’s long-term outcomes (e.g., Hampton & Kaiser, 2016), the specific importance of achieving functional communication by the end of the preschool period for maximizing long-term outcomes (e.g., Tidmarsh & Volkmar, 2003), and the fact that families frequently seek out the services of SLPs following their preschoo1er’s diagnosis (e.g., Volden et al., 2015). We chose to use a scoping review because this method is particularly useful for mapping a specific area of research that has not been comprehensively reviewed before and examining ‘what’ and ‘how’ research has been conducted within a particular field (Arksey & O’Malley, 2005; Munn et al., 2018). A scoping review involves broadly searching the available literature and extracting relevant information, and is often a pre-cursor to more detailed systematic reviews focused on examining the effectiveness and meaningfulness of particular practices (Munn et al., 2018). Five key phases are involved in conducting a scoping review: (1) articulating the research question; (2) identifying relevant studies; (3) selecting studies; (4) charting the data; and (5) collating, summarizing, and reporting results, and an optional sixth phase - consulting with stakeholders (Arksey & O’Malley, 2005; Levac et al., 2010). The optional sixth phase was not formally conducted in this study. However, stakeholders (i.e., practicing SLPs and SLP-researchers) were well represented on our team and thus were able to provide insight about the clinical relevance of the review.

2.2 Methods

Methodology for this scoping review was in accordance with the guidelines outlined by Arksey and O’Malley (2005). Our review included articles published since
1980, when autism was first included as a diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (American Psychological Association, 2013).

2.2.1 Phase 1: Articulating the Research Question

The central question guiding our scoping review was: What is the extent, range, and nature of published experimental literature on preschool autism interventions implemented – in part or in whole – by SLPs? In order to reflect the range of real-world SLP-delivered services, we included studies examining interventions delivered solely by SLPs, and those examining interventions where the SLP was one of the professionals within a group of non-SLPs delivering the intervention. Specifically, we were interested in identifying: (a) the extent of research conducted to date on interventions delivered to autistic preschool children by SLPs, including information about the progression of research over time, the study characteristics (i.e., study design, location, participant diagnostic information), and the role of SLPs in delivering intervention, (b) the range of intervention targets examined within the literature, and (c) the nature of these interventions including theoretical underpinnings of the interventions researched, service delivery models, and treatment dosage.

2.2.2 Phase 2: Identifying Relevant Studies

In consultation with an expert health sciences librarian at Western University, we developed a concept map and search queries for seven electronic databases: Scopus,ERIC, PsycINFO, EMBASE, AMED, PubMed and CINAHL using a combination of relevant keywords and controlled vocabularies such as MeSH terms. Search strategies were adjusted to each database to identify relevant articles published between January 1980 and December 2019. Our search strategy was intentionally designed to be comprehensive to include all relevant articles. All searches included at least one identifier
for ASD (e.g., autism, PDD-NOS, etc.) linked to at least one identifier for intervention (e.g., therapy, treatment, intervention) and one identifier for SLP (e.g., clinician, therapist, speech-language therapist). Search results were imported into an Excel document and duplicates were identified and removed using the sorting feature. Search strategies and limits for all databases are provided within Appendix A.

2.2.3 Phase 3: Selecting Studies

After removing duplicates, articles were reviewed in three steps: titles, abstracts, and full text review. Five reviewers (2 SLPs and 3 graduate students training to become SLPs) participated in the selection of studies. Prior to independently reviewing titles and abstracts, 25% of the articles were double coded to establish a minimum of 95% reliability between coders for kept articles. During full text review, two reviewers independently assessed the full text of all potentially relevant articles for eligibility. During both the abstract and full text reviewing steps, at least one of the reviewers was a certified SLP. Discrepancies between reviewers were resolved through consensus with the first author. Reference lists of all included articles were also reviewed to identify additional studies to be assessed for eligibility. Inter-rater reliability was calculated for full text screening.

For articles to be included in this review, they had to meet the following predetermined criteria: (1) participants were between 1 month and 5;11 years old, or the mean age was below 6 years; (2) children were diagnosed with autism (inclusive of past diagnostic labels PDD-NOS or Asperger syndrome) or were suspected to have autism; (3) the study evaluated a treatment provided or supervised by a SLP; (4) articles were written in English. We included children suspected to have autism, but not yet diagnosed because many children do not receive an autism diagnosis until they are 4 years old (Christensen
et al., 2016). For single subject studies that included subjects outside of our pre-determined age range, only data for subjects who fell below 6 years of age were included. Community based studies that included over 90% of subjects with autism or suspected of having autism were also included. For the purposes of this article, suspected of having autism was defined as showing documented challenges in social communication skills and restricted or repetitive behaviours. Treatments provided by a SLP were defined as services directly provided by a SLP or SLP graduate student, supervised by a certified SLP, or provided in collaboration with a SLP. Articles were accessed electronically or authors were contacted to obtain a reprint.

2.2.4 Phase 4: Charting Data

A table for extracting information from the included articles was developed a priori and inter-rater reliability between reviewers was calculated for data extracted. Information extracted from each article included: author names, year of publication, article title, study design, sample size, the SLP’s role within the program (e.g., supervision, team, direct service), participant characteristics (i.e., age, autism diagnosis or suspected autism), type of speech-language intervention (i.e., skill development area(s) targeted), brand name of treatment program, theoretical approaches underlying intervention, service delivery model (i.e., group, 1:1 intervention, parent/caregiver training, remote therapy), intervention dosage (intensity, frequency, duration), location of service (e.g., home, clinic, daycare), country where intervention was delivered, and notes or questions for future reference.
2.2.4.1 Participant Characteristics

For each participant meeting criteria for this review, we recorded the child’s age and whether there was a diagnosis of autism or if the child was suspected of having autism but did not have a formal diagnosis.

2.2.4.2 Type(s) of Speech-Language Intervention

For each included study, we identified primary skill area(s) that each intervention aimed to support. We pre-defined social communication interventions as programs that targeted foundational communication skills including engagement, synchronous communication, joint attention, reciprocal interaction, use of affect, and regulation (Binns et al., 2019; 2020). Language focused interventions were classified within three different categories: general language (including both language production and comprehension), programs that specifically targeted language production, and programs that focused on language comprehension skills. Studies where augmentative alternative communication (AAC) systems were sometimes used by children, but use of the system was not the focus of the intervention, were not identified as AAC interventions. Instead they were classified according to the distinct skill area(s) addressed by the intervention (e.g., social communication and targeted behaviour; Smith et al., 2015). Interventions where clinicians supported children’s use of AAC systems were identified separately. We defined speech-based interventions as those that targeted one of articulation, oral-motor production of speech sounds, voice, or fluency. Interventions that focused on skills such as imitation, flexibility, and adaptive behaviour were identified as interventions for targeted behaviours. Feeding interventions were distinct from other behaviour focused treatments. Finally, we pre-defined play interventions as those that aimed to support
children’s development of play skills or use of social dialogue specific to play scenarios (e.g., peer play, use of social scripts).

2.2.4.3 Theoretical Approaches Underpinning Interventions

Each intervention was classified using one of the three common approaches in which SLPs receive training: clinician-directed, child-centred, and hybrid (Paul et al., 2018). Theoretical models underpinning interventions were identified using information provided within the article (e.g., authors self-identified the theoretical model influencing the intervention, intervention descriptions), and searching supplemental material describing intervention approaches (i.e., therapy manuals, therapy brand websites). The following definitions were used to guide classification of theoretical models informing intervention programs. Clinician-directed interventions were defined as using a high level of structure, drill, explicit prompting, error shaping, reinforcement of correct responses, clinician-directed modelling, or principles of applied behaviour analysis to support communication and language. Child-centred interventions (also known as developmental social pragmatic or naturalistic approaches) were identified as treatment approaches that created communication and language learning opportunities within natural settings and used strategies such as following the child’s lead, recasting, expanding, extending, modeling, and language mapping (Binns & Oram Cardy, 2019; Ingersoll, 2010). The classification of a hybrid approach was assigned to interventions that included a balanced use of both clinician-directed and naturalistic elements to support communication and language development. When a single study examined two different interventions with different theoretical models underlying each intervention, we documented both of the theoretical models used (e.g., Paul et al., 2013).
2.2.5 Phase 5: Collating, Summarizing and Reporting Results

Following data extraction, we used frequency analysis and narrative synthesis involving extraction of themes around treatment characteristics to summarize our findings.

2.3 Results

2.3.1 Extent of Research

Our initial search of seven databases yielded 23753 potentially relevant citations. After removing duplicates (n=3442) and completing title (n=19796) and abstract screening (n=4506), 1026 citations remained for full text review. Following full text review, a total of 108 articles, reporting on 104 treatment studies met inclusion criteria and remained for data extraction. When study results were reported within more than one article, information from each of the articles was included and collapsed into one entry (e.g., Casehniser et al., 2013; 2015). An additional 10 studies were included after searching reference lists of all articles meeting inclusion criteria, resulting in a total of 114 studies included within this scoping review.

Interrater agreement during title and abstract screening was 97% based on double coding of 25% of the articles, and interrater reliability was $k=0.90$. For full text review, agreement between reviewers double coding all articles was 96%, with interrater reliability $k=0.88$. There was 94% interrater agreement for the data extraction phase after double coding of all articles meeting inclusion criteria. References for the 118 included articles, reporting on 114 studies, are available within Appendix B

2.3.1.1 Study Characteristics

Publication dates of the selected studies ranged from 1980 to 2019. There was a marked increase in SLP-delivered autism intervention publications since 2010, with 67%
of the articles \( n=76 \) in this review having been published since 2010. Another 23\% of the articles \( n=26 \) were published between 2000 and 2009. Studies were conducted across 6 continents within 21 unique countries, with the majority of studies occurring within North America. See Figure 1 for a breakdown of the number of articles published over the last four decades and study locations.

2.3.1.2 Study Designs

As outlined in Figure 1, case study or single subject study designs were the most frequently documented within the literature (51\%; \( n=58 \)), followed by pre-post single group designs (18\%; \( n=21 \)), randomized control trials (RCTs; 18\%; \( n=21 \)), and quasi experimental group study designs (12\%; \( n=14 \)). All RCTs were conducted within the last 10 years. Data analysis techniques used within the studies varied greatly and included descriptive analysis, measures of central tendency (means, median, mode) and variation (Standard Deviations), changes in raw scores, percentage correct, and inferential analysis (paired T-test, ANOVA/ANCOVA, linear regression).

2.3.1.3 Participants

Sample sizes varied from 1 to 210. Within the included studies, 3095 children who ranged in age from 7 months to 5;11 participated. Overwhelmingly, the treatment programs were provided to children who had received a diagnosis of autism (90\%; \( n=103 \)). See Figure 1.

2.3.1.4 SLP Involvement in Intervention Programs

A variety of terminology was used within publications to identify clinicians as SLPs (e.g., speech language clinician, speech language therapist, speech therapist, specially trained language clinician, clinician with familiarity with developmental psycholinguistics, and communication interventionists). When clinicians were not explicitly identified as SLPs
Figure 1. Number of studies by (a) decade published, (b) continent of origin, (c) participant diagnostic information, and (d) study design.
(e.g., clinician with familiarity with developmental psycholinguistics), the professional background of the therapists was verified with the authors of the publications. Also prevalent were non-specific references to the professional background of the clinicians delivering intervention (e.g., clinician, therapist, the second author, the researcher). Of the 114 studies included in this review, 21% \( (n=24) \) did not report the professional background of the therapists within the publication. When publications reported that ‘the authors’ delivered interventions, we searched their professional background using Google to determine if the interventionists providing therapy in these studies included SLPs. We were also able to obtain information about the professional background of interventionists from the authors via email. Notably, an additional 23 articles within the full text review phase of study selection also had missing information about the professional background of clinicians delivering the intervention studied in their article. We were not able to obtain information about the professional background of the clinicians for these articles therefore they were excluded. This resulted in a total of 47 of the articles reviewed during the full text inclusion/exclusion phase requiring reviewers to search for additional information about the professional background of clinicians.

Almost half of the treatment programs were provided by SLPs or SLP graduate students alone (45%; \( n=51 \)), while 63 programs (55%) were provided by a range of professionals (that in some way included SLPs) – referred to within this article as *multi-professional delivery*. Of the 76 articles published within the last 10 years, 63% involved interventions delivered by multi-professionals \( (n=48) \). When interventions were delivered by multi-professionals, the SLP’s role varied greatly across studies. Within the group of interventions classified as multi-professional, some programs had SLPs providing direct 1:1 therapy to some of the participants, while the other participants did not receive SLP
services, rather therapists from other professional backgrounds serviced them (e.g., Weatherby & Woods, 2006; Yu et al., 2010). Other intervention programs classified as being delivered by multi-professionals, had each participant receiving 1:1 direct therapy from SLPs, and 1:1 direct therapy from other professionals on the team (e.g., Occupational Therapists; Casenhiser et al., 2013; 2015). Within other programs, SLPs played the role of supervising educators or behaviour therapists providing 1:1 therapy (e.g., Dyer, 2008; Friedman & Woods, 2015; Muldoon et al., 2018). The extent of supervision varied across the studies, ranging from SLPs supervising each session (e.g., Koegel et al., 1996) to SLPs supervising a program every 3 months (i.e., Dawson et al., 2010).

2.3.2 Range of Skill Development Areas Targeted

We identified 9 skill development areas targeted within the 114 included studies: social communication, language, AAC, targeted behaviours, play, speech, feeding, auditory processing, and social emotional skills. Some programs targeted multiple skill development areas (32%; n=36). We identified programs as comprehensive interventions when they were delivered by multiple professionals who did not examine specific skill development areas within the outcome measures (i.e., instead only used autism rating scales or diagnostic assessment tools as outcome measures) (4%; n=4; e.g., Hojati, 2014; Papavasiliou et al., 2011). See Table 1 for a list of skill development areas targeted and examples of specific skills falling within each identified area.

2.3.2.1 Social Communication and Language Interventions

The majority of programs targeted social communication (n=63). Almost half of these interventions (48%; n=30) also targeted other skill development areas within the program (e.g., language, play, AAC, targeted behaviours). Interventions targeting autistic
Table 1. Range of Skill Development Areas Targeted Within the Included Studies

<table>
<thead>
<tr>
<th>Skill development area</th>
<th>Examples of specific skills targeted</th>
<th>Examples of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Communication</td>
<td>Engagement, gestural communication, reciprocal interactions, use of affect, joint attention, synchronous communication and initiation of communication</td>
<td>Green et al., 2010; Mcduffie et al., 2015; Rogers et al., 2012; Smith et al., 2015; Venker et al. 2012</td>
</tr>
</tbody>
</table>
| Language               | *Production:* language use, question asking, expanding use of commenting, vocabulary use, verbal language  
Comprehension: response to question probes | Brown & Woods, 2015; Casenhiser et al., 2015; Hampton et al., 2019; Salt et al., 2001; Summers et al., 2017 |
| AAC                    | Use of low or high tech devices, PECS, sign language | Tan et al., 2014; Thiemann-Bourque et al., 2018; Yoder & Stone, 2006 |
| Targeted Behaviour     | Imitation, escape behaviours, flexibility in routines, academic performance | Koegel et al., 2003; Dawson et al., 2010; Shire et al., 2017 |
| Play                   | Peer play behaviours, play dialogue, play steps, occurrence of novel play | Barbar et al., 2016; Murdock et al., 2013; Shire et al., 2017 |
| Speech                 | Articulation, oral motor production | Chenausky et al., 2017; Dyer, 2008; Rogers et al., 2006 |
| Feeding                | Level of food acceptance, mealtime behaviours | Muldoon & Cosby, 2018 |
| Auditory Processing    | Auditory perception (in children with cochlear implants and autism) | Mikic et al., 2016 |
| Social Emotional       | Regulation of emotions, social emotional functioning | Mahoney & Perales, 2003; Yu & Zhu, 2018 |
preschoolers’ language development were also prevalent within the studies in this review (n=39). Language production skills were most frequently targeted (n=19), followed by studies targeting both language comprehension and production (n=18). Two studies (Grela & McLaughlin, 2006; Yorke et al., 2018) targeted language comprehension alone (n=2).

2.3.2.2 AAC Interventions

AAC was another predominant skill development area targeted within the SLP-delivered interventions (n=20). Both low (n=13) and high tech (n=7) communication systems were included within this category. Three additional studies reported that participants receiving treatment were provided access to AAC supports when it was determined to be appropriate (i.e., Paynter et al., 2018; Reis et al., 2018; Smith et al., 2015). However, we did not classify these interventions as targeting AAC specifically as we could not identify how often this support was used across participants and supporting use of AAC was not the primary focus of the intervention.

2.3.2.3 Targeted Behaviours and Other Areas

Targeted behaviours were also addressed within the interventions included within this review (n=13). Targeted behaviours included interventions focused on supporting imitation skills (e.g., Cardon et al., 2012), non-contingent escape (e.g., Coleman et al., 1998), developing flexibility within routines (e.g., Ivey et al., 2004), reducing problem behaviours (Koegel et al., 2003), and adaptive functioning (e.g., Smith et al., 2015). Over half of the studies that addressed targeted behaviours also focused on supporting other skill development areas (64%; n=9; i.e., language, social communication or play). The remaining skill development areas targeted within the included studies were play (n=9), speech (n=3), social emotional (n=2) auditory processing (n=1), and feeding (n=1).
2.3.3 The Nature of Interventions Delivered by SLPs

2.3.3.1 Theoretical Models

The most frequently reported theoretical models underlying intervention programs were child-centred, developmental-naturalistic models (38%; \( n=45 \)), followed by clinician-directed interventions based on applied behaviour principles (30%; \( n=36 \)) and hybrid approaches that combine aspects of both behaviour and developmental-naturalistic models (22%; \( n=26 \)).

Five studies compared two different treatments aligned with different theoretical models (i.e., Hilton & Seal, 2007; Koegel et al., 1996; Koegel et al., 1992; Paul et al., 2013; Prelock et al., 2011). For these studies we extracted information about both intervention programs, thus we examined a total of 119 different programs. We were not able to determine the theoretical models underlying 12 of the interventions (10%).

We also examined the theoretical models underpinning the interventions that targeted specific skill development areas. For programs that targeted multiple skills, we accounted for each skill area separately within our calculations. For the 5 studies that examined two different interventions that aligned with different theoretical models, each intervention was accounted for separately within the analysis. See Figure 2 for an examination of the theoretical models used to underpin each of the targeted skill development areas.

2.3.3.2 Service Delivery Models

Across the included 114 studies, we identified 9 unique service models used to deliver the interventions. The majority of studies used a single service model (61%; \( n=70 \)), while 38% (\( n=43 \)) used a combination of service delivery models (e.g., parent coaching + direct therapy), and 1% (\( n=1 \)) was unknown.
Direct Therapy. Direct therapy, where a clinician worked 1:1 with a child, was the prominent model (n=63) and was used in conjunction with other service delivery models within 24 of the interventions. Proportionally, interventions targeting speech (75%), AAC (52%) and play (50%) were most likely to use a direct service delivery model. Direct 1:1 therapy models were also frequently used when targeting behaviours (47%) and language skills (42%).

Parent Coaching. Delivering intervention programs using parent coaching was also prevalent (n=36). We defined parent coaching as an intervention that involved clinicians providing direct 1:1 guidance and support to parents as they were interacting with their child. Some interventions exclusively used parent coaching (n=18), while the others combined parent coaching with other service delivery models (e.g., direct therapy, group therapy). Social communication was the most common skill area targeted using parent coaching.

Figure 2. Theoretical models underpinning interventions targeting the nine skill development areas, and comprehensive interventions.
Caregiver Education. We differentiated treatment programs that used parent coaching from those that provided caregiver education \((n=22)\); i.e., workshops, webinars, clinician parent review meetings not in the presence of the child). Exclusive use of caregiver education was rare \((n=2)\). Most programs used caregiver education in addition to other service delivery models (e.g., direct 1:1, parent coaching).

Other. Other service delivery models identified included educator coaching \((n=6)\); educator training \((n=4)\); classroom delivered interventions \((n=4)\); small group therapy \((n=13)\); peer mediated interventions \((n=7)\); and remote (virtual) services \((n=3)\). For a breakdown of service delivery models used across the different skill development areas targeted, see Figure 3.

Figure 3. Number of times service delivery models were used across interventions targeting specific skill development areas.

Note: Some interventions used multiple service delivery models and each was accounted for within this graph. No service delivery model was identified for the single intervention targeting auditory processing skills.
2.3.3.3 Dosage

Treatment dosage varied greatly across the included studies. Session length ranged from 10 minutes to 3 hours. Frequency of sessions ranged from 1 session monthly to 7 times/week and the duration of the intervention programs ranged from 3 weeks to 2 years. Reporting details of treatment dosage also varied vastly across studies. Generally, articles published since 2000 provided more information about treatment dosage than those published before 2000, with some even sharing the number of trials with which a child was presented during treatment (e.g., Al-dawaideh & Al-Amayreh, 2013; Reichle et al., 2018).

It is expected that the treatment dosage of interventions delivered by SLPs independently would differ from interventions provided by multi-professionals, and that different service delivery models would also differ in treatment dosage (e.g., caregiver education vs direct 1:1 services). Furthermore, with many of the studies that examined interventions delivered by multi-professionals not specifying the breakdown of treatment dosage across service providers, we decided to examine patterns in treatment dosage only for interventions delivered solely by SLPs. We were able to examine treatment dosage patterns in the two most frequent service delivery models delivered by SLPs alone (direct 1:1 and parent coaching), but there was not an adequate number of studies delivered solely by SLPs using other service delivery models to comment on patterns of treatment dosage within them.

**Direct 1:1 Services.** For interventions delivered solely by SLPs using a direct 1:1 service delivery model, the session length (intensity) ranged from 15-60 minutes, with 30-45 minutes being the most frequently reported length. Session frequency ranged from 1/week to 7/week, with 3/week being the most common. Duration of the programs
delivered with 1:1 SLP sessions ranged from 3 weeks to 10 months and varied across studies.

**Parent Coaching.** For parent coaching sessions delivered solely by SLPs, the intensity of treatment ranged from 30 minutes to 2 hours. The frequency of sessions ranged from daily to monthly, and the duration of the program ranged from 10 weeks to 12 months.

### 2.4 Discussion

This scoping review provided important insights into the literature on interventions delivered to autistic children via SLPs. We mapped the literature base to identify: the extent and location of research conducted on interventions delivered by SLPs, the progression of research over time, the study designs used, and the skill development areas targeted. Additionally, we examined the nature of the interventions studied to date, including the SLP’s role in delivering the intervention, the theoretical models guiding the intervention program, service delivery models, and treatment dosage.

#### 2.4.1 Extent of Research Specific to Speech-Language Pathology

We identified a total of 114 studies examining interventions delivered, at least in part, by SLPs to autistic children under the age of 6 years. Single Subject Designs were the most prevalent research design, followed by pre-post single group designs, RCTs, and quasi experimental group study designs. Most studies involved children who had already received a diagnosis of autism and were conducted within North America. Given that 78% of SLPs in the United States report servicing autistic children (Plumb & Plexico, 2013), the frequent use of SLP services by families of young children diagnosed with ASD (e.g., Volden et al., 2015), and the range of skill development areas that fall within SLPs’ scope of practice, the quantity of studies examining SLP-delivered preschool
interventions is relatively small. However, it is consistent with the general need for more intervention studies in the field of speech-language pathology (Justice et al., 2008).

Although the total number of studies examining preschool autism interventions over the past 40 years is relatively small, there has been an upsurge in these publications over the past 10 years. Over half of the studies and all of the RCTs included in this review were conducted between 2010-2019. This increase in publications on autism interventions and investment in larger scale RCT studies mirrors the continued increase in the number of children diagnosed with autism and the progressively earlier age of diagnosis (Baio et al., 2018). Nonetheless, the extent of research examining interventions provided by SLPs to autistic preschool children continues to lag behind research conducted on other approaches for autism intervention (e.g. behavioural interventions; see Sandbank et al., 2020).

Notably, two-thirds of the studies conducted since 2010 were delivered by multi-professionals (inclusive of at least one SLP) working either alongside or in collaboration with one another. Timing of the shift toward conducting research examining interventions delivered by a variety of professionals aligns with clinical practice recommendations for more holistic, comprehensive service provision within early interventions (American Speech-Language Hearing Association, 2008; Wallace & Rogers, 2010). This shift also mirrors common real-world practices reported by SLPs (in the United States) and family reports of multidisciplinary care (Green et al., 2006; Plumb & Plexico, 2013).

2.4.1.1 Potential Factors Impacting the Extent of Research

The relatively small number of studies on SLP-delivered preschool autism interventions, and the smaller proportion examining interventions delivered solely by SLPs, could be due to a variety of factors. First, there may be less opportunity to conduct
research within our field in general. Training in research foundations and participation in research labs during SLP graduate training appear to occur proportionally less often than seen in other fields (e.g., psychology, audiology, and medicine; Roberts et al., 2020). This is an important consideration for future curriculum and course development within graduate level SLP academic programs. Additionally, a subset of the articles we examined within our broad search of the literature did not mention the professional background of those delivering the interventions. Some studies indicated that “the first author” or “the researchers” provided the intervention, however, others categorized all professionals delivering the intervention as “interventionists” or “clinicians”. For these articles, we only learned that SLPs had a role in delivering the intervention after we did a significant amount of investigating (e.g., emailing, Google searches, examining university department websites). We were not able to determine the role of the therapists delivering the interventions for an additional 23 articles from the full text review phase, thus prohibiting their inclusion within this review. This lack of clear reporting of the professional designation of the professionals delivering the interventions within the autism intervention literature may have contributed to the relatively small literature base we were able to identify that examined SLP-delivered preschool autism interventions.

The absence of explicit information about the professional training of clinicians delivering the interventions is problematic for a number of reasons. First, this is considered to be a key quality indicator when evaluating the methodological rigor of interventions studies (Reichow, 2011), thus its absence reduces the quality of studies. Second, not mentioning speech-language pathology or speech-language therapy within the publication hinders the ability of researchers, policy makers, clinicians, and families to search for and meaningfully use the information published within these studies.
Finally, studies that generically referred to the people delivering the interventions as clinicians or therapists fail to acknowledge that practitioners with different educational backgrounds are likely to approach service delivery differently. Therefore, the unique skill set that SLPs bring to their clients’ communication challenges are not recognized. Moving forward, researchers need to make a concerted effort to clearly document the professional designation of clinicians delivering the interventions.

2.4.1.2 Study Designs

Another important finding to consider is the predominance of single subject designs across the literature in this review. Single subject designs are widely used within the field of speech-language pathology, and communication sciences and disorders at large. Historically, single subject designs have not been considered methodologically rigorous or generalizable to the larger population due to the small sample size. They are often excluded from reviews evaluating treatment effectiveness and study quality and are frequently overlooked within health systems when considering evidence-based practice (Byiers et al., 2012). However, well-designed, single subject study designs can produce valuable information for clinicians, families, and policy makers. They allow for systematic evaluation of the effects of a treatment at an individual level rather than examining the average impact of an intervention across patients, which is important when considering the heterogeneity of autism. Single subject designs are also well suited to allow researchers and clinicians to ask complex questions that may not be feasible to answer within traditional group or RCT designs (Byiers et al., 2012). Additionally, these study designs are usually more accessible because they are not as expensive to conduct as larger scale group or RCT designs. Within the field of autism intervention, there is precedent for using outcomes from single case experiments to inform policy
development. For example, the widespread global adoption of ABA intervention programs and public policy changes including state level mandated insurance coverage for ABA treatment (e.g., Steven’s Law, Arizona House Bill 2487), were predominantly supported by several hundred single case experiments (Matson et al., 1996).

Although single subject designs occurred most often across the studies included in this review, the variety of study designs used to examine preschool autism interventions have diversified over the past 10 years. Still, within our field there remains a need for additional research using differentiated study designs in addition to methodologically strong single subject designs. Of particular interest would be exploratory and pragmatic RCT study designs. RCTs are considered gold standard for treatment effectiveness research. They allow for examination of active therapeutic ingredients and subgroup variation in treatment response (e.g., comparative efficacy trials, adaptive treatment designs, mediation and moderation analysis), and results would provide SLPs with evidence that could be used to guide selection of intervention(s) or combining of supports to tailor SLP services to children and families’ needs. Pragmatic RCT designs are especially desirable as the interventions being investigated are administered in a way that captures real-world SLP service delivery. Thus, there is a strong focus on external validity (i.e. generalizability of the results to real-world clinical practice).

2.4.4 SLP Roles in Delivering Intervention

Interventions delivered solely by SLPs and in part by SLPs were relatively equally represented in this review. Interventions delivered in part by SLPs included programs delivered by multi-professionals (including SLPs) working either alongside or in collaboration with one another. The heterogeneity and complexity inherit in autism
make multi-professional delivered collaborative services a logical choice, but also pose problems for research.

When intervention programs are delivered by multi-professionals, each therapist comes to the team with their own educational background and professional views, potentially adding to the complexity of the intervention. As interventions become increasingly complex, the risk for variation in intervention delivery increases (Santacroce et al., 2004) and the need for examination of the potential impact of intervention components is underscored. Within the interventions that were delivered in part by SLPs, we found variability in the professional background of team members, access to services from members of the team (i.e., each participant did not always receive treatment from each professional on the team), the service delivery models used, and treatment dosage. Even the SLPs’ roles within teams differed across studies (i.e., supervision of non-SLPs vs direct 1:1 service provided by SLPs).

With autism intervention research shifting toward use of multi-professional interventions that are susceptible to variability, there is the opportunity to use evidence from these studies to inform development of evidence-informed care pathways for preschool children with autism. To support development of care pathways, future research focused on improving our understanding of processes, structures, and components used within interventions delivered by multi-professionals is essential (e.g., embedding process evaluations within RCTs), as are more studies using adaptive treatment designs and examining mediators and moderators of effective multi-professional interventions (e.g., dosage, service delivery models, child’s language level, caregiver stress). This work would also provide guidance for SLPs aspiring to providing flexible individualized intervention programs.
2.4.5 Range of Skill Development Areas Targeted

The literature map generated by this scoping review revealed that research activity reflects the breadth of SLPs’ scope of practice in terms of the range of skill development areas targeted. However, the research across different skill development areas was not evenly distributed. A total of nine skill development areas were targeted within the included studies, but interventions targeting three skill development areas made up the vast majority of the research.

Most widely researched were interventions that focused on supporting autistic children’s social communication skills, language, or use of AAC. This is not surprising given that autism affects how a person communicates with and socially relates to other people. Furthermore, SLPs report that they frequently target these skill development areas when working with young autistic children in real world clinical practice (Gillion et al., 2017). Nonetheless, further research efforts are needed to examine the impact of SLP interventions covering a wider range of skill development areas, including play, motor-speech production, feeding, and social emotional development.

To address these gaps, it would be useful to focus future research efforts on treatments for skill development areas that SLPs report they frequently target in sessions. For example, studies on interventions targeting play were few, despite play being a common skill development area targeted by SLPs working with autistic preschool children (Gillion et al., 2017). Another focus to future research could be interventions targeting skill development areas that SLPs are uniquely trained to support (e.g., motor-speech production), since it is less likely that research from other disciplines are contributing to the advancement of these types of interventions. Additionally, conducting practice-based research that examines interventions used in the delivery of real-world
SLP services would provide opportunity to capture information about, and generate more research aligned with, the range of skill development areas targeted by SLPs.

2.4.6 Nature of SLP-delivered Interventions

2.4.6.1 Theoretical Models Underpinning Interventions

Interventions underpinned by child-centred, clinician-directed, and hybrid models were relatively evenly represented in the studies included in this review. Those using child-centred models were most prevalent across the included studies and were predominantly used to target social communication and language skills. Child-centred models align with recommended early intervention practice (American Speech-Language-Hearing Association, 2008; Division for Early Childhood, 2014) and there is accumulating evidence supporting the use of these models for targeting social communication outcomes (Binns & Oram Cardy, 2019; Sandbank et al., 2020).

Interventions influenced by hybrid theoretical models were most likely to target social communication skills. Evidence for the effectiveness of treatments developed using hybrid models is also accumulating for both social communication and language outcomes (Sandbank et al., 2020).

Interventions targeting AAC were likely to use clinician-directed models. Because many of the AAC interventions examined in this review used the Picture Exchange Communication System (PECS; e.g., Lerna et al., 2012; Min & Wah, 2011; Reichle et al., 2018) and PECS is a program rooted in applied behaviour analysis, it is logical that most AAC interventions were classified as being clinician-directed. Only a few interventions appeared to deliver AAC interventions guided by child-centred or hybrid models of intervention (i.e., Barton-Hulsey et al., 2017; Min & Wah, 2011; Tan et al., 2014). More
research examining SLP-delivered AAC interventions using child-led and hybrid models to guide treatment programs is needed.

Despite theoretical differences between child centred, hybrid and clinician directed intervention programs, there are likely to also be common elements shared across these programs. Therefore, working toward gaining a clear understanding of the unique and shared elements of interventions guided by child centred, hybrid and clinician directed theoretical models is an important direction for future research in the field. This work would support efforts to: improve the consistency of assigning theoretical categories to interventions, identify which ingredients from child-centred models and clinician-directed models are being combined within hybrid interventions, and guide the analysis of how different intervention features mediate children’s response to treatment. Access to such information would support clinical decision making and development of evidence-informed policies.

2.4.6.2 Service Delivery Models and Treatment Dosage

Variability across treatment dosage and the service delivery models used within the interventions included in this review was pervasive across the studies. Given the range of skill development areas targeted by SLPs, the varying roles SLPs play within intervention delivery, and SLPs’ focus on individualizing intervention programs to fit each child’s unique needs, a certain degree of variability was to be expected. Variability is not inherently bad. It poses complexities for researchers but can also be a positive discovery when broadly examining a literature base within any given field. Variability within the literature means we have access to information about a variety of interventions, targeting different skill development areas, in different ways. This is meaningful given the heterogeneity of autism and SLPs intentions to provide flexible,
individualized supports. Nonetheless, we need research focused on understanding the impact of different service delivery models or treatment dosages (i.e., intensity, frequency, duration) on child outcomes, parent acceptability and stress levels, and the accessibility and feasibility of implementation within community programs.

Related to the accessibility of services for families and feasibility of implementation of treatment programs, the most predominant service delivery model used across the research was a direct 1:1 therapy model, and almost half of these programs used direct 1:1 therapy in combination with other models. Few studies used group-based service delivery models, which have been reported to be a cost-effective model within other speech-language services (e.g. Gibbard et al., 2004). Even fewer examined the use of remote (virtual) therapy services. Given the high prevalence of autism diagnoses globally, and the limited resources of many countries and health systems, a focus on conducting research examining potentially accessible and scalable service delivery models (e.g. peer, group, classroom, remote) within a range of real-world, community contexts, is also warranted.

2.4.7 Future Directions

Overall, it is clear that more research is needed examining interventions delivered by SLPs to autistic preschool children. A number of gaps and needs for future research were identified while conducting this scoping review and have been previously discussed. Beyond these, attention to broad methodological improvements is also warranted.

2.4.7.1 Evaluation of Efficacy, Effectiveness, and Study Quality

Quality appraisal of research and examination of treatment effectiveness falls outside the purview of scoping reviews (Arksey & O'Malley, 2005), but future efforts should be made to further examine the methodological quality and treatment
effectiveness of sub-groups of interventions delivered to preschool autistic children by SLPs (e.g., AAC interventions, play interventions, parent-coaching studies). With the high percentage of single subject studies examining SLP-delivered interventions, and the previously mentioned impact that well designed single subject designs can have on clinical decision making and policy development within the field of autism, examination of treatment effectiveness and study quality of preschool autism interventions delivered by SLPs – inclusive of single subject designs - is warranted. This suggestion is supported by the Oxford Centre for evidence-based medicine where single subject designs are ranked as Level 1 evidence, which means that single subject studies can be used to inform decisions about treatment for individual clients when they are used alongside systematic reviews of RCTs (http://www.cebm.net/).

2.4.7.2 Improving the Reporting of Intervention Components

Some of the studies included in this review provided complete information about the professional background of clinicians, service delivery, treatment dosage, and implementation of interventions (or referenced treatment manuals used to guide intervention delivery). However, many studies did not provide comprehensive and systematic information about the interventions delivered. The scarcity of such information is a significant shortcoming. First of all, it does not allow for study replication. It also makes it difficult to gain a clear understanding of the unique and shared theoretical underpinnings across interventions (e.g., child-led vs directive models) and does not cultivate examination of treatment mechanisms underlying change in children’s outcomes. Furthermore, without this information, clinicians are unable to use the information within the research articles to guide implementation of the interventions within real-world practice with autistic preschool children. As such, improving the
reporting of intervention characteristics through systematic presentation of the processes, structures and components used within interventions is necessary within future research studies.

One tool that could be useful for improving reporting quality is the Template for Intervention Description and Replication (TIDieR; T. C. Hoffmann et al., 2014), a 12-item checklist developed to address widespread poor reporting of clinical interventions within research articles (Hoffmann et al., 2014) that has been recommended for use within the field of speech-language pathology (Ludemann et al., 2017). The first two items provide background information about the intervention (Brief name & Why - Rationale/Theory). Procedural elements of the intervention are also accounted for within items 3-9 (What – materials; What – procedures; Who provided – drawing on what knowledge/training, how, where, when and how much; and Tailoring – what, when, why how). The final three items examine issues relevant to treatment fidelity (Modifications – what, when, why, how; How well – planned; and How well – actual). The checklist and further explanation, elaboration, and examples for each item, can be found at https://doi.org/10.1136/bmj.g1687.

2.4.8 Strengths and Limitations

This review offers a comprehensive picture of the state of research on interventions delivered by SLPs to autistic preschoolers and clearly demonstrates existing gaps. Findings can be used to guide future research within the field of speech-language pathology and can be used to support efforts advocating for the versatile role of the SLP within preschool autism services and for the need for more research in the area of preschool autism interventions delivered by SLPs. Although this review was an important first step, it has certain limitations. First, some relevant studies may not have been
identified despite our use of comprehensive and systematic search methods. Despite our best efforts to contact the authors of the publications that did not report the clinical training of the interventionists delivering therapy, we were not able to identify the interventionists within all of the studies and therefore these publications were not included in the review. Another limitation is that only citations that provided full texts in English were included (because of limited financial resources to translate); therefore, there is a chance that relevant studies, written in other languages, were left out. Additionally, only peer-reviewed articles were included within this review, leaving the possibility that publication bias might have impacted our dataset. We decided to only include peer-reviewed articles because we wanted to capture the literature base that was most likely to be accessible to clinicians and policy makers when developing plans. Finally, we did not pre-register the protocol for the scoping review, which would have added transparency and more rigor to the review process (Munn et al., 2018).

2.5 Conclusion

The current study sheds light on the status of research within the field of SLP and preschool autism interventions. Our findings captured the versatility of the SLP’s role within preschool intervention and revealed that research in the area of autism interventions delivered, at least in part, by SLPs has markedly increased over the past ten years. With this, there is still certain need for more research within our field. Future efforts focused on capturing the complex and individualized nature of interventions through improving reporting, increasing the sophistication of intervention study methodology (e.g., RCTs, comparative efficacy trials, adaptive treatment designs, mediation and moderation analysis), and aligning research and clinical practice through
community practice research would further the development of effective, evidence-informed policy and practice in the field of speech-language pathology.
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https://doi.org/10.1177/1362361319874647

https://doi.org/10.1159/000479063


Chapter 3

Developmental Social Pragmatic Interventions for Preschoolers with Autism Spectrum Disorder: A Systematic Review

3.1 Background and Aims

Developmental social pragmatic (DSP) treatment models have been cited as one of the primary treatment approaches used to address the social communication and language challenges characteristic of children with autism spectrum disorder (ASD) (Ingersoll et al., 2005; Prizant & Wetherby, 1998; Smith & Iadarola, 2015). These models are based on an integration of developmental psychology (Piaget, 1936), transactional models of development (Sameroff & Fiese, 2000), and the social pragmatic model of language acquisition (Bates, 1976; Bruner, 1975, 1983; Prutting, 1982). Like other interventions that are considered developmental, DSP interventions use the developmental sequences observed in typical development to inform assessment and treatment, with the assumption that the overarching principles of development are applicable to all children regardless of diagnosis (NRC, 2001). In alignment with social pragmatic theory, DSP interventions direct their emphasis away from focusing on the content and form of spoken language, and instead emphasize the importance of social engagement, communicative intent, and the flexible use of symbols within meaningful contexts (Gerber, 2003). Influenced by both transactional and social pragmatic models of development, DSP interventions also underscore the interpersonal aspects of communication and language development. They draw from the assumption that both social communication and language are learned within the context of affective social engagement with caregivers during natural interactions. Therefore, caregiver involvement—via training, coaching, and reflective practice—is a key component of DSP
interventions. Some inherent features of DSP interventions include encouragement of caregivers to join in with children’s ideas rather than promoting their own agenda during play, attunement, responsiveness, and natural reinforcement to all forms of children’s communication and arrangement of the environment to support communication (Ingersoll, 2010). These interventions align with recommendations by the National Research Council that ASD interventions (a) emphasize the inclusion of developmentally appropriate activities and individualized goals, (b) include ongoing assessment of the child’s developmental progress, (c) occur in inclusive settings, (d) include caregivers and family (e.g. parent training or coaching), and (e) are intensive (25 or more hours per week, when we consider both direct therapy and the amount of time parents implement the learned strategies at home) (NRC, 2001).

Previous reviews of interventions for children with ASD have included treatments classified as DSP within their evaluation (e.g. McConachie & Diggle, 2007; Odom et al., 2010; Oono et al., 2013; Smith & Iadarola, 2015; Vismara & Rogers, 2010; Wagner, et al., 2014; Warren; Wetherby & Woods, 2008). However, we still do not clearly understand the effectiveness of this approach to intervention. One of the barriers to progress is that previous reviews have not used consistent or explicit criteria to differentiate interventions claiming to be using a DSP model from other developmental or naturalistic behavioral approaches. This leads to inconsistency within the current literature regarding which treatments are classified as DSP. Ensuring that treatments share not only the self-identified title of DSP intervention, but more specifically share DSP theoretical principles and practice elements, is important for ensuring more homogeneity among the DSP treatment studies being examined. Additionally, having a set of core common features among the interventions under evaluation can provide the
advantage of examining potential mechanisms of action for efficacious DSP treatment models.

The aim of this systematic review was to build on the current literature, and add a level of specificity, in identifying DSP interventions used with children with ASD. Our first step was to develop a clear approach to classifying DSP interventions. With this in hand, we were then able to systematically evaluate whether DSP interventions are effective in (a) improving children’s foundational social communication skills (e.g. regulation, attention, engagement, joint attention, reciprocity), (b) improving children’s language, and (c) changing caregivers’ interaction style or communication. Additionally, we were able to explore which (if any) participant characteristics or intervention variables may impact the effectiveness of DSP-based interventions.

3.2 Methods

3.2.1 Search Procedures

Phase one search strategy. With the aim of being comprehensive in our scan of the literature, a multistep search strategy was used. The first phase involved identifying treatment interventions that either self-identified as a DSP intervention or were identified as DSP within peer-reviewed journals. Two independent reviewers explored previously published articles discussing DSP theory or DSP-branded interventions (e.g. Brunner & Seung, 2009; Ingersoll, 2010; Smith & Iadarola, 2015) and compiled a list of those treatments referred to as DSP.

Phase two search strategy. Following the identification of brand named DSP treatment approaches, we conducted systematic searches for each treatment approach using the name of the treatment (e.g. “DIR” OR “developmental, individual difference, relationship” OR “Floortime”; “Responsive Teaching”) and the key words (“Autism” OR
“ASD”) AND (“Intervention” OR “Treatment”). The searches were completed between November 2017 and April 2018 within five electronic databases: PsychINFO, SCOPUS, ERIC, CINAHL, and PUBMED. Publication dates were unrestricted in our search; however, only articles published in English in peer-reviewed journals were included. This initial search limited us to only studies that had been conducted after the treatment had formally received a name and would not have identified new DSP treatment approaches or DSP treatments not given one of the aforementioned brand names. Therefore, we also elected to conduct a broader search of the literature.

**Phase three search strategy.** To cast a wider net, we entered the following key words into the search databases: (“Developmental Social Pragmatic” OR “Relationship-based” OR “Transactional” OR “Social-Developmental”) AND (“Autis*” OR “ASD”) AND (“Intervention” OR “Treatment”) AND (“Communication” OR “Language”) AND (“RCT” OR “Randomized Control Trial”). Publication dates were unrestricted but the search was limited to articles on children from 0 to 5 years published in English in peer-reviewed journals. When available (i.e. PUBMED), a randomized trial filter was applied to the search in lieu of RCT search terms. Because terms related to DSP-based treatments may not appear in the title, abstract, or keywords, search parameters were set to “open field.” Google Scholar and reference lists of articles that met inclusion criteria were also examined to identify any articles that might have been missed.

**3.2.2 Selection criteria**

**Phase one selection criteria.** The compiled list of self-identified and previously identified DSP interventions was independently screened by two speech-language pathologists (SLPs) to determine whether (a) the intervention targeted social communication or language development and (b) the intervention aligned with our DSP
criteria (described below). Reviewers were asked to answer either yes, no or unknown for each of the DSP criteria outlined in Table 2.

Interventions that received yes responses for each of the DSP criteria were classified as DSP and those that met only some of the criteria were classified as non-DSP. Inter-rater agreement was substantial, $k = 0.886$. Based on recommendations from the Cochrane Collaboration, the disagreement was resolved by discussion between the authors (Higgins & Green, 2011).

An adaptation of Ingersoll’s (2010) classification of DSP interventions was used to decide if a treatment was DSP or non-DSP. This classification system was selected because it included intervention elements that aligned with core elements of developmental and social pragmatic theories. We extended Ingersoll’s (2010) DSP criteria by including an additional core feature within our classification system that is integral to social pragmatic theory. In order for a treatment to be considered a DSP intervention, the treatment had to meet the following criteria: (a) describe itself as based on developmental principles; (b) use a natural play-based setting; (c) ensure that teaching episodes are child initiated; (d) include child-selected teaching materials and activities; (e) target general social communication skills that are foundational to verbal communication; (f) use facilitation strategies (e.g. adult responsiveness, contingent
### Table 2. Interventions proposed to be DSP and evaluation of how they incorporate core features of DSP interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Previously identified as DSP</th>
<th>Natural setting</th>
<th>Child initiated episodes</th>
<th>Child selected materials</th>
<th>Targets general social communication</th>
<th>Adult responsiveness as key strategy</th>
<th>Arrange environment</th>
<th>Reinforce naturally</th>
<th>Reinforce all attempts</th>
<th>Only indirect prompts</th>
<th>Decision</th>
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<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
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<td>NO</td>
<td>NO</td>
<td>Non DSP</td>
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<td>DIR(^2)</td>
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<td>YES</td>
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<td>YES</td>
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<tr>
<td>Enhanced Milieu Training(^3)</td>
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<td>YES</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>DSP</td>
</tr>
<tr>
<td>RDI(^13)</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>Non DSP</td>
</tr>
<tr>
<td>Responsive Teaching(^14)</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>DSP</td>
</tr>
<tr>
<td>Son-rise(^15)</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>Non DSP</td>
</tr>
<tr>
<td>SCERTS(^16)</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>DSP</td>
</tr>
<tr>
<td>The Denver Model(^17)</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>DSP</td>
</tr>
<tr>
<td>The Scottish Centre Program(^18)</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>Non DSP</td>
</tr>
<tr>
<td>Stronger Families Project(^19)</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>UN</td>
<td>UN</td>
<td>UN</td>
<td>UN</td>
<td>UN</td>
<td>UN</td>
<td>UN</td>
<td>Non DSP</td>
</tr>
</tbody>
</table>

**Note.** DSP = Developmental Social Pragmatic. UN = unknown.

\(^1\)Wong & Kwan, 2010; \(^2\)Greenspan & Wieder, 2006; \(^3\)Ingersoll, Meyer, Bonter & Jelinek, 2012; \(^4\)Siller, Hutman, & Sigman, 2013; \(^5\)Oosterling et al., 2010; \(^6\)Ingersoll & Wainer, 2013; \(^7\)Schertz, Odom, Baggett & Sideris, 2013; \(^8\)Kasari, Freeman & Paparella, 2006; \(^9\)Casenhisier, Shanker & Stieben, 2013; \(^10\)Sussman, Drake, Lowry & Honeyman, 2016; \(^11\)Green et al., 2010; \(^12\)RDI Connect, 2017; \(^13\)Mahoney & Perales, 2003; \(^14\)Kaufman, 1994; \(^15\)Prisant, Wetherby, Rubin, Laurent, & Rydell, 2005; \(^16\)Rogers & DiLalla, 1991; \(^17\)Salt, Shemilt, Sellars, Boyd, Coulson & McCool, 2002; \(^18\)Keen, Roger, Doussin & Braithwaite, 2007.
imitation, indirect language stimulation, affective attunement); (g) use environmental arrangement to support communication and language (e.g. communicative temptations, playful obstruction, wait time); (h) reinforce communication using natural properties; (i) use reinforcement contingencies that reinforce all communicative behavior (treating all behavior as intentional); and (j) avoid use of explicit prompts that does not consider the child’s intent (e.g. “Say ______”).

We elected to include *avoidance of explicit prompts for communication* as a core feature of DSP interventions in our classification. This differentiation between DSP and non-DSP interventions was mentioned by Ingersoll (2010) but not included within her table comparing DSP and naturalistic developmental behavioral intervention (NDBI) techniques. We decided to include this in our categorization because use of prompts to elicit expressive language without consideration of speaker intent is explicitly avoided in DSP interventions (Gerber, 2003). Prompting for expected verbal outcomes rather than providing scaffolding to support children’s spontaneous generation of speech is fundamentally different. This feature can differentiate DSP and NDBI interventions and thus should be included in DSP criteria when looking at mechanisms of change in DSP interventions. Treatment approaches that met all 10 criteria mentioned above were screened by two independent reviewers for phase two selection criteria.

**Phases two selection criteria.** To be included in phase two of this review, studies had to (a) be peer reviewed, (b) be published in English, (c) be a randomized control trial (RCT), (d) evaluate social communication and/or language treatment effects of DSP-based treatment for children or for caregivers, (e) report effects using quantitative data, and (f) include preschool children (0–5 years) with a diagnosis of ASD. We excluded studies where only a minority of the participants fell within the age range of 0–5 years or
when diagnostic groups (those without ASD, or those with co-occurring diagnosis such as untreated seizure disorder and ASD or Cerebral Palsy and ASD) were combined in the data reporting (e.g. Siller et al., 2013).

3.2.3 Data collection

The first author developed a coding manual for extracting and analyzing data from the articles meeting inclusion criteria. After completion of data collection, a graduate SLP student independently verified 30% of the included studies and perfect inter-rater agreement was attained $k = 1.0$. When two studies reported intervention outcomes for the same group of participants, data for both studies were consolidated and reported as a single entry in the table (e.g. Casenhiser et al., 2015, 2013). If a study contained more than one experiment, only the experiments meeting inclusion criteria were incorporated into our analysis (e.g. Green et al., 2020).

The following information was extracted from each study: (a) participant characteristics (number, sex, and age), (b) research design, (c) intervention characteristics (setting, practitioners, dosage), (d) dependent variables and intervention outcomes for children (i.e. foundational social communication outcomes involving regulation, attention, joint attention, engagement, reciprocity, and child language outcomes), (e) dependent variables and intervention outcomes for parent language, (f) effect size estimates, and (g) measurement tools. Where effect size was not reported, Cohen’s $d$ was calculated for each variable using means and $SD$s (Cohen, 1988).

3.2.4 Assessment of evidence-based quality

An integration of the Critical Appraisal Skills Programme tool (CASP, 2018) and Dollaghan’s (2007) scale for appraising communication treatment evidence was used to determine whether each article met one of three levels of evidence-based quality. CASP
tools provide a framework for assessing the study quality through considering a series of appraisal criteria designed to collectively answer three broad questions: (a) Is the study valid? (b) What are the results? and (c) Will the results help locally? Some of the appraisal criteria require a simple binary judgment; however, other ratings are more subjective. As several criteria were used to assess these CASP questions, they were then weighed and graded to derive both validity and importance (e.g. substantial effect size, social validity, maintenance) scores using a three-point scale. A score of compelling was assigned if all CASP questions on the topic being scored (i.e. validity or importance) received a response of yes. If a low risk of bias was noted or only minor details were questionable, a score of suggestive was provided. If there was a high risk of bias (a rating of no or unknown response to more than two questions on the topic), a score of equivocal was provided. These validity and importance ratings were then used to derive overall assessments of the quality of the evidence using Dollaghan’s (2007) three-point scale:

1. **Compelling:** The evidence is such that unbiased experts would find little or nothing about the information to debate. Both the validity and importance of results are rated compelling. Altering one’s current clinical approach should be seriously considered.

2. **Suggestive:** A rating of suggestive could be indicative of inconsistent quality open to debate on a few criteria. It requires at least a suggestive level of validity and certainty of results. Clinicians might reach different decisions about whether to use the information to support altering their current clinical practice.

3. **Equivocal:** An equivocal rating suggests low validity and questionable certainty of results. No change to clinical practice needs to be considered.
Methodological quality, risk of bias, and importance of results were independently assessed by two SLPs (one of whom was blind to the authors and dates of publications). Initial inter-rater agreement for overall quality ratings was $k = 0.78$ and 100% agreement was attained through item-by-item discussion between the reviewers (Higgins & Green, 2011).

3.3 Results

3.3.1 Systematically Identifying DSP Interventions

Eighteen treatment approaches were either self-identified as being a DSP-based intervention or identified in other literature as being DSP, and were examined during phase one of our search. A total of 10 brand named treatments met all of the DSP criteria, and thus were included in phase two of our search. See Table 3 for a list of all the treatments referred to as DSP and our analysis of their alignment with the DSP intervention components that we based on Ingersoll (2010).

We do not intend to imply that interventions receiving a response of no in any DSP category mean that the treatment never incorporates the DSP feature into their model, but rather that it is not a core feature of the intervention. For example, RDI focuses on establishing shared partnerships (RDIConnect, 2017). Therefore, having children select materials or initiate the teaching episodes is not a defining feature of the intervention. Similarly, JASPER is a treatment that incorporates having children initiate teaching episodes and selecting activities, but this is reportedly only done after children have been primed to provide appropriate responses using discrete trial training (Kasari et al., 2006). Additionally, interventions such as Enhanced Milieu Training and IMPACT incorporate many DSP features that align with cognitive developmental psychology, but were missing core features that align with social pragmatic theory (e.g. treating all forms
of communication as intentional and avoiding explicit prompting for communication). For example, Enhanced Milieu Training reports use of *elicited modeling* and *manding* to target social communication and language, and IMPACT promotes having clinicians only respond to correct communication attempts and withholding objects from the child until a correct response is attained. Similarly, although the Denver Model meets DSP criteria, the Early Start Denver Model, which evolved from the original Denver Model, did not because it incorporates behavioral principles in how challenges in language production are addressed (e.g. Picture Exchange Communication System; Rogers, 2017). Although these treatments might meet the criteria for DSP interventions aligned with cognitive developmental psychology, their failure to incorporate key social pragmatic aspects classified them as *non-DSP* within this review.

### 3.3.2 Description of Studies

Consolidation of phase two and three of our search yielded a total of 289 abstracts for review. Reference list and Google Scholar searches resulted in identification of an additional four articles. After removing duplicates, 151 articles were screened for inclusion. In order for a study to be definitively excluded, the title and/or abstract had to undoubtedly fail to meet one of the predetermined inclusion criteria. Full text reviews were conducted on 30 articles. A total of 10 studies (14 articles) examining 6 identified DSP treatments met inclusion criteria. See Figure 4 for the PRISMA flow diagram outlining our search and screening results.

**Sample characteristics.** A summary of participant characteristics for the included articles is presented in Table 3. The 10 studies reported on outcomes for 716 children diagnosed with ASD who ranged in age from 1:3 to 6:0 years with a mean of 37.8
months. Sex was reported for 546 of the children; of these, 443 of participants were male and 103 were female. Sample size across all studies ranged from 23 to 152 participants. Studies were conducted across four countries, and thus included participants from a variety of socioeconomic and cultural backgrounds.

**Research design and rigor.** All of the RCTs included at least one natural parent–child observation measure that evaluated generalization of skills learned in intervention during play interactions and all but one study (Schertez et al., 2013) reported adequate measures of inter-rater reliability for the observational scales they used. Nine studies included a social validity measure (Carter et al., 2011; Pajareya & Nopmaneejumruslers, 2011; Schertz et al., 2013, 2018; Venker et al., 2012; Wetherby et al., 2014), which included parent satisfaction questionnaires, a parent stress index, and a clinician experience questionnaire. Implementation of some form of fidelity measure was included in six studies. Most of these studies evaluated clinician implementation of the intervention (Carter et al., 2011; Green et al., 2010; Schertz et al., 2013, 2018; Solomon et al., 2014; Venker et al., 2012; Wetherby et al., 2014), while only a few examined parent implementation of strategies (Casenhiser et al., 2013; Schertz et al., 2013, 2018).

Evidence was assessed to be compelling for four of the studies, suggestive for one and equivocal for five (see Table 4). Notably, one of the studies rated as equivocal was conducted in Thailand, a country where access to intervention services and resources is limited (Pajareya & Nopmaneejumruslers, 2011). Factors identified as recurring challenges in study design included small sample size (under powered), participant attrition, variable blinding of assessors (i.e. use of parent report outcome measures when parents were not blind to group allocation), lack of clarity in the identification of the
active ingredients used with caregivers and children within the treatment, and lack of comprehensive fidelity measurement.

Figure 4. Prisma flow diagram

Records identified through phase 2 and phase 3 database searching (n=289)

Records after duplicates removed (n=151)

Records screened (n=151)

Records excluded (n=121)

Full-text articles assessed for eligibility (n=30)

Articles included in quantitative synthesis (n=14)

Full-text articles excluded (n=16) for the following reasons:
- Participant age (n=2)
- Participants at risk for ASD but not diagnosed (n=3)
- Study design (n=7)
- Did not meet DSP criteria (n=2)
- Not parent implemented treatment (n=2)
### Table 3. Summary of included studies

<table>
<thead>
<tr>
<th>Articles</th>
<th>Articles</th>
<th>N (n females)</th>
<th>Age Range&lt;sup&gt;a&lt;/sup&gt; (mean age&lt;sup&gt;b&lt;/sup&gt;)</th>
<th>Treatment Condition (Control Condition)</th>
<th>Intervention Setting; Frequency; Duration</th>
<th>Practitioner; Practitioner Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldred, Green &amp; Adams (2004)</td>
<td>28 (3 f)</td>
<td>2:0-5:11 (48)</td>
<td>Child Talk (Routine Care)</td>
<td>Clinic; 1 session/month for 6 months, then “less frequent” follow-ups for 6 months; 12 months</td>
<td>Unknown; Unknown</td>
<td></td>
</tr>
<tr>
<td>Carter, Messinger, Stone, Celimli, Allison, Nahmias &amp; Yoder (2011)</td>
<td>62 (11 f)</td>
<td>1:3-2:1 (20)</td>
<td>More Than Words (No treatment)</td>
<td>Clinic &amp; Home; 8 parent only sessions, 3 in home sessions; 3.5 months</td>
<td>SLP; Hanen certified</td>
<td></td>
</tr>
<tr>
<td>Casenhiser et al. (2012; 2014)</td>
<td>51</td>
<td>2:11–4:11 (44)</td>
<td>MEHRIT, DIR based (Community treatment)</td>
<td>Clinic; 2 hour/week; 12 months</td>
<td>SLP, OT; DIR certification</td>
<td></td>
</tr>
<tr>
<td>Green, Charman, McConachie et al. (2010); Pickles (2016)</td>
<td>152 (28 f)</td>
<td>2:0-4:11</td>
<td>PACT (Treatment as usual)</td>
<td>Clinic &amp; Home; Biweekly sessions for 6 months, monthly follow ups, 18 sessions total; 12 months</td>
<td>SLP; “Specially trained,” supervised by senior SLP with clinical autism experience</td>
<td></td>
</tr>
<tr>
<td>Pajaraya &amp; Nopmaneejumruslers (2011)</td>
<td>32 (9 f)</td>
<td>2:0–6:0 (54)</td>
<td>DIR (Community standard care)</td>
<td>Home; 1.5 hours first session, no specified time for remainder of sessions; 3 months</td>
<td>Rehabilitation Therapist; Reading books, viewing training videos</td>
<td></td>
</tr>
<tr>
<td>Schertz, Odom, Baggett, &amp; Sideris (2013)</td>
<td>23</td>
<td>(26)</td>
<td>Joint Attention Mediated Learning (Community treatment)</td>
<td>Home; at least 15 sessions; 4-12 months with a mean treatment time of 7 months</td>
<td>Early Childhood Educators, Counsellor; “Prior training”</td>
<td></td>
</tr>
<tr>
<td>Schertz, Odom, Baggett, &amp; Sideris (2018)</td>
<td>144 (29 f)</td>
<td>1:4-2:6 (24)</td>
<td>Joint Attention Mediated Learning (Community treatment)</td>
<td>Home; 1 hour/week; 32 weeks</td>
<td>Unknown; Unknown</td>
<td></td>
</tr>
<tr>
<td>Soloman (2014)</td>
<td>128 (23 f)</td>
<td>2:8–5:11 (50)</td>
<td>Play Project – DIR based</td>
<td>Home; 1, 3 hour session/month; 12 months</td>
<td>OT, SLP, Special Educator; 4 day Play</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Sample Size</td>
<td>Age Range</td>
<td>Treatment Description</td>
<td>Setting</td>
<td>Training Duration</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<td>---------------------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Venker, McDuffie, Weisemer &amp; Abbeduto (2011)</td>
<td>14</td>
<td>2:4-5:8 (41)</td>
<td>Adapted More than Words (Delayed treatment group)</td>
<td>Clinic; 5, 2-hour parent education sessions, 2, 45-minute individual sessions, twice weekly 60-minute group sessions; 7 weeks</td>
<td>SLP, Graduate student SLP; Hanen certified</td>
<td></td>
</tr>
<tr>
<td>Wetherby, Guthrie, Woods, Schatschneider, Holland, Morgan, &amp; Lord (2014)</td>
<td>82</td>
<td>1:4-1:8 (20)</td>
<td>SCERTS individual treatment (SCERTS group treatment)</td>
<td>Clinic &amp; Home; 3 sessions/week for 6 months, then 2 sessions/week for 3 months; 9 months</td>
<td>Unknown; Unknown</td>
<td></td>
</tr>
</tbody>
</table>

Note: f = female; RCT = Randomized Control Trial; SLP = Speech-Language Pathologist; MEHRIT = Milton and Ethel Harris Research Initiative Treatment; DIR = Developmental, Individual Difference, Relationship Based Intervention; OT = Occupational Therapist; PACT = Preschool Autism Communication Treatment; SCERTS = Social Communication, Emotional Regulation, Transactional Support Intervention; aYears:months bMonths
3.2.3 Description of Intervention

Setting and intensity. Characteristics of the interventions are presented in Table 4. It was most common for therapy sessions to be provided within the child’s home setting at least some of the time ($n = 7$). Only three studies conducted sessions solely in a clinic setting. The range of treatment intensity was extensive, from an unspecified amount of treatment over 3 months, to a hybrid of individual and group sessions over 7 weeks, to 2 hours weekly over 12 months.

Service delivery. The trainers implementing the DSP interventions varied across studies. SLPs were the most frequently noted professionals ($n = 5$). Other professional backgrounds included occupational therapists, a social worker, a psychologist, rehabilitation therapists, recreation therapists, and educators, and three studies did not report the professional background of the clinicians. The level of training of the therapists was diverse and ranged from therapists who had undergone four years of training (e.g. Casenhisser et al., 2013), to students reading a book and watching videos on the intervention (e.g. Pajareya & Nopmaneejumruslers, 2011), to having no mention of specific training (e.g. Schertz et al., 2018).
Table 4. Summary of included studies outcomes and certainty of evidence

<table>
<thead>
<tr>
<th>Citation</th>
<th>Outcome Measures used</th>
<th>Social Communication Variable, p-value (Effect size)</th>
<th>Language Variable, p-value (Effect size)</th>
<th>Parent Outcome Variable, p-value (Effect size)</th>
<th>CASP Certainty of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldred, Green &amp; Adams (2004)</td>
<td>ADOS social interaction domain; Parent-Child video analysis; VABS Communication domain; MCDI</td>
<td>Social Interaction, p=.004 (d=.85) Child communication acts, p=.041 (d=.73) Child shared attention, p=.204 (d=.57) Communication, p&gt;.05 (unable to calculate effect size due to insufficient data)</td>
<td>Expressive Language, p&lt; .001 (d=.01) Language Comprehension, p=.10 (d=.00) Communication, p=.121 (d=.43)</td>
<td>Increase in parent synchrony, p=0.16 (d=.93) Decrease in parent asynchrony, p=.009 (d=1.07) Parent shared attention, p=.176 (d=.37) Parent communication acts, p=.293 (d=.54)</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Carter, Messinger, Stone, Celimli, Allison, Nahmias &amp; Yoder (2011)</td>
<td>ESCS; PCFP; Non-verbal communication of PIA-NV</td>
<td>Initiating joint attention, p&gt;.05 (d=.00) Initiating behavior requests, p&gt;.05 (d=.00) Frequency of intentional communication, p&gt;.05 (d=.00)</td>
<td>-</td>
<td>Parent responsivity, p=.08 (d=.71)</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Casenhiser, Shanker &amp; Stieben (2012); Casenhiser, Binns, McGill, Morderer &amp; Shanker (2015)</td>
<td>CBRS; PLS &amp; CASL; Language Sample Analysis; Parent Fidelity to Treatment</td>
<td>Initiation of Joint Attention, p&lt;.001 (d=1.02) Enjoyment, p&lt;.05 (d=.63) Attention, p&lt;.05 (d=.69) Involvement, p&lt;.01 (d=.87)</td>
<td>Total Language, p=.214 (d=.63) Number of utterances, p=.002 (η²p=.191) MLU, p=.015 (η²p=.123) Number of Different Communication Acts, p&lt;.001 (η²p=.208) Contingent Responses, p=0.28 (η²p=.138)</td>
<td>Fidelity Parent co-regulation, p&lt;0.001 (d=.996) Fidelity Parent joining, p&lt;0.01 (d=.92) Fidelity Supporting Reciprocity, p&lt;0.01 (d=.86) Fidelity Use of affect (facial expressions,</td>
<td>Suggestive</td>
</tr>
<tr>
<td>Commenting, p=.012, ($\eta^2_p=.239$)</td>
<td>Parent-Child Video Analysis; CSBS-DP Social Composite; ADOS Social Communication Modified Algorithm Total; PLS; MCDI; VABS Communication domain</td>
<td>Child Initiations, p=.009 (d=.44)</td>
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<tr>
<td>Labeling, p=.021, ($\eta^2_p=.104$)</td>
<td>Social Composite, n.s., no p-value reported (log-odds=2.49)</td>
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<tr>
<td>Responding, p=.147, ($\eta^2_p=.161$)</td>
<td>Social Communication, n.s., no p-value reported (log-odds=0.64)</td>
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<tr>
<td>Directing, p=.132, ($\eta^2_p=.001$)</td>
<td>PLS Receptive Language, n.s., no p-value reported (d=1.09)</td>
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<tr>
<td>Sharing, p=.005 ($\eta^2_p=.234$)</td>
<td>PLS Expressive Language, n.s., no p-value reported (d=.00)</td>
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<tr>
<td>Obtaining Information, p=.005 ($\eta^2_p=.151$)</td>
<td>MCDI Receptive, n.s., no p-value reported (log-odds=2.49)</td>
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<tr>
<td>Rejecting/protesting, p=.015 ($\eta^2_p=.160$)</td>
<td>MCDI Expressive, n.s., no p-value reported (log-odds=1.63)</td>
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<tr>
<td>Social Conventions, p=.57, ($\eta^2_p=.024$)</td>
<td>Vineland Communication, n.s., no p-value reported (d=.17)</td>
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<td>Spontaneous Social Expressions, p=.05, ($\eta^2_p=.075$)</td>
<td>Parental Synchrony, p&gt;.00, (d=1.09)</td>
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<tr>
<td>gestures, intonation changes etc.), p&lt;0.001 (d=.96)</td>
<td>Shared Attention, n.s., no p-value reported (d=.38)</td>
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<tr>
<td>Study</td>
<td>Measures</td>
<td>Findings</td>
<td>Effect Size</td>
<td>Significance</td>
<td>Notes</td>
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<tr>
<td>Pajareya &amp; Nopmaneejumruslers (2011)</td>
<td>FEAS; FEDQ</td>
<td>Functional emotional capacities, p=.031 (d=.82)</td>
<td></td>
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<td>-</td>
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<td>Emotional development, p=.006 (d=1.18)</td>
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<td>Equivocal</td>
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<tr>
<td>Schertz, Odom, Baggett &amp; Sideris (2013)</td>
<td>PJAM; VABS Communication domain; MSEL</td>
<td>Focusing on Faces p&lt; .01 (d=1.24)</td>
<td></td>
<td></td>
<td>-</td>
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<tr>
<td></td>
<td></td>
<td>Responding to Joint Attention p&lt; .001 (d=1.39)</td>
<td></td>
<td></td>
<td>Equivocal</td>
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<tr>
<td></td>
<td></td>
<td>Turn Taking p&gt;.05 (d=.55)</td>
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<tr>
<td></td>
<td></td>
<td>Initiated Joint attention p&gt;.05 (d=.70)</td>
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<td>Schertz, Odom, Baggett &amp; Sideris (2018)</td>
<td>PJAM</td>
<td>Focusing on Faces, p&lt; .001 (d=1.20)</td>
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<td>Responding to Joint Attention, p&lt; .001 (d=2.80)</td>
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<td>Turn Taking, p&lt; .001 (d=0.85)</td>
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<td>Soloman, Van Egeren, Mahoney, Quon Huber &amp; Zimmerman (2014)</td>
<td>CBRS; SCQ; MBRS; MSEL; MCDI-Words Gestures; MCDI-Words Sentences</td>
<td>Attention, p&lt;.01, n²=.07</td>
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<td>Maternal Directiveness, p&lt;.001 (n²=.08)</td>
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| Venker, McDuffie, Weisemer & Abbeduto (2011) | Parent-Child video transcription | Spontaneous non-verbal communication acts, $p=.320$ ($d=.09$) | Prompted communication acts, $p=.007$ ($d=.74$)  
Spontaneous communication acts, $p=.196$ ($d=.54$) | Follow in comments, $p=.029$ ($d=.06$)  
Linguistic mapping, $p=.025$ ($d=1.12$)  
Prompting, $p=.002$ ($d=1.39$)  
Redirects, $p=.004$ ($d=.89$) | Equivocal |
|---------------------------------|---------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| Wetherby, Guthrie, Woods, Schatschneider, Holland, Morgan & Lord (2014) | CSBS; VABS Communication & Socialization domains; MSEL | Social, $p=.04$ ($g=.48$)  
Socialization, $p=.04$ ($g=.66$) | Receptive Language, $p=.008$ ($g=.58$)  
Expressive language, $p=.61$ ($g=.18$)  
Speech, $p=.81$ ($g=.05$)  
Symbolic, $p=.72$ ($g=.13$)  
Communication, $p=.004$ ($g=.69$) | - | Compelling |
3.2.4 Intervention Impact

**Foundational social communication skills.** All of the RCTs examined the impact of DSP intervention on social communication outcomes (see Table 5). The most common social communication capacities targeted were overall social interaction or communication \( (n = 4) \), attention \( (n = 3) \), joint attention \( (n = 4) \), and initiation \( (n = 3) \). Studies also examined children’s focusing on faces \( (n = 1) \), involvement \( (n = 1) \), engagement \( (n = 1) \), reciprocal interactions \( (n = 1) \), gesture use \( (n = 1) \), nonverbal communication \( (n = 1) \), and intentional communication \( (n = 1) \).

**Social interaction or social communication.** Each of the four studies evaluating social interaction capacities or overall social communication reported positive results, with moderate (Solomon et al., 2014; Wetherby et al., 2014) to large effects (Aldred et al., 2004; Green et al., 2010; Pajareya & Nopmaneejumruslers, 2011). Aldred et al. (2004) included both social interaction and communication outcome measures, and reported positive results in the social interaction domain of the ADOS, but no significant change on the communication domain.

**Attention, interest, engagement, and involvement.** Children’s overall attention was considered in three studies. Results were mixed. Positive results were reported in two studies (Casenhiser et al., 2013; Solomon et al., 2014). The other study reported no significant changes in children’s attention posttreatment (Aldred et al., 2004), but found small to moderate effects, possibly related to small sample size (i.e. \( N = 28 \)). A more specific form of attention, focusing on faces, was also positively impacted for children who had received DSP intervention (Schertz et al., 2013, 2018). Joint attention (including initiating and responding to bids for joint attention) was examined in four studies. Large positive effects postintervention were reported in studies rated suggestive and compelling...
(Casenhiser et al., 2013; Schertz et al., 2013, 2018) and no effects were reported in one study that was underpowered (Carter et al., 2011). Children’s involvement in interactions with caregivers and overall engagement were also found to be positively impacted postintervention with large to moderate effects (Casenhiser et al., 2013).

**Initiations.** Moderate to large positive effects for children’s initiation were found in two studies (Green et al., 2010; Solomon et al., 2014). However, Carter et al. (2011) found no significant improvements in initiations of behavior requests.

**Reciprocity.** Only one study examined children’s reciprocity skills. Schertz et al. (2018) found large positive effects on children’s turn taking post-DSP treatment.

**Gestures, nonverbal, and intentional communication.** No effects were found for children’s use of gestures (Solomon et al., 2014), spontaneous use of nonverbal communication (Venker et al., 2012), or frequency of intentional communication (Carter et al., 2011).

**Language capacities.** Children’s posttreatment language skills were considered within seven studies (see Table 3). Outcome measures used to assess language varied across studies. Six studies used standardized language tests as outcome measures (e.g. Preschool Language Scale; Zimmerman et al., 2006). Of these, three reported mixed results across different language tests (Green et al., 2010; Schertz et al., 2013; Wetherby et al., 2014) and three reported no effects (Aldred et al., 2004; Casenhiser et al., 2013; Solomon et al., 2014). Two of the studies that reported mixed results found small to moderate positive effects in children’s receptive language, but not in expressive language (Schertz et al., 2013; Wetherby et al., 2014). Green et al. (2010) found no effects using assessor-rated measures of language. However, parent ratings showed large positive effects on both children’s expressive and receptive language. Casenhiser et al. (2013) and
Aldred et al. (2004) found no significant differences for children’s receptive, expressive, or total language scores using standardized language tests; however, moderate to large positive effects on children’s language use were found when language skills were analyzed during naturalistic videotaped interactions (Casenhiser et al., 2015). Venker et al. (2012) also used naturalistic observation tools to evaluate language. They found mixed results, with no changes observed in children’s use of spontaneous communication acts, but large positive effects on children’s use of prompted communication acts, following DSP intervention.

**Short-term follow-up.** Four studies reported on outcomes from follow-up assessments that were conducted between 1–2 months and 1 year postintervention (Carter et al., 2011; Pajareya & Nopmaneejumruslers, 2011; Schertz et al., 2013, 2018). One study did not find significant treatment effects posttreatment or at follow-up (Carter et al., 2011). However, Schertz et al. (2013) found significant improvements in their DSP intervention group relative to a community intervention group that were maintained 4–8 weeks’ postintervention for following faces of communication partners \((d = .84)\) and responding to joint attention \((d = 1.18)\). Schertz et al. (2018) reported similar maintenance of skill improvements in the DSP group six-month postintervention \((p = .007, d = .77)\), in addition to improvements in reciprocal turn taking \((p < .001, d = .78)\). However, improvements in initiating joint attention were not maintained \((p = .082, d = .69)\). Another study found children’s overall socioemotional skills (e.g. attention, reciprocity, use of affect) continued to significantly improve one-year postintervention relative to a community treatment group \((p < .001;\ Pajareya & Nopmaneejumruslers, 2012)\).

**Long-term follow-up.** A 5.75-year follow-up of children who received PACT intervention revealed a smaller group difference for child initiations at follow-up \((d = .29,\)}
95% CI: −0.02 to 0.57) than directly postintervention (Pickles et al., 2015). However, the
mean treatment effect from baseline to follow-up was stronger ($d = 0.33$, 95% CI: 0.1–
0.6, $p = 0.004$). Similarly, parent synchrony did not maintain treatment effects at follow-
up ($d = .02$, 95% CI: −0.30 to 0.36) but when the overall study duration was taken into
account, the effects of the intervention were significant ($d = .61$, 95% CI: 0.38–
0.86, $p < 0.0001$). Postintervention differences between groups in language were no
longer present at follow-up ($d = .15$, 95% CI: −0.23 to 0.53).

**Caregiver interaction outcomes.** Pre–post social communication or language
outcomes of caregivers were examined within six studies. Parent outcomes most
commonly reported related to parent responsiveness and parental control.

**Responsiveness.** Parental responsiveness significantly increased for parents who
had participated in DSP intervention, with two studies reporting large positive effects
(Casenhiser et al., 2013; Solomon et al., 2014). By contrast, Carter et al. (2011) reported
no changes in parental responsiveness with moderate effects noted, which may have
related to small sample size ($n = 28$).

**Parental control/directiveness.** Within DSP interventions, parental directiveness
is not thought to support spontaneous communication or language and is therefore
discouraged. Three studies reported reductions in directiveness with moderate (Solomon
et al., 2014) to large effects (Aldred et al., 2004; Venker et al., 2012).

**Synchrony/joining and shared attention.** Parent’s synchrony with their children
showed significant positive improvements in two studies (Aldred et al., 2004; Green et
al., 2010). Similarly, Casenhiser et al. (2013) reported large positive effects
postintervention for parents joining their children’s ideas. Parents’ use of comments that
followed the children’s interests also improved with moderate effects (Venker et al.,
Green et al. (2010) found positive changes in parent–child shared attention post-DSP intervention but Aldred et al. (2004) did not.

**Affect and coregulation.** Both studies evaluating parents’ use of affect to engage their children found large positive effects with DSP intervention (Casenhiser et al., 2013; Solomon et al., 2014). Parents’ coregulatory strategies also had large positive changes (Casenhiser et al., 2013).

**Parent communication acts, linguistic mapping, and indirect prompting.** Aldred et al. (2004) reported no changes in the frequency of parent communication acts post-DSP intervention; however, moderate effects were noted. Large positive changes in parents’ use of linguistic mapping and indirect prompting to encourage communication were also observed post-DSP treatment (Venker et al., 2012).

### 3.2.5 Factors influencing DSP intervention effects

Four studies examined child or intervention features that may have influenced children’s response to DSP treatment (Carter et al., 2011; Casenhiser et al., 2013; Pajareya & Nopmaneejumruslers, 2012; Schertz et al., 2018). Formal mediation analysis examining the relationship between treatment elements and children’s response to treatment was only conducted for two studies (Mahoney & Solomon, 2016; Pickles et al., 2015). The following themes emerged.

**Child’s pre-treatment object interest.** Carter et al. (2011) reported that children’s object interest prior to treatment influenced the treatment effect on the residualized gain for several communication variables. Children who played with fewer than three toys during the pre-treatment assessment demonstrated greater gains in initiating joint attention and initiating requests if they were assigned to the DSP intervention. However, children who played with five or more toys during the initial assessment showed fewer
gains in initiating joint attention, initiating requests, and the weighted frequency of intentional communication if they were assigned to the DSP treatment group. This suggests that children’s level of object interest at the time they entered the study had an impact on how they responded to the DSP intervention.

**Autism severity and overall development.** Two studies examined how a child’s autism severity influenced treatment effects, and results were conflicting. Pajareya et al. (2012) found that the less severe the impairments or the higher the level of overall performance of the child prior to intervention, the more likely they were to have positive gains from the DSP intervention. In contrast, Schertz et al. (2018) found that more positive changes in responding to joint attention occurred for the children with more severe autism. However, treatment effects for following faces, turn taking, and initiating joint attention were not influenced by autism severity.

**Expression of enjoyment of the child, joining, support of reciprocity, and support of independent thinking.** Casenhiser et al. (2013) found that parent fidelity to treatment predicted both language and social communication outcomes in children following DSP intervention. Specifically, positive child outcomes were predicted by parent fidelity on expression of enjoyment during interactions with the child, joining, support of reciprocity, and support of independent thinking. However, caregiver behaviors before treatment were not significantly associated with any of the changes in child outcomes.

**Amount of treatment.** Pajareya and Nopmaneejumruslers (2014) found that the more hours per week of intervention, the better the gain in functional emotional capacities. However, fidelity to treatment was not considered, so it is unknown whether therapists or parents were implementing DIR therapy as it was intended. Therefore, it is
unclear whether gains were related to time in the intervention per se or time spent interacting with a parent.

**Caregiver responsiveness and use of affect.** Mahoney and Solomon (2016) conducted a secondary analysis of data from Solomon et al. (2014) to examine potential mediators of their DSP treatment. Intervention effects on children’s social engagement were mediated by increases in parental responsiveness. Similarly, intervention effects on children’s social affect were mediated by increases in parental responsiveness and use of social affect. A large portion of the gains in children’s social engagement and functional emotional capacities following DSP intervention was explained by change in caregiver responsiveness and use of social affect.

**Caregiver synchronous behavior.** A follow-up study examining the treatment mechanisms of PACT intervention found that children’s improvements in communication initiations were mediated by an increase in caregivers’ synchronous behaviors. Repeated measures reliability models and a two-mediator reliability mode indicated that approximately 70–90% of the changes in the children’s improvement in communication were attributed to improvements in parent synchronous behavior (Pickles et al., 2015).

### 3.4 Discussion

This systematic review examined the impact of six different DSP interventions on children’s or caregivers’ social communication across 10 studies. Consolidation of results from the studies identified as being compelling reveal consistent empirical support for the effectiveness of DSP interventions for enhancing foundational social communication capacities, namely positive changes in children’s attention, focusing on faces, responding to bids for joint attention, use of affect, engaging in reciprocal interactions, and initiating communication. It is critical to identify interventions that support the development of
these foundational communication skills given that they can have a tremendous positive impact on children’s social interactions and language development, yet these skills can be particularly challenging for children with ASD (Watt et al., 2006). Within the few \( n = 4 \) studies that included maintenance measures, positive gains in social communication remained, further supporting the effectiveness of DSP.

The effect of DSP interventions on children’s language is less clear. Positive findings in some studies are tempered by null findings in others. Notably, of the studies rated compelling, none revealed lasting, large effects on children’s language posttreatment. In light of these findings, we should consider factors that may have impacted children’s response to treatment. First, given the young age at which some of the children began treatment, and the marked improvements in children’s social communication but not language, we might consider the possibility that some of the children included in the studies were not developmentally ready to use symbolic language. Therefore, it would have been developmentally appropriate to solidify these foundational communication skills prior to targeting specific language goals, and this might be reflected within the results. Future studies should consider examining the impact of children’s pretreatment language level on their response to DSP interventions.

Additionally, the heterogeneity in both the language capacities assessed and the tools used to measure change may have played a role in the inconsistent language results across studies. Children’s social communication and functional language use are particularly difficult to evaluate using standardized or parent report measures (Teger-Flusberg et al., 2009) and yet standardized language testing was the most frequent tool used to evaluate children’s language outcomes. In alignment with social pragmatic theory, DSP interventions focus on developing children’s communicative intent and
communication functions, rather than language form. Natural play interactions create an environment to more effectively evaluate these skills. Only two studies included in this review evaluated language within natural contexts and found positive results (Casenhiser et al., 2015; Venker et al., 2012). The inclusion of such natural outcome measures aligns with previous recommendations and underscores the importance of including tools that examine language within natural contexts as outcome measures to ensure that the data gathered have the highest degree of validity possible (Tager-Flusberg et al., 2009).

Variability in the professional background and experience of the treating clinicians, combined with the limited use of fidelity measures within the studies included in this review also raises questions about the effective implementation of treatment designed to support children’s language. A comprehensive evaluation of treatment fidelity may help to resolve these issues. DSP interventions are considered triadic treatment models where there is (a) a therapist providing treatment to a child and coaching caregivers, (b) caregivers receiving training and then implementing strategies learned during interactions with their child, and (c) a child receiving intervention directly from both the therapist and the caregiver. When working within a triadic treatment model, researchers would be wise to measure fidelity of treatment implementation at each level of the intervention (e.g. therapist’s fidelity to delivering treatment, fidelity of parent training, and fidelity of parent use of DSP strategies; Roberts & Kaiser, 2011). Within our review, although many studies reported use of fidelity measures, only one Schertz et al., 2018) looked at fidelity at more than one level of implementation (i.e. clinician and caregiver).

Despite the importance DSP places on including caregivers in the treatment process and previous research outlining the relationship between parent interaction and
communication styles and children’s communication outcomes (Siller & Sigman, 2002, 2008), only three studies included outcome measures evaluating caregiver communication. Access to both parent and child data will bolster further exploration of the mediating effects of specific parent interaction styles on children’s communication and language and vice versa.

Of the studies that included caregiver outcomes, increases in parent synchrony, responsiveness, and use of affect were observed post-DSP intervention, as was a decrease in the amount of directiveness. Uptake of these strategies aligns with a number of the core features of DSP interventions, namely: (a) allowing children to initiate activities and select materials, that is joining in with their ideas rather than directing the interactions and (b) adult responsiveness. However, these changes were not universal across all studies or all parent behaviors. To better understand why some studies found changes in caregiver behavior and others did not, future research should examine not only parent behaviors, but also the mechanics and techniques used in parent coaching. This information would also allow for study replication and analysis of the relations between coaching/training strategies and parents’ effective use of DSP techniques.

Two specific mediating effects of DSP treatments were revealed in our review: caregiver responsiveness and caregiver synchronous behavior. Both positively predicted children’s communication development and response to DSP interventions (Mahoney & Solomon, 2016; Pickles et al., 2015). These findings align with previous research demonstrating that parental responsiveness supports children’s cognitive, communication, and socioemotional development (e.g. Kochanska et al., 1999; Mahoney & Perales, 2003, 2005; Tamis-LeMonda et al., 1996; Wolff & Ijzendoorn, 1997). Both responsiveness and synchronous behavior (joining in with ideas children have initiated)
are specifically targeted within DSP interventions and were included within the framework we used for identifying DSP-based interventions. Caregiver responsiveness in particular is one of the critical differences in how DSP and some NDBI interventions are implemented (with responsiveness not being a core defining feature of NDBI treatment models; Ingersoll, 2010). It is possible that this feature influences interventions’ effectiveness for social communication and language development (Ingersoll, 2010). Given the movement toward integrating developmental principles within behavioral intervention models (Lord et al., 2005; Schreibman et al., 2015), it will be important to understand which features of DSP interventions best predict positive treatment response. Including analysis of potential treatment mediators in future research should be a priority. This could help clinicians better tailor interventions to each child’s individual profile and enhance the decision-making process about which treatment characteristics to integrate when combining the two treatment models.

3.4.1 Limitations and future research

Within the studies that met inclusion criteria, there was sizable heterogeneity specifically with respect to (a) study design; (b) methodological quality; (c) duration, intensity, and implementation of treatment programs; (d) professional background of professionals delivering the treatment; (e) fidelity to treatment; (f) level of training of therapists; and (g) outcome measures used. Consequently, a meta-analysis was not conducted (Sterne et al., 2011). There is need for additional RCTs that are adequately powered and that employ greater consistency in the frequency, duration, and delivery of the intervention provided to both the treatment and control groups. Consensus on outcome measures used across studies will also help researchers draw more definitive conclusions about DSP interventions. Although treatment effects were significant in
many cases, wide confidence intervals demonstrating the variability of outcomes were also common across studies. Within future research, it might be advantageous to look at how DSP interventions impact more homogeneous groups of children with ASD (e.g. smaller age range, similar pretreatment language level).

Inclusion of measures of generalization and maintenance when evaluating treatment effectiveness is important (Dollaghan, 2007) and was scarce within the studies included in this review. The necessity of these kinds of measures is underscored when assessing interventions that include a parent training component. One goal of including parents in intervention is to increase the child’s treatment dosage through having parents generalize the strategies learned during intervention to their interactions with their child outside of intervention. Without generalization measures, it is difficult to determine what might be driving change within the intervention. For parent coaching interventions, different levels of generalization that researchers should include: (a) whether the caregiver and child, as a dyad, are able to generalize skills learned in treatment to natural interactions that are outside of the treatment setting, and (b) whether the child is able to maintain communication and language gains when interacting with someone who has not received the intervention, and who therefore may not be providing scaffolds to enhance the child’s communication or language. Examining generalization at these two levels can help researchers to answer the question: Did the child’s language change because the caregiver learned to effectively scaffold the child’s language, or was it specifically the child’s language that changed, thus enabling the child to maintain changes across different partners? In future research, it is imperative that measures of generalization are included and that consideration is given to the tools used to evaluate generalization. Kazdin (2008) explored opportunities to bridge clinical research and
practice, reporting that “even changes on well-established rating scales are often difficult to translate into every-day life” (p. 148). None of the studies included in this review assessed generalization or maintenance of social communication or language gains by removing the familiar caregiver during interactions. However, all studies employed at least one outcome measure that evaluated children with caregivers or therapists in natural play contexts. Including more extensive measures at multiple levels of generalization in future research would support evaluation of real-world generalization.

Finally, including detailed information about service delivery factors (e.g. intervention duration and frequency, clinician training) and how specific capacities are targeted during intervention would be a valuable addition to this body of research. Including this information would allow for analysis of how service delivery factors or use of specific treatment strategies might relate to children’s response to treatment and inform service delivery. Within the studies we reviewed, specific capacities targeted during intervention were often described vaguely, and many of the DSP programs were not manualized. This may be due to the concern that manuals do not always allow for enough flexibility and customization of intervention to meet the diverse needs for the children and families (Smith, 2012). However, a manual that provides guidance on how to consider implementation of the intervention in a way that allows for flexibility and individualized adaptation would help to make DSP intervention studies more replicable.

3.5 Conclusions

As far as we are aware, this is the first systematic review to identify a group of interventions that met clearly defined DSP intervention criteria. Our review examined the effectiveness of DSP treatments on the social communication and language of young children with ASD. It also investigated how parents’ interaction and communication
styles were impacted by these interventions. Our review suggests that DSP treatments positively impact children’s foundational social communication capacities such as attention, focusing on faces, joint attention, initiation, and reciprocity, but do not consistently improve children’s language skills. These interventions have the capacity to enhance the interaction styles of caregivers, optimizing them for supporting children’s communication development. The two studies that examined mediating factors impacting children’s response to DSP interventions suggest that caregiver responsiveness and synchronous behavior positively predict response to treatment, and thus inclusion of these intervention features should be strongly considered when working with preschool children with ASD. Future research efforts should aim to isolate and test potential active ingredients unique to DSP interventions to enhance understanding of how to most effectively combine evidenced, effective treatment mechanisms and personalize and adapt them to children’s unique profiles and communication needs.
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Chapter 4

Trampolines and Crash Mats or Pretend Food and Toy Cars? How Play Contexts Impact the Engagement and Language of Preschool Autistic Children

4.1 Introduction

Social communication challenges or variations are considered a core feature of autism. However, the extent and range of these differences are variable across autistic individuals (American Psychological Association, 2013; Masi et al., 2017; Tager-Flusberg, 2005). Some autistic individuals remain minimally communicative even after receiving intensive supports, while others attain language abilities similar to same aged peers (Tager-Flusberg & Kasari, 2013; Tek et al., 2014). Autistic children’s early development of social communication skills is among one of the most important contributors to long-term outcomes (Tidmarsh & Volkmar, 2003; Venter et al., 1992). Specifically, preschool aged children who communicate often, are reciprocal and referential with their communication partners, and use language in a semantically diverse manner are more likely to attain positive social and vocational outcomes later in life (Billstedt et al., 2005; Howlen et al., 2000; Howlen et al., 2004; Tidmarsh & Volkmar, 2003; Venter et al., 1992). Furthermore, parents have consistently identified the communication and social domains as treatment priorities for their children with autism (Pituch et al., 2011). Therefore, identifying and implementing effective supports to strengthen social communication capacities in children with autism is crucial for enhancing quality of life for both the child and parent.

*Social attention* abilities are thought to be critical for early social communication and language development (Adamson, 1995; Mundy, 2016). This is because children’s capacity to socially attend facilitates their ability to link behaviours, experiences, or
words with meaning, and develop social interaction competencies (Bottema-Beutel et al., 2020; Mundy & Jarrold, 2010; Nelson, 2007). Conceptually, social attention can be viewed as a broad construct inclusive of social orienting, attending, and joint attention behaviours (Mundy, 2016). At its most basic form, social orienting is thought of as directing our sensory organs toward sources of social stimuli (Mundy, 2016). Neurotypically developing children show a tendency to autonomically align their attention with social stimuli, rather than attending to non-social stimuli within the same context (e.g., Scaife & Bruner, 1975; Farroni et al., 2004). Social orienting is necessary for, but different from attention, which is thought of as an active process whereby information processing occurs after having oriented toward the stimuli (Mundy, 2016). Joint attention is more complex, involving social orienting, attending, referential processing, and signal sending. It consists of a triadic pattern of social attention that involves coordinating attention with another person to attend to, and ultimately share, a common point of reference (i.e., objects, events, ideas; Mundy et al., 2009; Tomasello & Farrar, 1986). Within clinical practice, the term *engagement* is often used in reference to social attention behaviours (e.g., Greenspan & Wieder, 2009; Solomon et al., 2014).

Rather than parsimoniously identifying social attention behaviours as discrete child skills (Adamson & Bakeman 1984; Bottema-Beutel et al., 2020), examination of engagement states (Adamson et al., 2010) is thought to capture the dyadic and interactive nature of social attention behaviours. Both the terms social attention and engagement will be used within this document.

Young autistic children consistently display different social orienting, joint attention, and social engagement patterns than their non-autistic and typically developing peers (e.g., Dawson et al., 2004; Jones et al., 2008; McArthur & Adamson, 1996). For
example, Jones and Klin (2013) found that autistic children displayed an increase in attending to objects compared to their non-autistic peers. Swettenham et al. (1998) examined children’s attention shifting during free play and found that autistic children spent less time looking at people than age-matched peers. Furthermore, the autistic children in this study were more likely than both their non-autistic and typically developing peers to shift attention from one object to another object, and were less likely to shift attention from person to person, or from person to object. Differences in social attention have been documented across different environments in autistic children including home settings (e.g., Baranek, 1999; Werner & Dawson, 2005) and clinical laboratory settings (e.g., Mcarthur & Adamson, 1996; Signman & Ruskin, 1999). Autistic children also tend to engage in and initiate joint attention less frequently than age matched peers (e.g., Dawson et al., 2004; Werner & Dawson, 2005). In the most recent version of the DSM (American Psychiatric Association, 2013), it is suggested that “impaired joint attention manifested by a lack of pointing, showing or bringing objects to share interest with others, or failure to follow someone’s pointing or eye gaze” (p. 54) is one of the earliest identifiable features of autism.

Social attention is an important construct to consider when working with autistic children, since evidence suggests that it is positively linked to social cognition (i.e., perspective taking, theory of mind, use of mental state vocabulary; Nelson et al., 2007; Brooks & Meltzoof, 2015; Kuhn-Popp et al., 2015). Additionally, the amount of time children spend in social interactions is positively associated with language development (e.g., Kasari et al., 2008) and social behaviour including social initiations and joint attention (e.g., Patterson et al., 2014). Thus, identifying supports to help autistic children maximize their opportunities to socially attend to their caregivers and access language
that facilitates interactions is critical given the challenges autistic children already experience in the social communication domain.

4.1.1 Considering the Role of the Environment

According to transactional and systems theories of development (Thelen & Smith, 1994; Sameroff & Fiese, 2000), children’s social attention and communication manifest differently depending on the social context, which can include the environment, materials available, and familiarity of play partners (e.g. Abbeduto et al., 1995; Miles et al., 2006; Kover et al., 2014; O’Brian & Bi, 1995). This has implications for professionals supporting the development of social communication skills and for assessing social communication capacities in autistic children. Adjustment of the environment is a key support strategy used in both Developmental Social Pragmatic and Naturalistic Developmental Behavioural Interventions (Binns & Cardy, 2019). However, specific information regarding when, why, and how environments should be adjusted is often not clearly specified or well understood.

When providing supports for preschool aged children, one essential environmental factor to consider is the play environment, specifically, the materials available in the children’s play context. This may be particularly important for autistic children given their sensory processing differences (Robertson & Baron-Cohen, 2017), differences in motor skill development (Flanagan et al., 2012), and reported differences in choice and interaction with toys. Dominguez et al. (2006) found that autistic children engaged in more exploratory, sensorimotor, and relational types of play than their neurotypical peers. Additionally, they used gross motor toys and figurines of popular characters in the media more than their neurotypical peers. Taking into consideration autistic children’s tendency to gravitate toward sensory motor play with gross motor toys,
the goal of this study was to examine and describe patterns of preschool autistic children’s social attention and communication skills in two different play environments, namely, a gross motor play environment and a symbolic play environment.

A substantial amount of research has examined the impact of play environments on the social communication of neurotypically developing children. During play with other people, 2-year-old children generate more complex language and more talking overall as compared to when they play independently (Bornstein et al., 2002). For neurotypical children under 3 years, free play environments are better for increasing their social engagement and vocabulary diversity, as compared to structured play environments (Kwon et al., 2013). At 5 years old, they speak more during free play contexts, but use more complex language during more structured contexts such as conversations and story generation (Southwood & Russell, 2004). O’Brien and Bi (1995) revealed that different types of play (i.e., symbolic vs gross motor) can yield very different language output from young children. Children in their study spoke more often and used more complex language during symbolic play as compared to gross motor play. They even found that different toys within the same type of play (i.e. symbolic play with blocks vs with dolls and food) can yield different language from children across the different contexts, with children using more statements and fewer labels during symbolic play contexts with open ended toys such as blocks and toy cars, as compared to symbolic play with play with dolls and a play house. For children with language impairments, we see similar results on the impact of play context on social communication to those reported for neurotypical children (e.g., Sealey & Gilmore, 2008).

Few studies, however, have empirically examined the impact of unstructured play environments on young autistic children’s social attention and communication skills, and
even fewer have looked at the relationship between gross motor play contexts and children’s attention and social communication. One study examined differences between autistic children’s language samples taken across three different contexts: parent-child free-play, during administration of the ADOS, and examiner-child free-play (Kover et al., 2014). They reported autistic children spoke more often, had higher intelligibility, requested more often, participated in turn-taking more often, and had a higher diversity of vocabulary when interacting with parents, as compared to the ADOS and examiner child-play contexts. The children’s language complexity (as measured by mean length utterance in morphemes; MLUm) was highest in the play context with the examiner. Another study by MacDonald et al. (2017) compared autistic and non-autistic children’s engagement, sustained attention, and connectedness with their caregiver across two parent-child play sessions: a traditional social play setting and a motor behaviour-based setting (i.e., fine and gross motor tasks). Results revealed significantly lower engagement, sustained attention, and level of connectedness with their parent in the motor behaviour-based play setting for the autistic children as compared to their neurotypical peers. Within the social play setting, autistic children and their peers performed similarly, with the exception of engagement, which remained significantly lower for autistic children compared to their peers. This suggested that children with autism have less engagement with their parent or caregiver than their typically developing peers across both motor and social play settings, although fewer group differences were observed in the latter. Swettenham and colleagues (1998) and Adamson and colleagues (2016) also found that autistic children were more likely than their age matched peers to spend longer durations attending to objects, and less time attending to people in their play environments.
4.1.2 The Current Study

With the long-term goal of contributing to the literature used to develop effective, adaptable assessment and intervention processes for autistic preschoolers, our study examined and described patterns of children’s language use and engagement in two different play environments (e.g., gross motor, symbolic). This study had two main aims.

Aim 1: To examine whether preschool-aged autistic children engaged with their caregiver differently in unstructured symbolic vs gross motor play environments. Social cognitive theories of development suggest environments can impact children’s social attention, and past research (e.g., O’Brian & Bi, 1995; MacDonald et al., 2017) has suggested there will be differences in how well children engage with adults in symbolic play environments and gross motor play environments. Specifically, children demonstrated less social engagement in the gross motor play environment than in the symbolic play environment. However, because autistic children display different social attention patterns and interactions with toys than their non-autistic and typically developing peers (e.g., Dawson et al., 2004; Domingez et al., 2006; Jones et al., 2008), and because the toys used in our motor context differ from those used in MacDonald’s (2017) study, we expected to see different patterns of engagement than other studies have found observing non-autistic children in symbolic and gross motor play (e.g., O’Brian & Bi, 1995). Namely, we predicted that the children in our study would demonstrate more social engagement in the gross motor play environments than in the symbolic play environments, and more engagement with objects and time spent unengaged with objects or people in the symbolic play environment.

Aim 2: To examine whether preschool-aged autistic children use language differently in unstructured symbolic and gross motor play contexts. Social cognitive
theories of development that suggest environments can impact children’s use of language, and past research with neurotypical children and children with language impairment (e.g. O’Brian & Bi, 1995; Sealey & Gilmore, 2008) has suggested that children speak more often and use more complex language during free play, and play with symbolic toys. Therefore, we expected autistic children would also speak more often and use more complex language in a symbolic play environment versus a gross motor environment. We expected autistic children to follow similar patterns to neurotypical and non-autistic peers for language, due to the nature of gross motor-based play, namely, because gross motor play makes fewer language demands than symbolic play.

4.2 Method

4.2.1 Participants

Participants included 70 children (and parents) who were recruited through diagnosing physicians, public service agencies, and newspaper advertisements in the Greater Toronto Area, and participated in a previously reported randomized control trial (Casenhiser et al., 2013). Children met the following criteria prior to entry into the treatment study: (a) clinical diagnosis of autism spectrum disorder, confirmed by the Autism Diagnostic Observation Scale and Autism Diagnostic Interview, (b) chronological age between 2 years 0 months and 4 years 11 months, and (c) no secondary neurological or developmental diagnoses (e.g., seizure disorder, global developmental delay; Casenhiser et al., 2015). Parents who enrolled in Casenhiser and colleagues’ study committed to attend a 2-hour session weekly for a period of 12 months, and spend an additional 10-13 hours per week implementing therapy strategies at home. Demographic information is presented in Table 5.
4.2.2 Overview of Design and Procedures

Institutional review board approval was obtained prior to enrollment of participants. A repeated measures design was used for this study. To collect data on children’s engagement states and language across two play contexts, we used a set of pre-treatment, videotaped, caregiver-child interactions. Videos were collected at in a research laboratory setting at York University in Toronto, Canada. The entire caregiver-child, free-play interaction was 25 minutes and consisted of 15 minutes of access to symbolic toys, 5 minutes of access to tactile toys, and 5 minutes of access to gross motor toys, presented in this same order for all participants. For the purpose of the present analysis, we elected to examine the first 5 minutes of the symbolic toy section and the 5-minute gross motor toy section. We used only 5 minutes of the symbolic section so that the amount of time was the same across both play contexts. Prior to being videotaped, caregivers were instructed to play with their child as they would at home. They were then presented with the different sets of toys. The symbolic toys included toy food, a shopping cart, a cash register, a toy house, toy cars, and puppets. Gross motor toys included a crash mat, small trampoline, exercise ball, and spinning desk chair.

4.2.3 Coding and Reliability

4.2.3.1 Social Attention/Engagement State Variables

Time-tagged video coding of the children’s engagement states was conducted using Datavyu software (Datavyu Team, 2014) and was informed by Adamson and colleagues’ (2010) engagement state coding system. Three distinct variables were examined: active engagement with caregiver (attending to social stimuli), engagement with objects only,
Table 5. Demographic information of participants

<table>
<thead>
<tr>
<th>Demographic Variables</th>
<th>Overall (N=70)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chronological Age Child (months)</strong></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>42.5</td>
</tr>
<tr>
<td>Median</td>
<td>44.0</td>
</tr>
<tr>
<td>Range</td>
<td>25.0 – 57.0</td>
</tr>
<tr>
<td><strong>Sex, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>5 (7%)</td>
</tr>
<tr>
<td>Male</td>
<td>65 (93%)</td>
</tr>
<tr>
<td><strong>Parent sex, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>54 (77%)</td>
</tr>
<tr>
<td>Male</td>
<td>16 (23%)</td>
</tr>
<tr>
<td><strong>Family income</strong></td>
<td></td>
</tr>
<tr>
<td>51% (over 100 000)</td>
<td></td>
</tr>
<tr>
<td>22% (50 000-100 000)</td>
<td></td>
</tr>
<tr>
<td>27% (less than 50 000)</td>
<td></td>
</tr>
<tr>
<td><strong>Mother’s education level</strong></td>
<td></td>
</tr>
<tr>
<td>16% (advanced degree)</td>
<td></td>
</tr>
<tr>
<td>52% (bachelors degree)</td>
<td></td>
</tr>
<tr>
<td>8% (associates degree)</td>
<td></td>
</tr>
<tr>
<td>22% (some university/college)</td>
<td></td>
</tr>
<tr>
<td>4% (high school)</td>
<td></td>
</tr>
<tr>
<td><strong>Language most often spoken at home</strong></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>62</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
</tr>
</tbody>
</table>

*Incomes are reported for 46 families and are in Canadian dollars. Six families elected not to provide information on their income, and family income was not available for 18 of the families. Statistics Canada reports the 2008 median gross income in Canada is approximately $76,000 (2010).

**Mother’s education level was reported for 52 families and was not available for 18 families.
and no engagement with objects or people (non-social attention). The variable
engagement with caregiver is inclusive of both children’s social orienting and joint
attention behaviours because evidence supports these behaviours are highly correlated,
suggesting that they measure a common construct (Dawson et al., 2004). Moments in
which the child was crying or the child’s body was offscreen were considered uncodable.
Descriptions and examples of each of the engagement codes appear in Table 6. To
calculate internal reliability of coding engagement states, 40% of the videos across both
play contexts were double coded by AB and two graduate students in speech-language
pathology. Reliability was good: Cronbach’s $\alpha = .840$.

4.2.3.2 Language Variables

Videos were transcribed in the Child Language Data Exchange System
(CHILDES) and utterances were coded for morphemes using the % mor tier in
CHILDES. The kidEVAL program was used to calculate number of utterances and mean
length of utterance in morphemes. Children’s reciting of songs or poems and exact
repetitions of previous utterances were excluded when calculating both MLUm and total
number of utterances produced. Transcription reliability between trained graduate
students in speech-language pathology and trained undergraduate research assistants was
computed for 25% of the participants and internal reliability was 96%.

4.2.4 Analytic Methods

To address our research questions, the relationship between play context
(symbolic vs gross motor) and child language and engagement variables was examined
with linear mixed effects modeling using R (R Core Team, 2012) and the lme4
Table 6. Descriptions and examples of engagement variables based on Adamson et al. (2000)

<table>
<thead>
<tr>
<th>Engagement Variables</th>
<th>Explanation</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Engaged with Caregiver            | Engagement with caregivers was defined as children’s time spent: watching/observing caregiver, engaged with a caregiver (with only minimal involvement of toys), engaged in social referencing (responding to, and initiating, using social referencing and/or verbal referencing). | • Child watching parent jump on the trampoline while waiting for a turn  
• People play, such as the child and caregiver making a game of the child jumping into the caregiver’s arms  
• Caregiver demonstrates how to use a toy, child watches then spontaneously imitates actions to use toy  
• The child bangs their hand onto the same toy that the caregiver is manipulating it, and then looks at the caregiver, bangs the toy, and then looks back at the caregiver, smiling |
| Engaged with Object (not socially attending) | The child is visually attending to an object, exploring or playing with it independently. The caregiver may attempt to engage the child, but the child ignores them. Segments in which the child is merely in contact with an object, as when they hold a small toy while scanning the room (not visually or auditorily attending to the toy) are not included. | • Child focuses attention on spinning wheels on a chair  
• Child visually explores the lines on the side of a doll house. |
| Not Engaged with Object or Caregiver (unengaged) | No apparent engagement with a specific person, object, or symbols. The child may be unoccupied, may be scanning the environment as though looking for something with which to be engaged, or may be flitting between foci without committing to any. | • Child walking the perimeter of the room  
• Child sitting independently and using self-talk without directing it to caregiver or shifting gaze toward caregiver. |
package (Bates, Maechler & Bolker, 2012). This method was selected because linear mixed effect models are relatively robust against violations of the assumptions of normality (Gellman & Hill, 2007), and they allow for the resolution of non-independencies in our data (Winter, 2013). Using linear mixed effect models, we are able to depict the relationships between play context and the engagement and language variables while properly accounting for the within-subject factor. That is, by including participant as a random effect in the linear mixed effects model, the idiosyncratic variation due to individual differences across participants is characterized. The assumption is that each participant has a unique intercept for each variable. Given the heterogeneity across autistic children, it is particularly advantageous to control for this individual variation among participants.

We ran separate models for each of our dependent variables. Within our models, play context (gross motor or symbolic) was entered into the model as a fixed effect, and all models were built with participants entered as a random effect (random intercept). Statistical significance of the fixed effect was obtained by testing the full model with the effect in question against the null model (without the effect in question) using the Akaike Information Criterion. This allowed for arbitrating the explanatory power of the models. Systematic visual inspection was used to examine homoscedasticity and normality of the residuals. Significant interaction effects were further explored using post-hoc pair-wise comparisons across participants and context, provided by the emmeans package (Lenth, 2018), with Holm-Bonferroni adjustment for family-wise error. Effect size (eta-squared) for each model was calculated using the anova_stats function, provided by the sjstats package (Lüdecke, 2020).
4.3 Results

Figure 5 presents visualization of the descriptive statistics for all dependent variables. The impact of context on children’s engagement and language variables was examined using linear mixed effect models, with context entered as a fixed effect and participant entered as a random effect. Separate models were created for each dependent variable. Table 7 presents random and fixed effects parameters for all five models. Systematic visual inspection of residual plots for each model did not reveal any obvious deviations from homoscedasticity or normality.

4.3.1 The Impact of Play Context on Social Attention/Engagement

Examination of the impact of play context (gross motor vs symbolic) on children’s overall social attention directed toward their caregiver revealed significant main effect, $F(1-69) = 9.36, p = 0.003$, with a moderate effect ($\eta^2 = 0.095$). Within the symbolic toy context, there was a decrease in time children spent engaged with their caregiver by $26.69s \pm 8.72$ (SE), as compared to the gross motor context. In other words, when in a symbolic play environment for 5 minutes, children spent roughly 9% less time attending to their caregiver than they did during the gross motor play environment. Play context also had an impact on children’s focus of attention solely on objects $F(1-69) = 24.10, p = 0.001$, with a large effect ($\eta^2 = 0.186$). During the 5 minutes
Figure 5. Pirateplots of descriptive data (group means, 95% confidence intervals) for engagement and language performance (dependent variables) in participants across symbolic and gross motor play contexts.

Note: Gross = Gross Motor Context; Sym = Symbolic Context; MLUm = Mean Length Utterance in morphemes.
### Table 7. Random and Fixed Effects Parameters for All Five Mixed Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>Estimate</th>
<th>SE</th>
<th>t</th>
<th>Variance</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engagement Models</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (seconds) engaged with caregiver</td>
<td>Intercept</td>
<td></td>
<td>182.84</td>
<td>9.12</td>
<td>20.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Context</td>
<td></td>
<td>-26.69</td>
<td>8.72</td>
<td>-3.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subject</td>
<td></td>
<td>3206</td>
<td>56.62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (seconds) engaged with objects only</td>
<td>Intercept</td>
<td></td>
<td>55.1</td>
<td>7.23</td>
<td>7.61</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Context</td>
<td></td>
<td>42.12</td>
<td>8.55</td>
<td>4.909</td>
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<tr>
<td></td>
<td>Subject</td>
<td></td>
<td>1121</td>
<td>33.48</td>
<td></td>
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<tr>
<td>Time (seconds) not engaged with objects or people</td>
<td>Intercept</td>
<td></td>
<td>48.11</td>
<td>5.15</td>
<td>9.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Context</td>
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<td>6.94</td>
<td>-2.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subject</td>
<td></td>
<td>171.6</td>
<td>13.10</td>
<td></td>
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</tr>
<tr>
<td><strong>Language Models</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Utterances</td>
<td>Intercept</td>
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<td>21.784</td>
<td>2.572</td>
<td>8.471</td>
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<tr>
<td></td>
<td>Context</td>
<td></td>
<td>-1.224</td>
<td>1.535</td>
<td>-0.798</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subject</td>
<td></td>
<td>81.45</td>
<td>9.025</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MLUmor</td>
<td>Intercept</td>
<td></td>
<td>1.56773</td>
<td>0.11835</td>
<td>13.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Context</td>
<td></td>
<td>0.15955</td>
<td>0.07745</td>
<td>-2.06</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Subject</td>
<td></td>
<td>0.4339</td>
<td>0.6587</td>
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<td></td>
</tr>
</tbody>
</table>
of play within the symbolic play environment, we saw children’s attention solely on objects increase by about 41.95s ±8.55 (SE) compared to their attention to objects in the 5-minute gross motor play context. This is an increase of about 14% in time spent engaged with objects only during the symbolic play. Finally, a significant main effect was also revealed for the relationship between play context and children’s focus of attention on neither objects nor people $F(1-69) = 24.01, p = 0.01$, with a small effect ($\eta^2 = 0.048$). On average, children decreased their time spent unengaged by 17.50s ±6.936 (SE) when in the symbolic play context as compared to the gross motor play context.

Table 8 outlines pairwise contrasts for the LME models.

Table 8. Pairwise Contrasts for LME Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Contrast</th>
<th>Estimate</th>
<th>SE</th>
<th>df</th>
<th>t ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total utterances</td>
<td>Gross-sym</td>
<td>1.22</td>
<td>1.53</td>
<td>68.5</td>
<td>0.798</td>
<td>0.4279</td>
</tr>
<tr>
<td>MLUm</td>
<td>Gross-sym</td>
<td>0.16</td>
<td>0.0775</td>
<td>68.8</td>
<td>2.060</td>
<td>0.0432*</td>
</tr>
<tr>
<td>Time actively engaged with caregiver</td>
<td>Gross-sym</td>
<td>26.7</td>
<td>8.72</td>
<td>69.2</td>
<td>3.059</td>
<td>0.0032*</td>
</tr>
<tr>
<td>Time engaged with objects only</td>
<td>Gross-sym</td>
<td>-42</td>
<td>8.55</td>
<td>69.2</td>
<td>-4.909</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Time not engaged with objects or caregiver</td>
<td>Gross-sym</td>
<td>17.5</td>
<td>6.94</td>
<td>69.8</td>
<td>2.524</td>
<td>0.0139*</td>
</tr>
</tbody>
</table>

*Note: Holm-Bonferroni method was used to adjust P-values for family-wise error

4.3.2 The Impact of Play Context on Language

No impact of play context on the total number of utterances spoken by children was found $F(1-68) = 0.636, p > 0.5$. However, a significant main effect between play context and children’s MLUm was revealed $F(1-69)= 4.24, p=0.04, \eta^2 = 0.053$, with children’s MLUm decreased by 0.16 ± 0.08 (SE) in the symbolic play context vs the gross motor play context. With the participants’ combined MLUm (inclusive of symbolic and gross motor contexts) ranging from 0 – 3.696, with a mean of 1.498, a change in 0.16
represents an 11% difference in children’s MLUm across contexts. See table 8 for pairwise contrasts.

### 4.4 Discussion

Our study examined autistic preschool children’s engagement and spoken language within two different play contexts, with the goal of identifying potential interactions between the contexts and children’s engagement or language. This is the first study of its kind to specifically examine the interaction between unstructured gross motor and symbolic play contexts and the engagement and spoken language use of autistic preschool children. Findings supported our general hypothesis as significant interactions between play context and autistic children’s engagement and language were revealed. Our findings were consistent with results from previous studies of autistic, neurotypical, and non-autistic preschool children, which suggested that a child’s play environment can influence their interaction patterns (e.g., Kover et al., 2014; Sealy & Gilmore, 2008).

#### 4.4.1 Engagement Differences Across Play Contexts

Our specific prediction for the impact of play environment on children’s social attention was that the autistic children in our study would demonstrate more social engagement in the gross motor play environment than in the symbolic play environment, and more time engaged with objects in the symbolic play environment. In alignment with our hypothesis, children in our study directed their attention socially toward caregivers more often, spent less time focusing on objects only, and spent slightly more time unengaged with objects or people in their environment, during the gross motor play context relative to the symbolic play context. Our findings may be related to a number of factors that have yet to be tested but are worthy of consideration. One possibility is that this was merely an artefact of the order in which the contexts were presented, that is,
children may have engaged more with caregivers in the gross motor play context because this context was always presented to the child after the symbolic context. It is plausible that children were *warming up* during the symbolic context, and the increase in engagement with caregivers in the gross motor context could be attributed to their becoming more comfortable with the environment over time. However, the data from our symbolic play context is closely aligned with data on young autistic children’s engagement states within semi-natural play interactions from Adamson et al. (2012). This suggests that although it is possible that children may have interacted differently in the symbolic play context as a function of the order in which the two contexts were filmed, the patterns of children’s engagement observed in our symbolic play context appear to be representative of young autistic children’s engagement in symbolic contexts.

It could also be the case that the properties of the toys provided in each of the play environments, rather than the nature of the toys (symbolic vs gross motor), contributed to our findings of systematic differences in children’s engagement across play contexts. Within the context of the toys used in this study, these properties include how they are used, their size, and the degree of visual detail within them. Differences in the properties of toys used in our study compared to those in MacDonald (2017) may also account for conflicting results between the studies. MacDonald used both fine and gross motor toys in their motor context and the toys in our motor play environment were solely gross motor toys.

Generally, symbolic and gross motor toys are designed to be used very differently. For young children, the gross motor toys may be more likely to require a partner’s assistance for use than the symbolic toys. For example, in the gross motor context a child could jump on a crash mat and might require caregivers to hold their
hands for stabilization, while in the symbolic context they could explore a toy car and figurine independently. It could be the case that the built in need for caregiver’s assistance to use many of the gross motor toys in our study contributed to children’s increase in attention directed toward caregivers in the gross motor context. Additionally, there was a distinct difference in the size of the toys provided in the symbolic vs the gross motor play context. Toys in the gross motor play context were much larger (i.e., personal trampoline, crash mat, large yoga ball, spinning chair) than the toys provided in the gross motor play context (i.e., action figures, small toy cars, play food items). For some children with autism, disengaging and then shifting attention is slower, and perhaps a more effortful process than that experienced by non-autistic peers (Burack et al., 1997; Elison et al., 2013; Waas, et al., 2015). It is possible that when children are playing with larger toys, their visual field is likely to be expanded, potentially making it less effortful for them to shift their focus of attention toward their play partners. Moreover, the toys in the gross motor environment also tended to have less visual detail than the toys presented in the symbolic play environment. For example, a large yoga ball has less complex visual details than a cat figurine. Thus, when children were in the symbolic play context, they could have been more focused on the objects in their environment because they tended to be more visually detailed. This viewpoint aligns with research by Remington et al. (2009) suggesting that autism maybe characterized by increased perceptual capacity. They propose that this perceptual difference may lead autistic individuals to be more detail focused and distracted by visual details of objects, which may also make it harder for them to shift attention to social stimuli (social orienting). Systematic testing of the impact of the aforementioned toy properties on children’s engagement should be explored in
future work, to form a more detailed understanding of the impact of play environments on young autistic children’s engagement.

The final factor to consider when interpreting the engagement results revealed in our study relates to the impact gross motor play activities can have on children’s arousal level. We know from listening to the lived experiences of autistic self-advocates and empirical research that autistic children have sensory-regulatory differences that can impact arousal (e.g., Fletcher-Watson & Happe, 2019; Baranek et al., 2007; Baranek et al., 2013; Cascio et al., 2016; Welch et al., 2019). In addition, there is evidence indicating a relationship between arousal and social attention behaviours such as attention shifting and re-orienting (e.g. Marrocco et al., 1998; Orekhova & Stroganova, 2014). Furthermore, gross motor play requires physical exertion and thus is likely to increase children’s arousal levels more so than symbolic play. Therefore, the toys provided to children during gross motor play could have been upregulating children’s arousal level, potentially making it easier (less effortful) for them to shift attention. In future work, adding a measure to examine children’s arousal during play interactions, and examining the relationships between arousal, engagement, and play environment would be of value and could be used to inform development of engagement supports.

4.4.2 Language Differences Across Play Contexts

Although there was a clear impact of play environment on our participants’ engagement, the impact of play environment on children’s spoken language was less robust. We had predicted that the preschool autistic children in our study would follow similar patterns to those revealed in neurotypical children and children with language impairments, that is, speaking more and using more complex language in the symbolic play environment than in the gross motor play environment. However, our findings
revealed there was no meaningful difference in how often children used spoken language across the symbolic and gross motor play contexts, and that children used more complex language in the gross motor play context. When considering the clinical significance of these results, it is important to note that although the children’s difference in MLUm across contexts was statistically significant, in absolute value, the difference in MLUm between the symbolic and gross motor play contexts is quite small (an increase of 0.16). Nonetheless, the fact that there was little difference in children’s spoken language across the two different contexts is meaningful, as this pattern of language use across symbolic and gross motor environments differs from the patterns observed in neurotypical children. Therefore, our findings, although preliminary, should expand consideration of how play contexts might be used in clinical settings when evaluating and working with young autistic children.

Increase in children’s MLUm in the gross motor play context could be related to their increase in social engagement in this same context, as the correlation between social attention and language is well documented (e.g. Charman, 2003; Poon et al., 2012). Furthermore, aligned with the transactional model of development, previous research has suggested that autistic children’s MLUm is significantly associated with their caregivers’ communication (Fusaroli et al., 2019). We have yet to explore if there were differences in how the parents used language across the two play environments, but we acknowledge that this could have impacted our findings.

4.2.3 Limitations

Although informative, this study is characterized by a number of limitations that should be considered. First, because we used previously collected videos, we were not able to alternate the order in which symbolic and gross motor toys were presented to the
children. As such, our analysis is subject to bias in that the order of presentation could have impacted children’s overall stronger performance within the gross motor context. In future work, this could be addressed by randomizing order of the play contexts.

It should also be noted that our data was extracted from 5-minute samples for each play context. This duration is consistent with recommendations for engagement language samples (Miller, 1981). However, we do not know if this pattern would be sustained over a longer period of time (e.g. a 30-minute therapy session). This should be taken into account when considering how to apply this information clinically. Future work could examine longer samples of play interactions to establish scalability.

Additionally, although efforts were made to avoid bias in the sample selection when participants were recruited for the original study, self-selection bias was present. Parents who signed up for the original study from which the data was obtained had to make a considerable time commitment (17-hours/week for 12months). Thus, participants might not be representative of the general population and thus limit generalizability of our findings.

Finally, and perhaps most importantly, this study did not explicitly consider the dyadic, bidirectional nature of social attention and communication, the impact that the play contexts may have had on caregiver language or interaction styles, and how these factors might interact with child outcomes. We know that children’s engagement and social communication is inextricably intertwined and dependent on their partner’s communication and actions. For example, caregiver quality of language and responsiveness have been shown to predict early language learning in neurotypical children (e.g., Tamis-LeMonda et al., 2001; Hirsh-Pasek et al., 2015) and autistic children (e.g., Haebig et al., 2013). Further, caregiver responsivity has been linked to the
amount of time children jointly engage with their interaction partners (Patterson et al., 2014; Ruble et al. 2008). Although our engagement coding system (Adamson et al., 2010) took into consideration the actions of both the caregiver and child, without systematic examination of caregivers’ contribution to this bidirectional interaction process, we only have a partial understanding of the impact of play contexts on autistic preschool children’s engagement and communication. Future work examining the impact of play contexts on caregiver’s language and interaction styles and examination of how they mediate children’s engagement and communication is needed to gain a more complete picture.

4.2.4 Clinical Implications and Significance

Although our results warrant replication and expansion before concluding that one particular play context is better than another for autistic preschoolers, our findings suggest there is value in clinicians differentiating play contexts when assessing and supporting the language and engagement capacities of young autistic children. It may be that specific elements within gross motor play environments provide some autistic children with important sensory-regulatory supports that positively impact their social engagement and communication. Thus, clinicians don’t need to feel confined to using symbolic play environments when supporting children’s social communication. If a child is having difficulty socially attending to their play partners in an environment with symbolic toys, the clinician may want to explore where positive changes can be made in the child’s social engagement within a gross motor play environment. Furthermore, the recognition that play context can influence preschool autistic children’s engagement and use of language can help in the design of supports for autistic preschoolers, and may encourage more interdisciplinary work between professionals who support social
communication and sensory-motor domains (e.g., speech-language pathologists with occupational therapists, physical therapists, and recreation therapists). Research exploring why and for whom play contexts impact social communication behaviours is needed to be able to more accurately guide clinical practice.

4.5 Conclusions

While our findings are preliminary, they support the idea that preschool aged autistic children’s play environments can influence their social attention and spoken language use. They also contribute to the literature helping clinicians better understand the impact the play environment can have on autistic preschool children’s social attention and language. Future work in this area should investigate the factors that predict the impact of play environment on children’s social attention and communication, which could be used to inform development of supports for autistic preschoolers. Moreover, the findings encourage us to continue to study the impact of children’s play environments on their engagement and language, using a broader cross disciplinary lens, in hopes of better understanding how to support autistic children’s social attention and communication.
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Chapter 5: General Discussion

Approaching this dissertation research from the viewpoint of both a speech-language pathologist (SLP) and a researcher, the primary purpose of my doctoral research has been to enhance our understanding of intervention programs offered by SLPs to children with autism, and to contribute to our knowledge about how to best support their social communication and language. As a clinician, I wanted to produce research that was meaningful to clinicians working within real-world community settings, and respectful of the values of parents and autistic individuals. As a researcher, I aimed to contribute to the limited literature base on SLP approaches to intervention for autistic preschool children. This integrated article dissertation began with a scoping review that broadly explored the literature on autism interventions within the field of speech-language pathology (Chapter 2). The aim of this review was to gain a comprehensive understanding of the state of research on preschool autism interventions provided by SLPs. Additionally, we wanted to identify the range of skill development areas targeted within the studies and to explore characteristics of the interventions (i.e., theoretical models underlying the programs, service delivery models, treatment dosage). The systematic review reported in Chapter 3 focused on one particular type of intervention frequently offered by SLPs, and examined the effectiveness of these interventions in supporting communication and language outcomes for autistic preschool children. Specifically, we aimed to differentiate interventions using a developmental social pragmatic model from other developmental or naturalistic behavioral approaches and examine the impact of developmental social pragmatic interventions in supporting (a) foundational social communication and language skills of preschool children with autism spectrum disorder and (b) caregiver interaction style. Finally, the study reported in Chapter 4 explored the impact of one
specific support strategy built into many preschool interventions, environmental modification, on autistic children’s social communication and language. Specifically, we examined whether preschool aged autistic children socially attended or used language differently in unstructured symbolic versus gross motor play environments.

In this final chapter, I discuss the main findings across the three studies included in this dissertation and highlight the contribution of these studies to the field, for both research and clinical practice. The chapter concludes with considering the ways in which this work provides directions for future research.

5.1 Foundational Knowledge: Mapping the SLP Autism Intervention Literature

In order to gain a better understanding of the available research examining preschool autism interventions in speech-language pathology, it was necessary to conduct a study broadly scoping the literature (Chapter 2). With speech and language therapy being one of the most frequently accessed early interventions for children with suspected or diagnosed Autism (Denne et al., 2018; Salomone et al., 2016; Volden et al., 2015), we were surprised to find that such a review had not already been done. A total of 114 studies met inclusion criteria with most published within the last decade. Case studies or single subject designs were predominant across the SLP intervention literature, underscoring the need for more methodologically rigorous and differentiated study designs. Nine skill development areas were targeted within the studies included in this review, but interventions targeting social communication, language, and augmentative communication skills made up the vast majority of the research. There was a great deal of variability across intervention characteristics (i.e., service delivery models and treatment dosage) and about half of the studies were delivered by SLPs working on multi-professional teams, however, very little information was provided regarding the nature of
the teams, how or if they worked collaboratively, roles of team members, etc. With regard to the theoretical underpinnings of interventions offered by SLPs, there was relatively even distribution of research on interventions informed by child-centred, clinician-directed, and hybrid models. Together, the results from this study shed light on the status of research within the field of SLP and preschool autism interventions, called attention to the versatility of the SLP’s role within preschool intervention, and reminded us of the limits of the evidence that we have to support the approaches used by SLPs in clinical practice. Although there has been an increase in research in our field over the last decade, the discipline of speech-language pathology still needs a stronger evidence-base to strengthen advocacy and policy development. The findings presented in this scoping review can be used as a rationale for conducting systematic reviews and research on SLP-delivered autism interventions and can be cited when applying for funding for such research.

The work done for this scoping review enabled me to broadly review the breadth of available literature related to preschool autism interventions, highlighted gaps in our current knowledge, and provided me with directions for future research. The gaps in the literature limit the ability of SLPs, organizational leadership, and policy makers to make evidence informed decisions when deciding on and developing social communication and language supports for young children and their families (e.g., service delivery, type of parental training, process for collaboration with multidisciplinary teams, program selection, etc.). Embedded within the scoping review article are several suggestions for future research. One idea that has particularly important implications for clinical practice is producing research that supports efforts in gaining a clear understanding of the unique and shared theoretical underpinnings informing intervention models. With SLP
interventions generally classified into one of three models, child-centred, clinician-directed, or hybrid models, identifying which therapeutic strategies or ingredients are used within each model, and which ingredient(s) from the child-centred and clinician-directed models are being combined within hybrid models, would support efforts to conduct research to understand which combination of supports mediate children’s response to treatment. Many of the studies included in the scoping review did not provide comprehensive and systematic information about the interventions delivered. The scarcity of such information is a significant shortcoming for research and hinders clinicians’ abilities to implement findings within real world service delivery. In our next study (Chapter 3), I focused on beginning to address this challenge.

5.2 Identifying and Evaluating Interventions using a Developmental Social Pragmatic (DSP) Model

The second study was narrower in focus, and systematically identified one type of parent-mediated intervention commonly used by SLPs that aligned with child-centred interventions, namely, developmental social pragmatic interventions (DSP). Ten studies of varying methodological rigor evaluated DSP programs and were included in this review. All of the studies examined foundational communication outcomes (e.g., shared social affect, reciprocity, joint attention) and all but one reported positive outcomes for at least one of the measures. Fewer studies (n=7) examined language outcomes and while results were positive for language use within natural contexts, they were mixed for overall, receptive, and expressive language. In addition, parents’ interaction styles significantly changed postintervention, namely in terms of increased responsiveness, synchronous behavior, use of affect, and decreased directiveness. Only two studies conducted formal mediation analysis and found that parent responsiveness and
synchronous behavior were related to children’s positive response to treatment. Together
the evidence suggested that these interventions positively impact autistic children’s
foundational communication capacities (i.e., attention, social referencing, joint attention,
initiation, reciprocity); however, there is need for more methodologically rigorous studies
and research exploring components of DSP treatments that might mediate response to
treatment is needed. The findings presented in this systematic review can be used as a
rationale for conducting more DSP and parent-mediated intervention research, can be
cited when applying for funding, and can be used to inform preschool autism intervention
policy development.

In this article we took a unique approach to identifying DSP intervention studies
to include in this review, which lead to important contributions to research and clinical
practice. The unique element included in our study identification process involved using
Ingersoll’s (2010) DSP criteria (which explain similarities and differences between DSP
and hybrid therapy models) as a guide to clearly specify criteria each intervention being
studied needed to meet in order to be classified a DSP intervention and included in our
review. Only 55% of the articles that self-identified as being DSP actually incorporated
all elements required to meet DSP criteria. From a research perspective, inclusion of this
step in our systematic review supported efforts to assess a more homogenous group of
interventions, and ensured our results genuinely reflected an evaluation of DSP
intervention studies. Clinically, by undertaking this step, it allowed us to include
information in our publication evaluating how each intervention self-reporting use of a
DSP model incorporated core features within their information. This information can be
used by SLPs to guide their responses to parents or colleagues inquiring about similarities
and differences between different intervention models.
5.3 The Relationship Between Play Contexts and Children’s Social Communication

To address limitations within the current literature surrounding the understanding of specific ingredients that may be used in SLP-delivered interventions, the final study in this dissertation examined one specific ingredient commonly used in SLP-delivered interventions – environmental modification. Specifically, we examined the relationship between play context (symbolic vs gross motor) and child language and engagement during free-play interactions between 70 autistic children aged 2-4 years and their parent. Although preliminary, our findings support the idea that preschool-aged autistic children’s play environments can influence their social attention and spoken language use. The most significant finding was that young autistic children were more likely to socially attend to caregivers in gross motor play contexts than in symbolic play contexts, and they were more likely to focus their attention solely on objects during symbolic play contexts as compared to gross motor contexts. Small effects were also found for children’s increase in MLUm and time spent unengaged with objects or caregivers, during the gross motor play contexts. The findings have potential to inform how SLPs use environmental modification during assessment and intervention and encourage continued exploration of the impact of children’s play environments on their engagement and language, using a broader cross-disciplinary lens.

This study stemmed from my clinical work, and observations of differences in children’s engagement and language production during SLP sessions using symbolic toys as compared to SLP-Occupational Therapist (OT) co-treatment sessions. When consulting the literature, little research was found examining the impact of gross motor play environments on children’s engagement and language. In addition, with so much work in the field of autism focused on supporting the ability of autistic children to adapt
to, or fit into, a neuro-typical world, I felt that we should also consider whether there are changes that we (as clinicians) could make to tailor the environment to better support the child. For these reasons, I aimed to contribute to the body of research focused on better understanding the impact of children’s environments (specifically play environments) on preschool autistic children’s social attention and language. By examining both gross motor and symbolic play contexts, it expanded my thinking about factors that might be impacting children’s engagement and language play (i.e., sensory-motor, regulation). More research is needed to further explore child factors (e.g., language level, play level) that might be impacting engagement and language use in different play contexts, and specific elements or changes in caregiver behaviors that may contribute to differences in their child’s engagement and use of language across symbolic and gross motor contexts (e.g., use of directives, language demands, affective interactions, use of routines in interactions). Nonetheless, our findings can still inform clinical practice, and encourage clinicians not to feel confined to using symbolic play environments when supporting children’s social communication. I am eager to continue this program of research, crossing disciplinary silos, and exploring why and for whom certain play contexts impact social communication behaviours.

5.4 Future Directions

Taken together, this research has uncovered exciting opportunities for new lines of inquiry about preschool social communication supports for autistic children. We identified many areas in need of further investigation in order to continue moving this work forward (e.g., systematic reviews of SLP interventions targeting specific skill development areas). However, foundational to this work is better understanding the complexities and nuances of the SLP-delivered programs offered in research studies, the
process involved in delivering the interventions, and the service delivery models used. One important suggestion for moving this work forward entails improving our reporting of speech-language pathology intervention components, processes of collaboration, and clinical decisions by sharing treatment manuals, making use of mixed methodologies, or using tools such as the Template for Intervention Description and Replication (TIDieR; T. C. Hoffmann et al., 2014). Following this recommendation alone would strengthen the precision of the research and enable service providers working in community settings to better relate to and apply the findings within their practice.

As I reviewed much of the literature on SLP-delivered interventions for preschool autistic children for the reviews, I noticed a tension or paradox between viewing the work through the lens of a researcher and a service provider. As a researcher, I recognize the need to conduct clean research that is consistent, with as few confounding variables as possible. However, as a clinician, I am well aware of the real-world need to embrace the complexity and messiness of delivering interventions in the community. I found myself asking questions such as: (a) are the interventions being examined in research studies aligned with the services and programs SLPs use in their day-to-day work? (i.e., are we measuring the interventions SLPs truly care about or already use?), (b) do the service delivery models being examined within the research align with what community programs are able to offer within real-world settings (e.g., duration, level of multi-disciplinary integration, cost)?, (c) what is the process involved in coaching or training the agent of intervention within parent-mediated or educator-training interventions?, (d) are the tools being used to measure outcomes within research studies in alignment with the tools SLPs use in clinical practice, or in alignment with outcomes that are important to families? I believe that in answering these questions, through mixed
methodological studies, we will be able to better align the design of future research studies with the values, needs and goals of the knowledge users (i.e. clinicians, parents, educators). This is important if our ultimate goal is real-world community adoption and implementation of the supports or interventions.

Another piece of working toward a more complete understanding of SLP-delivered autism interventions is understanding active therapeutic ingredients and subgroup variation in treatment response. This work can be done using comparative efficacy trials, adaptive treatment designs, and RCTs with adequate power to allow for mediation and moderation analysis. Once mediators and moderators are identified, they can be taken into account when developing interventions, and can then be further tested and refined through a series of experimental studies. Given the heterogeneity of autism, and the focus on individualizing treatment programs for each child within SLP services, this information would be immensely meaningful to clinicians and could be used to guide their selection and provision of services.

Finally, the findings from our third study (Chapter 4) led me to a new line of inquiry focused on investigating factors that predict the impact of play environment on children’s social attention and communication using a broader cross disciplinary lens. Currently, I am in the process of conducting a follow up study (to chapter 4), examining the transactional nature of interactions within different play contexts, specifically examining the impact of play environments (gross motor or symbolic) on parent interaction style, and the interaction between play context, parent interaction and child variables. The findings from such work could be used to inform development of supports, and inform clinical decision making for SLPs working with autistic preschoolers and their parents.
5.5 Conclusions

This dissertation set out to enhance the understanding of interventions offered by SLPs to children with autism and contribute to our knowledge about how to best support social communication and language of children with autism. The research took the form of three studies, each one informed by my experience working as a clinician. The first study shed light on the status of research within the field of SLP and preschool autism interventions, called attention to the versatility of the SLP’s role within preschool intervention, and reminded us of the limits of the evidence that we have to support the approaches used by SLPs in clinical practice. The second study revealed DSP interventions positively impact autistic children’s foundational communication capacities (i.e., attention, social referencing, joint attention, initiation, reciprocity), and identified that further inquiry is needed to better understand the inconsistent results found for the impact of these interventions on language. Findings from the final study support the idea that preschool autistic children’s play environment can influence their social attention and spoken language use and confirm the importance of considering their impact on clinical assessment and intervention and continuing to investigate the impact of unstructured play environments on children’s social attention and communication. Collectively, the findings from the studies included in this dissertation provide several directions for future research and have opened important questions to consider in an effort to better align research with real-world clinical practice. Taken together, these works set a foundation for the speech-language pathology field to move forward with a focus on autism intervention research that is meaningful to the children, and families, and the clinicians who serve them.
References


Appendices

Appendix A: Scoping Review Search Strategies and Limits

Based on our research question, four key criteria were used and combined to search databases for relevant articles. Studies were only included if they 1) included children with ASD, 2) involved services delivered at least in part by a SLP, 3) Included children aged birth to 5-11 years of age, 4) outlined intervention practices with child outcomes. To extract articles most likely to fit the above criteria, the following search terms were used.

Keyword search terms used for SCOPUS, AMED, ERIC, PsycInfo, EMBASE, CINAHL:

1. ASD: “Autis*” OR “Asperger*” OR "Pervasive Developmental Disorder*" OR "Pervasive-Developmental Disorder*
2. SLP/ CDA: “Speech-Language Patholog*” OR “Speech-Language Therap*” OR “Speech Patholog*” OR “language patholog*” OR “Communicative Disorders Assistant*” OR “Communication Disorders Assistant*” OR “Speech Therap*” OR “Language Therap*” OR “supportive personnel*” OR “support personnel*” OR “speech teach*” OR “language teach*” OR “clinician*” (Note: In AMED, EMBASE, and CINAHL, the keyword “Speech-language pathology assistant” was also added. Due to an oversight, “speech patholog*” was not included in the search of the EMBASE database.)
4. Intervention: “Intervention*” OR “Therap*” OR “Program*” OR “Treat*” OR “Train*”

Subject Heading searches for AMED, PsycInfo, EMBASE, CINAHL:

Where applicable in a given database, relevant subject headings were also searched. Subject headings included in each database are outlined below.
The PubMed database was also searched, using the following keywords and MeSH terms:


The following keywords were searched in PubMed:

1. “Asperger AND syndrome” OR “Asperger syndrome” OR “Asperger” OR “Asperger’s AND syndrome” OR “Asperger’s syndrome” OR “Asperger’s” OR “Autistic AND disorder” OR “autistic disorder” OR “autism” OR “autistic” OR “autistics” OR “Child AND development AND disorders AND pervasive” OR “pervasive child development disorders” OR “pervasive AND developmental disorder” OR “pervasive developmental disorder”

2. “speech-language AND pathology” OR “speech-language pathology” OR “speech AND language AND pathology” OR “speech language pathology” OR “speech-language pathologist*” OR “speech language pathologist*” OR “speech therapist*” OR “language therapist*” OR “clinician” OR “communication AND disorders” OR “communication disorders” OR “communicative AND disorders” OR “communicative disorders AND assistant”

3. “therapy” OR “treatment” OR “therapeutics”, OR “intervention” OR “interventions” OR “therapies” OR “treatments” OR “program” OR “programs” OR “training” OR “trainings”

This search yielded only 370 results, so further limiting by preschool age was not deemed necessary and all articles were included to be screened for inclusion.
Appendix B: References of Articles Included Within the Scoping Review


https://doi.org/10.2147/NDT.S81233

https://doi.org/10.1007/BF03393070

https://doi.org/10.1007/s10643-014-0677-y


83. Reis, H. I., Pereira, A. P., & Almeida, L. S. (2018). Intervention effects on communication skills and sensory regulation on children with ASD. *Journal of...


## Appendix C: CASP Systematic review tool

<table>
<thead>
<tr>
<th>VALIDITY</th>
<th>IMPORTANCE</th>
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<tbody>
<tr>
<td><strong>Are the results of the trial Valid?</strong></td>
<td><strong>What are the Results?</strong></td>
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<tr>
<td><strong>How large was the treatment effect?</strong></td>
<td><strong>How precise was the estimate of the treatment effect?</strong></td>
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<tr>
<td><strong>How was the assignment of patients to treatments randomized?</strong></td>
<td><strong>Consider:</strong></td>
</tr>
<tr>
<td>Consider: Was the trial stopped early?</td>
<td><strong>How was this carried out?</strong></td>
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<tr>
<td>Were patients analyzed in the groups to which they were randomized?</td>
<td><strong>Were patients allocated to treatments randomly?</strong></td>
</tr>
<tr>
<td>Was there a high attrition rate?</td>
<td><strong>Was there a big difference between groups?</strong></td>
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<tr>
<td>Was there a valid reason for attrition rate?</td>
<td><strong>Aside from the experimental intervention, were the groups treated equally?</strong></td>
</tr>
<tr>
<td><strong>Were the groups similar at the start of the trial?</strong></td>
<td><strong>Consider:</strong></td>
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<td>Consider: Also look at other factors that might affect the outcome...</td>
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<tr>
<td>age, sex, social class etc. (was there a big difference between groups?)</td>
<td><strong>Also look at other factors that might affect the outcome...</strong></td>
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<td><strong>Aside from the experimental intervention, were the groups treated equally?</strong></td>
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<td><strong>Consider:</strong> did both groups receive same assessments? at same timing?</td>
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<td><strong>How large was the treatment effect?</strong></td>
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<td><strong>Consider:</strong></td>
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<td>What outcomes were measured? Is the primary outcome clearly specified?</td>
<td><strong>Were all clinically important outcomes considered?</strong></td>
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<tr>
<td>What tools were used for measurement? What results were found for each outcome?</td>
<td></td>
</tr>
<tr>
<td><strong>How precise was the estimate of the treatment effect?</strong></td>
<td><strong>Are the benefits worth the harms and costs?</strong></td>
</tr>
<tr>
<td><strong>Consider:</strong></td>
<td><strong>Even if this is not addressed by the trial what is your opinion?</strong></td>
</tr>
<tr>
<td>What are the confidence limits?</td>
<td><strong>Certainty of Evidence</strong></td>
</tr>
<tr>
<td><strong>Can the results be applied in your context (or to the local population)?</strong></td>
<td>(Equivocal, Suggestive, Compelling)</td>
</tr>
<tr>
<td><strong>Consider:</strong> Do you think that the patients covered by the trial are similar enough to patients to whom you will apply this? if not how do they differ?</td>
<td></td>
</tr>
<tr>
<td><strong>Will the results help locally?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Were all clinically important outcomes considered?</strong></td>
<td></td>
</tr>
<tr>
<td>(See fidelity &amp; generalizati on chart for additional info on these measures)</td>
<td></td>
</tr>
</tbody>
</table>

### Article Details

<table>
<thead>
<tr>
<th>Article</th>
<th>Randomized</th>
<th>Allocation concealment</th>
<th>Y - no dropouts from active treatment once treatment started</th>
<th>Y - matched according to amount of routine treatment received – but not matched on important measures such as age, language or severity of ASD</th>
<th>N - matched according to amount of intervention after the first 6 months was not clearly defined (e.g. “less frequent”) therefore difficult to replicate</th>
<th>CT – for the most part yes, but amount of intervention</th>
<th>CT - no CIs were reported</th>
<th>Maybe – small N Y</th>
<th>Overall – no positive statistical significance for treatment group– Wide CI particularly for standardized language</th>
<th>Y Y (as above)</th>
<th>Y Y Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldred, Green, &amp; Adams, 2004</td>
<td>Randomized</td>
<td>But very small sample size</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Carter, Messinger, Stone, et al, 2011</td>
<td>Allocation concealment unknown</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>
to begin with thus some risk of bias - partial intent to treat (5 participants were included in analyses when their outcome data were available). any Time 1 measures of the experimental or clinical child variables although some moderate effect sizes (possibly due to small sample size). testing – VABS & Mullen (but notably wide across both treatment and control groups) - additionally Confidence intervals straddled zero - some measures parental report (and parents not blind to treatment group so some risk of assessment bias).

<table>
<thead>
<tr>
<th>Study</th>
<th>N (risk of bias)</th>
<th>Social interaction/communication</th>
<th>Language</th>
<th>Parent Interaction</th>
<th>Validity</th>
<th>Importance</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casenhiser, et al., 2011; 2014</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Suggestive</td>
<td>Suggestive</td>
<td>Suggestive</td>
</tr>
</tbody>
</table>

- 9 families withdrawing from the MEHRIT treatment group and 13 withdrawing from the CT group. “We cannot be sure of the effect of this attrition on the outcomes. We decided not to continue to collect measurements from these children because the different methods used by the several government treatment centers, and the variance in the amount of time individuals were receiving treatment through our program, would have

relatively wide CI; Language CI straddling zero

large positive effects

matched based on age, baseline language level and cognitive function

Large positive

- but majority were from 2 parent household - depending on structure of intervention could be difficult to deliver 1 year of intervention with both OT and SLP

Y Y (as above)
effectively erased any homogeneity in treatment among the individuals who withdrew, and the 20–30 hours of treatment these individuals were receiving was not comparable to the 3.9 hours (on average) being received by the rest of the CT group. These children were not accounted for statistically.

<table>
<thead>
<tr>
<th>Study</th>
<th>Risk of Bias</th>
<th>Compliance</th>
<th>Y</th>
<th>Social Communication: Large positive effects</th>
<th>CI’s do not straddle zero; but are relatively narrow.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green, Charman, McConachie, et al, 2010</td>
<td>(low risk)</td>
<td>- attrition to endpoint was low (6 [4%] of 152 for primary endpoint and 101 [7%] of 1520 for all secondary endpoints).</td>
<td>Y</td>
<td>Language: moderate to large positive effects</td>
<td>-some measures parental report but were not primary outcome measures and data was not extracted as no p values were reported, nor were we able to obtain the effect size measurement used by authors.</td>
</tr>
<tr>
<td>Pajareya &amp; Nopmaneejumruslers (2011)</td>
<td>(risk of bias)</td>
<td>- Four strata were generated within both treatments to guarantee baseline similarity</td>
<td>Y</td>
<td>Parent Interaction: Large positive</td>
<td>Maybe intervention was 2 hours biweekly for 6 months and then monthly booster sessions for 6 months. Depends on program if this would be feasible.</td>
</tr>
</tbody>
</table>

| Validity: | Compelling |
| Importance: | Compelling |
| Overall: | Compelling |

| Validity: | Equivocal |
| Importance: | Suggestive |
| Overall: | |

May not be the most relevant measures.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design/Methodology</th>
<th>Retention Rate</th>
<th>Treatment Differences</th>
<th>Social Communication</th>
<th>Validity</th>
<th>Importance</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schertz, Odom, Baggett &amp; Sideris (2013)</td>
<td>CT Random sequence generation or allocation concealment</td>
<td>9 dropped out/withdrew in treatment group - and 4 dropped out in control group (13 total) - another 9 lost at follow up for treatment group and 8 lost at follow up for control group - Accounted for in analysis (intent to treat)</td>
<td>Y = No significant difference on pre-test measures.</td>
<td>Not entirely – but accounted for in statistical analysis. - No statistically significant difference in the amount of time spent in treatment. - Assessment times varied but researchers took this into account and treated different assessments as categorical variables.</td>
<td>CT - no confidence intervals were reported - SD were smaller than mean - some measures parental report (and parents not blind to treatment group) for some risk of assessment bias</td>
<td>Y - but small sample size – higher number of parents not working but staying home with children (almost half of the group) - positive, children were recruited across various cites across US - but parents were primarily Caucasian from 2 parent household</td>
<td>Y (as above)</td>
</tr>
<tr>
<td>Schertz, Odom, Baggett &amp; Sideris (2018)</td>
<td>Randomly assigned but no allocation concealment (&quot;assigned to group as they were determined eligible&quot;)</td>
<td>Y = children from metropolitan and rural areas across 3 states - but primarily Caucasian and 83% of parents received post high-school education</td>
<td>Y - same</td>
<td>Social communication: Large positive effects. Gains maintained at follow up.</td>
<td>Acceptable CI social communication</td>
<td>Y (as above)</td>
<td>Compelling</td>
</tr>
<tr>
<td>Solomon, Van Egeren,</td>
<td>Y - although randomization</td>
<td>Y = retention rate was 89% of PLAY - Did not differ significantly on any</td>
<td>Y = - no real harm as the children who</td>
<td>Social communication: Mixed - no change social communication</td>
<td>Y</td>
<td>Y</td>
<td>Compelling</td>
</tr>
<tr>
<td>Study</td>
<td>Randomized</td>
<td>Attrition</td>
<td>Social communication</td>
<td>Language: no effect</td>
<td>Parent interaction/language: Large positive effects</td>
<td>Y - treatment conducted in real world clinical setting</td>
<td>Validity</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------</td>
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<td>----------------------</td>
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<td>-----------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Venker, McDuffie, Weismer, Abbeduto, 2014</td>
<td>Randomized</td>
<td>Y (low risk of bias) - no children dropped out of the study early</td>
<td>Y (low risk of bias) - no children dropped out of the study early</td>
<td>Y (low risk of bias) - no children dropped out of the study early</td>
<td>Y (low risk of bias) - no children dropped out of the study early</td>
<td>Y (low risk of bias) - no children dropped out of the study early</td>
<td>Y (low risk of bias) - no children dropped out of the study early</td>
</tr>
<tr>
<td>Y - Attrition was 16% (13/82) overall, 19% (8/42) in individual-ESI, and 13% (5/40) in group-ESI</td>
<td>Y - Attrition was 16% (13/82) overall, 19% (8/42) in individual-ESI, and 13% (5/40) in group-ESI</td>
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<td>Y - Attrition was 16% (13/82) overall, 19% (8/42) in individual-ESI, and 13% (5/40) in group-ESI</td>
</tr>
<tr>
<td>Social communication: no statistical significance</td>
<td>Social communication: no statistical significance</td>
<td>Social communication: no statistical significance</td>
<td>Social communication: no statistical significance</td>
<td>Social communication: no statistical significance</td>
<td>Social communication: no statistical significance</td>
<td>Social communication: no statistical significance</td>
<td>Social communication: no statistical significance</td>
</tr>
<tr>
<td>Language: Large positive effects – prompted communication acts</td>
<td>Language: Large positive effects – prompted communication acts</td>
<td>Language: Large positive effects – prompted communication acts</td>
<td>Language: Large positive effects – prompted communication acts</td>
<td>Language: Large positive effects – prompted communication acts</td>
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<td>Language: Large positive effects – prompted communication acts</td>
<td>Language: Large positive effects – prompted communication acts</td>
</tr>
<tr>
<td>Parent interaction/language: Large positive effects</td>
<td>Parent interaction/language: Large positive effects</td>
<td>Parent interaction/language: Large positive effects</td>
<td>Parent interaction/language: Large positive effects</td>
<td>Parent interaction/language: Large positive effects</td>
<td>Parent interaction/language: Large positive effects</td>
<td>Parent interaction/language: Large positive effects</td>
<td>Parent interaction/language: Large positive effects</td>
</tr>
<tr>
<td>CT - Wide CI’s straddling zero ranges were reported and ranges from some measures were very wide indicating variability among the group (occurred for both groups at times)</td>
<td>CT - Wide CI’s straddling zero ranges were reported and ranges from some measures were very wide indicating variability among the group (occurred for both groups at times)</td>
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<td>CT - Wide CI’s straddling zero ranges were reported and ranges from some measures were very wide indicating variability among the group (occurred for both groups at times)</td>
</tr>
</tbody>
</table>

**Notes:**
- Groups did not differ in ADOS severity, PLS-4 Auditory Comprehension, Mullen Visual reception, parent report of vocabulary or chronological age.
- But delayed treatment group was significantly higher in PLS-4 expressive language.
- Widely CI’s large, and straddling zero. Some measures relied on parent report and parents aware of treatment.
- ¼ of participants non-Caucasian - most from 2 parent home - more than half reported family incomes less than 60,000 (US median was 51,000 at the time) - but 12 months may not be feasible for all public systems.

**Implication:**
- Importantly, the study did not undergo experimental intervention. Participants received the intervention they would've received in their community settings otherwise.

**Overall:**
- Compelling

**Importance:**
- Compelling

**Overall:**
- Equivocal

**Validity:**
- Equivocal

**Importance:**
- Equivocal
| .42) and sites (P = .91). - intent to treat analysis used | Fine Motor but not Receptive or Expressive Language | similar to other group parent interventions available. |
## Appendix D: DSP Systematic Review: Inclusion of Reliability, Generalization and Maintenance, Social Validity and Fidelity Measures

<table>
<thead>
<tr>
<th>Citation</th>
<th>Reliability</th>
<th>Generalization (other than natural video interaction) or Maintenance</th>
<th>Social Validity</th>
<th>Fidelity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldred et al.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Carter, Messinger, Stone, Celimli, Allison, Nahmias &amp; Yoder, 2011</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (clinician)</td>
</tr>
<tr>
<td>Casenhiser et al., 2012</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Green, Charman, McConachie et al. 2010</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Pajareya &amp; Nopmaneejumruslers, 2011</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Schertz, Odom, Baggett &amp; Sideris, 2013</td>
<td>No</td>
<td>Yes (4 &amp; 8 weeks)</td>
<td>Yes</td>
<td>Yes (2 levels – clinician implementation &amp; parent implementation)</td>
</tr>
<tr>
<td>Schertz, Odom, Baggett &amp; Sideris, 2018</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (2 levels clinician &amp; parent)</td>
</tr>
<tr>
<td>Soloman, 2014</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Venker, McDuffie, Weisemer &amp; Abbeduto (2011)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes (2 levels clinician implementation &amp; clinician coaching)</td>
</tr>
<tr>
<td>Wetherby, Guthrie, Woods, Schatschneider, Holland, Morgan, and Lord (2014)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes (clinicians)</td>
</tr>
</tbody>
</table>
# Curriculum Vitae

**Name:** Amanda Binns

**Post-secondary Education and Degrees:**

- University of Western Ontario
  - London, Ontario, Canada
  - In Progress, PhD. Health and Rehabilitation Sciences
  - Note: Maternity leaves of absence 2015-2016 (12 months) and 2018-2019 (18 months)

- University at Buffalo
  - Buffalo, New York, United States
  - M.A., Speech–Language Pathology

- Brock University
  - St. Catharines, Ontario, Canada
  - B.A. Communication Sciences and Disorders

**Honours and Awards:**

- Autism Scholar’s Doctoral Award
  - 2019-2020

- Autism Research Training Award
  - Training Tuition and Travel
  - 2016-2018

- Ontario Mental Health Foundation 3-year Studentship
  - Doctoral Award
  - 2014-2018

- CCHCSP Rising Researcher Symposium Training Award
  - Training, Tuition and Travel
  - 2015

- Council of Canadian Child Health Research Training Award
  - Training, Tuition and Travel
  - 2014

**Related Work Experience:**

- Research Assistant/SLP Clinician
  - Milton and Ethel Harris Research Initiative, York University
  - Toronto, Ontario, Canada
  - 2006-2013

**Peer Reviewed Publications:**


**Other Publications**


**Presentations and Special Lectures**

1. International
Abstracts and Other Papers

2019 Jun  Does the play environment impact parent’s communication or style of interaction with their autistic child? Poster presented at the Symposium on Research in Child Language Disorders, Madison, WI, USA. Presenter(s): Binns, A., Casenhiser, D., Shanker, S., & Oram Cardy, J. (Poster Presentation).


2017 Jun  Trampolines and crash mats or pretend food and toy cars? How play contexts impact language production in children with ASD. Oral presentation at the Symposium on Research in Child Language Disorders, Madison, WI. Presenter(s): Binns, A., Casenhiser, D., Shanker, S., & Oram Cardy, J. (Submitted Oral Presentation).


2016 Sep  Recent research session: Two researchers in the area of communication disorders in children with Autism will present their most recent studies. The Interdisciplinary Council of Developmental Learning Disorders annual conference. Orlando, FL. Presenter(s): Binns, A. & Grosvenor, M. (Submitted Oral Presentation).


2012 Nov  Re-framing play & behavior: Coaching parents from a multicultural perspective. Oral presentation at ICDL Annual International Conference:


Invited Lectures and Presentations

2019 Apr Invited Keynote Speaker. Setting the stage for communication to flourish: The role of regulation. The International Scientific-Practical Conference: Innovations in Autism Interventions, Moscow, Russia. Presenter(s): Binns, A.

2016 Nov Invited Speaker. DIR/Floortime therapy: Engaging parents. DIR/Floortime Centre Korea Parent and Professional Conference, Seoul, South Korea. Presenter(s): Binns, A.

2016 Nov Invited Speaker. Developmental individual difference relationship based therapy: Coaching parents and professionals. Daejeon Centre for Child Development Professional Development Conference Daejeon, South Korea. Presenter(s): Binns, A.


2016 Apr Invited Keynote Speaker. Supporting parents as partners in communication. JISH Annual Scientific Symposium XVII of Communicative Disorders, Jeddah, Saudi Arabia. Presenter(s): Binns, A.

2015 Nov Invited Speaker. DIR/Floortime therapy: An introduction for parents and professionals. Love Tree Childcare Centre Conference for Parents and Professionals. Changwon, South Korea. Presenter(s): Binns, A.


Montclair, NJ. Presenter(s): Shahmoon-Shanook, R., 

Binns, A., Cordero, M., Ehlers-Flint, L., Janert, S., Lalvani, P., & White, R.

2013 Oct
Invited Speaker. Parents and professionals working together as a team. Invited Presentation at Growing Tree Centre for children with Autism. Busan, South Korea. Presenter(s): Binns, A.

2013 Feb
Invited Speaker. Using play-based therapy to target communication and language development: Assessment and clinical applications. Alia Intervention Centre, Kingdom of Bahrain. Presenter(s): Binns, A.

2013 Jan
Invited Speaker. DIR/Floortime therapy: Parents and professionals working together as a team. Care Oyun Akademisi, Istanbul, Turkey. Presenter(s): Binns, A.

2011 Sep

2010 Nov

2. National

Invited Lectures and Presentations

2014 Feb

Media Appearances

2012 May
3. Provincial/Regional

Invited Lectures and Presentations

2019 Nov  Invited Speaker. Looking back and moving forward: Uncovering the state of autism intervention research in the field of speech-language pathology. Ontario Association of Speech-Language Pathologists and Audiologists Autism Educational Event, Markham, ON. Presenter(s): Oram Cardy, J., Binns, A.


2016 Apr  Invited Keynote Speaker. Making the connection: Self-regulation communication & language. The York Region District School Board Speech-Language Pathology Department annual conference, Toronto, ON. Presenter(s): Binns, A.

2015 Sep  Invited Keynote Speaker. Self-Regulation: Music for Young Children. Music for Young Children Annual Conference. Woodstock, ON. Presenter(s): Binns, A.


2013 Nov  Invited Speaker. What is our role as an SLP in Supporting Self-Regulation? Yukon Ministry of Education: Self-Regulation Summer Institute, Whitehorse, YT. Presenter(s): Binns, A.

2013 Aug  Invited Speaker. What we learned from our work: Milton & Ethel Harris research initiative. The Yukon Ministry of Education: Self-Regulation Summer Institute, Whitehorse, YT. Presenter(s): Binns, A., Robinson, C. & Shanker, S.


2012 Jun  Invited Speaker. Theoretical and clinical perspectives on the importance of play and interaction for young children. The ninth annual summer institute
on early childhood development, Toronto ON. Presenter(s): Binns, A., Lee, E., McGill, K. F., & Robinson, C.

2012 Feb

Presented Abstracts

2013 Apr

4. Local

Invited Lectures and Presentations

2019 Oct
Invited Speaker. Supporting clinicians to use a self-regulation framework to support young children with communication challenges. Invited presentation to George Hull Ontario Preschool Speech and Language Program Site. Toronto, ON. Presenter(s): Binns, A.

2015 Nov
Invited Speaker. The brain empathy and self-regulation. Invited presentation to Hope 24/7. Brampton, ON. Presenter(s): Binns, A.

2015 Aug
Invited Speaker. Self-regulation: What is it and why should we care? Invited presentation for George Brown College Student Mentor Workshop. Toronto, ON. Presenter(s): Binns, A.

2015 Jul
Invited Speaker. Fostering co-regulation en-route to self-regulation: In home and early learning settings. Invited presentation for The MEHRIT Centre & Trent University Summer Institute. Peterborough, ON. Presenter(s): Binns, A.

2015 May

2014 Jun
Invited Speaker. Self-Regulation. Toronto Catholic District School Board parent night. Toronto, ON. Presenter(s): Binns, A.

2013 Nov
Invited Speaker. DIR/Floortime based therapy: Parents and professionals working together as a team. Toronto District School Board, Toronto, ON. Presenter(s): Binns, A.

2013 May
Invited Speaker. Supporting language development during all classroom interactions. KidsCAN Oakwood Academy Professional Development Day, Mississauga, ON. Presenter(s): Binns, A.

2013 Apr
Invited Speaker. Assessment, goal setting and treatment: Supporting parents to be part of the process. Toronto Pre-School Speech-Language Services professional development day, Toronto, ON. Presenter(s): Binns, A., Lee, E. & McGill, K. F.

2012 Apr
Invited Speaker. Goal setting using a DIR/Floortime framework. Invited presentation at Kids Can Oakwood Academy, Mississauga ON. Presenter(s): Binns, A., Lee, E., & McGill, K. F.

2011 Sep  Invited Speaker. Supporting foundational capacities for language development. Interdisciplinary Council on Development and Learning online training program. Presenter(s): Binns, A.

Presented Abstracts

2016 Jul  As we speak: Preliminary results from the MEHRIT study on how a parent coaching treatment model rooted in DIR and Self-Reg impacts how parents communicate with their child. Oral presentation at The MEHRIT Centre (TMC) self-regulation symposium, Peterborough, ON. Presenter(s): Binns, A. (Submitted Oral Presentation).

Other Presentations

2011 Dec  Self-regulation case review. Presentation at infant mental health promotion rounds Sick Kids Hospital, Toronto ON. Presenter(s): Binns, A., Lee, E. & McGill, K. F.