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Peer-mediated teaching and augmentative and alternative communication for preschool-aged children with autism*

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Abstract

Background The aim of this study was to assess the effectiveness of two communication interventions for preschool-aged children with autism.

Method Six typically developing peers were taught to implement peer-mediated naturalistic teaching, with and without a speech generating device (SGD), during play sessions with 3 classmates with autism in three preschools. Generalisation probes were conducted during mealtimes at the preschools. A multiple baseline design was used to assess the outcomes of the two intervention conditions.

Results All 3 children with autism increased their communicative behaviours immediately following the introduction of the two interventions, and generalised these increases to mealtime interactions with their peers. However, only 1 child maintained these increases in communication.

Conclusion These results provide preliminary evidence for the effectiveness of combining peer-mediated naturalistic teaching with the use of SGDs for preschool-aged children with autism. Suggestions for improving the maintenance of intervention effects are provided.

Keywords: *autism, augmentative communication, peer-mediation, naturalistic teaching*

Introduction

Inclusive education

Increasingly, children with autism are attending inclusive preschools. These preschools offer an ideal context in which to support the communication development of children with autism, through interactions with their same-age peers without disability (Jones & Schwartz, 2004; National Research Council, 2001). However, placing children with autism in inclusive preschools without adequate communication support is unlikely to result in successful interactions, participation, or learning (Holahan & Costenbader, 2000; Kohler & Strain, 1999). Children with autism require both structured opportunities to communicate with their peers and a functional communication mode (Kent-Walsh & Light, 2003; Koegel, 2000). Children with autism, including those who use little or no functional speech, may benefit from communication support in the form of augmentative and alternative communication (AAC), which may facilitate their participation as equals in these everyday interactions (von Tetzchner, Brekke, Sjøthun, & Grindheim, 2005). Children without disability may benefit from instruction in how to interact effectively with their classmates with autism (Kohler & Strain, 1999; Laushey & Heflin, 2000; Simpson, de Boer-Ott, & Smith-Myles, 2003) and may be able to use this instruction to improve the communication of their classmates with autism (Goldstein, Kaczmarek, Pennington, & Shafer, 1992).

Peer-mediated naturalistic teaching

Children without disability can be instructed to implement peer-mediated naturalistic teaching. This involves instructing one child to teach social, communication, or academic skills to another (Odom & Strain, 1984b). Peer-mediated naturalistic teaching methods have been used successfully to increase communicative interactions between children with autism and their peers without disability

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(Hwang & Hughes, 2000; McGee, Almeida, & Sulzer-Azaroff, 1992). Peer-mediated naturalistic teaching methods are effective in producing generalised changes in the communication of children with autism, thus enabling them to apply their skills across a range of contexts and communication partners (Strain & Kohler, 1998). In addition, peer-mediated teaching can be incorporated into natural everyday activities; therefore, it is well suited for use in inclusive preschools (Hemmeter, 2000).

A number of factors influence the effectiveness of peer-mediated interventions for preschool-aged children with autism (Odom & Strain, 1986). These include (a) the presence of naturally occurring distractions in inclusive classrooms (Charlop & Walsh, 1986; McGee et al., 1992); (b) the personal characteristics of the peers including their age and social and communicative competence (Carter & Maxwell, 1998); (c) the extent to which peers and children with autism become reliant on teacher prompts (Goldstein et al., 1992; McGee et al., 1992); (d) the effects of fatigue associated with studies conducted over a long period of time (Odom & Strain, 1984a); and (f) the characteristics of the children with autism, including the presence of self-stimulatory behaviours (Strain & Kohler, 1998), their social and communication skills (Strain & Kohler, 1998), and their responsiveness to peers (Charlop & Walsh, 1986).

Carter and Maxwell (1998) noted that children without disability are less likely to persist in interactions with children with autism who are not responsive. Although peer-mediators may be willing to participate in interactions with children with autism, they often fail to receive the inherent social rewards associated with interactions with their typically developing peers (Lord & Garfin, 1986). Therefore, for peer-mediated teaching to be successful, peers without disability may need more support and feedback. Such feedback can come from providing children with autism with additional communication support in the form of AAC so that their communication can become more explicit.

Augmentative and alternative communication

Augmentative and alternative communication systems, including speech generating devices (SGDs), have been used to support the communication of children with autism (Mirenda, 2001). Speech generating devices have been used effectively to support both the expressive and receptive communication of these children (e.g., Light, Roberts, Dimarco, & Greiner, 1998; Schepis, Reid, Behrmann, & Sutton, 1998; Sigafoos, Didden, & O'Reilly, 2003) and provide a number of benefits (Mirenda, Wilk, & Carson, 2000; Schlosser & Blischak, 2001). Firstly, the consistency of messages produced using SGDs may complement the preference that many children with autism have for sameness (Koul, 2003; Schlosser & Blischak, 2001; Sigafoos & Iacono, 1993). Secondly, the representation of words and messages using picture symbols supports the preference for visually presented information that children with autism frequently demonstrate (Cafiero, 2001; Light et al., 1998; Mirenda & Schuler, 1988; Parsons & La Sorte, 1993). Thirdly, children with autism using SGDs with good quality voice output can produce clear messages that are easily recognised and understood by their communication partners (Light et al., 1998; Mirenda, 2001; Schepis et al., 1998). Despite these potential benefits, the authors do not know of any reports on the effectiveness of combining peer-mediated naturalistic teaching with the use of a SGD to enhance the communication of preschool-aged children with autism.

Aims of the study

The aims of this study were (a) to measure the effectiveness of peer-mediated naturalistic teaching, without and with a SGD, on the number of communicative behaviours produced by three children with autism during play with their typically developing peers at preschool; (b) to compare the effectiveness of the two interventions; and (c) to determine whether changes in the number of communicative behaviours produced by the children with autism generalised to mealtime interactions with their peers.

Method

Participants

The participants were six typically developing preschool-aged children and three children with autism attending three different preschools. The six children without disability were three boys and three girls, aged 3–5 years. The three children with autism were all boys, aged 3–5 years. The study was approved by the University of Sydney Human Research Ethics Committee, and the parents of the children provided informed consent for their children to participate. A summary of the participants is provided in Table 1. The children have been given pseudonyms to protect their privacy.

Table 1. Participants

Participant	Gender	Age	Diagnosis	Preschool
Jeremy	Male	4	Autism	A
Kathryn	Female	5	–	A
Brandon	Male	5	–	A
Aaron	Male	5	Autism	B
Damien	Male	4	–	B
Kimberley	Female	5	–	B
Shane	Male	3	Autism	C
Charlotte	Female	3	–	C
Luke	Male	4	–	C

Typically developing children. The directors of the three preschools were asked to identify two typically developing children with age appropriate language skills to act as peer-mediators in each preschool. The directors reported that the children were active participants in preschool activities, were able to follow instructions and routines, and were generally enthusiastic during interactions with other children. These comments were supported by caregiver reports and observations made by the researcher during initial visits to the preschools. Measures of language development, which included Type Token Ratios (Templin, 1957) and Number of Different Words (Watkins, Kelly, Harbers, & Hollis, 1995), were calculated for each child prior to the present study (Trembath, Balandin, & Togher, 2007) and were within normal limits. The calculations were based on 3,000 word conversational samples collected from each of the children during regular play activities at their preschools.

Children with autism. The three children with autism attended their preschools 2 days each week, and accessed at least one other early intervention program (e.g., speech pathology) during the study. These additional programs were not associated with the preschools and were conducted at other locations. Each child had been diagnosed as having autism by a paediatrician or psychologist. None of the three children were diagnosed as having a hearing or vision impairment.

Jeremy was 4 years old. His teachers reported that he used a small number of spoken words in a functional manner when prompted by staff, but rarely used them during interactions with other children. He did not have access to an aided AAC system in his classroom and had no experience using a SGD. Jeremy often played alone and rarely initiated interactions with other children. He usually responded to initiations by other children without using spoken words (e.g., looking at the face of a child who initiated an interaction, responding to another child's request for a toy by handing the toy to the other child). Jeremy engaged in most preschool activities without one-to-one teacher support, and his teachers reported that he did not have any challenging behaviours.

Aaron was 5 years old. His teachers reported that he rarely used functional spoken words at preschool, although he occasionally repeated words spoken by teachers. However, he usually made requests by taking a teacher's hand and leading her. Aaron had access to a visual timetable for daily activities. He recognised the visual graphic symbols on the timetable and was able to select preferred activities by placing the symbols in order. He had no experience using a SGD. Aaron usually played alone and had difficulty sharing equipment with other children. He would accept offers of toys and equipment from other children by taking the toys and equipment, but would then usually move away to play with them on his own, or leave the activity if the other child persisted in his or her attempts to interact with him. At times he would become frustrated with other children, and occasionally pushed them out of the way to obtain toys or equipment he wanted. However, according to his teachers, Aaron did not demonstrate other challenging behaviours at preschool. During morning tea, Aaron usually sat at a table alongside other children but rarely made eye contact or initiated social interactions. He selected food by reaching for preferred items or by taking them directly from the tray held by the teacher.

Shane was 3 years old. His teachers reported that he used no functional spoken words, although he sometimes made unintelligible vocalisations. Shane had no access to an AAC system at preschool and he had no experience using a SGD. He occasionally walked over to a teacher, apparently to seek attention, but did not pass objects or take a teacher's hand to make requests. Shane frequently engaged in self-stimulatory and self-injurious behaviour: repeatedly hitting the sides of his face with the palms of his hands. His teachers regularly provided one-to-one support in an attempt to reduce these behaviours. This usually involved sitting with him at a table away from other children and encouraging him to do puzzles or fine motor activities (e.g., threading beads, peg boards) in an attempt to keep his hands occupied. On occasion, Shane would look at other children as they approached him or at the teacher with whom he was sitting; however, he did not respond to their initiations with words, gestures, or actions. Shane's teachers reported that he rarely engaged in constructive play. During mealtimes,

Shane sat with the other children but often had additional one-to-one teacher support to open containers, unwrap his lunch, and to cut it into bite sized pieces. Shane occasionally watched the other children during these times; however, he did not respond to their initiations.

Settings

The study was conducted in three inclusive preschools in the Sydney metropolitan area. The teachers in the preschools were all experienced in working with children with autism, and at least one teachers' aide was available in each preschool to provide one-to-one support to these children. In each preschool there was an established routine that included indoor and outdoor play activities, group activity time, and designated morning tea and lunch time during which the children were required to sit together. Data were collected in 10-minute segments of child-chosen play activities and routine mealtime (morning tea).

Materials

Speech generating device. A Talara-32 SGD was used during the interactions between peer-mediators and children with autism across the three preschools. The first author recorded eight spoken words and messages on the device in a digitised speech format using his own voice. These were represented using colour Boardmaker™ symbols. The words and messages on the AAC systems for all three children with autism were *yes, good, don't, no, more, I want, help*, and *finish*. The eight words and messages recorded into the device were selected on the basis that (a) they had been frequently and commonly used by the six typically developing peers during a vocabulary study (Trembath, Balandin, & Togher, 2007) conducted immediately prior to the present study and were thus relevant in each setting, (b) they could serve a range of communicative functions (e.g., requesting, commenting, rejecting), and (c) they could be used across a range of preschool activities and interactions. The same vocabulary was used in each setting to ensure consistency in the intervention.

Baseline and intervention stories. The researcher used two illustrated stories to help explain baseline and intervention procedures to the peer-mediators, prior to baseline sessions and intervention training. The baseline story was used to explain to the peer-mediators that they were ''special helpers'' who were going to help the children with autism learn to play and talk. The intervention story was similar to the baseline story, except that it also illustrated the naturalistic teaching procedure that the peer-mediators were to use and explained the use of the SGD. The baseline and intervention stories are included in Appendix A, without the graphics that illustrated each step in the story.

Design

A multiple baseline design (Kazdin, 1982) was used to measure and compare the effectiveness of the two intervention conditions for each child with autism. The intervention conditions were (a) peer-mediated naturalistic teaching, and (b) peer-mediated naturalistic teaching with a SGD. The baseline phase was followed by an intervention phase in each preschool. Generalisation probes were conducted during a second activity (morning tea) in each preschool during baseline and intervention conditions. The independent variables were the two interventions: peer-mediated naturalistic teaching and peer-mediated naturalistic teaching with a speech generating device. The dependent variable was the number of times the children with autism produced potentially communicative behaviours that resulted in a response from a peer-mediator during the play sessions and the generalisation probes at mealtimes. Data were collected in both baseline and intervention phases during 10-minute play activities in the classroom. Peers were randomly assigned to either condition A (naturalistic teaching alone) or condition B (naturalistic teaching with SGD).

Communicative behaviours were defined as any behaviour produced by the child with autism, expressed using one or more communication modes (e.g., natural speech, eye gaze, SGD) that were potentially communicative in the context in which they occurred and that resulted in one or more of the following: (a) the peer-mediator looking at the face of the child with autism, (b) the peer-mediator repeating all or part of a spoken or aided phrase produced by the child with autism, or (c) the peer-mediator responding directly to the comment or question of the child. Communicative behaviours were only coded if both the child with autism and the peer-mediator were in view of the camera. Communicative behaviours directed towards other peers not involved in the study or adults were not included, except in circumstances where the peer-mediator responded to the behaviour in one of the three ways outlined above. Due to differences in the duration of play sessions across the participants, the results of each session were expressed as the number of

communicative behaviours per minute. This was calculated by dividing the total number of communicative behaviours produced each session by the duration of each session. Data were recorded in a Microsoft Excel™ spreadsheet and presented in graphical form for visual analysis.

Statistical analysis was conducted to determine whether changes in the number of communicative behaviours produced by the three children with autism across the two intervention conditions and during generalisation probes were significant. The Percentage of All Non-Overlapping Data (PAND) (Parker, Hagan-Burke, & Vannest, 2007) and Pearson Φ effect size were calculated to assess changes in communicative behaviours following the introduction of the two intervention conditions. Percentage of All Non-Overlapping Data (PAND) assesses the overlap of data between baseline and intervention phases of a study. It is similar to Percentage of Non-Overlapping Data (PND) (Scruggs, Mastropieri, & Casto, 1987), which is an expression of the percentage of data points in the intervention phase that exceed the highest data point in the baseline phase. PAND differs from PND in that PAND compares all intervention phase data with *all* baseline data, not just the highest baseline data point. The key advantages of PAND over PND are that (a) it accounts for outliers in the baseline phase which may distort the calculation by including all data points across both phases, and (b) it can be translated to Pearson's Φ and Φ^2 effect sizes (Parker, Hagan-Burke, & Vannest, 2007). A value of PAND of 50% represents no difference between baseline and intervention phases (i.e., half of the intervention baseline comparisons favour intervention so the other half favour baseline). Values exceeding 50% represent an increasingly strong effect as the percentage increases. The significance and size of the effect may be evaluated using Φ. Percentage of All Non-Overlapping Data (PAND) was also used to determine whether differences in the number of communicative behaviours produced by the children with autism during baseline interactions with the two sets of peers were statistically significant. That is, whether the children with autism communicated more with the peer-mediators who subsequently delivered the naturalistic teaching condition than they did with the peer-mediators who subsequently delivered the naturalistic teaching with speech generating device condition, or vice versa. Percentage of All Non-Overlapping Data (PAND) was not used to analyse the generalisation data as there were less than the minimum required 20 data points (Parker, Hagan-Burke, & Vannest, 2007).

Procedures

Pre-baseline. The researcher conducted two 10-minute video acclimatisation sessions in each preschool prior to commencement of baseline conditions. These were conducted on two separate days and involved the researcher videoing the child with autism during his regular play activities. Following the second session, the researcher and a teacher sat down with the two peer-mediators and read them the pre-baseline illustrated story. The story outlined that the peer-mediators were to follow the child with autism and play with him for 10 minutes. The researcher read the story twice to the peer-mediators prior to baseline.

Baseline. Baseline play sessions were conducted during regular indoor free play time in each setting. Each peer-mediator played with the child with autism for 10 minutes on each occasion. Where possible the peer-mediators were randomly assigned to either the first or second play opportunity each day based on the toss of a coin. However, on a number of occasions the researcher arrived at the preschool to find one or both peers immersed in an activity (e.g., finger painting) with or without the child with autism. Under these circumstances, due to time constraints, the peer who was most readily available was asked to play with the child with autism first, with toys of their choosing.

At the start of each session, the researcher asked the peer-mediator to ''follow [enter child's name] and play with him.'' The researcher or a teacher facilitated the start of the interaction by suggesting activities that the children could play together. The researcher then followed the children with the video camera in order to record the play session. On occasions when the peer-mediator and the child with autism became separated, such as when the child with autism moved quickly between activities, the researcher repeated the request to ''follow [enter child's name] and play with him.'' He also praised the peer-mediator intermittently for continuing to play with the child with autism. At the completion of the two sessions, each peer-mediator received a sticker for his or her efforts. The SGD was not available to the children during baseline conditions and only play sessions lasting a minimum of 5 minutes were included in analysis.

Pre-intervention instruction. Once a stable baseline was established for each child in all three preschools, intervention instruction commenced with Jeremy's peers in preschool A. Baseline continued in preschool B and preschool C. Pre-intervention

instruction for each participant was conducted during two 20-minute sessions on consecutive days. The sessions were conducted in an area of the classroom in which play activities usually occurred. Only the two peer-mediators, a teacher, and the researcher were involved in the instruction sessions. The researcher taught the peer-mediators to (a) implement the naturalistic teaching procedure, and (b) model the use of the SGD during play interactions with the researcher and each other.

The researcher read the peer-mediators a second illustrated story that described the naturalistic teaching procedure they were to implement. The same story was used in each setting to ensure consistency in teaching across peer-mediators. The naturalistic teaching procedure was designed to be implemented across the contexts of play activities and mealtimes and comprised the following three steps:

(1) ''Show him what you are doing or something he can play.''
(2) ''Wait to see if he wants to play.''
(3) ''Tell him what you are doing or tell him its name.''

After reading the story to the peer-mediators, the researcher modelled the use of the *show, wait, and tell* procedure with the first peer-mediator while the second peer-mediator observed the interaction. The researcher demonstrated the procedure three times and then asked the second peer-mediator who was observing to take over the researcher's role. The second peer-mediator then practised implementing the procedure until successful on three consecutive occasions. The same procedure was then repeated for the first peer-mediator using the same criteria. Finally, the two peer-mediators were encouraged to play together and implement the teaching procedure. Instruction ceased when both peer-mediators had independently and successfully implemented the procedure on a further three occasions.

The researcher presented the SGD to the two peer-mediators and allowed them to explore it for 5 minutes. He explained the meaning of each visual-graphic symbol and demonstrated how to operate the device. He then asked the peer-mediators, ''Can you make it work?'' and encouraged them to operate the device. Once the peer-mediators were producing messages independently the researcher asked them to look at the visual graphic symbols and tell him what each symbol meant. The exploration of the device was terminated when both peer-mediators were able to label all the visual graphic symbols correctly.

The researcher then modelled the use of the SGD while interacting with the first peer-mediator (e.g., playing with blocks) while the second peer-mediator looked on. The researcher then asked the second peer-mediator to take over the modelling of the device by saying ''show [enter first peer-mediator's name] how to use the talker.'' The researcher provided prompts and suggestions until the second peer-mediator had used all of the symbols on the device. The researcher encouraged the second peer-mediator modelling the device to ''keep showing [enter first peer-mediator's name] how to use the talker'' and moved back from the interaction. The second peer-mediator continued to model the use of the device until he or she was successful at producing an appropriate message while playing with the other peer on three consecutive occasions. The same procedure was then repeated for the first peer-mediator to the same criteria. Finally, the two peer-mediators were encouraged to play together and to ''show each other how to use the talker.'' Instruction ceased once both peer-mediators had each independently modelled the use of the device on three occasions.

Intervention. Intervention sessions were conducted during regular indoor free play time in each setting, consistent with baseline. Each peer-mediator played with the child with autism for 10 minutes each. One peer-mediator implemented naturalistic teaching alone; the other peer-mediator implemented naturalistic teaching and modelled the use of the SGD. The researcher verbally prompted the peer-mediators to ''remember to show, wait, and tell'' immediately prior to and during the intervention play sessions. Consistent with baseline procedures, a toss of coin was used to decide the order in which the peers played with the child with autism. However, on a number of occasions the peer who was most readily available to participate in the play session (i.e., not as involved in another activity) was asked to play with the child first.

Intervention analysis. Analysis during intervention was conducted in the same manner as in baseline, except that use of the SGD was also counted as a communication mode. The researcher counted the number of potentially communicative behaviours that were successful in gaining a response from the peer-mediator. These behaviours were coded as either aided or unaided to indicate whether or not the behaviour included the use of the SGD.

Generalisation. Generalisation probes were conducted in a second activity during baseline and

intervention conditions. The researcher recorded interactions between the children with autism and their peers without disability during the first 10 minutes of morning tea. The SGD was placed on the table in front of the child with autism, and the peers were told that the device belonged to him. No specific instruction or instructions were provided to the peer or teachers.

Generalisation analysis. Recordings were analysed using the same procedure as that used during the intervention conditions, except that successful communicative interactions were measured between the children with autism and both peers without disability who were and were not involved in baseline and intervention session.

Inter-observer agreement. A speech pathologist who was experienced in working with children with disabilities and in video analysis independently coded a randomly selected 20% of video recordings. These reliability data were compared with those of the researcher. An agreement was scored each time the two observers agreed that a communicative behaviour had occurred during each 1-minute interval. An agreement was also scored for each 1-minute interval of recording in which the coder and researcher had agreed that no behaviours had occurred during the 1-minute interval. Inter-observer agreement was calculated for each video by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100 to yield a percentage (Kazdin, 1977). Agreement ranged from 73% to 100%, with a mean of 86.16%. Kappa was calculated and found to be .693 (95% confidence interval = .593–.793).

Intra-observer agreement. The researcher re-coded 20% of the videos 7 months after the original coding. *Intra-observer agreement* was calculated for each video by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100 to yield a percentage. Agreement ranged from 90% to 100%, with a mean of 97.69%. Kappa was calculated and found to be kappa .948 (95% confidence interval = .902–.992).

Results

Baseline

Jeremy, Aaron, and Shane each produced, on average, fewer than one successful communicative behaviour per minute during interactions with the peer-mediators during baseline play sessions. These sessions were characterised by the children with autism engaging in solitary play, while the peer-mediators played alongside. The peer-mediators were willing participants in the play sessions but were easily distracted by other children and activities in the classrooms. They often required prompting to follow the children with autism as they moved between activities. The number of prompts provided to the children was not controlled and therefore varied across participants. The researchers reviewed a randomly selected 29% of baseline videos (2 play sessions per peer-mediator) and found that researcher prompts encouraging the children to follow the child with autism ranged from 0 to 16 per session, with an average of 4.42 prompts per session.

The number of communicative behaviours was low for each of the three children with autism during baseline, regardless of which peer-mediators were involved in the play sessions, as illustrated in Table 2. When considered as two groups, there was not a significant difference in the number of communicative behaviours produced by the children with autism during interactions with the group of three peers who went on to deliver the naturalistic teaching intervention and those who went on to deliver the naturalistic teaching intervention and the SGD (PAND = 46.34%, $\phi = .04$, $p > .50$).

Intervention

Peer-mediated naturalistic teaching. The introduction of the peer-mediated naturalistic teaching condition resulted in an immediate increase in communicative behaviours for all three children with autism. Shane demonstrated the largest initial increase in communicative behaviours, from 0.10 per minute in the last session of baseline to 1.80 per minute in the first intervention session, whereas Jeremy and Aaron demonstrated modest increases. However, Shane only received two complete sessions of peer-mediated naturalistic teaching as a third session was abandoned prior to the minimum 5 minutes due to him displaying frequent self-injurious behaviour. Nevertheless, on average, the children with autism each produced more communicative behaviours during the intervention phase than they did during baseline. Analysis of the combined data for the three children with autism indicates that these increases were statistically significant (PAND = 76.1%, $\phi = .52$, $p < .001$). The number of communicative behaviours produced by each child per minute during baseline, intervention, and generalisation conditions is illustrated in Figure 1.

Table 2. Average number of successful communicative behaviours produced by the children with autism per minute during baseline, intervention, and generalisation sessions

			Jeremy	Aaron	Shane
Naturalistic teaching	Baseline	Number of sessions	4	11	9
		Communicative behaviours per minute (average)	0.48	0.34	0.31
		Communicative behaviours per minute (range)	0.1–1.1	0–0.7	0–0.5
	Intervention	Number of sessions	13	7	2
		Communicative behaviours per minute (average)	1.48	0.36	1.10
		Communicative behaviours per minute (range)	0.3–3.2	0.1–0.7	0.4–1.8
Naturalistic teaching with SGD	Baseline	Number of sessions	3	8	6
		Communicative behaviours per minute (average)	0.97	0.25	0.02
		Communicative behaviours per minute (range)	0.3–1.9	0–0.6	0–0.12
	Intervention	Number of sessions	10	8	3
		Communicative behaviours per minute (average)	2.11	1.19	0.53
		Communicative behaviours per minute (range)	0.9–4.2	0.2–3.1	0.3–0.9
Generalisation	Baseline	Number of sessions	1	2	3
		Communicative behaviours per minute (average)	0.00	0.25	0.03
		Communicative behaviours per minute (range)	–	0.00–0.50	0–0.1
	Intervention	Number of sessions	1	1	1
		Communicative behaviours per minute (average)	0.90	1.00	0.05
		Communicative behaviours per minute (range)	–	–	–

Although the intervention resulted in an immediate and statistically significant increase in communicative behaviours for all three children with autism, the extent to which they maintained their initial increases varied. Jeremy maintained the increase, albeit sporadically, as illustrated in Figure 1, by the gradual upward trend in his data throughout the intervention phase. However, Aaron did not maintain his initial increase in communicative behaviours. A downward trend is noted following the initial rise, with his communicative behaviours similar to baseline levels. However, he received only two sessions of intervention in this condition due to time constraints, making it impossible to establish a trend. In addition, his communicative behaviours fell in the second intervention session to a level similar to baseline.

Consistent with baseline procedures, the number of prompts provided to the peer-mediators during the intervention phase was not controlled. The researchers reviewed a randomly selected 13% of intervention videos (2 play sessions per peer-mediator) and found that researcher prompts encouraging the children to follow the child with autism ranged from 3 to 47 per session, with an average of 24.16 prompts per session.

Peer-mediated naturalistic teaching with a speech generating device. The introduction of peer-mediated naturalistic teaching combined with a SGD condition resulted in an immediate increase in the communicative behaviours produced by each of the children with autism. These increases are illustrated in Figure 1. Following the initial increase, Jeremy continued to increase his communicative behaviours. Aaron continued on an upward trajectory for a further four sessions after the initial increase, before his communicative behaviours decreased to near baseline levels. Shane, however, did not maintain the increase in communicative behaviours experienced in the first session. His number of successful communicative behaviours decreased in subsequent sessions to slightly above baseline levels.

Peer-mediated naturalistic teaching with a SGD resulted in an increase in the average number of communicative behaviours from baseline to intervention for all three children with autism. As illustrated in Table 2, Jeremy's increased from 0.97 per minute during baseline to 2.11 per minute during intervention. Aaron's increased from an average of 0.25 per minute in baseline to 1.19 per minute in the intervention phase. Shane's increased from 0.02 communicative behaviours per minute in baseline to 0.53 communicative behaviours per minute in the intervention phase. The changes in communicative behaviours that occurred following the introduction of peer-mediated naturalistic teaching with a SGD were statistically significant (PAND 89%, $\phi = .78$, $p < .001$).

Jeremy used the SGD during 7 of the 10 intervention sessions in which it was available. His use of the SGD accounted for 12.3% of his total communication behaviours during these sessions.

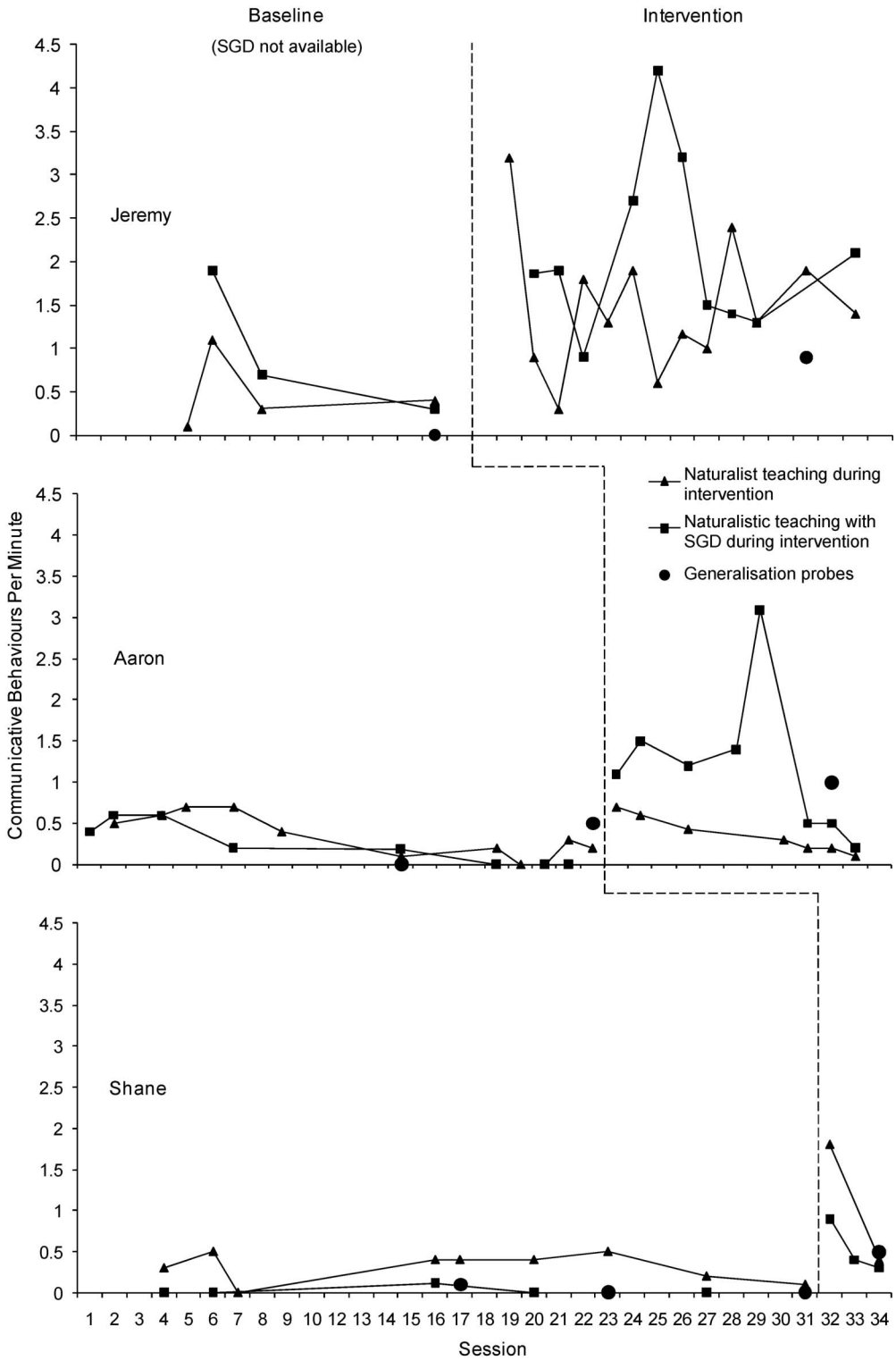

Figure 1. Number of successful communicative behaviours produced by the children with autism per minute during baseline, intervention, and generalisation sessions.

Aaron used the SGD during 5 of the 8 intervention sessions in which it was available. His use of the SGD accounted for 12.4% of his total communication behaviours during these sessions. Finally, Shane used the SGD during all three intervention sessions in which it was available. His use of the SGD

accounted for 44.3% of his total communication behaviours in these intervention sessions.

The number of prompts provided to the children was not controlled and therefore varied across participants. The researchers reviewed a randomly selected 16% of baseline videos (2 play sessions per peer-mediator) and found that researcher prompts encouraging the children to follow the child with autism ranged from 4 to 17 per session, with an average of 12.2 prompts per session.

Comparing intervention approaches. A comparison of the outcomes of the two interventions for Jeremy and Aaron indicates that peer-mediated naturalistic teaching with a SGD resulted in more communicative behaviours per minute than peer-mediated naturalistic teaching alone. Figure 1 shows that for Jeremy, peer-mediated naturalistic teaching with a SGD was more successful than peer-mediated naturalistic teaching alone for 6 out of the 8 sessions in which both interventions were administered. For Aaron, peer-mediated naturalistic teaching with a SGD was always more successful than peer-mediated naturalistic teaching alone. However, for Shane, peer-mediated naturalistic teaching with a SGD was not as successful as peer-mediated naturalistic teaching alone, despite it leading to increases in his communicative behaviours. On average, Shane produced 0.53 communicative behaviours per minute during intervention when the SGD was available compared with 1.10 communicative behaviours per minute when it was not. The overall effect size was greater for the condition in which the SGD was used ($\phi = .78$ versus $\phi = .52$); however, the changes that occurred under both conditions were significant at $p < .001$.

Generalisation

All three children with autism demonstrated slight increases in communicative behaviours during generalisation probes. This is summarised in Table 2. Aaron's results are confounded by an upward trend in communicative behaviours during baseline, as illustrated in Figure 1. Both Aaron and Shane produced more communicative behaviours per minute during the intervention generalisation probes than in either of the two intervention sessions conducted during play time on the same day. The generalisation data points taken during the intervention phase exceeded the highest generalisation data point taken during the baseline phase for each child. No prompts were provided to the children during generalisation probes, as confirmed by a review of all generalisation session videos.

Discussion

The results indicate that both peer-mediated teaching and peer-mediated teaching with a SGD led to modest yet statistically significant increases in the number of communicative behaviours produced by each child with autism during intervention play sessions. In addition, all three children generalised these increases to interactions with their peers during a second activity (morning tea), in which no training or instruction was provided. Consistent with findings from previous studies of peer-mediated teaching for preschool-aged children with autism (e.g., Goldstein et al., 1992; McGee et al., 1992), these results demonstrate that instructing peers to implement a simple naturalistic teaching procedure during regular preschool activities has a positive effect on the communication of their classmates with autism.

Benefits of the SGD

Jeremy and Aaron appeared to benefit most from the introduction of the SGD. Both children produced, on average, more communicative behaviours in sessions in which the SGD was provided. In addition, teachers reported that both children began to produce words and messages contained on the device using natural speech, soon after its introduction. Jeremy reportedly used words and phrases including *my turn, no, finished*, and *I want* during play interactions with peers. Aaron began to use the word *finish* spontaneously at the end of mealtimes. According to Koul (2003), SGDs provide consistent speech output that may facilitate children with autism in learning to understand and use spoken language. In addition, the combination of non-transient visual symbols with consistent speech output may also facilitate language learning (Light et al., 1998; Schlosser, 2003). Although conclusive research evidence for the effectiveness of SGDs in supporting natural speech has not yet been published (Millar, Light, & Schlosser, 2006; Schlosser, 2003; Schlosser & Blischak, 2001), and despite the fact that these reports of natural speech development are anecdotal, they may be indicative of the potential for these devices to support the development of natural speech in children with autism.

Nevertheless, although all three children with autism responded immediately to the interventions, and the changes in communicative behaviours were found to be significant, only Jeremy maintained his initial increases in communication. It is possible that initial increases were due to a ''novelty effect'' following the introduction of the SGD or a ''first day effect'' described by Kohler and Strain (1999).

First day effects can occur when peer-mediators are first taught to recognise and respond to subtle and often idiosyncratic communicative behaviours produced by children with autism that have previously gone unnoticed. Odom and Strain (1986) identified a number of other factors that may influence the extent to which children with autism respond to and benefit from peer-mediated interventions. These factors include the context in which interventions are provided, the extent to which peer-mediators are able to effectively implement the interventions and the individual variations in skills of the children with autism receiving the interventions.

Factors that may have influenced outcomes

Context. The preschools in which the study took place were busy and dynamic. The peer-mediators were frequently distracted by other children, activities, and special events occurring within their classrooms. These distractions reduced their capacity to encourage, recognise, and respond to the communicative behaviours of the children with autism. In the final week of the study, a teacher in Aaron's preschool remarked of one peer-mediator, ''You will be lucky to get anything out of her today: all she is thinking about is the Christmas concert!''.

The contexts also had an impact on the children with autism. In Shane's preschool, teachers combined his class with a group of older children in the adjacent room towards the end of the baseline condition. This led to a substantial increase in the level of noise and general commotion during play sessions, and coincided with an escalation in Shane's self-stimulatory and self-injurious behaviour. This made it difficult for the peer-mediators to engage with him.

It is also possible that differences in toys and equipment in each preschool had an impact on the interactions between the children with autism and the peer-mediators. Toys and equipment that enable multiple children to participate, such as imaginative play centres and wooden blocks, tend to elicit more social interactions than toys that are more suitable for solo use, such as jigsaw puzzles. Although a range of toys and equipment was available in each preschool, no attempt was made to control for the types of toys and equipment the children played with during the sessions or the time they spent with any particular toy or piece of equipment. Similarly, the play skills of the peer-mediators were not assessed prior to the study and so it is possible that some of the peer-mediators may have been more familiar and proficient with the toys and equipment than the other peer-mediators.

Ability of peer-mediators. Despite all peer-mediators receiving the same instruction prior to intervention, their ability to implement the interventions varied. The peer-mediators required consistent prompts to model the use of the SGD during play interactions. They tended to show the children with autism how to activate the device, but had difficulty modelling its use in the context of meaningful communicative interactions. The peer-mediators were 3 to 5 years of age and may not have had the communication competency necessary to successfully and independently model the use of the SGD during natural interactions with the children with autism, despite reaching criterions in training. Further research is needed in order to better understand the instruction and support needs of young peer-mediators in preschools, including the extent to which their ability to implement interventions is dependent on teacher prompts and reinforcement.

Responsiveness of the children with autism. Not surprisingly, the responsiveness of the children with autism to the peer-mediator's approaches also appeared to influence the intervention outcomes. The peer-mediators interacting with Jeremy usually received positive responses from him. When these occurred the peer-mediators tended to make consecutive initiations to him in rapid succession, apparently buoyed by the success of each previous attempt. The peer-mediators interacting with Shane and Aaron often received no discernable response and therefore required more consistent encouragement from the researcher to continue trying to implement the procedure. The lack of reciprocity may have reduced the effectiveness of the intervention by creating a greater reliance among the peer-mediators on the researcher prompts to continue implementing the intervention. This illustrates the need for peers to be taught explicitly how to cope with rejection behaviours from children with autism in order for them to engage in successful interactions.

Teachers may need to monitor the effectiveness of peer-mediators in providing intervention over time, and modify the level of support that they provide to the peers accordingly. Further research is required to examine the benefits of combining adult mediated interventions with whole class instruction of peers in order to support the communication development of children with autism in inclusive preschools.

Clinical implications

In practical terms, this study provides teachers and therapists with preliminary data to support two intervention approaches that can be incorporated

into everyday preschool activities in an effort to increase the communicative behaviours of children with autism. Without support, preschool-aged children with autism and their typically developing peers are unlikely to engage in successful interactions in inclusive preschools (Kohler & Strain, 1999). This was evident in the baseline performance of the three children with autism. Although the three children produced a range of potentially communicative behaviours, the peer-mediators rarely recognised or responded to these behaviours in a meaningful way. Consequently, interventions aimed at increasing the social communication interactions between preschool-aged children with autism and their peers without disability must focus on teaching the peers to recognise and respond to the communicative behaviours of children with autism if successful interactions are to occur (Kohler & Strain, 1999; Laushey & Heflin, 2000; Simpson et al., 2003).

Interventions aimed at increasing communicative behaviours between children with autism and their peers without disability need to be applicable across a range of contexts. Consequently, strategies that are naturalistic, flexible, and relevant in a range of situations are likely to be effective. If AAC systems, including SGDs, are to be used effectively by young children with autism in inclusive preschools, they must contain vocabulary that is meaningful to the children. The fact that the three children with autism were successful in using the device across a range of play and mealtime activities with trained and untrained peers is testament to the social validity of the vocabulary selected for inclusion on the device.

The results demonstrate that children as young as 3 years of age can be taught to implement simple naturalistic teaching methods during regular play interactions with their classmates with disability. Nevertheless, the age and communication competence of the peer-mediators may have influenced their ability to effectively model the use of the SGD during play interactions with the children with autism. Consequently, peer-mediators may require additional instruction and support if they are to effectively model the use of SGDs for their classmates with autism during regular preschool activities.

Despite the difficulties experienced by the peer-mediators in modelling the use of the SGD, both peer-mediated naturalistic teaching with and without a SGD were effective in achieving statistically significant increases in the communication behaviours of the children with autism. This preliminary data points to the possibility that both interventions may be appropriate for use in inclusive preschools. Teachers or therapists could provide the initial instruction, monitor the effectiveness of the peers in implementing interventions and modify their own input into the interactions accordingly. However, further research is needed to replicate these findings and to address the limitations of the present study.

Limitations of the study

Only three children with autism participated in the study: each with differing levels of social, communication, cognitive, and educational skills prior to the study. Given that the individual learning characteristics of each child with autism influence the effectiveness of peer-mediated interventions (Lord & Garfin, 1986), caution should be exercised in generalising the results of this study to other children with autism. Caution must also be exercised in interpreting Shane's data for the naturalistic teaching intervention, given that only two sessions were completed. A third session was abandoned prior to the minimum 5 minutes due to him displaying frequent self-injurious behaviour.

Care should be taken in comparing the outcomes of the two intervention conditions, due to the use of across subject control in the intervention phase and the possibility of carryover effects from one intervention condition to the other. Different peers were used to implement the different interventions in each setting. Although (a) baseline rates of communication with all peers were low and differences not statistically significant, and (b) all peers received the same instruction and achieved the same level of competency in delivering both interventions during instruction, it is possible that differences in the individual abilities of the peer-mediators to encourage and respond to communication by the children with autism contributed to the success of the interventions. An alternating treatment design was not used in this study because it was not possible to exert sufficient control over the order of intervention sessions. Time constraints meant that the researcher was required to start the play sessions each day with the first peer who was available.

It is likely that prompts provided by the researcher influenced the extent to which the peer-mediators were able to implement the interventions effectively. The number of prompts was not controlled in the present study because these were new interventions and the researchers did not want to set an arbitrary limit on the amount of support they could provide to the children. To do so may have increased the risk that one or more children may not have coped with the interactions and may have become distressed. This was particularly of concern in relation to Shane who demonstrated frequent self-injurious behaviour,

as well as the peer-mediators who interacted with him. The prompts were a legitimate and necessary part of the intervention. Nevertheless, the findings must be cautiously viewed and interpreted in light of and because of this limitation. Controlling for these in future studies would enable researchers to draw clearer conclusions about the relative contribution they make to the success of the interventions and indeed the extent to which preschool-aged peer-mediators are able to adopt and implement the naturalistic teaching procedures independently.

Finally, although the results indicate that the effects of peer-mediated naturalistic teaching with a SGD generalised to interactions at mealtime, only a small number of probes were conducted during the study due to time constraints. The study was concluded in December due to the start of the southern hemisphere summer holidays. It was not possible to continue data collection the following year because three of the nine children who participated in the study had left their preschools and commenced kindergarten.

Future research directions

The present study provides preliminary evidence to support the effectiveness of peer-mediated naturalistic teaching and SGDs for preschool-aged children with autism. Further research is now needed to replicate the findings in larger populations and to better understand the contribution that SGDs may provide in supporting both the receptive and expressive communication of these children. Such studies should include control for teacher prompts and might involve instruction to larger groups or even whole classes of peers to implement interventions in order to increase the capacity of all children within these settings to provide communication support to children with autism in the hope of improving maintenance of intervention effects.

Conclusion

Inclusive placements for preschool-aged children with autism have long-term implications for their development of social communication competence, their access to inclusive education later in childhood, and their independence and choices later in life. In the present study, the effectiveness of two peer-mediated communication interventions for three young children with autism in three inclusive preschools was examined. The results demonstrate that children without disability can act as agents of intervention in inclusive settings; encouraging and supporting the communication development of their classmates with autism. The initial increases in communication for all three children with autism illustrate the importance of providing communication support that is relevant and effective across a range of activities and communication partners.

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Appendix

Baseline Story: Helping [Shane] Play and Talk

At preschool there are lots of children.
The children learn to play and talk.
David helps [Shane] learn to play and talk.
[Charlotte] and [Luke] help [Shane] learn to play and talk.
[Charlotte] and [Luke] play with Shane for 10 minutes.
They follow him and play together.
Sometimes they draw or do a puzzle.
Sometimes they read a book or play with the dolls.
David videos [Shane] while he is playing.
[Charlotte] and [Luke] get a sticker for being special helpers.

Intervention Story: Show, Wait, and Tell

At preschool [Charlotte] and [Luke] are special helpers.
They help [Shane] learn to play and talk.
They play with [Shane] for 10 minutes.
There are three ways to help [Shane] learn to play and talk.
Show him what you are doing or something he can play.
Wait to see if he wants to play. [Shane] might tell you with his eyes, hands, words, or the talker.
Tell him what you are doing or tell him its name.
[Charlotte] and [Luke] will also show [Shane] how to use a talker.
The talker says words when they press the pictures.
David videos [Shane] while he is playing.
[Charlotte] and [Luke] get a sticker for being special helpers.