

EFFECTS OF ONLINE, CAREGIVER-MEDIATED JASPER ON THE
PLAY SKILLS OF CHILDREN WITH AUTISM

by

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A THESIS

Presented to the Department of Neuroscience
and the Robert D. Clark Honors College
in partial fulfillment of the requirements for the degree of
Bachelor of Science

December 2025

An Abstract of the Thesis of

Maddison Perring for the degree of Bachelor of Science
in the Department of Neuroscience to be taken December 2025

Title: Effects of Online, Caregiver-Mediated JASPER on the
Play Skills of Children with Autism

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Play is a key component to early child development of cognitive and language skills in children with autism, but research on how intervention affects play skills is limited. The current study attempts to answer how an online, caregiver-mediated JASPER intervention changes play skills over the intervention period. The study included 49 children and their caregivers enrolled in the intervention program who were randomly assigned to either an immediate intervention or a waitlist group. Play skills were assessed at entry and exit using standardized observational coding for total play frequency, play diversity, and play levels (simple, combination, presymbolic, and symbolic). Intervention groups and time effects were examined to evaluate changes in play over the 12-week intervention period. The play skills of the children are scored before and after the intervention. There were no significant differences found between groups or across timepoints; however, small descriptive trends showed modest increases in play diversity for children receiving immediate intervention. The findings indicate that play is a difficult domain to shift within short intervention periods, which suggests a need for targeting joint engagement, before symbolic play can really develop.

Acknowledgements

I would like to thank Dr. Stephanie Shire for her unwavering support and encouragement during this process. She gave me the opportunity to work in her lab and explore new facets of early intervention that I was previously unaware of. She was a true inspiration for this project, and I could not have done it without her guidance and support.

I would also like to thank Dr. Dare Baldwin, my CHC representative, for helping me to meet the guidelines of this project and for serving on my committee. She has helped me meet requirements while structuring a timeline for my project.

Additionally, I would like to thank my family and friends for taking this journey with me and encouraging me every step of the way. They have truly motivated me and been there for me on the latest nights, pushing me to continue onwards. I am forever grateful for the love and support they have given me and am so thankful for this opportunity.

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Introduction

Play is a critical component of early childhood development, providing a foundation for social interaction, language acquisition, problem-solving, and emotional regulation (Mundy et al., 1987). For children with autism spectrum disorder (ASD) play often develops differently, with limited symbolic or social play (Mundy et al., 1987). The play skills of children with autism are often described as simpler than their typically developing peers, displaying repetitive, sensory, isolated, and primarily functional rather than symbolic play acts (Thomas & Smith, 2004). Many children with autism will engage with the same sets of toys with similar actions (limited diversity) or scripted sequences of actions (Jarrold, 2003). These differences can have significant effects on peer relationships and learning.

Early intervention (EI) has been widely recognized as one of the most effective ways to support developmental progress in children with autism (Ribeiro, 2022). Many EI approaches use toys and other household objects as the context to target joint attention, language, and social engagement (Ribeiro, 2022). Yet, few EI approaches target the development of children's play skills. Given that play is a natural and common activity for young children, it is commonly used in Naturalistic Developmental Behavioral Interventions (Schriebman et al., 2015) as the context to teach various developmental skills (e.g., social interaction, language acquisition).

Development of Play Skills

Research on the development of play has discovered a reliable sequence of changes in play over the early years of life (Ungerer & Sigman, 1981). During the first 12 months of development, observed play typically consists of simple object manipulations (e.g., mouthing, waving, banging, throwing) and relational play (e.g., touching two objects together, banging

objects together; Ungerer & Sigman, 1981). Function play (using objects or actions in a conventional, intended manner, demonstrating an understanding of the typical function) begins to emerge between 12 and 18 months in the form of simple play (cause and effect), combination play (e.g., building, spoon to cup, furniture to house), and pre-symbolic play (extends familiar actions to self and figures, e.g., spoon to self, brush to doll, cookie to self) (Ungerer & Sigman, 1981; Shire et al., 2018). This is followed by the emergence of symbolic play between 18 and 24 months, which is characterized by complete differentiation of objects and actions, having play no longer bound by the physical and functional use of objects (e.g., substituting tissue for blanket, doll answering the phone and talking; Ungerer & Sigman, 1981). From here, Ungerer and Sigman (1981) found that children begin to integrate more elaborate play by performed related acts in sequence (e.g., brushing a doll's teeth and then putting it to bed, putting the lid on a pot, pouring the pot into the cup, and then using a utensil to stir in the cup). Beyond this, children begin to add roles to their play through sociodramatic play (the child adopts a role, e.g., cashier or chef) and thematic play (the child adopts role of fantasy character, e.g., Superman or Spider Man; Lifter & Bloom 1989). However, research has demonstrated that many children with autism and other neurodevelopmental delays produce less elaborate and varied play across play levels (Medeiros et al., 2024; Shire et al., 2018).

Play skills have important connections to other core domains of development for young children. Many studies have found correlations between play skills and language development (e.g., Mundy et al., 1987). Specifically, Kasari et al. (2012) found that children with higher levels of play are able to use higher functional spoken language skills. Given the mixed effects and challenges to maximize language outcomes in children with autism, finding early nonverbal

skills that are associated with or predictive of communicative development are key targets for early intervention.

EI Approaches Targeting the Development of Play Skills

Although the development of play skills is essential in early childhood, there are very few interventions that explicitly target the development of the diversity and complexity of children's play skills. A specific type of social communication intervention, Joint Attention, Symbolic Play, Engagement, and Regulation (JASPER; Kasari et al., 2021) which supports the development of children's spontaneous play skills through establishing and expanding developmentally appropriate play routines, has been found effective when mediated by clinicians (e.g., Kasari et al., 2006), educators (e.g., Lawton & Kasari; 2012, Chang et al., 2016; Shire et al., 2017), and caregivers (e.g., Kasari et al., 2015) to advance children's play skills.

Caregiver-mediated approaches empower the people who have the greatest daily contact with young children with autism with the tools to have the biggest impact on children's development while also increasing accessibility to high quality support. Although not all EI approaches demonstrate significant effects when transitioned from clinical to caregiver-mediated models, the JASPER caregiver-mediated model has demonstrated success across multiple randomized controlled trials with caregivers implementing the intervention with a high degree of fidelity, and their children demonstrating significant increases in time jointly engaged, response to joint attention, and play diversity (e.g., Kasari et al., 2010). Further trials have found that caregiver-mediated in-person coaching interventions can lead to improvements for children during early childhood skills by increasing caregivers' responsivity and use of intervention strategies (Shire et al., 2016). This is important because it shows there is great potential for other caregiver-mediated interventions, however, to date caregiver-mediated JASPER has been

delivered in person, requiring twice weekly in person coaching sessions where the caregiver practices implementing the strategies with their child while receiving live feedback and support from a trained interventionist. This approach is time intensive and inaccessible for families who do not have access to research centers or licensed providers who are often located in major urban centers. This is why it is important to explore effective and acceptable intervention modalities that can be accessed on mobile devices or computers to allow for virtual meetings and works with toys typically found around the home. The new online adaptation of caregiver-mediated JASPER has the potential to close these gaps, but further research needs to be done to investigate the efficacy of the program.

The Current Study

This secondary analysis aims to investigate the effects of an online adaptation of the caregiver-mediated JASPER intervention on young children's play skills over time. Through data from a pilot randomized controlled trial, we will explore the difference in play skills between entry and exit of the 12-week online intervention in comparison to caregiver-child dyads randomized to a waitlist. The following research questions will be addressed:

Primary research question:

What is the effect of intervention condition (waitlist and immediate JASPER) on play diversity (unique play types) and play frequency from entry to 12-week intervention exit?

Secondary research question:

What is the effect of intervention condition (waitlist and immediate) on play diversity (types) for each of the four sublevels of play including: (a) simple, (b) combination, (c) pre-symbolic, and (d) symbolic from entry to 12-week intervention exit?

To address the above research questions, we will apply mixed linear models to investigate the interaction between time and intervention conditions. In addition, descriptive statistics will be provided to share demographic information about the child and participating primary caregivers as well as descriptives for the child and caregiver outcomes.

Methods

Participants

Participants included 49 young children diagnosed with autism ($n= 48$) or another neurodevelopment disability ($n= 1$) and their caregivers. On average, children entered the study at 5.30 years of age ($SD=1.34$ years). Caregivers reported children to be either male ($n=34$) or female ($n=15$). Caregivers and their children resided in multiple states, including California, Florida, Indiana, Massachusetts, New Jersey, New York, Oregon, Texas, Virginia, and Washington. Caregivers reported children's race/ethnicity as Asian ($n=27$), Hispanic ($n=3$), White ($n=8$), and Multiracial ($n=11$). Caregivers reported speaking multiple languages in the home, including English ($n=23$), Mandarin ($n=6$), Mandarin and English ($n=10$), Greek and English ($n=1$), Spanish and English ($n=4$), Russian and English ($n=2$), Telugu and English ($n=1$), ASL and English ($n=1$), and Spanish, ASL, and English ($n=1$). Caregivers reported having mixed levels of education, ranging from some high school, high school graduate, some college, a college degree, or a graduate degree (See Table 1). Caregivers' intervention implementation fidelity has been examined at study entry, and 12-week intervention exit. Caregivers entered the study with an average of 38% implementation fidelity with no significant difference between immediate intervention and waitlist groups ($p=.808$; Shire et al., 2025). Caregivers in the immediate treatment group reached an average of 67.8% ($SD=13.4\%$) fidelity by exit while those randomized to the waitlist on average reached 40.4% ($SD=12.8\%$; Shire et al., 2025).

Table 1 Child and Caregiver Demographics.

Child Demographics	Immediate		Waitlist	
	Mean/N	SD/%	Mean/N	SD/%
Age	5.09	1.21	5.50	1.45
Sex n/ (%):				
Female	8	33.33%	7	28.00%
Male	16	66.67%	18	72.00%
Race/Ethnicity: n/ (%)				
Asian	12	50.00%	15	60.00%
Hispanic	3	12.50%		0.00%
White	3	12.50%	5	20.00%
Multiracial	6	25.00%	5	20.00%
State: n/ (%)				
California	12	50.00%	15	60.00%
Florida	1	4.17%	2	8.00%
Indiana	1	4.17%		0.00%
Massachusetts	2	8.33%	1	4.00%
New Jersey	3	12.50%	1	4.00%
New York	1	4.17%	3	12.00%
Oregon	1	4.17%		0.00%
Texas	1	4.17%		0.00%
Virginia	1	4.17%		0.00%
Washington	1	4.17%	3	12.00%
Language at Home: n/ (%)				
English	10	41.67%	13	52.00%
Mandarin	4	16.67%	2	8.00%
Mandarin and English	2	8.33%	8	32.00%
Greek and English	0	0.00%	1	4.00%
Spanish and English	4	16.67%	0	0.00%
Russian and English	2	8.33%	0	0.00%
Telugu and English	1	4.17%	0	0.00%
ASL and English	0	0.00%	1	4.00%
Spanish, ASL, English	1	4.17%	0	0.00%
Caregiver Demographics				
Primary Caregiver				
Mother	23	95.83%	23	92.00%
Father	1	4.17%	1	4.00%
Grandparent			1	4.00%
Education				
Some High School			1	4.00%

High School Grad	1	4.17%		
Some College			1	4.00%
College Degree	5	20.83%	7	28.00%
Graduate Degree	18	75.00%	16	64.00%

Note. M=Mean; SD = Standard Deviation; N=Number. This table presents the mean age, sex distribution, racial ethnic background, state of residence, home language, caregiver relationship to child and caregiver education level for participants in immediate JASPER intervention and waitlist groups.

Randomization

After completion of entry assessments, participants were then randomized to either receive immediate JASPER intervention (n=24) or be assigned to the waitlist (n=25) by an independent statistician. The randomization was stratified by children’s chronological age at entry (0-54 months, greater than 54 months) and caregivers’ baseline responsivity (scores of 1 or 2 vs scores of 3,4,5 using the Maternal Behavior Rating Scale- MRBS Mahoney and Perales, 2003). Those randomized to WL received the intervention after the week 16 follow-up.

Online JASPER Intervention

The intervention in this study is a version of caregiver-mediated Joint Attention, Symbolic Play, Engagement, and Regulation (JASPER; Kasari et al.,2021), adapted for online remote delivery to support caregivers to learn the intervention. JASPER is a comprehensive social communication intervention based in toy play. This technique uses toy play to target developmentally appropriate engagement, play skills, and communication goals. There are seven subscales of strategies built into the intervention: setting up and managing the environment (e.g., appropriate toy selection, provide choices, sitting face to face, etc.) supporting engagement and regulation (e.g., pacing, modulate affect, behavioral strategies, etc.), balancing imitation and modeling (e.g., immediate and consistent imitation of productive play acts, model actions when support is needed), establishing routines (e.g., routine matches child’s level, has balanced child

and adult turns, has a clear sequence), expanding routines (e.g., giving child space to add new steps, models we needed to support), programming for social communication (e.g., prompts to shape or support gestures to request and share), and language strategies (e.g. imitate, expand, model at child's level). Shire et al. (2021) created a web-based adaptation of JASPER which presents the content and strategies in modules that take 3-10 minutes to complete. The modules follow the structure of the in-person caregiver-mediated approach beginning with an introduction to the child's goals and development across each of the target developmental domains (e.g., engagement, play, communication) followed by setting up the environment and planning for routines, then layering in additional core and conditional strategies. The modules are framed using wh-questions (e.g., What is imitation? Why do we imitate? What do we imitate? How do we imitate? Etc.; Shire et al., 2021). The modules are highly visual, using illustrations, graphics, and videos with brief text inserted (Shire et al., 2021). There are options to read the text captions or listen to the audio commentary, and the site is set-up for mobile use, making it available on computers, tablets, and phones (Shire et al., 2021). Each participant is provided with a personal login that allows them to continue where they left off each time they log in (Shire et al., 2021). The online platform is also paired with a trained interventionist who meets with the family and aids in individualizing the content and helps support the caregivers' implementation for 20 minutes weekly (Shire et al., 2021).

Measures

Entry Demographics

Demographic Form. At study entry, families were asked to complete a demographic form that provides basic information about the child and family's characteristics, including the child's ethnic/racial background and the language spoken at home.

Primary Outcome Measure

Short Play and Communication Evaluation (SPACE: Shire et al., 2018). The SPACE assessment was conducted at study entry, after intervention (12-week exit), and a follow-up an additional 4 weeks later (16-week follow-up). The SPACE takes approximately 15-30 minutes to complete. Children are presented with (a) bubbles or balloons, (b) two toy sets, (c) a ball, (d) distal points, and (e) an alternative social game for children who did not show engagement with the toy materials. Toy set one includes a puzzle, blocks, truck, and a shape sorter/ring stacker which generates opportunities for simple and combination play types. Toy set two includes toy furniture, two figures that fit the furniture, a house, a cookie set (including Velcro cookies, a Velcro baking tray, and a cookie tube), a set of plates, bowls, and utensils, and a wind-up toy. The toys are selected to create opportunities for play acts across the simple, combination, pre-symbolic, and symbolic play levels.

The assessor is asked to follow the child's requests for the materials, so they may present the toys in any order and follow along with the child's toy selection as appropriate. The assessor is a social partner who may comment on what the child is doing and praise them but not direct or prompt play actions. The assessor is responsive to the child's communication and actions, watching closely for when the child begins to repeat actions or no longer displays new play acts, at which time they can offer a new toy.

The SPACE has been adapted for remote caregiver-assisted delivery. Caregivers are sent the SPACE materials via USPS and are asked to bring them out only during the assessment of visits. A trained member of the research team joins the family on Zoom for the visit, records the assessment via Zoom, and provides guidance for the implementation of the SPACE with the

child. The caregiver facilitating the assessment may not prompt play acts of communication but should respond to the child’s initiations to create a welcoming responsive environment.

SPACE Video Coding: Children’s Play Diversity and Frequency

Independent, reliable coders who were blinded to time point and intervention condition coded the SPACE videos for children’s unique play acts (types- diversity) and the frequency of those acts. The independent variables are timepoint (entry vs. exit) and intervention condition (waitlist vs. immediate JASPER intervention). The dependent variables are total play types, total play frequency, simple play types, combination play types, pre-symbolic play types, and symbolic play types. The dependent variables were coded by individual play acts performed by each participant and sorted into different categories created by Lifter and Bloom (1989; Table 2).

Table 2 Play Levels used in SPACE video coding.

Play Levels	Major Categories	Description
1	Simple	Indiscriminate actions: all objects are treated alike (e.g., mouthed, banging, flipped)
2	Simple	Discriminate actions: differentiates among objects, preserving conventional characteristics (e.g., roll/push car, open and close fridge)
3	Simple	Take apart combinations: separates configurations of objects (e.g., lid off cookies, dump bag, pillow off bed)
4	Combination	Presentation combination: recreates combinations of objects according to their presentation (e.g., puzzle pieces in slots, shapes in the sorter, nests cups inside each other)
5	Combination	General combination: creates combinations of objects that result in simple, nonspecific configurations (e.g., stack nesting cups, stacking blocks, items into cup)
6	Pre-Symbolic	Specific combinations (physical attributes): preserves unique physical characteristics of objects in the configuration (e.g., blocks into “rocket ship” or “house”)

7	Pre-Symbolic	Specific combinations (conventional attributes): preserves unique conventional characteristics of objects in the configuration (e.g., chair to table, pillow to bed, spoon to cup)
8	Pre-Symbolic	Pretend self: relates objects to self, indicating a pretend quality to the action (e.g., fork to self, brush to hair, cup to self)
9	Pre-Symbolic	Child as agents: Extends familiar actions to doll figures, with child as agent of the activity (e.g., brush to doll, doll on bed, doll to house)
10	Pre-Symbolic	Single scheme sequences: extends same familiar action to two or more figures (e.g., fork to horse and then fork to chicken, doll to bed, and then another doll to bed)
11	Symbolic	Substitutions: use one object to stand in place for another (e.g., mirror as magnifying glass, tissue as blanket)
12	Symbolic	Substitutions without object: pretends to use something that is not there (e.g., liquid in cup, food on fork)
13	Symbolic	Doll as agent: moves doll figures as if they are capable of action (e.g., doll sleeping, animal eating)
14	Symbolic	Multi-scheme sequences extends two or more different doll as agent actions to same figure (e.g., doll is eating, then wipes face, then washes hands)
15	Symbolic	Sociodramatic play: adopts various familiar roles in play themes (e.g., child as chef, child as cashier, child as baker)
16	Symbolic	Thematic fantasy play: adopts roles of fantasy characteristics (e.g., plays "Superman" or "Spider Man", assigning the various roles)

Note. This table presents the major categories and descriptions of the 16 distinct play levels coded during the SPACE assessment. These categories were used to evaluate the diversity and developmental progression of children's play behaviors in the study.

Reliability was calculated for independent coders that are blinded to group status.

Reliability for each play category (Cronbach's alpha) are as follows – indiscriminate: 0.960, discriminate: 0.891, take apart: 0.968, presentation: 1.00, general: 0.945, pretend self: 0.948,

child as agent: 0.938, physical combination: 1.00, conventional combination: 1.00, single scheme: 1.00, substitution with object: 0.873, substitution without object: 0.889, doll as agent: 0.904, and multischeme: 1.00.

Statistical analysis

Descriptive statistics will be examined for total play types, total play frequency, as well as diversity (types) for each of the four broad levels of play (simple, combination, pre-symbolic, symbolic). Mixed linear models will be used to compare the relationship between timepoint and intervention condition for each outcome variable.

Results

All analyses were conducted using IBM SPSS Statistics Version 30.0.0.0 (172). A linear mixed-effects model was used to examine the effects of time (entry vs. exit), group (immediate JASPER intervention vs. waitlist), and their interaction on children’s total play types, total play frequency, and number of play types by each of four broad developmental levels of play (simple, combination, pre-symbolic, and symbolic). The model included time, group, and group x timepoint interaction as fixed effects, and a random intercept for each participant was included to allow the model to account for individual differences in baseline play skill levels.

Descriptives

Study descriptives are displayed in Table 3. Children in the immediate JASPER intervention group increased slightly in total play diversity, and in combination, pre-symbolic, and symbolic play from entry to exit, while children in the waitlist group remained consistent or slightly decreased in play diversity and types. Across children in both groups, there are fewer types of symbolic play acts than other levels of play.

Table 3 Descriptives of Play Data

Play Category	Immediate JASPER Intervention		Waitlist Group	
	Entry	Exit	Entry	Exit
Total Play Frequency				
M (SD)	60.42 (38.99)	59.05 (36.98)	75.56 (39.55)	74.26 (41.40)
Total Play Diversity				
M (SD)	14.54 (7.68)	16.68 (9.19)	17.69 (9.76)	16.26 (8.46)
Simple Play				
M (SD)	5.29 (2.22)	4.63 (2.77)	5.2 (2.63)	5 (3.09)
Combination Play				
M (SD)	3.96 (1.95)	4.27 (1.75)	5.44 (2.35)	5.91 (1.44)
Pre-Symbolic Play				
M (SD)	4.17 (3.05)	5.55 (3.90)	4.48 (3.64)	3.83 (3.60)
Symbolic Play				
M (SD)	1.13 (1.90)	2.23 (3.61)	2.56 (3.88)	1.52 (2.52)

Note. M=Mean; SD=Standard Deviation. This table displays the mean and standard deviation for total play frequency, total play diversity, and the number of play types across 4 developmental levels at study entry and exit for both immediate JASPER and waitlist groups.

Total Play Frequency

Results from the linear mixed-effects model are presented in Table 4. Mean counts for frequency of play actions decreased slightly for children across time and between intervention groups (Table 3). The interaction between the intervention group and time was not statistically significant ($F(1,90)=.000, p=.996$), indicating no differential change in play frequency over time between the intervention and waitlist groups. There were also no significant main effects of intervention group or time ($p=.065, p=.870$, respectively).

Table 4 Linear Mixed-Model Analysis for Total Play Frequency

Total Play Frequency	Numerator df	Denominator df	F	Sig.
Intervention	1	90	3.500	.065
Timepoint	1	90	.270	.870
Intervention x Timepoint	1	90	.000	.996

Note. This table presents the results of a linear mixed model examining the effects of intervention group, time, and their interaction on children’s total play frequency.

Total Play Diversity (unique play types)

Linear mixed model results are presented in Table 5. Both groups increased slightly in their number of different play actions (Table 3). There was no significant main effect of intervention group ($p=.457$) or time ($p=.843$). The interaction between intervention group and time was not statistically significant ($F(1,90)=.955, p=.311$), indicating no statistically significant change in play skills over time or differentially between the intervention and waitlist groups.

Table 5 Linear Mixed-Model Analysis for Total Play Diversity

Total Play Diversity	Numerator df	Denominator df	F	Sig.
Intervention	1	90	.557	.457
Timepoint	1	90	.039	.843
Intervention x Timepoint	1	90	.955	.331

Note. This table displays the results of a linear mixed model assessing the impact of intervention group, time, and their interaction on the number of unique play types observed.

Simple Play Types

The mean simple play scores showed little difference between timepoints for both groups (Table 3), and the interaction between time and intervention group was not statistically significant ($F(1,90)=.168, p=.683$), revealing no differential change. There were no significant main effects of time ($F(1,90)=.594, p=.443$) or intervention group ($F(1,90)=.060, p=.060$).

Combination Play Types

Descriptive statistics and linear mixed model results for children’s combination play acts showed little fluctuation in combination scores over time (Table 3), and the interaction between intervention group and time was not statistically significant ($F(1,90)=.040, p=.841$), indicating no differential change in play skills over time between the intervention and waitlist groups. There was a significant difference for the intervention type ($F(1,90)=15.614, p<.001$) suggesting a differential change in play skills based on intervention group, but not for timepoint ($F(1,90)=.993, p=.322$).

Pre-Symbolic Play Types

Descriptive statistics and linear mixed model results demonstrate that children in both groups showed minimal changes in play scores over time (Table 3), and the interaction between intervention group and timepoint was not statistically significant ($F(1,90)=1.918, p=.169$), suggesting no differential change in play skills over time between the intervention and waitlist

groups. There were also no significant main effects of intervention group ($F(1,90)=.918, p=.341$) or time ($F(1,90)=.244, p=.623$).

Symbolic Play Types

Descriptive statistics and linear mixed model results for children's symbolic play acts demonstrate that the number of unique symbolic play actions showed little difference between timepoints for both groups (Table 3), and the interaction between timepoint and intervention group was not statistically significant ($F(1,90)=2.816, p=.097$), revealing no differential change. There were no significant main effects of time or intervention group ($F(1,90)=.003, p=.960, F(1,90)=.327, p=.569$, respectively).

Discussion

The current study examined a group of diverse children and their play skills as a developmental outcome of an online adaptation of the caregiver-mediated JASPER intervention. While no statistically significant effects were observed in children's play skills, small directional trends were evident for overall play diversity, suggesting subtle differences in how play behaviors changed over time. Despite overall play skill improvements being minimal, some patterns emerged. For example, participants in the immediate intervention group showed a slight increase in total play diversity, whereas the waitlist group showed a small decrease. This trend may suggest that this JASPER intervention could help maintain or slightly expand play variety, even if the presented effect was not large enough to reach significance. Additionally, combination, pre-symbolic, and symbolic play scores increased slightly for immediate intervention, whereas the waitlist group showed little or negative change. These patterns may indicate that the intervention provided children with more structured opportunities to practice higher level play, even though individual variability is limited in statistical effects. In contrast, simple play and overall play frequency did not change meaningfully across groups. From a developmental perspective, simple play is typical for infants who are taking their first actions to explore items (e.g., mouthing, banging) as well as basic cause and effect (e.g., push a button, push a car down a ramp) and taking items apart. Given that on average, children were just over 5 years of age entering the study and no participant displayed only simple level actions at entry, we would not expect to see growth in simple play as the intervention would be targeting higher level skills (combination and up) that are a match to the child's current developmental level.

The majority of play acts observed in the participants are functional (simple, combination, and presymbolic), with fewer actions at the symbolic level. The acts of symbolic

play that we are seeing typically appear in the lower levels (e.g., substitution with object) which are typically expected first in development instead of higher levels (e.g., multischeme, thematic, or sociodramatic). Given the typical progression of play described by Ungerer and Sigman (1981), typically developing peers of the same average age would show high levels and amounts of symbolic play. The participants in this study, however, are showing few symbolic play acts with 49% of children not yet demonstrating actions at the symbolic level at exit. Instead, children largely demonstrated functional play actions at the combination and presymbolic levels, which are developmental precursors to symbolic play. This has implications for children with autism within preschool and kindergarten classroom settings. Activity based instruction is often centered on offering play options at the “dramatic play” level such as a house, cooking, or role play type of station. It is important for families and educators to consider the full range of play levels and understand the level at which individual students are playing in order to set up instructional opportunities that are a match to the current developmental level of the child. If learning key pre-academic content (e.g., STEM topics, early literacy) is contingent upon symbolic level play, we may be setting many children up to miss out on these topics since the barrier for entry into the activity is beyond their current developmental play level. This reiterates the potential impact of developmental differences between young children with autism and typically developing peers.

The JASPER caregiver-mediated model has previously demonstrated success across various randomized controlled trials, resulting in participants producing increased time jointly engaged, response to joint attention, and play diversity (e.g., Kasari et al., 2015, Kasari et al., 2014), however, in these studies, JASPER caregiver coaching was provided by a trained interventionist and occurred in person at a much higher dose, twice weekly for 30 minutes with toddlers and twice weekly 60 minute sessions in home with preschool age children with autism.

In contrast, this pilot study intentionally shifted the dose, intensity, and caregiver coaching modalities to a primarily self-directed approach using online content with weekly brief (20 minute) discussion only contact with an interventionist (Shire et al., 2021). The goal of the pilot was to look for initial signals of effect with an online light touch approach. Although analyses indicate significant gains in caregiver fidelity, children's time jointly engaged, and children's initiations of social communication for those randomized to immediate JASPER intervention compared to those on the waitlist, additional teaching strategies to support caregivers' learning may be needed to impact change in children's play diversity and frequency.

The findings of this study also illuminate why play may be particularly resistant to change in children with autism. Other studies have described play patterns in children with autism to be repetitive and rigid (e.g., Thomas & Smith, 2004; Jarrold, 2003). Given these habits, children may be less willing to accept caregivers' models of different play actions and attempts to mix up their routines. When caregivers attempt to introduce new play themes, alter familiar routines, or extend play narratives, children may respond with distress or disengagement as the disruption can trigger dysregulation. Over time, repeated rejections of caregivers' attempt to expand play may diminish caregivers' sense of efficacy and their persistence in scaffolding higher-level play opportunities. The combination of repetitive rigid play with discouragement in caregiver teaching attempts may help explain why play skills often show limited short-term change even in high-quality interventions.

Conceptually, these findings align with Shih et al. (2021), who proposed joint engagement as the mechanism of change in the intervention targeting social communication. Their study suggests that before distal developmental outcomes (e.g., language or symbolic play) can shift, children and caregivers must first achieve sustained joint engagement (time when adult

and child actively focus on shared objects/events) (Shih et al., 2021). Applying this framework to play, it may be that joint engagement functions as the necessary foundation upon which symbolic and imaginative play are built. Without first developing this platform, caregiver attempts to model new play behaviors may fail because the underlying structure is not yet stable.

While this study had many implications, it also had some limitations. It had a relatively small sample size which may have reduced the statistical power and limited the ability to detect subtle changes in play skills. This is highlighted by the high variability in both baseline and exit play abilities, which can be seen in the large standard deviations across each measure. Additionally, as previously mentioned, the duration and intensity of the study period may have been too little to show meaningful change. Play often develops gradually, and measurable effects may only emerge over longer observational periods or intervention practice. Last, intervention techniques may have been inconsistent between participants. Caregivers met with interventionists weekly but only for discussion, and the child was not present. This is a significant departure from the established in-person model that provides intensive real time coaching to help the caregiver implement the strategies with their child. Future studies can explore the impact of augmenting self-directed learning with remote synchronous real-time coaching or replacing self-directed learning with this more traditional format, adapted for remote delivery.

Based on the findings and limitations of the current study, there are several avenues that researchers could use to expand future projects. Future researchers need to follow the participants longitudinally to determine if small descriptive trends represent early stages of long-term growth. Further research should also investigate the mechanisms underlying play change. Additionally, studies should explore variations of strategies to support caregivers' involvement

and implementation with their children. Together, these directions can enhance the understanding of how online caregiver-mediated JASPER supports play growth in children with autism.

Conclusion

This study aimed to investigate the effects of an online adaptation of the caregiver-mediated JASPER intervention on the play skills of young children with autism. While significant differences in play diversity and frequency were not found between children randomized to immediate intervention and waitlist groups, it provided important insight into the complexity of advancing the development of play for children with autism. Results highlight small descriptive trends that suggest that intervention may gradually enhance aspects of play skills. These findings further illustrate the complexity of play and the need for further research to support caregivers' success to advance not only children's social engagement and communication skills but also their play skills.

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