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MARYANN T. BURTON
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Chapter 10

TRAINED PEERS' INTERACTIONS WITH CHILDREN WITH AUTISM DURING PLAY

Serene Hyun-Jin Choi* *and Timo A. Nieminen*†
School of Physical Sciences, The University of Queensland,
Brisbane, QLD 4072, Australia

Abstract

In view of the trend towards increased inclusion, the placement of children with autism into inclusive educational settings is likely to increase. Such placement typically fails to result in social interaction with typically developing peers, which is usually explained as a result of deficits of social skills in the children with autism. However, social interaction is a reciprocal process, and it is reasonable to expect that the difficulty at least partly lies with the other child.

Accordingly, a training program, to teach typically developing children how to interact with children with autism in indoor and outdoor play activities was developed. The effectiveness of the training program was tested experimentally (a modified subjects-as-their-own-controls design) in dyad groups, with the same children with autism each playing with a trained peer and an untrained peer in dyads. This models a peer-mediated play intervention, and the difference in success between trained and untrained dyads allows the effectiveness of the peer training to be determined. The level of social interaction displayed by the children with autism was measured and compared in the dyads. As the cognitive aspect of play, using Piaget–Smilansky types of categories, is a commonly-used measure of effect, this was also measured and compared in the dyads.

It was demonstrated clearly and conclusively that when typically developing peers were systematically trained, they were more effectively and consistently able to play and interact with the children with autism. Untrained peers, on the other hand, were not able to interact effectively with the children with autism, and the level of social interaction did not improve over time, indicating that proximity alone is ineffective. This demonstrates that the peer training program was both effective, resulting in statistically improved social interaction, and necessary, as no improvement occurred without training. However, the measurement of the cognitive play did not provide clear answers,

*E-mail address: serene@aanet.com.au
†E-mail address: timo@physics.uq.edu.au

implying that the Piaget–Smilansky cognitive play categories are a poor indicator of success of intervention programs for children with autism.

1. Introduction

In view of the trend towards increased inclusion, the placement of children with autism into inclusive educational settings is likely to increase. An important benefit of such inclusive placement is the opportunity for the children with autism to socially interact with typically developing peers. This is an important issue, since a child can influence the social development of other children, either positively or negatively. Positive and supportive interaction with peers contributes to development in both children with and without disabilities, as discussed by Hartup (1999), Piaget (1959), and Vygotsky (1962). On the other hand, peers can negatively influence children by reinforcing inappropriate behaviour, for example by paying attention to aggressive disruptive behaviours in children with developmental disorders (Marcus, Vollmer, Swanson, Roane, & Ringdahl, 2001). Therefore, the sense of well-being, and quality of life, of students with disabilities at educational settings might be more dependent on supportive peer relationship in terms of inclusive education programs, rather than either integrated or segregated placement issues (Allodi, 2000).

However, when children with autism are placed in inclusive settings, social interaction typically fails to result—physical proximity is insufficient. This is not so surprising, since difficulty in social interaction has been recognised as a major diagnostic sign of autism; manifesting as interaction with typically developing peers being either negative or rare. Accordingly, much research has focussed on improving social interaction between children with autism and peers and others; this field of research has been reviewed by McConnell (2002) and Choi (2007). Not unexpectedly, no panacaea has emerged. While there has been some success, further progress towards training methods or interventions that can enhance social interaction while minimising participation by skilled personel and other adults remains highly desirable.

Theories and hypotheses on this difficulty in interaction have focused on the difficulty caused by children with autism, with the lack of social interaction usually explained as a result of deficits of social skills in the children with autism. However, social interaction is a reciprocal process, and it is reasonable to expect that the difficulty that children with autism experience in social interaction with typically developing children is partly due to the typically developing children being unable to recognize or understand social cues and responses used by the children with autism.

Therefore, a training program to teach typically developing children how to interact with children with autism was developed (Choi, 2005). The training program was designed so that it would be possible for a regular classroom teacher to train the typically developing children in the class in preparation for the inclusive placement of a child with autism. The experimental test of this training program was the primary focus of the research described here.

A modified subjects-as-their-own-controls design was used, with the same children with autism each playing with a trained peer and an untrained peer in dyads, in a naturalistic setting. This simplified model of peer interaction during non-class school time allowed reliable quantitative results to be obtained. It should also be noted that this test also indicated the

expected performance of the training program if used in a peer-mediated play intervention.

The training program was clearly shown to be effective. The design of the training program and its experimental test, and the results of that test, are described below.

2. Method

2.1. Measurement of success

Since the effectiveness of the peer training was determined by measurement of the difference in success between trained and untrained dyads, it will be beneficial to first consider the methods by which the level of success of such an intervention can be measured, before considering the details of the experimental design.

Perhaps the most common method for quantitative measurement of success of peer interventions is measure the "level" of cognitive behaviour by classification using the Piaget–Smilansky categories (Piaget, 1962; Smilansky, 1968)—since the pre-eminent theory relating play and cognitive development is that of Piaget (1952, 1977), it is hardly surprising that taxonomies and classification schemes, which provide a bridge between the concepts embodied in the theory and the practical matters of measurement and experiment, based on his theory and its derivatives are in common use. However, it must be noted that Piaget deliberately ignored social factors. As Piaget (1962, p. 68) explained, "We are of course entirely in agreement that thought cannot be explained without recourse to social factors, but the general concept of 'social life' seems to us inadmissible in psychology. 'Society' is neither a thing nor a cause, but a system of relationships, and it is for the psychologist to classify these relationships and analyse separately their respective effects". Hetherington, Parke, and Locke (1999) pointed out that the focus of Piagetian theory is on the set of innate cognitive abilities or limitations of children associated with each stage and as such social and cultural influences on children's cognitive development are largely not addressed. Thus, one should consider carefully the relevance of a Piagetian classification for a measurement of success of a *social* intervention. On the other hand, such a classification allows comparison of results with studies making use of similar schemes.

Therefore, the cognitive level of play was measured using the Piaget–Smilansky categories, but it was also decided to make a more direct measurement of the level of social interaction. Unfortunately, while the Piaget–Smilansky categories are widely-used and widely-accepted, amounting to a de facto standard set of categories, there is no equivalent measure of social interaction behaviour (especially for children with autism). The six categories (unoccupied play, onlooker play, solitary play, parallel play, associative play, and cooperative play) established by Parten (1932) are widely used for the measurement of the social aspect of peer play in typically developing children (Farran & Son-Yarbrough, 2001; Fox, 1996; Johnson, Christie, & Yawkey, 1999; Pugmire-Stoy, 1992; Saracho, 1993), and have even been used in some studies of children with developmental delay (e.g., Brophy & Zukowski, 1984) or with autistic spectrum disorder (e.g., Anderson, Moore, Godfrey, & Fletcher-Flinn, 2004; Jahr, Eikeseth, Eldevik, & Aase, 2007; Yang, Wolfberg, Wu, & Hwu, 2003), and Parten's categories appear to be the closest that there is to a standard set of categories for the classification for peer play behaviour. However, Parten's categories do not seem to be sufficient to classify *meaningful* types or levels of social *interaction* of children

with or without disabilities—Parten's categories do not allow the measurement of social interaction occurring without play. Even in play-centred settings, this is a serious limitation; while social interaction during play sessions will usually be part of play activities, non-play social interaction can occur, and must be measured. If play is not the primary activity of the children whose behaviour is being measured, this limitation makes Parten's categories fundamentally unsuitable. This has been recently noted by Anderson et al. (2004) with some surprise, since the categories are in wide use.

Especially since the cognitive level of play would already be measured using the Piaget–Smilansky cognitive categories, it was decided to design new categories to classify social interaction and play with peers in children with autism to allow for the hesitant, vague, uncertain, and brief social behaviours that can be expected. The new social interaction categories were to be independent of the actual play, so as to provide an independent (of the cognitive level of play) dimension of measurement.

This development of a taxonomy of social interaction can be carried out in conjunction with the development of a binary key as a practical tool for the classification of the observed behaviour, as has been described in detail elsewhere (Choi, 2005; Nieminen & Choi, 2008). The key for the classification of the cognitive level of play is shown in figures 1 and 2, and the key for the classification of the level of social interaction is shown in figures 3 and 4. The keys are shown in both the more traditional typeset "list" form (figures 1 and 3) and the easier-to-use graphical tree form (figures 2 and 4). The keys themselves provide a compact definition of the categories; for example, the *active–low* category can be specified as: the child with autism shows non-negative social responses or initiation with the peer, with at least some initiation by the child with autism; however, while the the interaction is reciprocal, the behaviour of the child with autism is unclear; and the peer shows a non-negative response to initiations by the child with autism.

Of these measurements of the levels of cognitive play and social interaction displayed by the the children with autism, the level of social interaction provides a direct measurement of the immediate success of the peer-mediated play intervention, and is the best available indicator of possible long-term benefit for the children with autism.

2.2. Design

In principle, it is quite straightforward to measure the effectiveness of a training program for typically developing children to improve their interaction with children with autism: simply compare the levels of social interaction shown by children with autism when playing with trained and untrained typically developing peers. In practice, however, inter-subject variability would require a large number of subjects before a statistically significant result could be established.

Therefore, a standard procedure is to make use of quasi-experimental methods, such as using a baseline/treatment design (AB design), where the subjects before treatment (in this case, before the training program) act as a control group. Since both the experimental group and the control group are made up of the same subjects, the effect of intersubject variability is virtually eliminated. This was the method adopted here, with typically developing children acting first as untrained peer play partners, undergoing training, and then acting as trained peer play partners.

1. Is the child obviously playing?
   (a) Yes—go to 4
   (b) No—go to 2
2. Is the child exploring or examining play objects or the play partner's play?
   (a) Yes—*Exploratory*
   (b) No—go to 3
3. Is the behaviour typical stereotype behaviour?
   (a) Yes—*Stereotype behaviour*
   (b) No—*Non-play*
4. Does the play consist only of play objects being used in a physical manner?
   (a) Yes—go to 5
   (b) No—go to 6
5. Are the play objects being organised spatially?
   (a) Yes—*Constructive play*
   (b) No—*Functional play*
6. Are rules obviously being followed?
   (a) Yes—*Rule-governed play*
   (b) No—*Symbolic play*

Figure 1. Key for classification of cognitive play (list format)

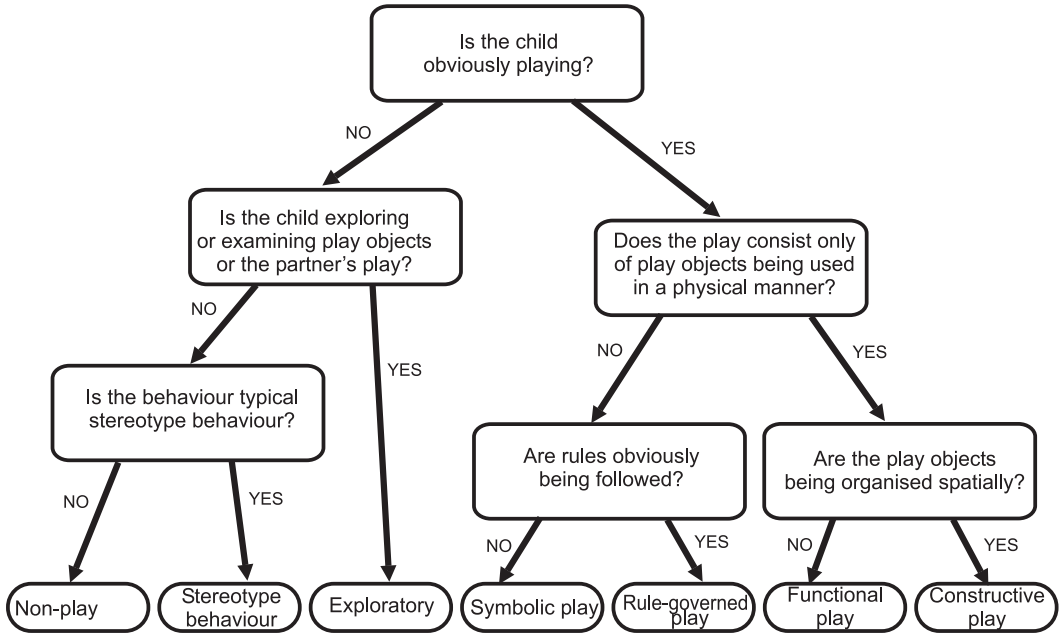

Figure 2. Key for classification of cognitive play (tree format)

However, and this is especially the case when testing the effect of a training program, any change could be due to the passage of time—improvement through practice, rather than through training. Since the trained peers cannot be untrained, it was not possible to use a baseline/treatment/reversal design (ABA design) to overcome this difficulty. It was then necessary to use a second group of peers who remained untrained to measure the amount of improvement that resulted from practice. In order to minimise the effect of variation among the children with autism, these untrained peers played with the same children with autism as the trained peers.

This left open the possibility that improvement in social interaction with the untrained peers could have been due to learning by the children with autism, from the trained peers. Although it was realised that a strong crossover effect of this type, if it occurred, would make it impossible to achieve the primary goal—measurement of the effectiveness of the training program—such rapid learning of social skills by the children with autism was considered highly unlikely, and in any case, if it did occur would be an observation of such importance as to compensate for the failure to determine the effectiveness of the training program.

In order to be able to use statistical methods to determine the likelihood that any change seen due to the training was genuine, the social interaction and play behaviour of the children was autism, in play sessions with trained and untrained peers, was recorded over multiple sessions both before and after the training, so that sufficient data were available to allow accurate determination of the mean levels of social interaction and cognitive play behaviour.

1. Does the child with autism show non-negative response or initiation?
   (a) Yes—go to 3
   (b) No—go to 2
2. Does the child with autism show negative social behaviour?
   (a) Yes—*Negative interaction*
   (b) No—*No interaction*
3. Is the child with autism only responding to the peer (i.e. not initiating)?
   (a) Yes–go to 6
   (b) No—go to 4
4. Is there any non-negative response from the peer?
   (a) Yes—go to 5
   (b) No—*Unilateral*
5. Is there clear and reciprocal interaction?
   (a) Yes—*Active–high*
   (b) No—*Active–low*
6. Is there clear initiation by the peer and clear response by the child with autism?
   (a) Yes—*Passive–high*
   (b) No—*Passive–low*

Figure 3. Key for classification of social interaction (list format)

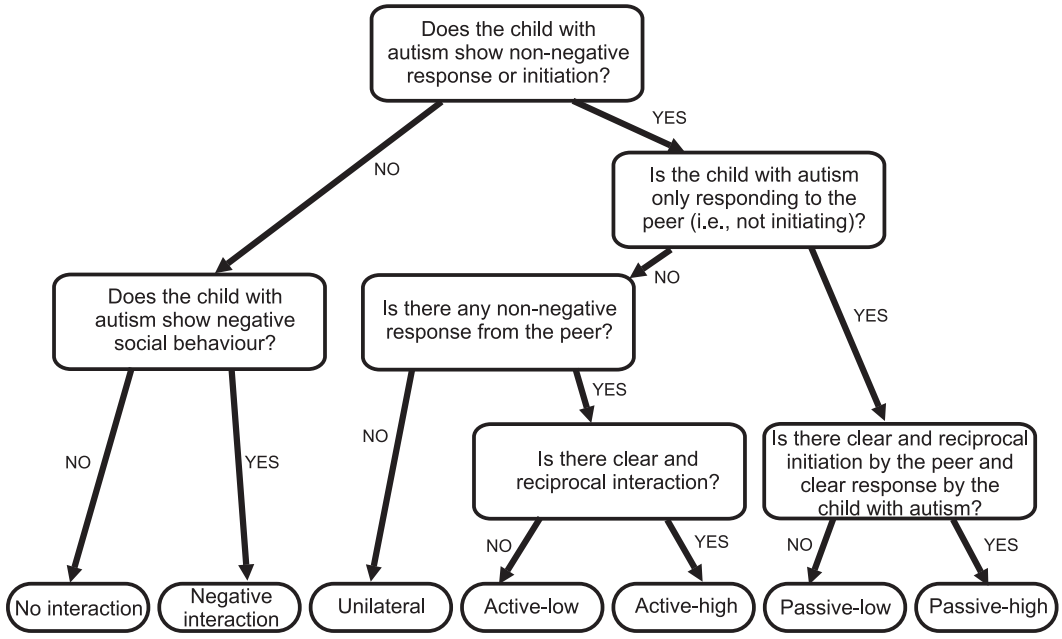

Figure 4. Key for classification of social interaction play (tree format)

2.3. Participants

After ethical clearance and consent by involved paerties, a total of nineteen children—five children with autism and fourteen typically developing peers—were recruited.

The five children diagnosed with autism were all boys, aged from three years and one month to six years and nine months at the time of their participation. These children autism were recruited from two Special Education Developmental Units (SEDU-A and SEDU-B) and one Special Education School (SES) associated with SEDU-A. They were all Caucasian and from families where English was the only language spoken at home. All the five children with autism had been diagnosed by a local psychologist. Four of them (CA1, CA2, CA4, and CA5) attended their SEDU on a part-time basis for special educational services with other children with developmental delay. The other boy with autism (CA3) was enrolled in the SES on a full-time basis with other students with special needs. A brief summary of the participating children with autism is give in table 1

Table 1. Summary of participants: Children with autism

Designation	Gender	Age
CA1	male	3 years, 1 month
CA2	male	5 years, 5 months
CA3	male	6 years, 9 months
CA4	male	4 years, 8 months
CA5	male	5 years, 9 months

Fourteen typically developing peers (seven boys and seven girls, aged eight to nine

years, designated P1 through to P14, with boys being the odd-numbered peers, and girls the even-numbered peers) were recruited from three grade three (year three) classes in two state primary schools (SPS-A and SPS-B). All of the children who acted as typically developing peers volunteered to take part in the study, following initial selection by their teachers (Jackson & Campbell, 2008). Apart from one girl (P8) who was non-Caucasion of unknown background (possibly Maori or other Polynesian), all other peers were Caucasian. One boy (P7) had mild paraplegia.

Of these fourteen cross-aged peer players, ten acted as regular peer players (two for each child with autism). The other four students (P6, P7, P12, and P13) were substitute or reserve peers, to replace regular peers who were not present for a scheduled session or withdrew their participation. In the event, P13 did not participate in any of the play sessions. Therefore, no details on P13 are reported in this study. Since the other reserve peers (P6, P7, and P12) did have contact with the children with autism, their profile and screening results are reported here. A brief summary of the typically developing peers is given in table 2 (excluding P13).

Table 2. Summary of participants: Typically developing peers

Designation	Gender	Age
P1	male	7 years, 11 months
P2	female	8 years, 9 months
P3	male	8 years, 8 months
P4	female	7 years, 10 months
P5	male	7 years, 6 months
P6	female	8 years
P7	male	7 years, 8 months
P8	female	8 years, 2 months
P9	male	7 years, 11 months
P10	female	7 years, 11 months
P11	male	8 years, 4 months
P12	female	7 years, 10 months
P14	female	8 years, 4 months

All schools and special education settings had similar Index of Relative Socio-economic Disadvantage (IRSD) scores (Pink, 2008) from 952 to 1043, ranging from the 25% quantile to the 75% quantile, which places them in "medium disadvantage" areas. The socio-economic status of students in these two SPS was identified by school staff as mostly working class.

2.4. Settings and materials

Play and interaction in both indoor and outdoor settings were measured in this study. These settings were simulated naturalistic settings, providing a high degree of both control and generalizability to real-life situations. Both indoor and outdoor settings were used since children in inclusive education could be expected to play together in both indoor and outdoor settings on a daily basis. Most similar studies were restricted to indoor settings only,

presumably on the grounds of experimental practicality. Thus, it was possible that the outdoor settings might provide especially new and interesting results.

The children with autism and their peer partners came from two Special Education Developmental Unit (called SEDU-A and SEDU-B) and State Primary School (called SPS-A and SPS-B) pairs. For the SEDU-A–SPS-A pair (dyads with CA1, CA2, and CA3), the play sessions were held at SPS-A. Teacher aides in SEDU-A escorted the children with autism to SPS-A. For the SEDU-B–SPS-B pairs (dyads with CA4 and CA5), the play sessions were held at SEDU-B. The researcher of this study escorted the typically developing peers to SEDU-B. These choices were necessitated by the practical availability of space.

In SPS-A, the indoor play setting was a space of approximately four and a half by five metres which was partitioned off by desks and chairs from a larger function room. In the SEDU-B, the indoor play setting was a room of approximately four metres by four metres in size.

The outdoor play settings at SEDU-B and SPS-A were similar in that both included a sandpit and an adequately-sized playground. The outdoor play setting at SEDU-B also had a play area used for playing with outdoor toys, distinct from the playground. The SEDU-B playground was also smaller, approximately half the size (but still of adequate size), and access was dependent on usage by other classes.

For the indoor play sessions, four sets of play materials were chosen from those available at the SEDU attended by the children with autism and placed on the floor. The play materials were selected to focus on the four cognitive play categories of functional, constructive, symbolic, and rule-governed play. Each set of toys was considered as a representation for each play category. For example, a cars and road set was for functional play, blocks for constructive play, a kitchen set for symbolic play, and matching-cards for rule-governed games (see table 3).

For outdoor play sessions, some sandpit play materials were chosen from the two SEDU (see table 4). In addition, playground facilities such as slides (and monkey bars at SPA-A) were used. Other outdoor play equipment such as a baseball set and a tenpin bowling set were set up in SEDU-B (see table 5).

Table 3. Indoor play materials

SPS-A (CA1–3)	SEDU-B (CA4–5)
Cars and road	Cars and road
Doll and bassinet	Doll and clothes
Doctor set	Doctor set
Ring-toss games	Lego train and track
Plastic chains and connectors	Dice
Skittles and ball	Card game set
	Plastic farm animals
	Cooking set
	Drinking straws

Table 4. Sandpit play materials

SPS-A (CA1–3)	SEDU-B (CA4–5)
Sieves	Sieves
Shovels	Shovels
Containers	Containers
Trucks	Trucks
Sand-turned wheels	Stove, frypan, and spoons

Table 5. Playground play materials and facilities

SPS-A (CA1–3)	SEDU-B (CA4–5)
Monkey bars	T-ball
Climbing bar	Hanging ball and rackets
Climbing net	Skittles and ball
Tyre tunnel	Hoops
	Baseball set

2.5. Play training for peers

Half of the typically developing peers were chosen randomly to receive a series of play training sessions (Trained Peers—TP), the other half, the comparison group, were not trained (Untrained Peers—UP). In this peer training phase, the play training sessions for the randomly chosen peers were arranged according to their school schedule, and implemented in the same places for indoor and outdoor sessions where they played in the pre-training phase. Untrained peer players kept their regular lessons in their classrooms.

The peer training was implemented in group sessions. However, if a TP missed a play training session due to sickness or some other reason, an individual session was arranged for him or her. A total of 12 peer training sessions was run at each SPS and each play training session lasted approximately 30 to 40 minutes.

The training program focussed on disability awareness and play interaction skills that were modified from peer approach interventions (see table 6).

Table 6. Training of peers

Structure	Contents
Being friends	Characteristics of friends and the importance of friendship
Play interaction skills	General play activities and behaviours
Different people	General and/or specific differences in people
Play with different friends	Verbal and non-verbal social communication skills
Understanding autism	Comparing general behaviours between children without autism and with autism
Play practices	Elaborating the play interaction skills to play with play partner with autism in indoor and outdoor settings

Total twelve specific play interaction skills were taught to the trained peers. Eleven play

interaction skills were adopted from Pivotal Response Training (PRT) (Pierce & Schreibman, 1995) as follows: getting attention from the child with autism by using eye-contact, touching, and speaking ("Hello, [name of the child]"), allowing the children with autism to choose play materials (e.g., "What do you want to play with, this car or this doll?"), paying attention and waiting ("Please, show me how to use this car"), demonstrating play activities, including verbal statements (e.g., "My car goes on the road, just like this, brrrrum!"), suggesting activites to children with autism ("Let's play with the car"), turn-taking ("It's my turn" or "It's your turn"), narration of play activity to children with autism (e.g., "This is very spicy pizza," or "You drive a car to go to the shop."), providing help to children with autism ("Push it more. I can help you."), sharing activity ("We can use the ball together"), explaining ("Stand up in the circle, then roll it in the circle"), and reinforcement of attempts to encourage and extend appropriate play behaviours and social skills in children with autism (e.g., "Well done!"). One additional play interaction skill, asking for help ("Can you help me? Push the block more"), was also included, with the intent of promoting cooperation skills in the children with autism by sharing activities (Liebal, Colombi, Rogers, Warneken, & Tomasello, 2008).

The training consisted of watching videotapes, discussions, specific instruction, modelling, role-playing, feedback, worksheets, self-monitoring and feedback (*'Play Note'*), and rewards (see table 7). Videotapes that show general information about friendship, differences in people, and typical behaviours of children with autism were used to help the peers' understanding of play interaction with children with autism. Relevant segments of educational films were prepared to fit within the limited time of play training session. Discussion about play and social interaction was guided in a child player-centred manner. The discussion was supported and facilitated by simple questions focussed on the theme of each session. The topic of discussion was started with general friendship in typically developing children's lives, and expanded to special friendships with children with disabilities, especially children with autism. Also, it focused not only on the notion that what children with disabilities are not able to do *due to* their disabilities, but what children with disabilities are able to do *with* their disabilities.

Table 7. Teaching strategies in peer play program

Methods	Aims
Audio-visual materials	To understand related topic and to monitor own play
Discussion	To clarify the topic
Specific instruction	To know interaction behaviours in children with autism
Modelling	To demonstrate appropriate or inappropriate play behaviours
Role play	To realize abilities and different needs of children with disabilities and to develop their own play interaction skills
Feedback	To evaluate own performance
Worksheet	To summarize and clarify what has been learned
Play Note	Self-monitoring method by scoring play activities
Rewards	To maintain and facilitate motivation

In the peer training, peers were guided to develop ways to play and interact with children with autism. The peers exchanged their experiences and ideas of play with their siblings or other friends in order to use these when playing with the children with autism. Role-playing was also used to assist the peer play partners to understand more about playing situations. In these role-play sessions, peers were 'given' a disability (such as being blindfolded to emulate visual impairment) so that they could more easily empathise with the children with disabilities. While peers experienced these disabilities, they could recognize the abilities and different needs of individuals with disabilities from individuals without disabilities. The worksheet enabled peers to summarize the session.

On the general understanding and experiences of dealing with people with disabilities, peers practised and elaborated the play interaction skills by performing peer-adult, peer-doll, and peer-peer in role-playing. When one peer demonstrated the play interaction skills, other peers monitored him or her and allocated them a score on the *Play Note.* This monitoring activity was also carried out visa versa. When one peer demonstrated play interaction skills, others identified what skill was used and their score on the *Play Note.* Eventually, each peer performed the play interaction skills with an accuracy level aove 80% to play and interact with an adult who took the role of a child with autism. All these practices were carried out in a playful mood.

After the peer training phase, five more training sessions were performed in the post-training phase. These on-going training sessions were given to the trained peers (TP) on a fading schedule. It commenced with two days play framework, with a training session following the third day's play day. Each consecutive playtime frame had an additional day added before the 'on-going training' day. These on-going training sessions lasted for about 20 minutes during lunch or recess time.

In the on-going training, the twelve play interaction skills were written on a piece of paper and read by the TP, before they played with the children with autism. After the play session, the TP watched videotapes that showed their play session with the children with autism, and monitored their play interaction skills on the *Play Note.* If they missed the on-going training session due to sickness or otherwise, an individual session was scheduled. Also, untrained peers watched their own play sessions of tapes. Untrained peers were not provided with the play interaction skills on the *Play Note*. All TP and UP watched their 'play movies' on the videotapes.

2.6. Procedure

After an initial profiling and screening phase, indoor and outdoor play sessions, covering a pre-training phase, a peer training phase, and a post-training phase) were held two days per week for each dyad, for approximately six months. Unfortunately, CA4's regular trained peer (TP10) withdrew after the peer training phase (and continued to participate in this study as a reserve trained peer). TP10 was replaced by TP12 as the regular trained peer player for CA4 during post-training phase. The data from these unmatched dyads (CA4–TP10 and CA4–TP12) were collected. Even though the data from these unmatched dyads could not provide conclusive evidence of improvement due to training (since improvement from CA4–TP10 before training to CA4–TP12 after training could be due to TP12 being more able to interact with CA4, independent of the training), it would still be useful to

check whether or not these data support the conclusions drawn from the matched dyads.

While the room in the SEDU-B was always available for indoor play sessions of this study, two other rooms had to be used occasionally due to the unavailability of the regular room and space in the SPS-A. Because this study was implemented in naturalistic education settings for about seven months, availability of the room and space for this study depended on the educational contexts such as extra room facilities for other educational programs and services, school time schedule, and school activities, requiring occasional changes of room. Such changes affected both trained and untrained peers equally.

While playground facilities in SPS-A were included, playground apparatus in SEDU-B was not used, for two reasons. Firstly, some apparatus, such as a swing bar, were too low for the typically developing peers. Secondly, this avoided conflict with use of those facilities by other children at SEDU-B, who used them on their regular schedule. Instead, other playground play materials, such as a T-ball, hoops, and a baseball set, were set up near the sandpit area for outdoor play sessions at SEDU-B.

Each child with autism was alternatively paired with an untrained peer (untrained dyad) and trained peer (trained dyad). Counterbalancing was generally maintained to minimize the effect of the problem of same order implementation through alternating sequence of untrained and trained dyad as well as alternating sequence of indoor and outdoor setting. However, sometimes, one of the players was not available. Then, it was necessary to change the sequence again.

At the start of a play session, each dyad was told "It is play time together! You can play with these toys and have fun!" Each dyad had two play sessions, one indoor and one outdoor, on each day they played. Therefore, each child with autism participated in four play sessions, two with the trained peer, and two with the untrained peer, on each day they played (twice per week). Each session lasted for about six minutes—six minutes was the standard play session length, but variations did occur, as discussed below. Where the session exceeded six minutes in duration, data were only recorded for the first six minutes.

In the play sessions, the dyad was reminded once or twice about unused available play materials if they used only one item for more than half the time of the session (3 minutes). Occasionally, other teaching materials were nearby, having been prepared for other children by teaching staff, in which case, near the play settings. Then, the dyad was reminded which play materials were available in the play session.

When one child in the dyad did not want to keep playing in the session, the child was encouraged to continuing playing. After one or two minutes, if the child still did not want to keep playing, the session was stopped. On the other hand, if both children in the dyad group wanted to keep playing longer than six minutes, they were told that they would have more opportunities to play together on other days. If they still insisted on playing longer, they were allowed to play for about one or two minutes more. However, this extra play time was only requested a couple of times from the trained dyad of CA4 in the late post-training play phase.

Given that children with autism are especially vulnerable to disruption of their routines (American Psychiatric Association, 2000), if a regular peer was unable to attend the scheduled play session, one of the reserve trained or untrained peers was used as a substitute. This was important to minimise disruption for the children with autism. No notable disruption was observed as a consequence of the substitute peer play partner. Play sessions with

substitute peers were not counted as play sessions for the regular dyad in data analysis, since the dyad was different. The play sessions with substitute peer were still all recorded, even though the data were not to be used in this study.

2.7. Data collection and analysis

Indoor and outdoor play sessions of each dyad were recorded using a compact video camera, and then transferred to VHS videotapes and coding was performed using an editing machine which provided high-quality stills and accurate rewinding and fast-forwarding. The dyad data on videotapes were classified into the two sets of behaviour categories described earlier: one measuring the cognitive play, and the other measuring the level of social interaction displayed by the child with autism as a function of time for each session.

The time at which the cognitive or social behaviour changed from one category to another was recorded to the nearest second, giving a real-time coding of behaviour. Classification of the behaviour from the videotapes was performed in two separate passes through the tapes: once for the cognitive behaviour, and again for the social behaviour. Videotapes were observed in a randomised order. The graphical tree versions of the cognitive and social keys were used for the classification. After all videotapes had been coded, some randomly selected videotapes were re-coded. The level of agreement between the original coding and the re-coding was 97%. The major part of the small amount of disagreement was due to small differences in the times at which one behaviour changed to another. It was also found that stretching or expansion due to heating in the VCR of the videotapes may have been responsible for a large part of these time differences. Accounting for this, the coding–re-coding agreement could have been better than 98%. All coding was performed by a single coder.

The total durations occupied by each category of behaviour of the child with autism in matching dyads are of greatest interest; these were calculated for each session, and are hereafter given as proportions of the total session. The data that is analysed here consists of the proportion of the total time for each six minute (360 second) play session occupied by each cognitive and social category. That is, each category has a duration of between 0 and 1, where 0 indicates a complete absence of the behaviour, and 1 would indicate that it was the only behaviour displayed during that entire session. For example, a duration of 0.4 would mean that a total of $0.4 \times 360 = 144$ seconds was occupied by that behaviour (assuming that the session was the standard 360 seconds long). Note that the sum of the proportions of all of the cognitive or social categories for a single must be equal to 1, and an increase in one category must be accompanied by decreases in other categories.

For a simplified overall analysis, it is very useful to condense the categorical data into a single overall cognitive score and social score. This can be done most easily by assigning numerical weights to each category and calculating the combined score as

$$S = \sum_{i=1}^{N} w_i d_i \tag{1}$$

where S is the combined score, and w_i is the weight for the ith category, d_i is the duration of the ith category, and N is the total number of categories. Suitable numerical weights must be chosen for each category; the weights used are shown in table 8. The actual numerical

values are somewhat arbitrary; however, the more desirable categories are (and must be) assigned higher values.

Table 8. Weights for cognitive and social sub-categories

Cognitive play		Social interaction	
Sub-categories	Weights	Sub-categories	Weights
Non-play	-1	Negative	-1
Stereotype	0	No interaction	0
Exploratory	1	Passive-low	1
Functional	2	Passive-high	2
Constructive	2	Unilateral	2
Symbolic	3	Active-low	3
Rule-governed	5	Active-high	5

3. Results

In general, the observed behaviour in children with autism showed much variation over the sessions, for both cognitive and social categories. This is to be expected—it would be highly unusual if the children with autism displayed identical behaviour in each session, given that children with autism have sufficient cognitive abilities to engage in a wide range of behaviours, despite general intellectual deficits (American Psychiatric Association, 2000; Sadock & Sadock, 2007). It is possible that children with autism might well show greater variation in their behaviour than typically developing children due to frequent and unpredictable shifts in attentiveness between on-task and off-task (Hume & Odom, 2007; Pelios, MacDuff, & Axelrod, 2003). In addition, the play sessions in this study were conducted over a period of six months, so extraneous confounding factors at home and school beyond experimental control may well influence the behaviour of not only the children with autism but also peer players. The play sessions were conducted in naturalistic settings at the participating SPSs and SEDUs, without artificial constraints that might restrict the range of behaviour. All of these factors might have contributed to the observed large variation in behaviour.

While the observed behaviour was quite variable, this session-to-session variation is actually of little importance—what is most important are the overall level of social interaction and the overall level of cognitive play behaviour. In particular, the use of overall scores is useful for the small sample size in this study to obtain greater statistical power. In this study, it is the difference in the level of social interaction and cognitive play behaviour between the pre-training and post-training play sessions that is crucial.

To determine whether or not the difference between the behaviour in the pre-training and post-training sessions is statistically significant, the mean behaviour and the standard error in the mean were calculated; this allows, firstly, a simple visual comparison of pre-training and post-training behaviour on graphs presenting the data, and secondly, testing of the statistical significance of the change from the pre-training to the post-training behaviour by determining the 95% confidence intervals for the differences in the means. This is done

for both the total cognitive play scores and social interaction scores, and for each cognitive and social category for each dyad.

On figures 5 to 8, the means and the intervals specified by the standard error (that is, the interval $\bar{x} - \Delta\bar{x}$ to $\bar{x} + \Delta\bar{x}$) are shown by the grey bars—the bar itself shows the interval specified by the mean and standard error, and the line through the centre shows the mean. If the pre-training and post-training gray bars overlap, then there is no statistically significant difference. if the vertical separation between the bars is large compared to their widths, then the difference is clearly statistically significant. If the two bars almost touch, then the tables 10 to 24, giving the changes, the standard errors in the changes, the p values, and whether or not the change is statistically significant at the $\alpha = 0.05$ level, should be consulted. An increase that is statistically significant at the $\alpha = 0.05$ level is indicated by an upwards arrow $\Uparrow$, a statistically significant decrease at $\alpha = 0.05$ by a downwards arrow $\Downarrow$, and a dash $-$ indicates that the change, if any, was not statistically significant at $\alpha = 0.05$.

3.1. Indoor play

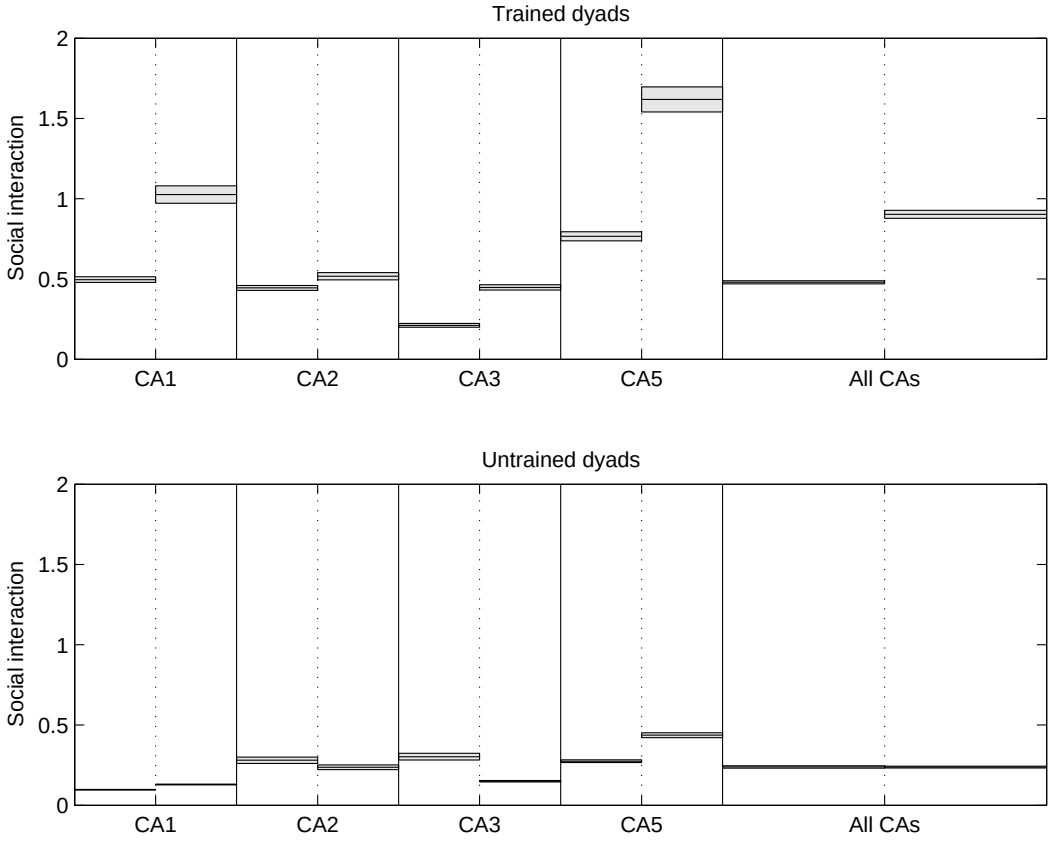

Figure 5. Social interaction behaviour (indoor setting)

Overall, in the indoor settings, the children with autism showed a large increase of social interaction in trained dyads. The increase was both clearly statistically significant

Table 9. Indoor social interaction

	Trained		Untrained	
CA	Pre	Post	Pre	Post
CA1	0.496 ± 0.208	1.026 ± 0.099	0.097 ± 0.043	0.129 ± 0.034
CA2	0.444 ± 0.049	0.517 ± 0.101	0.281 ± 0.070	0.237 ± 0.064
CA3	0.211 ± 0.056	0.448 ± 0.060	0.303 ± 0.069	0.150 ± 0.043
CA5	0.766 ± 0.252	1.619 ± 0.289	0.275 ± 0.081	0.437 ± 0.070
all	0.479 ± 0.109	0.902 ± 0.085	0.239 ± 0.039	0.238 ± 0.032

Table 10. Change in indoor social interaction

	Trained			Untrained		
CA	Change	p		Change	p	
CA1	0.530 ± 0.200	0.020	$\Uparrow$	0.032 ± 0.067	0.875	$-$
CA2	0.073 ± 0.181	0.695	$-$	-0.044 ± 0.120	0.813	$-$
CA3	0.237 ± 0.111	0.050	$-$	-0.153 ± 0.077	0.204	$-$
CA5	0.853 ± 0.427	0.062	$-$	0.162 ± 0.115	0.708	$-$
all	0.423 ± 0.129	0.002	$\Uparrow$	-0.001 ± 0.047	0.991	$-$

Table 11. Indoor social interaction

	Trained		Untrained	
Cat.	Pre	Post	Pre	Post
NEG	0.004 ± 0.001	0.053 ± 0.011	0.001 ± 0.001	0.006 ± 0.004
NOI	0.656 ± 0.039	0.343 ± 0.025	0.781 ± 0.029	0.782 ± 0.029
P-L	0.278 ± 0.026	0.380 ± 0.025	0.201 ± 0.025	0.186 ± 0.026
P-H	0.026 ± 0.009	0.153 ± 0.016	0.002 ± 0.003	0.002 ± 0.002
UNI	0.004 ± 0.004	0.001 ± 0.000	0.012 ± 0.015	0.019 ± 0.007
A-L	0.009 ± 0.004	0.041 ± 0.012	0.004 ± 0.002	0.006 ± 0.002
A-H	0.024 ± 0.017	0.029 ± 0.015	0.000 ± 0.000	0.000 ± 0.000

Table 12. Change in indoor social interaction

	Trained			Untrained		
Cat.	Change	p		Change	p	
NEG	0.049 ± 0.002	0.000	$\Uparrow$	0.005 ± 0.001	0.000	$\Uparrow$
NOI	-0.313 ± 0.046	0.000	$\Downarrow$	0.001 ± 0.035	0.982	$-$
P-L	0.102 ± 0.031	0.002	$\Uparrow$	-0.015 ± 0.030	0.615	$-$
P-H	0.127 ± 0.010	0.000	$\Uparrow$	-0.001 ± 0.004	0.898	$-$
UNI	-0.003 ± 0.004	0.478	$-$	0.007 ± 0.018	0.683	$-$
A-L	0.032 ± 0.005	0.000	$\Uparrow$	0.002 ± 0.003	0.416	$-$
A-H	0.005 ± 0.021	0.818	$-$	0.000 ± 0.000	1.000	$-$

Table 13. Indoor cognitive play

	Trained		Untrained	
CA	Pre	Post	Pre	Post
CA1	0.286 ± 0.102	0.709 ± 0.079	0.033 ± 0.027	0.168 ± 0.084
CA2	0.591 ± 0.134	0.775 ± 0.128	0.490 ± 0.069	0.470 ± 0.107
CA3	-0.131 ± 0.114	0.094 ± 0.072	-0.001 ± 0.162	-0.382 ± 0.056
CA5	1.735 ± 0.139	1.881 ± 0.159	1.680 ± 0.114	1.103 ± 0.118
all	0.620 ± 0.068	0.864 ± 0.059	0.550 ± 0.059	0.340 ± 0.056

Table 14. Change in indoor cognitive play

	Trained			Untrained		
CA	Change	p		Change	p	
CA1	0.423 ± 0.133	0.007	$\Uparrow$	0.135 ± 0.155	0.328	$-$
CA2	0.184 ± 0.238	0.453	$-$	-0.020 ± 0.193	0.934	$-$
CA3	0.225 ± 0.141	0.133	$-$	-0.382 ± 0.146	0.027	$\Downarrow$
CA5	0.145 ± 0.235	0.545	$-$	-0.577 ± 0.186	0.024	$\Downarrow$
all	0.244 ± 0.080	0.004	$\Uparrow$	-0.211 ± 0.071	0.004	$\Downarrow$

Table 15. Indoor cognitive play

	Trained		Untrained	
Cat.	Pre	Post	Pre	Post
NON	0.492 ± 0.041	0.481 ± 0.026	0.553 ± 0.036	0.583 ± 0.033
STE	0.081 ± 0.020	0.049 ± 0.012	0.079 ± 0.025	0.134 ± 0.012
EXP	0.207 ± 0.038	0.139 ± 0.018	0.161 ± 0.021	0.139 ± 0.024
FUN	0.151 ± 0.037	0.201 ± 0.023	0.143 ± 0.036	0.093 ± 0.016
CON	0.013 ± 0.014	0.050 ± 0.026	0.008 ± 0.009	0.005 ± 0.007
SYM	0.055 ± 0.034	0.066 ± 0.021	0.056 ± 0.025	0.046 ± 0.013
R-G	0.000 ± 0.000	0.015 ± 0.008	0.000 ± 0.000	0.000 ± 0.000

Table 16. Change in indoor cognitive play

	Trained			Untrained		
Cat.	Change	p		Change	p	
NON	-0.011 ± 0.048	0.819	$-$	0.030 ± 0.043	0.488	$-$
STE	-0.033 ± 0.023	0.165	$-$	0.054 ± 0.031	0.082	$-$
EXP	-0.069 ± 0.046	0.138	$-$	-0.022 ± 0.026	0.394	$-$
FUN	0.050 ± 0.044	0.258	$-$	-0.050 ± 0.044	0.261	$-$
CON	0.037 ± 0.016	0.028	$\Uparrow$	-0.003 ± 0.011	0.774	$-$
SYM	0.011 ± 0.040	0.790	$-$	-0.010 ± 0.031	0.756	$-$
R-G	0.015 ± 0.000	0.000	$\Uparrow$	0.000 ± 0.000	1.000	$-$

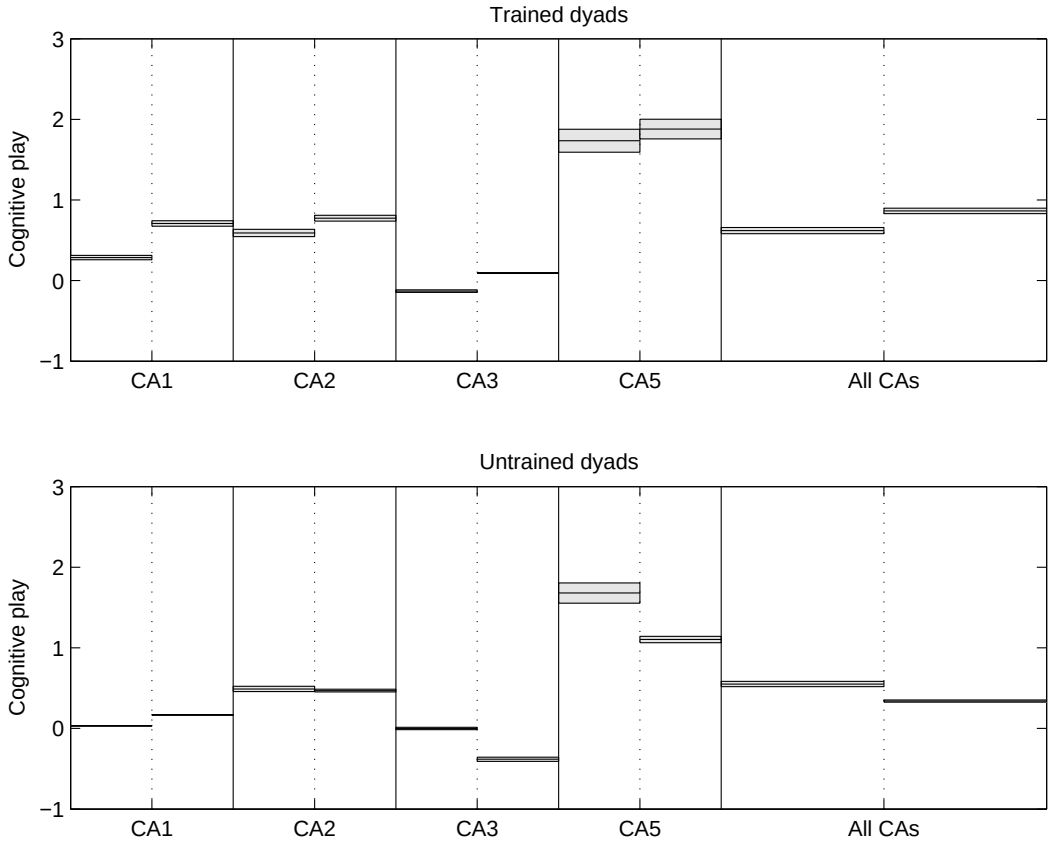

Figure 6. Cognitive play behaviour (indoor setting)

($p = 0.002$) and large, with the mean social interaction score approximately doubling. In the untrained dyads, on the other hand, the was no change, with the predominant feature of the indoor social behaviour shown by children with autism in untrained dyads being uniformity.

This clearly demonstrates the success of the peer training, and the lack of both measurable learning how to socially interact with children with autism by the untrained peers and any crossover effect in social interaction of children with autism.

Interestingly, negative interaction was significantly increased in both trained and untrained dyads (table 12). While the total duration of negative behaviour was still small, its degree of increase was surprisingly larger in trained dyads than in untrained dyads. In the trained dyads, this increase was counterbalanced by a large decrease in no interaction, and increases in appropriate social behaviour. This increase did not appear to be a problem, and at least partly represents failed attempts by the trained peers to initiate to and interact with the children with autism. Similar increases in negative behaviour have been noted by others. Guralnick, Connor, Hammond, Gottman, and Kinnish (1996) reported such an increase, and assumed that it was due to the higher activity levels in inclusive setting. In the study presented in this paper, it was observed that when trained peers started to interact, children with autism resisted against the interaction. “Being alone” time (no-interaction be-

haviour) of the children with autism was constantly interrupted in the trained dyads because trained peers kept initiating and responding to play together ("desirable" interruption by the trained peer) despite resistance (negative interaction) from the children with autism.

Occasionally, this negative interaction in children with autism was also caused by "immature" interaction delivered from trained peers. Although trained peers have learnt how to interact with the children with autism, it did not mean they always know how to handle uncooperative interaction such as rejecting, ignoring, and avoiding behaviours shown by children with autism. They did not seem to know when was the best time to interact again after strong resistance from children with autism. Sometimes, trained peers missed the time when the children with autism were ready, or could not notice the best time to interact again. This indicates that one more component—observing and waiting skill—for play interaction skills may be required in the peer training program.

In spite of the difficulties in interacting with the children with autism, trained peers were sufficiently enthusiastic so as to keep interacting with them. With this consistent interaction provided by trained peers, the children with autism significantly increased their social interactions by showing appropriate responses (passive-low and passive-high interactions). Initiation (active-low interaction) in children with autism was also significantly increased by positive or non-negative responses from trained peers. These results, increases of social interaction in children with autism by interacting with trained peers, support other studies on peer-mediated interventions (e.g., Harper, Symon, & Frea, 2008).

With the untrained peers, there was almost no change in the pattern of social interactions in the children with autism other than the increase in negative interaction noted above. Essentially, and especially when compared to the intensive interaction trials shown by the trained peers as the result of peer training, untrained peers did not interact with children with autism. It does not mean that untrained peers did not try to play with or interact with the children with autism—untrained peers occasionally showed some general social conventional manners such as greeting, smiling, suggesting sandpit play, providing toys, and so on—but when untrained peers received no response or unfamiliar interaction behaviour from children with autism, they showed fewer and fewer further attempts to do so.

Contrasting the result on social interaction in children with autism when paired with trained peers versus untrained peers, the importance or the necessity of peer training is clearly evident. Without play training that includes proper information about autism, practical interaction skills, and so on, these naïve (untrained) peers would not try to interact with children with autism because they cannot understand the social responses and cues shown by the children with autism. In addition, uncorrected stereotypical notions or prejudice about children with disabilities could also contribute to this unwillingness to interact.

If the cognitive level of play were to be used as the primary measure of success of the training program, the same conclusion would have been reached, as a similar pattern emerged. However, the increase in cognitive play in trained dyads, while still statistically significant, was smaller than the increase in social interaction in the same dyads. In the untrained dyads, there was a statistically significant (but small) decrease in untrained dyads, as opposed to the absence of change in social interaction in untrained dyads. Some further discussion is warranted, but this is best deferred until the outdoor play results have been presented.

3.2. Outdoor play

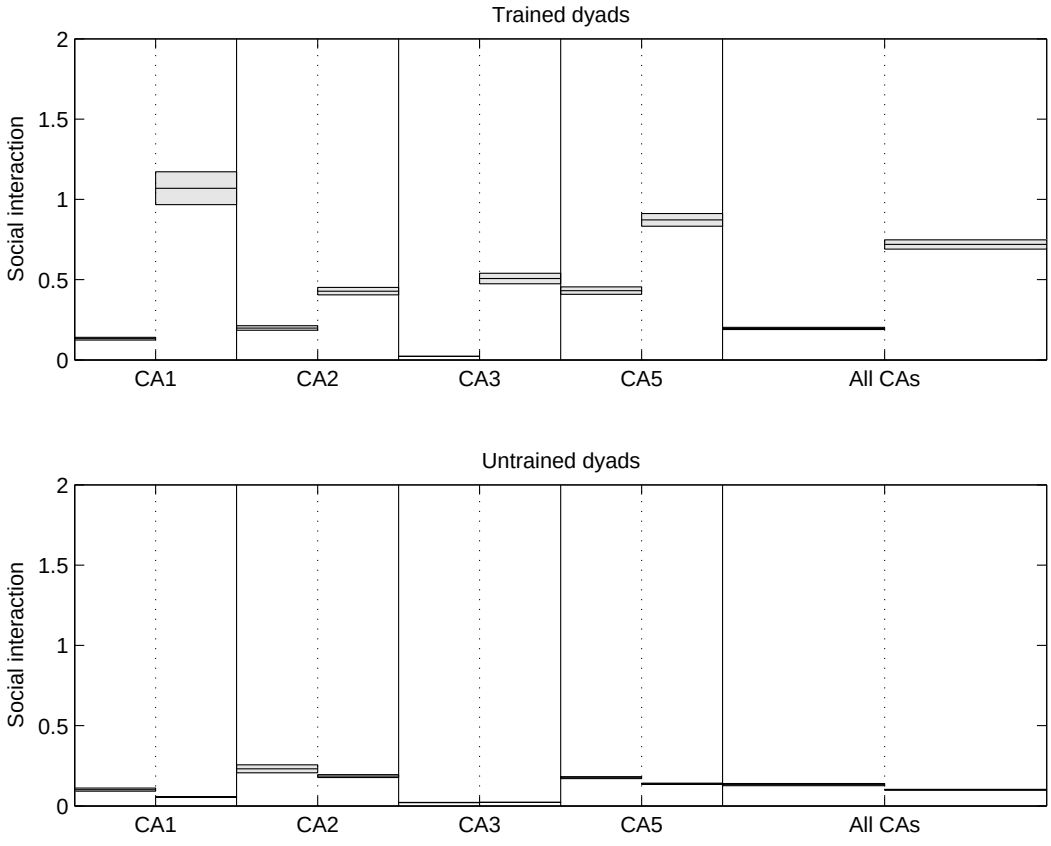

Figure 7. Social interaction behaviour (outdoor setting)

The overall pattern of change in social interaction in outdoor settings was very similar to that seen in indoor settings—a large and statistically significant improvement in trained dyads, and no change in untrained dyads. For the trained dyads, this increase was even larger than in the indoor settings, with a post-training social interaction score over three times larger than the pre-training score.

This even larger increase may have resulted from the playground facilities and apparatus being more familiar and age-appropriate for the peers than the indoor setting toys (which were chosen to be suitable for the children with autism). The peers could then concentrate on social interaction to play with children with autism in outdoor setting, rather than being distracted by novel toys. The children with autism may have also been interested in learning how to play with new equipment, and been more willing to listen to and follow the peers.

However, compared to the indoor settings, a smaller proportion of time was spent in social interaction. This is likely to be due to the wide-open setting in the playground—it was easier for the two children to play without interaction, and if the children with autism wished to avoid interaction, they had much more space and opportunity to do so. The availability of such easy "escape" from unwanted interaction may explain the lower level

Table 17. Outdoor social interaction

	Trained		Untrained	
CA	Pre	Post	Pre	Post
CA1	0.132 ± 0.060	1.069 ± 0.181	0.101 ± 0.089	0.055 ± 0.016
CA2	0.199 ± 0.071	0.428 ± 0.083	0.231 ± 0.107	0.186 ± 0.050
CA3	0.022 ± 0.009	0.507 ± 0.146	0.021 ± 0.012	0.022 ± 0.004
CA5	0.431 ± 0.126	0.872 ± 0.145	0.176 ± 0.032	0.138 ± 0.033
all	0.196 ± 0.046	0.719 ± 0.069	0.132 ± 0.029	0.100 ± 0.020

Table 18. Change in outdoor social interaction

	Trained			Untrained		
CA	Change	p		Change	p	
CA1	0.937 ± 0.204	0.001	$\Uparrow$	-0.046 ± 0.058	0.825	$-$
CA2	0.230 ± 0.152	0.154	$-$	-0.045 ± 0.103	0.772	$-$
CA3	0.484 ± 0.236	0.062	$-$	0.001 ± 0.015	0.997	$-$
CA5	0.441 ± 0.218	0.062	$-$	-0.038 ± 0.053	0.865	$-$
all	0.523 ± 0.056	0.000	$\Uparrow$	-0.032 ± 0.038	0.398	$-$

Table 19. Outdoor social interaction

	Trained		Untrained	
Cat.	Pre	Post	Pre	Post
NEG	0.004 ± 0.002	0.007 ± 0.002	0.008 ± 0.006	0.000 ± 0.000
NOI	0.817 ± 0.037	0.492 ± 0.040	0.851 ± 0.029	0.901 ± 0.020
P-L	0.162 ± 0.031	0.289 ± 0.029	0.141 ± 0.029	0.098 ± 0.019
P-H	0.016 ± 0.011	0.204 ± 0.030	0.000 ± 0.000	0.000 ± 0.000
UNI	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
A-L	0.002 ± 0.003	0.008 ± 0.004	0.000 ± 0.000	0.000 ± 0.001
A-H	0.000 ± 0.000	0.001 ± 0.001	0.000 ± 0.000	0.000 ± 0.000

Table 20. Change in outdoor social interaction

	Trained			Untrained		
Cat.	Change	p		Change	p	
NEG	0.003 ± 0.003	0.308	$-$	-0.008 ± 0.008	0.292	$-$
NOI	-0.325 ± 0.046	0.000	$\Downarrow$	0.049 ± 0.037	0.189	$-$
P-L	0.127 ± 0.038	0.002	$\Uparrow$	-0.042 ± 0.037	0.251	$-$
P-H	0.189 ± 0.013	0.000	$\Uparrow$	0.000 ± 0.000	0.000	$\Uparrow$
UNI	0.000 ± 0.000	1.000	$-$	0.000 ± 0.000	0.000	$\Uparrow$
A-L	0.005 ± 0.004	0.134	$-$	0.000 ± 0.000	0.000	$\Uparrow$
A-H	0.001 ± 0.000	0.000	$\Uparrow$	0.000 ± 0.000	1.000	$-$

Table 21. Outdoor cognitive play

	Trained		Untrained	
CA	Pre	Post	Pre	Post
CA1	0.382 ± 0.200	0.822 ± 0.099	0.245 ± 0.110	0.347 ± 0.101
CA2	0.486 ± 0.181	0.953 ± 0.205	0.443 ± 0.093	1.033 ± 0.228
CA3	-0.063 ± 0.035	0.376 ± 0.154	-0.003 ± 0.043	0.251 ± 0.325
CA5	1.275 ± 0.089	1.563 ± 0.070	1.178 ± 0.113	1.439 ± 0.096
all	0.520 ± 0.077	0.928 ± 0.079	0.466 ± 0.047	0.767 ± 0.091

Table 22. Change in outdoor cognitive play

	Trained			Untrained		
CA	Change	p		Change	p	
CA1	0.440 ± 0.212	0.063	$-$	0.102 ± 0.176	0.640	$-$
CA2	0.466 ± 0.377	0.236	$-$	0.590 ± 0.374	0.143	$-$
CA3	0.439 ± 0.250	0.105	$-$	0.254 ± 0.262	0.340	$-$
CA5	0.288 ± 0.115	0.025	$\Uparrow$	0.260 ± 0.161	0.037	$\Uparrow$
all	0.408 ± 0.095	0.000	$\Uparrow$	0.302 ± 0.060	0.000	$\Uparrow$

Table 23. Outdoor cognitive play

	Trained		Untrained	
Cat.	Pre	Post	Pre	Post
NON	0.657 ± 0.050	0.454 ± 0.037	0.703 ± 0.030	0.473 ± 0.050
STE	0.034 ± 0.017	0.029 ± 0.010	0.019 ± 0.010	0.066 ± 0.018
EXP	0.064 ± 0.015	0.078 ± 0.019	0.072 ± 0.020	0.089 ± 0.023
FUN	0.245 ± 0.034	0.437 ± 0.042	0.206 ± 0.022	0.372 ± 0.041
CON	0.000 ± 0.000	0.003 ± 0.003	0.000 ± 0.000	0.000 ± 0.000
SYM	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
R-G	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000

Table 24. Change in outdoor cognitive play

	Trained			Untrained		
Cat.	Change	p		Change	p	
NON	-0.203 ± 0.062	0.002	$\Downarrow$	-0.230 ± 0.039	0.000	$\Downarrow$
STE	-0.005 ± 0.020	0.798	$-$	0.047 ± 0.013	0.001	$\Uparrow$
EXP	0.014 ± 0.019	0.453	$-$	0.017 ± 0.025	0.506	$-$
FUN	0.192 ± 0.041	0.000	$\Uparrow$	0.166 ± 0.029	0.000	$\Uparrow$
CON	0.003 ± 0.000	0.000	$\Uparrow$	0.000 ± 0.000	1.000	$-$
SYM	0.000 ± 0.000	1.000	$-$	-0.000 ± 0.000	0.534	$-$
R-G	0.000 ± 0.000	1.000	$-$	0.000 ± 0.000	1.000	$-$

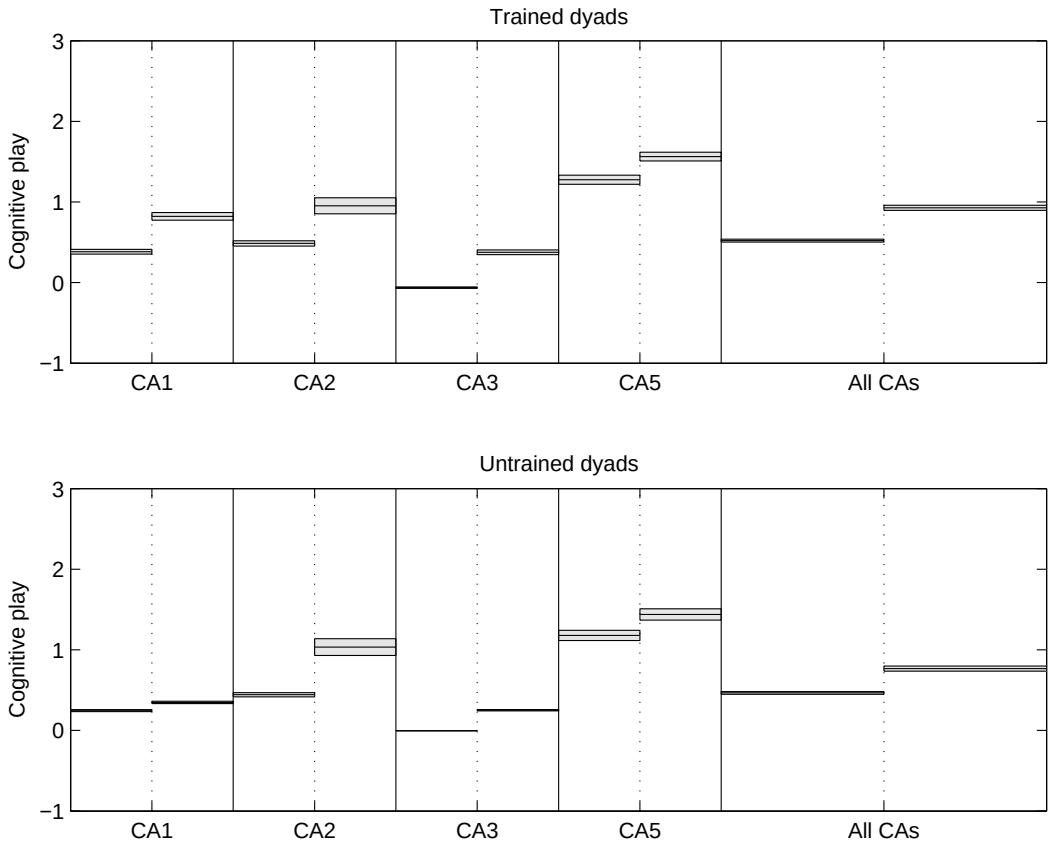

Figure 8. Cognitive play behaviour (outdoor setting)

of negative interaction compared to the indoor settings. Generally, it was more difficult for trained peers to establish and maintain social interaction with children with autism. However, the post-training social interaction score for the trained dyads was almost as high as in the indoor settings, despite the pre-training score being much lower, so the trained peers were clearly able to overcome such difficulties.

This increased area in which to avoid one's play partner is also likely to be the cause of the lower level of interaction seen in the untrained dyads—avoidance could appear to be a "safe" strategy for both the children with autism and the untrained peers.

In the trained dyads, three sub-categories (passive-low, passive-high, and active-high interaction) of social interaction showed statistically significant increases, accompanied by a corresponding large and statistically significant decrease of no-interaction (see table 20). The children with autism and trained peers were able to interact in a simple and clear manner in outdoor setting. For example, despite occasional distractions such as PE sessions held nearby in the playground, children with autism successfully using playground equipment and sandpit toys with the trained peers. The trained peers then guided and encouraged the children with autism to try another equipment (sometimes, as mentioned earier, perhaps to excess).

While statistically significant changes were seen in some categories of social interaction

in untrained dyads, both the pre-training and post-training durations, and the change in them were less than 0.0005, and only made a negligible contribution to the overall social behaviour. These changes cannot be regarded as important.

Measurement of the cognitive level of play, on the other hand, provided a surprising and remarkable result: all children with autism, in both trained dyads and untrained dyads, showed a similar and large increase in cognitive play in outdoor setting. While the increase in trained dyads was about 25% greater, this is within the range of variation indicated by the standard errors in the changes.

The increase in the cognitive level of play shown in the trained dyads was even larger in the outdoor settings than in the indoor settings. This larger improvement of cognitive play might have been due to the initial novelty of outdoor playground facilities and apparatus, compared to the more familiar indoor toys. Since the outdoor setting was located in the regular state primary school (SPS-A) for CA1, CA2 and CA3, the change might indicate learning to use these unfamiliar playground facilities. Overall, children with autism seemed to be quite interested in the playground facilities.

While trained peers interacted with children with autism using the "play interaction skills" that they learned during peer training, untrained peers mainly played by themselves. Occasionally, especially at the beginning of the pre-training play phase (i.e., the earliest play sessions), untrained peers asked children with autism to use playground equipment together. However, when they could not get appropriate responses (e.g., no response) from the children with autism, they simply played by themselves. Sometimes, untrained peers and children with autism were far apart from each other, with, for example, the untrained peer in the sandpit area and the child with autism using other playground equipment. Untrained peers also seemed to be embarrassed when children with autism suddenly initiated without verbalization—in these kinds of "awkward" situations, untrained peers were not likely to know how to interact with children with autism, and chose the easiest path for them: leaving the area or ignoring the child with autism.

Therefore, the improvement in untrained dyads does not appear to result from any improvement in social interaction with the untrained peers. It could possibly be due to the children with autism having been taught by the trained peers how to use the available playground facilities and equipment; since the improvement occurred after the peer-training phase, this is certainly a possible explanation, and would demonstrate a generalization of cognitive play skills. However, since the "higher" categories of cognitive play (i.e., symbolic and rule-governed play) were almost completely absent, the improvement in outdoor cognitive play does not represent any significant cognitive gains by the children with autism.

Since the improvement could be due to this possible carryover effect, or could be due to the children with autism learning from experience with the facilities and equipment, without assistance from the peers, little can be concluded.

As noted above, these results were surprising and unexpected. It appears that there is no primary cognitive deficit in children with autism preventing appropriate use of outdoor playground facilities or equipment, and such play behaviour can be readily learned by children with autism.

4. Discussion

It was demonstrated clearly and conclusively that when typically developing peers were systematically trained (peer training), they were able to more effectively and consistently able to play and interact with children with autism. Untrained peers, on the other hand, were not able to interact effectively with the children with autism, and the level of social interaction did not improve over time, indicating that practice alone is ineffective.

The main results found here in this peer-mediated play intervention suggest that social skill training for only children with autism may have little or no effect on the facilitation of positive interaction with peers, in the absence of training of peers. Although children with autism can improve their social skills when carefully trained by educators, this does not mean that their expression of these social skills is such that typically developing peers generally understand or accept—their social behaviour is still often regarded as bizarre and incomprehensible by untrained peers.

Through systematic peer training, typically developing peers are able to realize diversity in people, and recognize abilities, rather than only disabilities, in children with disabilities including autism. Trained peers can appreciate the similarities between themselves and children with autism as well as their differences. They can learn how to play and interact with children with autism.

Without systematic peer training, typically developing peers may not know how to play or interact with children with autism, and cannot easily learn to do so through practice alone. With untrained peers, social development as a result of social interaction in children with autism cannot be expected.

Therefore, systematic interaction training should be provided not only to children with autism but also to typically developing peers. When both groups of children are trained, the optimal outcome for positive social interaction between them results because social interaction can be maintained in a reciprocal way with initiation followed by appropriate response in human relationships. With no, or insufficient, initiation, then response will not occur or will be infrequenct. If interaction is initiated, but the initiation is not recognized by the recipient, no response occurs. If the initiation is perceived negatively, the response is likely to be negative. Such failures of interaction were observed in this study. For example, when CA1 did not get any response from UP12, despite several attempts, CA1 stopped trying to interact with UP12. Untrained peers also showed a similar pattern of behaviour, with unsuccessful attempts at initiation followed by a cessation of such attempts; P7 stated that when he could not any response from CA3, he stopped greeting CA3 because P7 had no reason to continue initiating to CA3.

Furthermore, given that social interaction is reciprocal, individualistic, and relative (Rubin, Bukowski, & Parker, 1998), aggressive behaviour in children with autism should be examined in the context of reciprocal interaction, investigating environmental factors and the circumstances leading up to the violent display. For example, in this study, from time to time CA5 invited UP14 to join in his play activities, but UP14 kept ignoring or rejecting him without any explanation. Finally, CA5 used aggressive behaviour to express his anger, throwing toys towards UP14 in the last play session. The reasons why P14 kept ignoring or rejecting CA5's invitations are not known. According to her class teacher, she was somewhat shy but compliant, getting along with her classmates. Does this mean that P14 should

have had no difficulty to play with other children, and that the lack of successful interaction is solely due to CA5 having no appropriate social skills to interact with typically developing peers? Would it be reasonable to describe CA5 as an aggressive boy with autism? The answers to both questions are clearly no, as evidenced by CA5 showing positive interaction and successfully playing with the trained peer, TP9. Therefore, social behaviour in children with autism should be interpreted from the viewpoint of *reciprocal* human interaction.

Finally, the surprising and contradictory results obtained from measurement of the cognitive level of play merit some further discussion. While the results from the indoor settings largely agreed with those deduced from the measurement of the level of social interaction, the outdoor results were remarkably different, with similar large and statistically significant increases in the cognitive level of play being seen in both trained and untrained dyads. Coincidence of the increase in both groups with the training of the trained peers makes a carryover effect from the trained dyads to the untrained dyads appear to be the most likely cause, especially in the presence of an accompanying decrease in social interaction in the untrained dyads. Since no large cognitive improvement in the children with autism would be expected in a short-term study (Luckett, Bundy, & Roberts, 2007) such as is reported here, it is most unlikely that this increase represents any real improvement in cognitive *ability*, any more than the small but statistically significant decrease in the cognitive level of play in untrained dyads in indoor settings indicated a decrease in cognitive *ability* (with a simultaneous increase with trained peers!).

Therefore, we strongly urge a degree of caution in the interpretation of results based on the measurement of the cognitive level of play based on the Piaget–Smilansky categories, or similar categories, especially for children with autism where the primary deficits are social rather than cognitive. Possible discrepancies between the cognitive level *displayed during play* and the actual level of cognitive *ability* should be kept in mind.

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