Research Article

Autism & Developmental Language Impairments

Autism & Developmental Language Impairments
Volume 8: 1–17

DOI: 10.1177/23969415231204837
journals.sagepub.com/home/dli

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Peer mediation in play settings for minimally verbal students with autism Spectrum disorder

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Abstract

Background and aims: Peer-mediated interventions (PMIs) are effective strategies to foster socialization of children with autism spectrum disorder (ASD) in natural settings. However, research examining the efficacy of peer mediation for students with ASD who have the greatest cognitive and language impairments remains limited. Additionally, previous studies essentially targeted communicative abilities of participants. To address this gap, the present study evaluated the effects of a play-based PMI on three socio-communicative skills (play, social engagement and imitation) of minimally verbal students with ASD who also have a comorbidity of intellectual disability (ID).

Methods: Seven children with ASD attending ordinary school settings and 14 typically developing (TD) preschoolers participated. Seven single-sex groups were formed, and children played together during two 30 min weekly sessions. TD children were trained according to the principles of the integrated play group model. We used a multiple-baseline design across participants to measure the effects of the intervention on play skills, social engagement and motor imitation of students with ASD.

Results: Outcomes revealed an intervention effect for most of the participants, despite some variations across children. After the peer training, four children increased their duration of functional/symbolic play, six children improved their duration of interactive play and five children increased their rates of motor imitation. Concerning maintenance gains, inter-individual differences are also important.

Conclusions and implications: These findings suggest that a play-based PMI may be a feasible option for targeting inclusive education and improving socio-communicative skills of some minimally verbal students with ASD who also have an ID. However, variations across children invite further research to clarify how individual factors can moderate the effects of PMIs in children with ASD who are the most impaired.

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Keywords
Peer-mediated intervention, Autism spectrum disorder, Minimally verbal children, Inclusive education, Play

Introduction

Peer-mediated intervention (PMI) focuses on coaching typically developing (TD) children to interact socially with peers who have disabilities (Boudreau et al., 2015). There is a growing body of research demonstrating the efficacity of PMIs for improving social participation of children with autism spectrum disorder (ASD) in inclusive settings (Gunning et al., 2019). By mobilizing peers as the primary intervention agents, this approach is a useful and socially valid strategy for promoting school inclusion of children with ASD (Hansen et al., 2014). PMIs have been effective to improve a wide range of social outcomes for students with ASD, including social initiations and social responses (Hu et al., 2018), conversational abilities (Thomas & Bambara, 2020), joint attention (Krier & Lambros, 2021) and play skills (Kent et al., 2021). By providing opportunities for children with ASD to interact with multiple social partners, peer mediation also increases the possibility of skill maintenance and generalization (Chan et al., 2009).

To date, PMIs are supported by sufficient high-quality studies conducted by sufficient different research groups for being considered evidence-based practices for children with ASD (Kamps et al., 2017; Wong et al., 2015). However, recent reviews demonstrated that research on PMIs in participants with ASD who have the most cognitive and language difficulties is still limited (Chang & Locke, 2016; O'Donoghue et al., 2021; Watkins et al., 2015). First, the majority of studies enrolled participants without intellectual disability (ID) and identified to be 'moderate to high functioning'. For example, Watkins et al. (2015) observed that only three of the 14 studies they reviewed were conducted in children noted to be 'low functioning' (i.e. few or no language skills and IQ < 55). Similarly, Chang and Locke (2016) noted that most of the studies enrolled participants who have at least average IQ and who can communicate through two- or three-word phrases minimum. Very recently, O'Donoghue et al. (2021) reviewed PMI studies for minimally verbal children and observed that only four studies focused specifically on this population. Thus, as suggested by the authors of these three reviews, it seems essential to us to include participants with more complex needs in research on PMIs. Although it is consistent with the general observation that this population described as the 'neglected end of the spectrum' is rarely enrolled in scientific studies (Tager-Flusberg & Kasari, 2013), the search for evidence-based practices requires to consider the wide spectrum of ASD to determine whether an intervention that is effective for verbal children without an ID can also be effective for minimally verbal children who often have an ID. Second, most of the PMI studies conducted in minimally verbal children were similar (O'Donoghue et al., 2021) and focused on coaching participants to use an augmentative and alternative communication system. Consequently, the target skills were often restricted to communication behaviours. For instance, Trottier et al. (2011) examined the relationship between a PMI incorporating speech-generating devices and an increase in appropriate communicative acts of two students with ASD. Similarly, Thiemann-Bourque et al. (2016) taught TD children to use the picture exchange communication system (PECS; Bondy & Frost, 1994) with four preschoolers with ASD to increase their rates of communication behaviours, modes and functions. Due to the increasing trend to educate children with disabilities in the mainstream school setting (Nilholm, 2021), including those who require the highest levels of support, we feel it is important to focus on students with ASD with the most significant cognitive and language difficulties while considering more diverse social outcomes than communicative abilities. Practically, for these students who tend to be educated in specialized units within mainstream schools, PMIs could enable them to interact regularly and positively with TD peers who have been coached and thus really benefit from the social opportunities offered by the mainstream setting (Hansen et al., 2014).

Play with objects is an important occupation during childhood and play skills are central to children's cognitive and social development (Goldstein, 2012). However, children with ASD often have difficulty playing with peers and are frequently observed playing alone (Anderson et al., 2004). They also experience difficulties with symbolic play and frequently produce repetitive and sensory play behaviours (González-Sala et al., 2021), which is a barrier to engaging in shared play with TD classmates. Thus, helping students with ASD to expand their play repertory and to increase their social exchanges with TD peers is an important objective for PMI research (Charlop et al., 2018). Among the existing programs within the literature, the integrated play groups (IPG) model (Wolfberg, 2003; Wolfberg et al., 2012) is certainly one of the best described and validated to promote socialization and play in natural settings for children with ASD. Grounded in social

constructivist theory (Vygotsky, 1978), this model focuses on children with ASD active engagement in culturally valued activity (i.e. play) through the guidance of more capable peers (named as expert players) and the support of an adult group facilitator. To date, a series of studies using a single-case experimental design (Wolfberg & Schuler, 1993; Yang et al., 2003; Zercher et al., 2001) or a group experimental design (Wolfberg et al., 2015) have been conducted to evaluate the effectiveness of the IPG model. The accumulated findings indicate that children with ASD increased their complexity of play (functional and symbolic) and were more socially engaged (playing in parallel and in an interactive way) after their participation in the IPG intervention. At the same time, they spend less time playing alone and decreased their amounts of not engaged and sensory play behaviour. Studies also showed that gains were maintained when adult support was removed (Wolfberg & Schuler, 1993; Yang et al., 2003; Zercher et al., 2001) and generalized to unfamiliar peers (Wolfberg et al., 2015). However, like previously noted for PMI research as a whole, there is a lack of studies specifically evaluating the effectiveness of the IPG model for children who have an ID and who are minimally verbal.

The present study aimed to investigate the effectiveness of a play-based PMI on socio-communicative skills in children with ASD who also have an ID and severe language impairment. We adopted a single-case multiple baseline design and asked whether an intervention adapted from the IPG model and implemented in naturalistic school settings can improve play skills, social engagement and imitation skills. Specifically, we addressed the following research questions:

1. Was the intervention effective in improving play complexity (from inoccupation and sensory play to functional and symbolic play), social engagement (from isolate and onlooker play behaviours to parallel and interactive play) and motor imitation?
2. Was the intervention equally effective for all focal students?
3. Did the intervention effects maintain in the short term when adult support was withdrawn?

Method

Participants

Participants were recruited from two schools in western France, each hosting a specialized unit for students with ASD and collaborating with the university on research projects. Seven students with ASD (aged from 3;2 years to 8;9 years) attending a specialized unit and 14 TD students (aged from 4;11 years and 5;10 years) attending an ordinary classroom participated. This study complies with the terms of the Declaration of Helsinki regarding ethical principles applicable to research involving human beings. Written consent was obtained from the parents of all children included in the study. After age-appropriate explanations, oral consent was also obtained from TD students. Since children with ASD were not able to provide oral consent, we were careful about their well-being during play sessions and stopped the sessions in case of significant discomfort.

Students with ASD. To be included in the study, participants with ASD had to be enrolled in one of the two specialized units collaborating with the university. Other inclusion criteria were (a) a clinical record mentioning a diagnosis of ASD confirmed by a child psychiatrist based on ICD-10 (World Health Organization, 1992), DSM-IV-TR (American Psychiatric Association, 2000) or DSM-5 (American Psychiatric Association, 2013) criteria, (b) limited functional and/or symbolic play skills as demonstrated by observations during free play, and (c) limited social interactions with peers as demonstrated by observations on the playground. Although the diagnosis of ASD was not confirmed by the research team for the study, all participants were diagnosed by the psychiatrist of an expert autism center following the national recommendations of the 'Haute Autorité de Santé'. Participants with ASD were identified as minimally verbal based on a standardized evaluation of language skills using the Psychoeducational Profile-Third Edition (PEP-3; Schopler et al., 2005) and the social cognitive evaluation battery (Thiébaut et al., 2010). In addition, all children included in this study used the PECS as the primary means of communication. At the cognitive level, children meet the criteria for a comorbid ID (DQ < 70), as indicated by a measure of intellectual functioning administered by a licensed psychologist using the French version of the Snijders-Oomen Nonverbal Intelligence Test (SON-R 21/2-7; Tellegen et al., 2009). Further descriptions of participants with ASD are provided in Table 1.

TD students. Children with ASD were paired with 14 TD students to form seven play groups for the duration of the study. To ensure that group members were familiar with each other before the beginning of the study, TD students were selected from preschool classrooms that already shared times with students with ASD (e.g., lunch, recess) before the beginning of the study. We also chose to recruit preschoolers because functional and symbolic play is predominant at this age (Lillard, 2015). As recommended in PMI literature (Charlop et al., 2018), TD participants were nominated by their teachers according to the five following criteria: (a) children must be willing to participate in the play sessions, (b) children must regularly attend school, (c) children must be receptive to instructions given by adult, (d) children must exhibit age-appropriate social and language skills, and (e) children must have a sufficiently high academic level to compensate for absences from the

Table 1. Description of participants with ASD

Student	Intellectual developmental quotient[a]	Expressive language and vocal imitation	Play and interactions
Anna Female, 8;9 years	24	• Nonverbal • No intelligible words and no imitation of sounds • Age equivalent in PEP-3: < 1 year	• Did not show much interest in toys • Stayed close to the adult and observed other children during recess
Bastien Male, 7;1 years	33	• 2–3 intelligible words production • Approximative novel words imitation • Age equivalent in PEP-3: 1;4 year	• Used toys for sensory purposes • Wandered in the playground, self-stimulated and occasionally observed other children
Caleb Male, 5;11 years	46	• 2–3 intelligible words production • Approximative novel words imitation • Age equivalent in PEP-3: 1;5 year	• Manipulated and explored toys with occasional functional uses • Played alone without paying attention to other children during recess
Damien Male, 5;3 months	59	• Fewer than 20 intelligible words and 2 words sentences used in specific context (request food) • Novel words imitation • Age equivalent in PEP-3: 1;8 year	• Did not show much interest in toys • Wandered in the playground and played alone without paying attention to his peers
Esteban Male, 3;2 years	55	• 2–3 intelligible words production • Approximative sounds imitation • Age equivalent in PEP-3: 1;1 year	• Manipulated objects but only used a set of toys car in a functional way • Wandered in the playground and occasionally played beside peers but did not initiate interactions
Fabio Male, 7;4 years	42	• Nonverbal • No intelligible word and approximative sounds imitation • Age equivalent in PEP-3: < 1 year	• Demonstrated functional play acts but restricted to a specific set of toys (baby doll and feeding bottle) • Played alone and did not initiate with peers
Gary Male, 6;4 years	50	• Fewer than 20 intelligible words and 2 words sentences used in specific context (request food) • Approximative novel words imitation • Age equivalent in PEP-3: 1;6 year	• Used toys for sensory purposes • Wandered in the playground and played with his own body without paying attention to his peer

[a]Obtained from the Snijders-Oomen Nonverbal Intelligence Test (SON-R $2^{1/2}$-7; Tellegen et al., 2009), by dividing the children's intellectual developmental age by their chronological age and multiplying the result by 100. A developmental Quotient (DQ) greater than or equal to 70 indicates no ID, a DQ between 55 et 69 indicates a mild ID, a DQ between 40 and 54 indicates a moderate ID and a DQ below 40 indicates a severe ID (Lafont et al., 2023).

classroom during the play sessions. TD students included twelve boys and two girls, with an average age of 5 years and 4 months (SD = 4 months).

Setting

All participants with ASD attended a specialized unit located in an ordinary school and received comprehensive intervention provided by a multidisciplinary team. They were at school 24 h a week, just like their TD peers. They received an intensive intervention based on structured teaching (Schopler et al., 1995) and effective behavioural and developmental approaches such as the Early Start Denver Model (Rogers & Dawson, 2010). Thus, each child had individualized educational objectives targeting multiple core developmental domains such as social interactions, communication, motricity and cognitive/academic learning.

Following Wolfberg (2003)'s guidelines, play groups consisted of one child with ASD and two TD students to create a natural social setting characterized by a higher proportion of children without disabilities. Given students' same-sex affiliative preferences during childhood (Martin et al., 2013), single-sex play groups were formed to encourage social interactions that occur more likely in ecological contexts. Six groups of boys and one group of girls were therefore created. In each school, boys with ASD were randomly assigned with two TD boys after participants recruitment. All play sessions were conducted in a quiet room adjacent to the students with ASD's classroom. In each room, we used kitchenette furniture and a low shelf to create a well-defined play area. All sessions were recorded using a camera mounted on a tripod and placed in a corner of the room outside the defined play area.

Materials

Based on Wolfberg (2003)'s recommendations, toys were selected to promote symbolic play and/or social interactions. We ensured that there were equal numbers of male, female and neutral objects, as the literature shows that gender influences the choice of objects both by TD children (Le Maner-Idrissi, 1996) and by children with ASD (Harrop et al., 2017). Based on Tap (1985)'s classification, four masculine toys (workbench, set of toy cars, fire engine and garage), four feminine toys (baby doll, accessories like teat, feeding bottle and bib, tea set and cash register) and four neutral toys (ball, jigsaw, magic slate and set of small farm animals) were placed in the playroom. To encourage participants to imitate each other, all toys were available in two. In addition to its learning function, imitation can be used to communicate in minimally verbal children with ASD (Nadel, 2002). Thus, by providing two identical copies of each toy, we aimed to promote observational learning in students with ASD, while hoping to facilitate social communication through imitation.

Experimental design

A single-case multiple baseline design (Kazdin, 2011; Krasny-Pacini & Evans, 2018) across participants was used to assess the effects of the intervention. Because the observations could not start at the same time in the two schools, this study incorporated non-concurrent multiple baselines (Christ, 2007; Watson & Workman, 1981), which is common in applied research such as this one (Brain & Mirenda, 2019; Katz & Girolametto, 2013). In such a design, participants were randomly assigned to predetermined baselines lengths to ensure that changes in behaviour occurring after the introduction of the intervention can be functionally related to the treatment. Following the conventions of the non-concurrent baseline design (Christ, 2007; Watson & Workman, 1981), participants of the present study were randomly assigned to baseline lengths of 6, 8 or 10 sessions. Then, the intervention was delivered for 10 sessions for all participants, which is a similar treatment intensity used in other play-based PMIs (Kent et al., 2021).

Procedures

Thirty-min play sessions were conducted twice a week (on Mondays and Thursdays or Tuesdays and Fridays, depending on the participants) with the same experimenter present for all groups. The experimenter was a licensed psychologist, trained in working with ASD children and preparing a PhD in developmental psychology. Play sessions took place on fixed days and times to be predictable for participants and professionals. According to Wolfberg (2003)'s guidelines, a clear timeline was also established within the play sessions: say hello and sing a song (~5 min), play together (~20 min), put the toys away, sing a song and say goodbye (~5 min).

Baseline. During baseline, children were instructed to play as usual without prompts or feedback from an adult. The experimenter was seated in a corner of the room but interacted as little as possible with the participants during play sessions. He occasionally helped to fix broken toys and ensured that participants were safe during the sessions.

Peer coaching. The experimenter provided coaching to each group of TD students during four 30-min sessions that occurred in the same room as the play groups. Students with ASD were not present during the coaching sessions. The first session consisted to read and discuss the children's book 'Mont petit frère superhéros' (Roy & Mezher, 2010) and to watch the animated film 'Mon petit frère de la

lune' (available online at https://www.youtube.com/watch?v=T_2lhIy_8zo). Both describe the characteristics of a child with ASD (strengths and difficulties) as seen from his sister's perspective. Thus, TD students were informed about autism, using age-appropriate vocabulary. Then, the experimenter led discussions about the importance of accepting differences between individuals and playing with peers that are different.

During the second session, behavioural strategies adapted from Wolfberg (2003)'s IPG model were taught to the TD students. These strategies were divided into three categories illustrating what they could DO, what they could SAY and how to PRAISE their friend with ASD. The DO category included the following specific strategies: stay close, take his/her hand, point a toy, give a toy, show how to play and take turns. The SAY category included the following strategies: say his/her first name to get his/her attention, explain what you are doing, ask him to give you a toy, encourage him to imitate you and ask him what he wants to play with. Children were taught to provide verbal instructions by using a language level appropriate to the students with ASD (i.e. short sentences of two —three words). Finally, the PRAISE category included behaviours such as smiling, doing a high five, clapping and saying 'well done' or 'great'. Three small posters (A4 size) depicting written instruction and pictorial representation of strategies belonging to the three broad categories (DO, SAY and PRAISE) were used as visual support for the children. For each strategy, the experimenter provided a brief description and modelled at least one example of its application.

During the last two coaching sessions, strategies were reviewed with the children. Then, role play was conducted to give each child opportunities to practice using the strategies. The role play was conducted with the experimenter as a player who needed support during the third session, while children took turns playing the role of a player who needed support during the last coaching session. Feedback was provided at each attempt to use a strategy during role play. Children were praised when the strategy was executed correctly. When a strategy was misused (e.g. did not call before showing how to play) or missed (e.g. did not praise after correct play behaviours), the experimenter provided corrective feedback by executing the behaviour himself and then asking the child to do it again.

Intervention. During the intervention, conditions were the same as in baseline, except that the experimenter encouraged TD children to use the newly learned strategies. Posters depicting strategies and presented during peer coaching were printed in A0 size and fixed on the wall inside the play area. TD students could look at them as much as they needed. The experimenter provided verbal feedback (e.g. 'show him how to drink', 'congratulate him') and praise (e.g. 'keep going, it's great') to the TD children, but avoided being physically involved during play sessions. During intervention sessions, TD children were asked to work together to make sure their peer with ASD had someone to play with but they were primarily encouraged to structure play interactions on their own (e.g. who plays with the child with ASD). When, after a reasonable delay (~ 1–2 min), the two TD children were playing without the child with ASD, the experimenter reminded them to use strategies to also play with him/her.

Follow-up. During follow-up, conditions were the same as in baseline. The posters were removed from the wall and the experimenter ceased to provide verbal feedback. Before each session, TD children were instructed to continue to play with the child with ASD while being informed that the adult would no longer assist them in this. The follow-up phase was conducted immediately after the intervention sessions. Four follow-up sessions were recorded for all groups, except for Damien's in which only three sessions could be conducted.

Dependent variables

The first author was the primary observer and coded-dependent variables from the videos of play sessions using The Observer XT software (Noldus Information Technologies). Three socio-communicative domains including play, social engagement and motor imitation were measured for all participants with ASD.

The play was coded by recording the duration (in seconds) of the following four categories of behaviours (adapted from Wolfberg et al., 2015): not engaged (the child shows no interest in the toys), sensory play (the child shows an interest in the toys, handling and exploring them, but does not conventionally use them), functional play (the child functionally uses the toys, performing simple familiar routines involving real-life accessories, directed to self, doll or peer) and symbolic play (the child acts as though he was doing something else or being someone else, with a representational or imaginative intention).

Social engagement was coded by recording the duration (in seconds) of the following five categories of behaviours (also adapted from Wolfberg et al., 2015): isolated (the child pays no attention to his peers), onlooker (the child remains at a distance from his peers, but shows an interest in them, either watching them or looking at the toys they are using, without directly joining in their game), parallel (the child plays alongside his/her playmates by simultaneously using similar or identical toys, but does not interact with them), common focus (the child interacts with one or more playmates through verbal exchanges, gifts of objects, turn taking, mutual imitation or receiving help and instructions) and

common goal (the child and his peers cooperate in play activities, explicitly planning each person's role and performing additional actions in pursuit of a common goal). Within play and social engagement domains, categories of behaviours were considered mutually exclusive, so that distinct behaviours could not be recorded at the same time. The total duration of each of these behaviours was collected for each session and then transformed into a percentage of time to accommodate possible variations in the total duration of play sessions and obtain comparable data across sessions and participants.

Motor imitation was coded by counting the number of behaviours per session that we then converted to a rate per minute. A motor imitation occurred when the student with ASD reproduced a gesture, a posture, a body movement or an action involving an object that had been performed by a TD child within the previous 10s. Imitation can be elicited or spontaneous. The behaviour did not have to be strictly identical to the model to be recorded, but it did have to resemble it very closely (e.g. mix with a spoon while the model mixes with a fork).

Interobserver agreement

The first author served as the primary data coder and three students (a PhD student and two bachelor's level in psychology) served as reliability coders. All reliability coders were independent of the experiment, previously trained to collect reliability data, and blind to the experimental phase they were coding. Reliability coders independently coded 20% of randomly selected videos within each condition for all participants. Inter-rater reliability was calculated for play, social engagement and motor imitation using a point-by-point-agreement (Kazdin, 2011). An agreement occurred when both observers recorded the same behaviour at the same time for all variables. For play and social engagement, a disagreement occurred when the two coders recorded at the same time subcategories that are different. For motor imitation, a disagreement occurred when a coder recorded an occurrence that was not observed by the second observer. For all variables, the number of agreements was then divided by the number of agreements plus disagreements to yield a percentage. Mean interobserver agreement was 94% for play, 92% for social engagement and 96% for motor imitation, demonstrating good reliability between the two coders for all variables.

Treatment fidelity

The first author and a PhD student in psychology examined the videos to ensure that the core components of the intervention phase were met. For each group, 20% of the intervention sessions were randomly selected and examined independently by the two coders. Using an 8-item implementation checklist, they observed whether (a) TD children used strategies from the SAY category to help and play with the student with ASD, (b) TD children used strategies from the DO category to help and play with the student with ASD, (c) TD students praised the student with ASD, (d) the posters were present in the room, (e) the experimenter provided prompts to the TD children, (f) the experimenter provided verbal feedback to the TD children, (g) the experimenter provided praise to the TD children and (h) the experimenter did not physically engage during the play session. Each of these eight items was rated on a four-point scale (scored from 0 to 3) according to its presence in the video (always present, present during more than half of the opportunities, present during less than half of the opportunities, never present). The treatment fidelity was then calculated by dividing the score obtained by the best score possible (i.e. 24) and multiplying by 100. The average treatment fidelity during the intervention phase was 81% (range: 67–94). Cohen's kappa value was 0.79, demonstrating a substantial interobserver agreement for treatment fidelity.

Data analysis

We used visual inspection of individual data to examine changes that occurred between phases, per the conventions of the single-case design (Kazdin, 2011; Krasny-Pacini & Evans, 2018). We examined changes from baseline to intervention for each child in terms of level, trend and variability. The immediacy of change and the overlap of data between phases were also considered. To supplement visual analysis, we calculated a Tau-U effect size metric for all our dependent variables. Although many methods exist for calculating an effect size in single-case research, we chose the Tau-U which was identified as one of the most relevant (Parker et al., 2011a). Tau-U offers a non-parametric effect size by calculating the non-overlap of all pairs of data between baseline and intervention while controlling for possible trend during baseline (Parker et al., 2011b). We calculated Tau-U with a web-based calculator (http://www.singlecaseresearch.org/calculators/Tau-U). Tau-U values range from 0.00 to 1.00 and effects size can be interpreted as small (between 0.00 and 0.65), medium (between 0.66 and 0.92) or large (between 0.93 and 1.00) (Rakap, 2015).

Results

Play skills

To investigate our first research question, the four categories of play were grouped into only two variables according to their level of complexity. Figure 1 shows the percentage

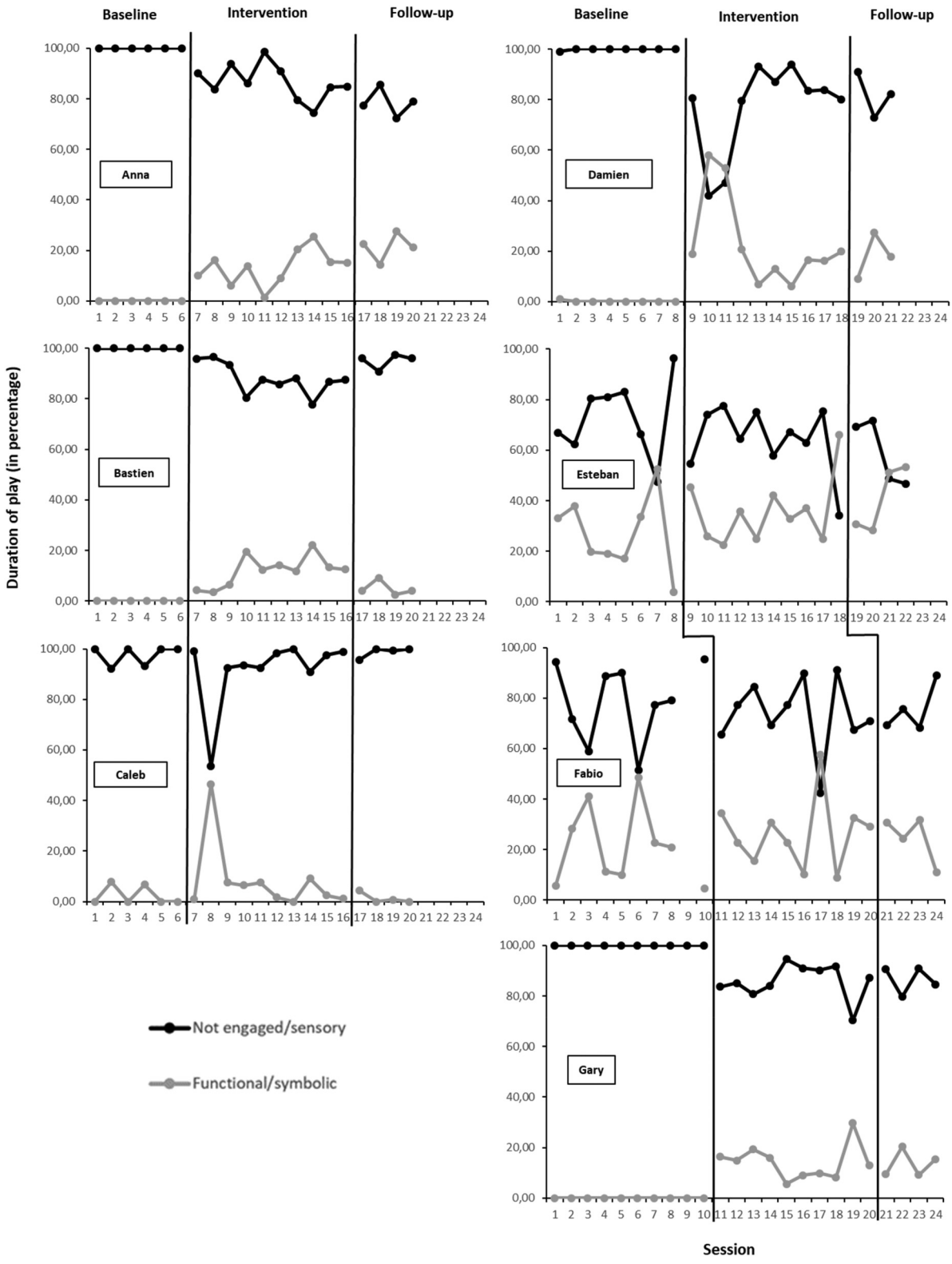

Figure 1. Percentage of time spent in categories of the play domain by children with ASD during baseline, intervention and follow-up.

of time spent in not engaged/sensory play behaviours and in functional/symbolic play behaviours by children with ASD during baseline, intervention and follow-up.

Among the seven participants, four exhibited stable baselines and demonstrated more variability in their play behaviours after the introduction of the intervention. *Anna* who

was exclusively not engaged or in sensory play during baseline (100.00%) increased her proportion of functional/symbolic play during the intervention (averaging at 13.32%). Changes appeared immediately after the introduction of the intervention, with no overlapping data point between baseline and intervention. Gains made by *Anna* then continued to increase at the follow-up to reach an average of 21.42% of functional/symbolic play. For *Bastien*, similar results were noted as we also observed immediate changes in the two play variables after the introduction of the intervention, without overlap in data between baseline and intervention. On average, his proportion of functional/symbolic play increased from 0.00% to 12.02%, while his per cent of time spent not engaged or in sensory play decreased from 100.00% to 86.98%. However, gains made by *Bastien* were not maintained at follow-up, as we noted an overall percentage of functional/symbolic play during this phase (4.90%) below the intervention level. For *Damien*, we observed a very low percentage of functional/symbolic play during his first session, which then disappeared completely during the following baseline sessions. After the introduction of the intervention, we observed an increase in his overall level of functional/symbolic play (from 0.13% to 22.88%) and a decrease in his time spent not engaged or in sensory play (from 99.87% to 77.12%). Despite some variability in data within the intervention, the effect was immediate and no overlap with the baseline was noted. Damien maintained his gains during follow-up and exhibited an overall percentage of functional/symbolic play (18.04%) close to the intervention condition. For *Gary*, no functional/symbolic play behaviour was noted during baseline, as he was exclusively not engaged or in sensory play. After the introduction of the intervention, we observed immediate changes in variability and level of his play behaviours. Overall, his percentage of functional/symbolic play increased from 0.00% to 14.17%, while his percentage of time spent not engaged or in sensory play decreased from 100.00% to 85.83%, with no overlap between baseline and intervention. He maintained his gains during follow-up, exhibiting an overall percentage of functional/symbolic play (13.57%) very similar to the intervention. For the three other children (i.e. *Caleb*, *Esteban* and *Fabio*), we did not observe a functional relationship between intervention and play variables. We noted variability in data within the baseline, without an observable change in variability, level or trend after the introduction of the intervention. We also noted multiple overlapping data points between baseline and intervention. The weighted average Tau-U for both play variables across participants was 0.73 [90% CI = 0.55–0.91], suggesting a medium effect of the intervention.

Social engagement

As we did earlier for the play domain, the five categories of social engagement were grouped into only three variables according to their level of social play. Thus, Figure 2 shows the percentage of time spent isolated or onlooker, in parallel play and play with a common focus or common goal by children with ASD during baseline, intervention and follow-up.

Among the seven participants, six exhibited stable baselines and demonstrated more variability in their social skills after the introduction of the intervention. *Anna*, who was exclusively isolated or an onlooker during baseline, spent more time in play with a common focus/goal during the intervention (averaging 25.18%). Changes were immediate with no overlapping data point between baseline and intervention. On average, Anna's percentage of parallel play also slightly increased from 0.00% in baseline to 4.49% during the intervention, but the inconsistency of change across sessions and the overlaps in data between phases limited causal attribution. Gains made by Anna in play with a common focus/goal continued to increase during follow-up to reach 35.55%. For *Bastien*, play with a common focus/goal increased after the introduction of the intervention (from 0.00% to 13.70%), as well as his overall percentage of parallel play (from 0.00% to 13.55%). Conversely, his percentage of time spent not engaged or onlooker decreased from baseline (100.00%) to intervention (73.11%). Changes observed on these three variables were immediate with no overlap in data between baseline and intervention. However, gains made by *Bastien* dwindled at follow-up, as indicated by overall percentages of parallel play (7.68%) and play with a common focus/goal (3.60%) which were below intervention levels. For *Damien*, percentages of parallel play and play with a common focus/goal during the intervention (averaging at 9.83% and 17.84%, respectively) were above baseline (averaging at 0.25% and 0.08%, respectively). Conversely, his overall percentage of time spent not engaged or onlooker during the intervention (72.33%) was largely below baseline (99.54%). Changes appeared immediately after the introduction of the intervention with no overlapping data point between baseline and intervention. Damien maintained his gains during follow-up by exhibiting, on average, 10.59% of parallel play and 19.41% of play with a common focus/goal. For *Esteban*, very similar results were noted. He immediately increased his percentages of play with a common focus/goal after the introduction of the intervention (from 0.00% to 21.32% on average), without overlap in data with the baseline. His percentages of parallel play also increased from baseline (averaging 3.59%) to intervention (averaging 24.95%) with an immediate effect. Conversely, Esteban's overall percentage of time spent isolated or with onlookers drastically decreased from 96.41% to 53.68%. During Follow-up, *Esteban* maintained his gains by exhibiting, on average, 18.90% of parallel play and 29.39% of play with a common focus/goal. For *Fabio*, we noted an immediate effect of the intervention on his proportions of parallel

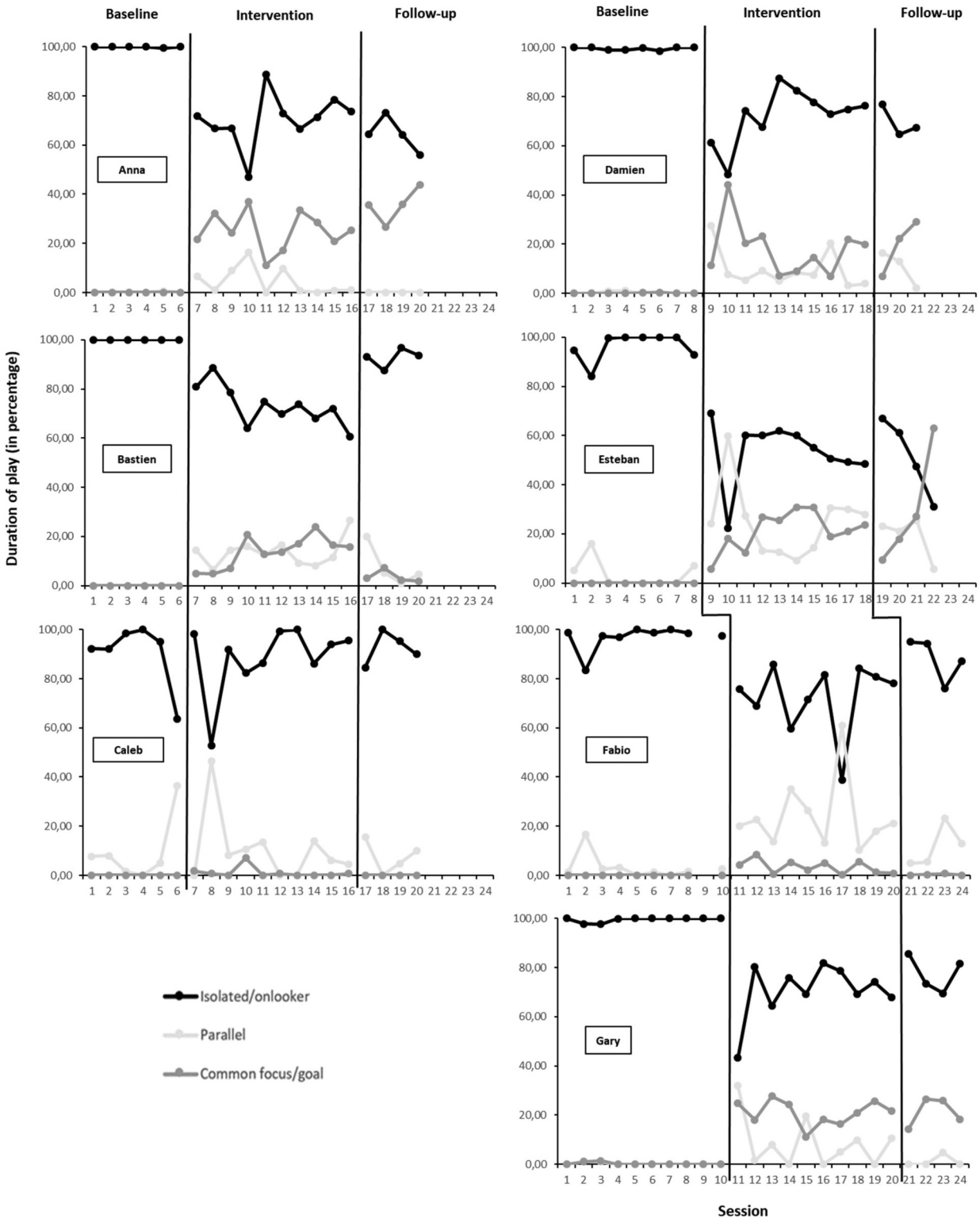

Figure 2. Percentage of time spent in categories of the social engagement domain by children with ASD during baseline, intervention and follow-up.

play which drastically increased from 3.25% in baseline to 24.14% during intervention. Despite more limited gains, his percentages of play with a common focus/goal also increased immediately after the introduction of the intervention (from 0.00% to 3.38%), with no overlap in data with the baseline. Conversely, his overall percentage of time

spent not engaged or onlooker decreased from 96.75% in baseline to 72.46% during intervention. The effect was immediate with only two overlapping data points with a baseline. Gains made by *Fabio* during intervention dwindled at follow-up with 11.64% of parallel play and 0.24% of play with a common focus/goal. For *Gary*, we observed an increase in percentages of play with a common focus/goal after the introduction of the intervention (from 0.25% to 20.86% on average) and a decrease in percentages of time spent isolated or onlooker (from 99.53% to 70.48% on average). These changes were immediate with no overlap in data between baseline and intervention and maintained during follow-up with overall levels at 21.25% for play with a common focus/goal and 77.56% for the time spent isolated or onlooker. His percentages of parallel play also increased immediately after the introduction of the intervention and averaged above baseline (8.65%), but dwindled and trended downward during follow-up (averaging at 1.17%). For the last participant, *Caleb*, visual analysis of data suggested that they were no effect of the intervention on the social engagement variables. Indeed, no change in variability, trend or level from baseline to intervention was noted. Moreover, significant overlaps between the two conditions were observed. The weighted average Tau-U was 0.88 [90% CI = 0.70–1.00] for the time spent isolated or onlooker and 0.77 [90% CI = 0.59–0.95] for parallel play, suggesting a medium effect of the intervention. For play with a common focus/goal, the weighted average Tau-U was 0.93 [90% CI = 0.75–1.00], suggesting a large effect of the intervention.

Motor imitation

Figure 3 shows the rates of motor imitation exhibited by children with ASD during baseline, intervention and follow-up.

Among the seven participants, five exhibited stable baselines with a total absence of motor imitation and then demonstrated more variability after the introduction of the intervention. For *Anna*, motor imitation immediately increased to reach an average rate of 0.23 behaviours per minute during the intervention, which was then maintained during follow-up at an average rate of 0.19 behaviours per minute. For *Bastien*, rates of motor imitation also increased in level during the intervention (averaging at 0.50 behaviours per minute), with immediate effect and no overlapping data point between baseline and intervention. However, gains dwindled during follow-up, occurring at an average of 0.25 behaviours per minute. For *Damien*, motor imitation increased to reach an average of 0.42 behaviours per minute during the intervention. Change appeared immediately after the introduction of the intervention, with no overlapping data points between the two conditions. Damien maintained his gains during follow-up with motor imitations occurring on average 0.41 times per minute. For *Esteban*, a very similar pattern of change was noted. He increased immediately his rates of motor imitation after the introduction of the intervention (averaging at 0.36 behaviours per minute), without overlap with the baseline. Then, he maintained his gains during follow-up despite a slightly lower average rate of motor imitation (0.21 behaviours per minute) than in intervention. For *Fabio*, we observed a slight immediate increase in his rates of motor imitation after the introduction of the intervention (averaging at 0.09 behaviours per minute), despite four intervention sessions with no behaviour observed. However, *Fabio*'s motor imitations trended downward during follow-up, occurring in only one session and averaging 0.02 behaviours per minute. For the two last participants (*Caleb* and *Gary*), there was no observable change in variability, level or trend after the introduction of the intervention. The two children exhibited imitation behaviours in only two intervention sessions, which is insufficient to support a functional relationship between intervention and imitation improvement. The weighted average Tau-U for motor imitation across participants was 0.71 [90% CI = 0.53–0.89], suggesting a medium effect of the intervention.

Discussion

The benefits of PMIs for students with ASD are well documented in the literature (Gunning et al., 2019), but children with the most substantial cognitive and language difficulties are largely understudied (Chang & Locke, 2016; O'Donoghue et al., 2021; Watkins et al., 2015). To address this gap, the present study aimed to evaluate the effectiveness of a play-based PMI adapted from the IPG model (Wolfberg, 2003; Wolfberg & Schuler, 1993) in seven minimally verbal participants with an ID.

Was the play-based PMI effective to improve socio-communicative skills of minimally verbal students who also have an ID?

Our results indicated that the IPG intervention led to socio-communicative skills improvements in most of the participants. Within the play domain, four of the seven children increased their functional/symbolic play behaviours, while spending less time not engaged or in sensory play. A similar pattern occurred in the social engagement domain with increases in parallel play for five children, increases in common focus/goal for six children and collateral decreases in isolate/onlooker play behaviours for six children. These findings suggest that the intervention led most of the participants with ASD to demonstrate more complex and social forms of play, which is consistent with previous studies on the IPG model (Wolfberg et al.,

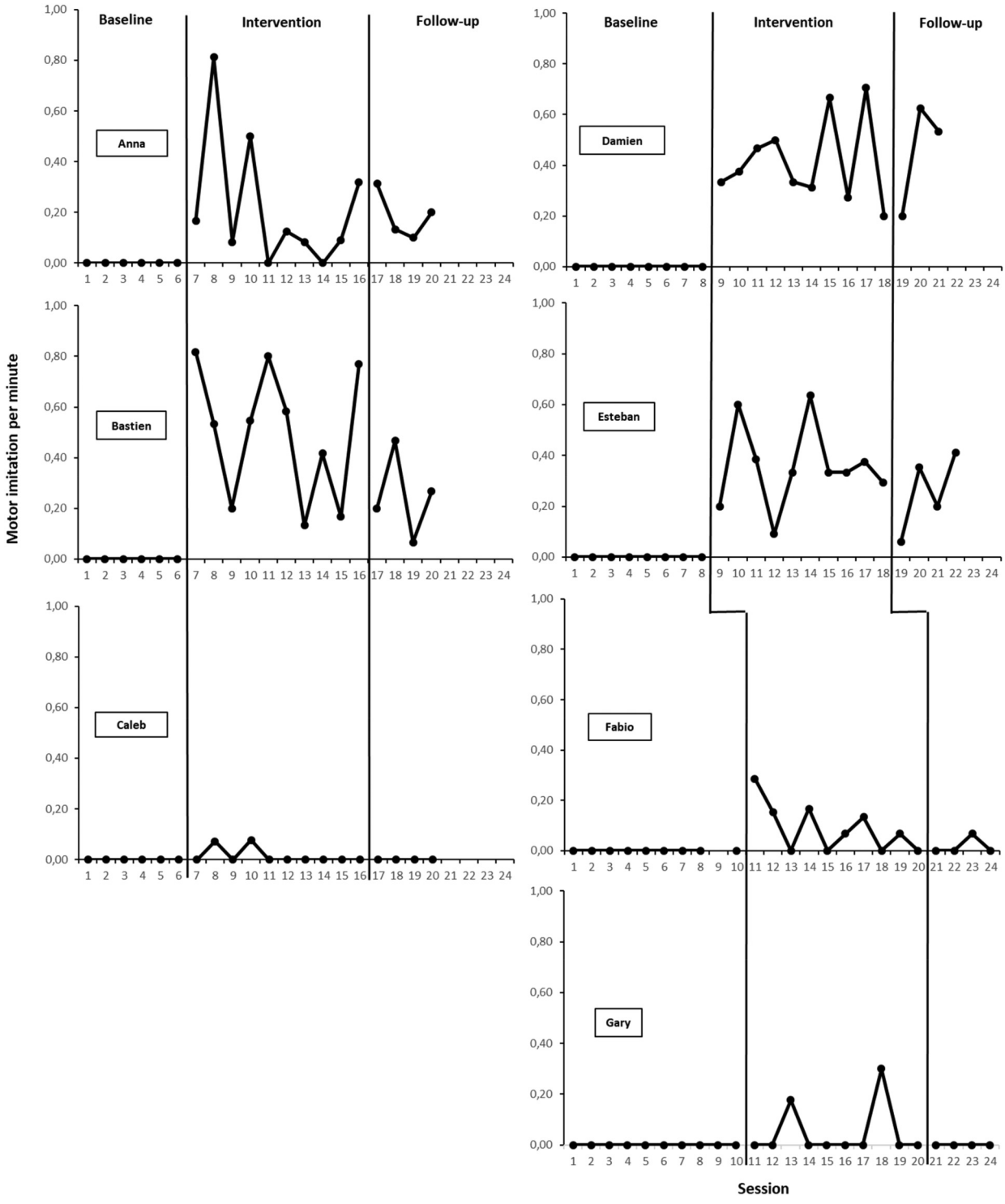

Figure 3. Rates of motor imitation exhibited by children with ASD during baseline, intervention and follow-up.

2015; Wolfberg & Schuler, 1993; Yang et al., 2003). Within the imitation domain, five of the seven children were more imitative after the introduction of the intervention. Imitation is a crucial developmental skill (Edwards, 2014), and children with ASD often have particular difficulty imitating others' actions (Williams et al., 2004). Thus, the fact that most of the children were able to imitate their peers more frequently through the play-based PMI is particularly notable. In addition, motor imitation and play with toys predict later communication in children

with ASD (Toth et al., 2006), as well as expressive language in those who are minimally verbal (Pecukonis et al., 2019). Consequently, the joint improvement in play and imitation skills that we observed in the present study is particularly encouraging, as progress in these areas could help minimally verbal children with ASD to develop communicative and language abilities.

Overall, these findings suggest that the IPG intervention may be effective to improve the socio-communicative skills of minimally verbal children with ASD who also have an ID. However, despite some evidence for improvements across play skills, social engagement and imitation skills, there is a notable difference in the degree to which these three domains responded to the intervention. The weighted average Tau-U analyses indicated that the effect of the intervention on play with a common focus/goal [0.93. (90% CI = 0.75–1.00)] was stronger than on functional/symbolic play [0.73 (90% CI = 0.55–0.91)] and motor imitation [0.71 (90% CI = 0.53–0.89)]. Thus, these data suggest that play and imitation skills may be less responsive to the IPG intervention than social engagement. Although this is consistent with the primary aim of PMIs which is to promote socialization (Charlop et al., 2018), we presume that being aware of the interaction is probably less demanding than producing new play behaviours or imitating the actions of another, especially for children who have substantial cognitive difficulties such as those included in the present study.

Was the play-based PMI effective for all children?

Although there is evidence of improvements across socio-communicative domains for the majority of the participants, our results suggest that the IPG intervention was not effective for all. One child in particular (*Caleb*) did not make progress in any domain after the PMI was introduced. Several explications can be formulated. First, *Caleb* tended to avoid social contact with his TD peers and to push back against their social initiatives during intervention sessions. And yet, a social approach may be critical to treatment response for a program that emphasizes social interactions in an inclusive setting (Ingersoll et al., 2001). For example, Sherer and Schreibman (2005) observed that children who had the best outcomes following pivotal response training exhibited low levels of social avoidance and high levels of social approach. Conversely, children who showed no or minimal gains had high levels of social avoidance and low levels of social approach. Second, *Caleb* frequently exhibited disruptive behaviours (crying, running away) in case of frustrations (e.g. broken toys or desired objects in possession of a peer), which are identified as barriers to social relationships and school inclusion within the literature (Majoko, 2016). It is therefore possible that disruptive behaviours are also a barrier to the implementation of PMIs, limiting interactions between peer coaches and children with ASD. Thus, these results may suggest that for children with ASD who are socially avoidant and who exhibit disruptive behaviours, a play-based PMI may not be the preferred approach for improving socio-communicative skills. Another explanation based on the children assigned with *Caleb* could also be advanced. It was in this group that the implementation fidelity was the lowest (averaging at 67%), partly because *Caleb*'s peers had more difficulty than other TD participants in the role of coach. They needed very substantial support from the adult to understand *Caleb*'s needs and to adjust their behaviour accordingly. They also needed regular encouragement to stay motivated to help *Caleb*. Although willing to participate and identified as socially competent by their teacher, these observations suggest that TD children's characteristics may also influence the effects of the IPG intervention and therefore explain *Caleb*'s non-evolution.

Beyond differences between *Caleb* and the other children, our results also showed variability among children who improved, suggesting that intervention was not equally effective for all. For example, three children simultaneously increased their play skills, social engagement and imitation skills, while the other three children improved in only two of these domains. Within the play domain, it seems that the intervention was particularly effective for children who had the fewest skills at intake. Indeed, the two children who substantially exhibited functional/symbolic play behaviours in baseline did not progress after the introduction of the intervention. Conversely, children who mostly exhibited not engaged/sensory play behaviours at intake increased their functional/symbolic play behaviours when the intervention was introduced. These observations are encouraging for the diversity of children who can benefit from the IPG intervention, although they are not specific to this model. Kent et al. (2021), for instance, indicated that children with the lowest pre-intervention play scores improved more than those with the highest pre-intervention play scores after another play-based PMI. Practically, such findings suggest that PMIs may be especially effective for supporting the emergence of new play skills in children who have the least resources in this area.

Did the intervention effects maintain when adult support was withdrawn?

Our results indicated that the gains observed in the IPG intervention were not systematically maintained when adult support was withdrawn. Maintenance skills concerned three out of four children for functional/symbolic play, two out of five children for parallel play, four out of six children for interactive play and three out of five children for imitation. These data suggest that skill maintenance was possible, although highly variable across children. We propose to explain these differences through the interaction

of two factors. First, we observed that students with ASD who have not maintained their gains were paired with TD children who had difficulty implementing the intervention and then drastically reduced their support during follow-up. For example, *Fabio*'s peers showed wide fluctuations in their use of intervention strategies (indicated by an average treatment fidelity score of 73%) and virtually stopped helping him when adult support was withdrawn. Although previous studies were more unanimous on the capacity of TD peers to continue to carry out activities without adult guidance (e.g.Harper et al., 2008; Zercher et al., 2001), the youngest age of the children included in the present study may explain their greatest difficulty to implement the intervention accurately and maintain their support afterward. Second, it appears that the children who maintained their gains tended to be those with the most cognitive resources in the sample. For example, *Damien* and *Esteban* who were the two participants with the smallest cognitive delays maintained their gains, while *Bastien* and *Fabio* who were two of the three children with the most substantial cognitive delays did not maintain their gains. *Anna* was the exception and maintained his gains despite a very low DQ, but she also was the child who received the highest level of peer support during and after the intervention. This would suggest that minimally verbal children who have the most cognitive difficulties need continued support to maintain their improvements over time or that an intervention longer than ten sessions is necessary to promote ongoing socio-communicative development.

Limitations and future directions

This study includes several limitations that may provide direction for future play-based PMI research with minimally verbal students with ASD. A first limitation has to do with the fact that we considered motor imitation as a whole, rather than in its different forms. Given that elicited and spontaneous imitation respond to functions that are different (Nadel et al., 2004), is it possible that the measurement of these two forms of imitation would reveal more nuanced findings about intervention effects. Additionally, children with ASD were encouraged to imitate their TD peers but intervention procedures did not include the reverse strategy. To the extent that repeated imitation sessions improve the social functioning of children with ASD (Field, 2017), it would be relevant to explore whether incorporating reciprocal imitation into a play-based PMI could add value. Second, although we observed that the maintenance of skills was possible immediately following the completion of the intervention, we do not know how long positive effects may persist, or whether they can be transferred across settings and peers. Future research is warranted to determine whether the gains made by minimally verbal students with ASD who also have an ID can be generalized and sustained throughout their childhood. In addition, the difficulties encountered by some TD peers in implementing the intervention and in maintaining their help without adult support raise questions about how they experienced their role of coach during and after the PMI, which would also merit further investigations. Third, although we hypothesize that the variability in intervention effects across groups can be explained by individual factors, we do not have sufficient data to confirm this. Future research is therefore needed to determine to what degree TD children's characteristics (e.g. ToM abilities, prosocial behaviours) and children with ASD's characteristics (e.g. cognitive abilities, social avoidance, challenging behaviours) influence participants with ASD's response to a play-based PMI. Finally, although the present study conforms to the standards for multiple baseline design across participants by incorporating at least three different baseline lengths (Krasny-Pacini & Evans, 2018), we recognize that it is more common to have a different number of baseline sessions for each participant.

Conclusion

The present study indicated that a play-based PMI adapted from the IPG model can be implemented in school settings for improving play, social engagement and motor imitation of minimally verbal students with ASD who also have an ID. Benefits were noted for most of the participants, although there were inter-individual variations among children that appeared to influence performance during intervention and follow-up. Thus, maintenance of the improvements was possible without being systematic. Overall, these findings suggest that a play-based PMI adapted from the IPG model may be a feasible option for addressing inclusive education of students with ASD who have the most cognitive and language difficulties, especially for promoting positive relationships with their peers. However, the present study implemented the intervention in a 'neutral' room in the school and further research is needed to determine whether children with ASD requiring the highest level of support and attending specialized units could benefit from an intervention that would be directly implemented within a regular class.

Acknowledgements

The authors would like to thank the children and their parents for their participation, as well as the professionals in the schools for their help and contributions.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: the Caisse nationale de la solidarité et de l'autonomie [Iresp-17-AUT4-06]; the Region Bretagne [ARED 2015-2018], the ADAPEI 56 [ARED 2015-2018] and the MSHB (for translation assistance).

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References

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders, text revision (DSM-IV-TR)*. American Psychiatric Association.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders DSM-5* (5th Edition). American Psychiatric Publishing.

Anderson, A., Moore, D. W., Godfrey, R., & Fletcher-Flinn, C. M. (2004). Social skills assessment of children with autism in free-play situations. *Autism*, *8*(4), 369-385. https://doi.org/10.1177/1362361304045216

Bondy, A. S., & Frost, L. A. (1994). The picture exchange communication system. *Focus on Autistic Behavior*, *9*(3), 1-19. https://doi.org/10.1177/108835769400900301

Boudreau, A. M., Corkum, P., Meko, K., & Smith, I. M. (2015). Peer-mediated pivotal response treatment for young children with autism spectrum disorders: A systematic review. *Canadian Journal of School Psychology*, *30*(3), 218-235. https://doi.org/10.1177/0829573515581156

Brain, T., & Mirenda, P. (2019). Effectiveness of a low-intensity peer-mediated intervention for middle school students with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *62*, 26–38. https://doi.org/10.1016/j.rasd.2019.02.003

Chan, J. M., Lang, R., Rispoli, M., O'Reilly, M., Sigafoos, J., & Cole, H. (2009). Use of peer-mediated interventions in the treatment of autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders*, *3*(4), 876-889. https://doi.org/10.1016/j.rasd.2009.04.003

Chang, Y.C., & Locke, J. (2016). A systematic review of peer-mediated interventions for children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *27*, 1–10. https://doi.org/10.1016/j.rasd.2016.03.010

Charlop, M. H., Lang, R., & Rispoli, M. (2018). Want to play? Peer-mediated intervention for young children with autism spectrum disorder. In M. H. Charlop, R. Lang, & M. Rispoli (Eds.), *Play and social skills for children with autism spectrum disorder* (pp. 107–127). Springer International Publishing. http://link.springer.com/10.1007/978-3-319-72500-0_7.

Christ, T. J. (2007). Experimental control and threats to internal validity of concurrent and nonconcurrent multiple baseline designs. *Psychology in the Schools*, *44*(5), 451–459. https://doi.org/10.1002/pits.20237

Edwards, L. A. (2014). A meta-analysis of imitation abilities in individuals with autism spectrum disorders. *Autism Research*, *7*(3), 363-380. https://doi.org/10.1002/aur.1379

Field, T. (2017). Imitation enhances social behavior of children with autism spectrum disorder: A review. *Behavioral Development Bulletin*, *22*(1), 86-93. https://doi.org/10.1037/bdb0000042

Goldstein, J. (2012). *Play in children's development, health and well-being*. Toy Industries of Europe.

González-Sala, F., Gómez-Marí, I., Tárraga-Mínguez, R., Vicente-Carvajal, A., & Pastor-Cerezuela, G. (2021). Symbolic play among children with autism spectrum disorder: A scoping review. *Children*, *8*(9), 801-819. https://doi.org/10.3390/children8090801

Gunning, C., Breathnach, Ó, Holloway, J., McTiernan, A., & Malone, B. (2019). A systematic review of peer-mediated interventions for preschool children with autism spectrum disorder in inclusive settings. *Review Journal of Autism and Developmental Disorders*, *6*(1), 40–62. https://doi.org/10.1007/s40489-018-0153-5

Hansen, S. G., Blakely, A. W., Dolata, J. K., Raulston, T., & Machalicek, W. (2014). Children with autism in the inclusive preschool classroom: A systematic review of single-subject design interventions on social communication skills. *Review Journal of Autism and Developmental Disorders*, *1*(3), 192–206. https://doi.org/10.1007/s40489-014-0020-y

Harper, C. B., Symon, J. B. G., & Frea, W. D. (2008). Recess is time-in: Using peers to improve social skills of children with autism. *Journal of Autism and Developmental Disorders*, *38*(5), 815–826. https://doi.org/10.1007/s10803-007-0449-2

Harrop, C., Green, J., & Hudry, K. (2017). Play complexity and toy engagement in preschoolers with autism spectrum disorder: Do girls and boys differ? *Autism*, *21*(1), 37–50. https://doi.org/10.1177/1362361315622410

Hu, X., Zheng, Q., & Lee, G. T. (2018). Using peer-mediated LEGO® play intervention to improve social interactions for Chinese children with autism in an inclusive setting. *Journal of Autism and Developmental Disorders*, *48*(7), 2444–2457. https://doi.org/10.1007/s10803-018-3502-4

Ingersoll, B., Schreibman, L., & Stahmer, A. (2001). Brief report: Differential treatment outcomes for children with autistic Spectrum disorder based on level of peer social avoidance. *Journal of Autism and Developmental Disorders*, *31*(3), 343-349. https://doi.org/10.1023/A:1010703521704

Kamps, D., Mason, R., & Heitzman-Powell, L. (2017). Peer mediation interventions to improve social and communication skills for children and youth with autism spectrum disorders. In J. B. Leaf (Ed.), *Handbook of social skills and autism spectrum disorder* (pp. 257–283). Springer International Publishing. http://link.springer.com/10.1007/978-3-319-62995-7_16

Katz, E., & Girolametto, L. (2013). Peer-mediated intervention for preschoolers with ASD implemented in early childhood education settings. *Topics in Early Childhood Special Education*, *33*(3), 133-143. https://doi.org/10.1177/0271121413484972

Kazdin, A. E. (2011). *Single-case research designs: Methods for clinical and applied setting* (2nd ed.). Oxford University Press.

Kent, C., Cordier, R., Joosten, A., Wilkes-Gillan, S., & Bundy, A. (2021). Can I learn to play? Randomized control trial to assess

effectiveness of a peer-mediated intervention to improve play in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *51*(6), 1823–1838. https://doi.org/10.1007/s10803-020-04671-5

Krasny-Pacini, A., & Evans, J. (2018). Single-case experimental designs to assess intervention effectiveness in rehabilitation: A practical guide. *Annals of Physical and Rehabilitation Medicine*, *61*(3), 164–179. https://doi.org/10.1016/j.rehab.2017.12.002

Krier, J., & Lambros, K. M. (2021). Increasing joint attention and social play through peer-mediated intervention: A single case design. *Psychology in the Schools*, *58*(3), 494–514. https://doi.org/10.1002/pits.22460

Lafont, C., Panjo, H., Michelon, C., Falissard, B., Speranza, M., Picot, M.C., Baghdadli, A., & Rouquette, A. (2023). Determinants of inclusion in mainstream school for children with autism spectrum disorders from the EpiTED study : A 10-year follow-up cohort. *Journal of Autism and Developmental Disorders*, *53*(1), 121–131. https://doi.org/10.1007/s10803-021-05404-y

Le Maner-Idrissi, G. (1996). An internal gender system at 24 months. *European Journal of Psychology of Education*, *11*(3), 301–312. https://doi.org/10.1007/BF03172942

Lillard, A. S. (2015). The development of play. In L. S. Liben & U. Mueller (Eds.), *Handbook of child psychology and developmental science* (7th ed., Vol. *2*, pp. 425–468). Wiley-Blackwell.

Majoko, T. (2016). Inclusion of children with autism spectrum disorders: Listening and hearing to voices from the grassroots. *Journal of Autism and Developmental Disorders*, *46*(4), 1429-1440. https://doi.org/10.1007/s10803-015-2685-1

Martin, C. L., Kornienko, O., Schaefer, D. R., Hanish, L. D., Fabes, R. A., & Goble, P. (2013). The role of sex of peers and gender-typed activities in young children's peer affiliative networks: A longitudinal analysis of selection and influence. *Child Development*, *84*(3), 921–937. https://doi.org/10.1111/cdev.12032

Nadel, J. (2002). Imitation and imitation recognition: Functional use in preverbal infants and nonverbal children with autism. In A. Meltzoff & W. Prinz (Eds.), *The imitative mind: Development, evolution, and brain bases* (pp. 42–62). Cambridge University Press.

Nadel, J., Revel, A., Andry, P., & Gaussier, P. (2004). Toward communication: First imitations in infants, low-functioning children with autism and robots. *Interaction Studies. Social Behaviour and Communication in Biological and Artificial Systems*, *5*(1), 45–74. https://doi.org/10.1075/is.5.1.04nad

Nilholm, C. (2021). Research about inclusive education in 2020 – how can we improve our theories in order to change practice? *European Journal of Special Needs Education*, *36*(3), 358–370. https://doi.org/10.1080/08856257.2020.1754547

O'Donoghue, M., O'Dea, A., O'Leary, N., Kennedy, N., Forbes, J., & Murphy, C. A. (2021). Systematic review of peer-mediated intervention for children with autism who are minimally verbal. *Review Journal of Autism and Developmental Disorders*, *8*(1), 51–66. https://doi.org/10.1007/s40489-020-00201-2

Parker, R., Vannest, K., & Davis, J. (2011a). Effect size in single-case research: a review of nine nonoverlap techniques. *Behavior Modification*, *35*(4), 303-322. https://doi.org/10.1177/0145445511399147

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

Pecukonis, M., Plesa Skwerer, D., Eggleston, B., Meyer, S., & Tager-Flusberg, H. (2019). Concurrent social communication predictors of expressive language in minimally verbal children and adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *49*(9), 3767-3785. https://doi.org/10.1007/s10803-019-04089-8

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

Rogers, S., & Dawson, G. (2010). *Early start Denver model for young children with autism: Promoting language, learning, and engagement*. Guilford Press.

Roy, D., & Mezher, O. (2010). *Mon petit frère super héros*. Fonfon.

Schopler, E., Lansing, M. D., Reichler, M. J., & Marcus, L. M. (2005). *Psychoeducational profile-third edition (PEP-3)*. Western Psychological Services.

Schopler, E., Mesibov, G. B., & Hearsey, K. (1995). Structured teaching in the TEACCH system. In E. Schopler & G. B. Mesibov (Eds.), *Learning and cognition in autism* (pp. 243–268). Springer US. https://doi.org/10.1007/978-1-4899-1286-2_13

Sherer, M. R., & Schreibman, L. (2005). Individual behavioral profiles and predictors of treatment effectiveness for children with autism. *Journal of Consulting and Clinical Psychology*, *73*(3), 525-538. https://doi.org/10.1037/0022-006X.73.3.525

Tager-Flusberg, H., & Kasari, C. (2013). Minimally verbal school-aged children with autism spectrum disorder: The neglected end of the spectrum. *Autism Research*, *6*(6), 468–478. https://doi.org/10.1002/aur.1329

Tap, P. (1985). *Masculin et féminin chez l'enfant*. Privat.

Tellegen, P., Laros, J., & Kiat, M. (2009). *SON-R 21/2–7—Test non-verbal intelligence. Adaptation Française*. Hogrefe.

Thiébaut, E., Adrien, J.L., Blanc, R., & Barthelemy, C. (2010). The social cognitive evaluation battery for children with autism : A new tool for the assessment of cognitive and social development in children with autism spectrum disorders. *Autism Research and Treatment*, *2010*, 1–9. https://doi.org/10.1155/2010/875037

Thiemann-Bourque, K. S., Brady, N., McGuff, S., Stump, K., & Naylor, A. (2016). Picture exchange communication system and pals: A peer-mediated augmentative and alternative communication intervention for minimally verbal preschoolers with autism. *Journal of Speech, Language, and Hearing Research*, *59*(5), 1133–1145. https://doi.org/10.1044/2016_JSLHR-L-15-0313

Thomas, A., & Bambara, L. M. (2020). Using peer-mediation to enhance conversation and reduce inappropriate communication acts in adolescents with autism. *Education and Training in Autism and Developmental Disabilities*, *55*(2), 185–200. https://www.jstor.org/stable/10.2307/27077910

Toth, K., Munson, J., Meltzoff, A. N., & Dawson, G. (2006). Early predictors of communication development in young children with autism spectrum disorder: Joint attention, imitation, and toy play. *Journal of Autism and Developmental Disorders*, *36*(8), 993–1005. https://doi.org/10.1007/s10803-006-0137-7

Trottier, N., Kamp, L., & Mirenda, P. (2011). Effects of peer-mediated instruction to teach use of speech-generating devices to students with autism in social game routines. *Augmentative and Alternative Communication*, *27*(1), 26–39. https://doi.org/10.3109/07434618.2010.546810

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard university press.

Watkins, L., O'Reilly, M., Kuhn, M., Gevarter, C., Lancioni, G. E., Sigafoos, J., & Lang, R. (2015). A review of peer-mediated social interaction interventions for students with autism in inclusive settings. *Journal of Autism and Developmental Disorders*, *45*(4), 1070–1083. https://doi.org/10.1007/s10803-014-2264-x

Watson, P. J., & Workman, E. A. (1981). The non-concurrent multiple baseline across-individuals design: An extension of the traditional multiple baseline design. *Journal of Behavior Therapy and Experimental Psychiatry*, *12*(3), 257-259. https://doi.org/10.1016/0005-7916(81)90055-0

Williams, J. H. G., Whiten, A., & Singh, T. (2004). A systematic review of action imitation in autistic Spectrum disorder. *Journal of Autism and Developmental Disorders*, *34*(3), 285-299. https://doi.org/10.1023/B:JADD.0000029551.56735.3a

Wolfberg, P. (2003). *Peer play and the autism spectrum: The art of guiding children's socialization and imagination*. AAPC Publishing.

Wolfberg, P., Bottema-Beutel, K., & DeWitt, M. (2012). Including children with autism in social and imaginary play with typical peers: Integrated play groups model. *American Journal of Play*, *5*(1), 55–80.

Wolfberg, P., DeWitt, M., Young, G. S., & Nguyen, T. (2015). Integrated play groups: Promoting symbolic play and social engagement with typical peers in children with ASD across settings. *Journal of Autism and Developmental Disorders*, *45*(3), 830–845. https://doi.org/10.1007/s10803-014-2245-0

Wolfberg, P., & Schuler, A. L. (1993). Integrated play groups: A model for promoting the social and cognitive dimensions of play in children with autism. *Journal of Autism and Developmental Disorders*, *23*(3), 467–489. https://doi.org/10.1007/BF01046051

Wong, C., Odom, S. L., Hume, K. A., Cox, A. W., Fettig, A., Kucharczyk, S., Brock, M. E., Plavnick, J. B., Fleury, V. P., & Schultz, T. R. (2015). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism and Developmental Disorders*, *45*(7), 1951-1966. https://doi.org/10.1007/s10803-014-2351-z

World Health Organization. (1992). *The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines*. World Health Organization.

Yang, T.R., Wolfberg, P. J., Wu, S.C., & Hwu, P.Y. (2003). Supporting children on the autism spectrum in peer play at home and school: Piloting the integrated play groups model in Taiwan. *Autism*, *7*(4), 437–453. https://doi.org/10.1177/1362361303007004009

Zercher, C., Hunt, P., Schuler, A., & Webster, J. (2001). Increasing joint attention, play and language through peer supported play. *Autism*, *5*(4), 374-398. https://doi.org/10.1177/1362361301005004004