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Keywords

expressive language,
social competence,
autism spectrum disorder,
peer networks,
language development

Pilot Investigation of Language Development of Children With Autism Receiving Peer Networks Intervention

Abstract

Peer mediated interventions are among the most successful in producing positive change in social competence for individuals with autism spectrum disorder (ASD). The current study extends the research in this area by reporting the outcomes of a pilot study that sought to investigate the discrete changes in language skills of elementary school-age children with ASD enrolled in a peer mediated intervention. The peer networks intervention consisted of social groups and literacy groups with peers. Detailed language transcriptions of video probes were used to examine the impact of the peer networks intervention on expressive language abilities of eight children with ASD over kindergarten and first grade as compared to eight children with ASD not receiving intervention. Video probes were collected pre-intervention and at one and two years post intervention. Participants were separated into two groups based on baseline language capabilities: moderate and highly verbal. Change in participant's expressive language was measured by total number of completed words, total number of different words, mean turn length, and type-token ratios.[1] Findings indicate that the experimental groups made more gains in the observed language variables than the comparison groups for both the moderate and the highly verbal groups. Differences between experimental and comparison groups as well as between moderate and highly verbal groups were observed. Greatest differences were found in participants' total number of words and number of different words. These differences were strongest after two years of intervention. With intervention, participants communicated with their peers in a naturalistic social setting using a larger total number of words and a larger total number of different words than before receiving intervention and compared to participants not receiving intervention. Results from the pilot study further support the call for explicit instruction in social competence for individuals with ASD.

Autism spectrum disorder (ASD) is a lifelong pervasive developmental disorder that includes restricted interests and repetitive behaviours which can have significant impact on social interaction and social communication (American Psychiatric Association [APA], 2013). Social competence deficits are a core symptom of ASD (APA, 2013; Krasny, Williams, Provencal, & Ozonoff, 2003). Social competence deficits alone can greatly impact an individual's ability to form friendships and integrate meaningfully into society.

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1   For definitions of mean turn length and type-token ratio, see Table 2

According to the National Professional Center on ASD (Wong et al., 2015) and the National Standards Project (Wilczynski et al., 2009), peer mediated interventions are among the most successful in producing positive change in social competence for individuals with ASD (Cappadocia & Weiss, 2011; Wang, Parrila, & Cui, 2012). These interventions are well suited for promoting a range of social skills development, such as increased initiations and responses to peers (Kamps et al., 2014a; Kamps et al., 2014b), improved affect (Carter, Hughes, Guth & Copeland, 2005), gaining attention (Thiemann & Goldstein, 2001), and increased appropriate talking (Chung et al., 2007).

Despite an impressive body of research on peer-mediated interventions, limited attention has focused on programming and generalization of skills within the context of peer inclusive groups such as those found in school settings. Further, few programs have addressed building social competence with peers combined with content area instruction (e.g., literacy) required for academic success (Mirenda, 2003). Recent work by Kamps and colleagues aimed to address this gap by combining a peer mediated social intervention with small group literacy instruction to create the peer networks intervention (see Kamps et al., 2014a; Kamps et al., 2014b). The current pilot study took place within the context of the development and implementation of the peer networks intervention, and the video probes that serve as the primary data source for this project were collected in the context of this project. The current study used these videos for transcription analysis so as to investigate language variance among study participants.

The focus of the current pilot study was to explore the impact of the peer networks intervention on participants' language development as well as what impact language skills might have on the peer networks study outcomes. Autism spectrum disorders present wide variability in language skills (Lord, Risi, & Pickles, 2004); many children with ASD have normal-to-advanced linguistic abilities while other children are markedly impaired (Tager-Flusberg & Joseph, 2003). Research suggests that most children with ASD have significant delays in acquiring language, with about half remaining functionally non-verbal (Bailey, Phillips, & Rutter, 1996; Tager-Flusberg & Joseph, 2003).

Even children with ASD who do acquire the use of spontaneous language typically exhibit deficits in vocabulary and the acquisition of complex syntax (Bartak, Rutter, & Cox, 1975). Given the wide variability in language ability among individuals with ASD, we sought to evaluate this variable in more detail beyond the peer networks intervention study.

The Peer Networks Intervention

The pilot study reported here is part of the peer networks intervention (Kamps et al., 2014a; Kamps, et al., 2014b), a two-year intervention project that takes place from the beginning of kindergarten until the end of first grade. Using teacher-led, small groups (including neuro-typical peers) and peer-led play, the intervention includes a combination social and academic peer-inclusive interventions to improve social communication skills and early literacy as well as classroom survival skills (e.g., group participation, peer interactions) for young children with ASD. The intervention consists of two inter-related components: (1) Social Peer Networks focusing on social communication skills and (2) Reading Peer Networks focusing on literacy. The Social Peer Networks provides instruction and practice in critical social communication skills with peers and generalization programming to promote skill use across settings. The Reading Peer Networks provides a reading curriculum for small groups with peers using teacher-led direct instruction in early literacy skills and peer tutoring using supplemental reading activities. Supportive activities with peers provide multiple practice opportunities in literacy skills while providing social interaction with peers. The social peer networks and reading peer networks intervention components are described below.

Social peer networks. The peer networks intervention consisted of social groups to teach social and communication skills using games and age-appropriate play activities (e.g., card games, popular board games). Peer network groups were designed to provide structured interactions with typical peers using toys and games that allowed for multiple practice opportunities to improve reciprocal social communication (Kamps et al., 2002; Thiemann & Goldstein, 2004). Specific skills taught in the group included (a) requests and shares,

(b) comments about one's own play (activities, or personal actions on objects), (c) comments about others' play (activities, or peer actions on objects, (d) niceties (e.g., please, thank-you, compliments), and (e) play organizers (e.g., talk about ways to play, and taking turns).

Reading peer networks. The direct instruction curriculum *Reading Mastery* (Osborn, 1995) was selected for the Reading Peer Networks. *Reading Mastery* is intended for use in kindergarten through fifth grade. The curriculum helps develop decoding, word recognition, spelling, and comprehension skills through daily, explicit, systematic lessons that include teacher modeling, carefully selected examples, guided practice, repetition and elaboration (Osborn, 1995). *Reading Mastery* is designed for use with students with disabilities, including learning disabilities, mental retardation, behavioural disabilities, autism, developmental delay and traumatic brain injury.

Methods

The peer networks intervention, from which the current study is derived, has established success empirically in improving social communication skills for children with ASD (Kamps et al., 2014a; Kamps, et al., 2014b). This study sought to take a closer look at the discrete changes in participant's language development, taking into account their varying baseline language capabilities. The research questions (RQs) that guided the pilot study were: RQ1: How does participation in the peer networks intervention impact participant's language as measured by changes in participant's total number of completed words, total number of different words, mean turn length, and type-token ratios as compared to a control group? RQ2: How does participation in the peer networks intervention impact moderately verbal participant's language as compared to highly verbal participants? The Human Research Protection Program at the University of Kansas approved all methods and procedures included in the pilot study.

Participants

Sixteen participants were randomly selected from the larger peer networks intervention for participation in this pilot study. Due to the time-intensive nature of video transcription, a representative sample was selected from the larger sample. The inclusion criteria for the peer networks intervention included: (1) a confirmed educational identification of ASD through reports from school personnel or parent reports of clinical evaluations confirming autism; (2) moderate to high functioning level based on school reports of functional communication such as the ability to make requests, and use of two to three word phrases; (3) ability to follow simple directions; and (4) a standard score of 50 or greater on the Peabody Picture Vocabulary Test 4 (PPVT-4; Dunn & Dunn, 2007).

Study participants were classified into two groups based on the number of communicative acts (verbal initiation or response to a peer) evoked during three 10-minute baseline video probes. Students with 15–24 communicative acts were assigned to the moderate language group and those with 25 or more were assigned to the advanced language group. Baseline video probes were taken before the beginning of intervention. To ensure group similarity, experimental and control groups were matched on results from the Childhood Autism Rating Scale (CARS; Schopler, Reichler & Renner, 1988) and the PPVT-4. Table 1 provides detailed individual participant characteristics. In the text, individual children have been denoted by pseudonyms.

Pilot Study Design and Procedures

Pre-post measures were used to determine changes in expressive language skills between the participants enrolled in the peer networks intervention versus those in the comparison group. For a comprehensive overview of the methods and procedures of the larger peer networks intervention, see Kamps and colleagues (2014b). For the pilot study, video probes were collected at three different time periods: (1) during baseline, before the peer networks intervention began; (2) at the end of one year of intervention; and (3) after two years of intervention.

The video probes were designed to capture child-peer interaction and language use in more naturalistic social settings with multiple choices of games and activities. Each probe consisted of three students (one child with ASD and two neurotypical peers) at a table with pre-selected

Table 1. Participant Characteristics

Group	Gender	Age	CARS Total Score	PPVT-4 Standard Score
Experimental Highly Verbal				
Maria	F	5y 9m	23	104
Josh	M	5y 4m	39.5	89
Ellen	F	5y 11m	36	72
Jack	M	5y 6m	34	135
Comparison Highly Verbal				
Peter	M	7y 1m	34	84
John	M	5y 11m	24	112
Tricia	F	6y 0m	33	75
Joan	F	5y 11m	30.5	87
Experimental Moderate				
Rob	M	5y 10m	35	74
Evan	M	5y 11m	35	86
Andrew	M	5y 10m	27.5	77
Ryan	M	5y 6m	34.5	72
Comparison Moderate				
Joe	M	7y 6m	30	105
Anne	F	7y 6m	29.5	78
Bill	M	5y 0m	30	99
Mark	M	4y 11m	29	68

social games. The three games available during kindergarten were: Ned's Head®, a memory game, and a puzzle or card game. During first grade, Zingo® was substituted for Ned's Head. Children were told they could have 10 minutes of free play, and the only rules were: (1) stay at the table, (2) play with items on the table, and (3) be nice to your friends. The same set of social games was used for all nine video probes. There was no adult prompting or interruption for the 10-min probe. Participant interactions were video recorded by project staff for later coding and analysis.

A total of eight children with ASD comprised the experimental group, for which a total of 24 pre-intervention video probes, 24 mid-project probes, and 16 post-intervention video probes were collected. Similarly, eight children with ASD comprised the participants in the control group, for which a total of 24 probes were collected at the beginning of kindergarten, 24 at the end of kindergarten, and 16 at the end of first grade. Baseline video probes allowed for comparison of participants' expressive language abilities before and after the intervention. Treatment probes at the end of year one and at the end of year two allowed for comparison both between and within intervention phases of the groups.

The first author and two trained staff members transcribed the 128 ten-minute video probes. We adopted a language sample analysis approach (LSA), as this method of analysis is

well established in the both the research literature and in clinical practice (Donaldson, 1986; Hart & Risley, 1995; Slobin, 1985; Southwood & Russell, 2004). LSA is used for describing language production and for monitoring change associated with linguistic development, variation in linguistic contexts, and change from intervention (Miller, Andriacchi & Nockerts, 2016). The Systematic Analysis of Language Transcripts (SALT; Miller & Iglesias, 2012) software package was used to facilitate the transcription of the video probes. Transcribers trained until they were able to achieve an 80% rate of agreement in their transcriptions. The transcripts were analyzed by using SALT's built-in "Standard Measures" analysis features. The standard measures that were used were Total Completed Words, Number of Different Words, Number of Total Words, and Type-Token Ratio. Table 2 provides operational definitions of these variables.

Inter-Observer Agreement

Inter-observer agreement was calculated for 32 (25%) of the transcription files. Best practice in single case research design recommends assess-

ing inter-observer agreement for a minimum of 20% of all sessions (Kratochwill et al., 2010). Transcription files were randomly selected with equal representation from the moderate group (16) and the highly verbal group (16). Final agreement was 85.7%. Inter-observer agreement summaries are provided in Table 3.

Results

In this section, we present the data gleaned using the methods described above. Data in each sub-section are organized by experimental and comparison groups. Moderate participants' results are presented first, followed by highly verbal participants' results.

Total Number of Completed Words

For the moderate participants, total completed words (TCW) are represented in Figures 1 and 2. Figure 1 shows an increasing trend from baseline to year one probes and then a substantial increase from year one probes to year two probes for all four participants in the moderate experimental group. The moderate comparison

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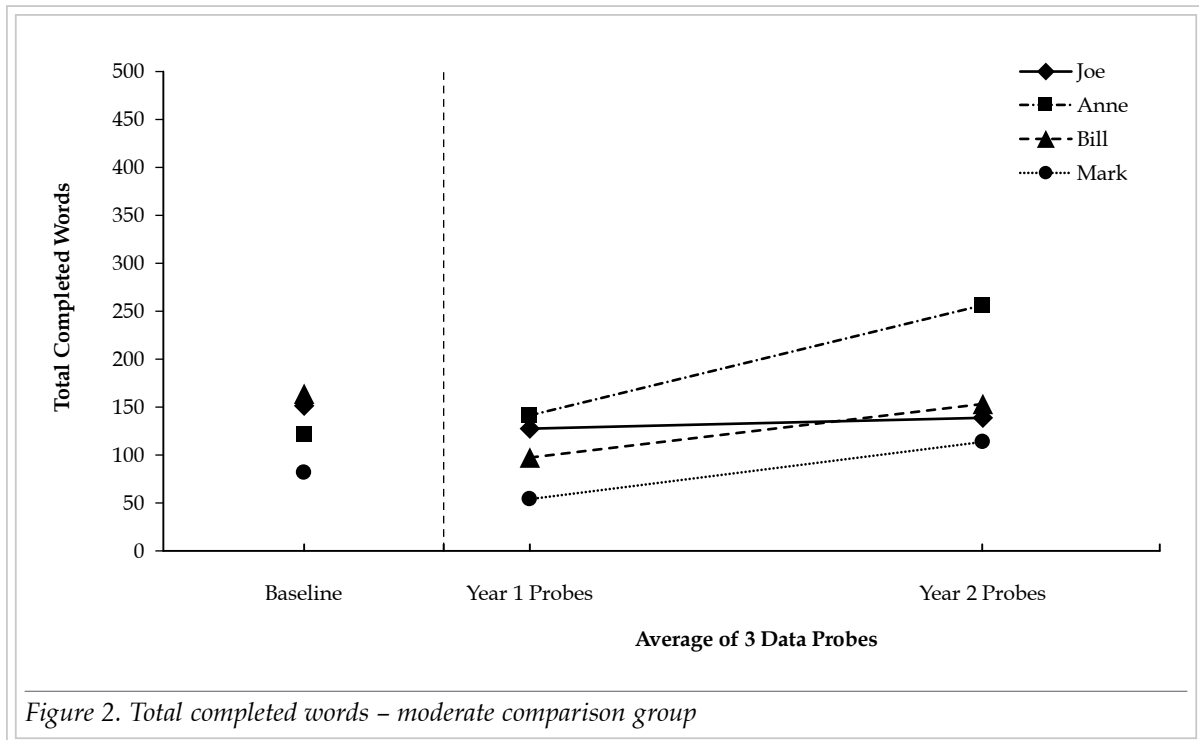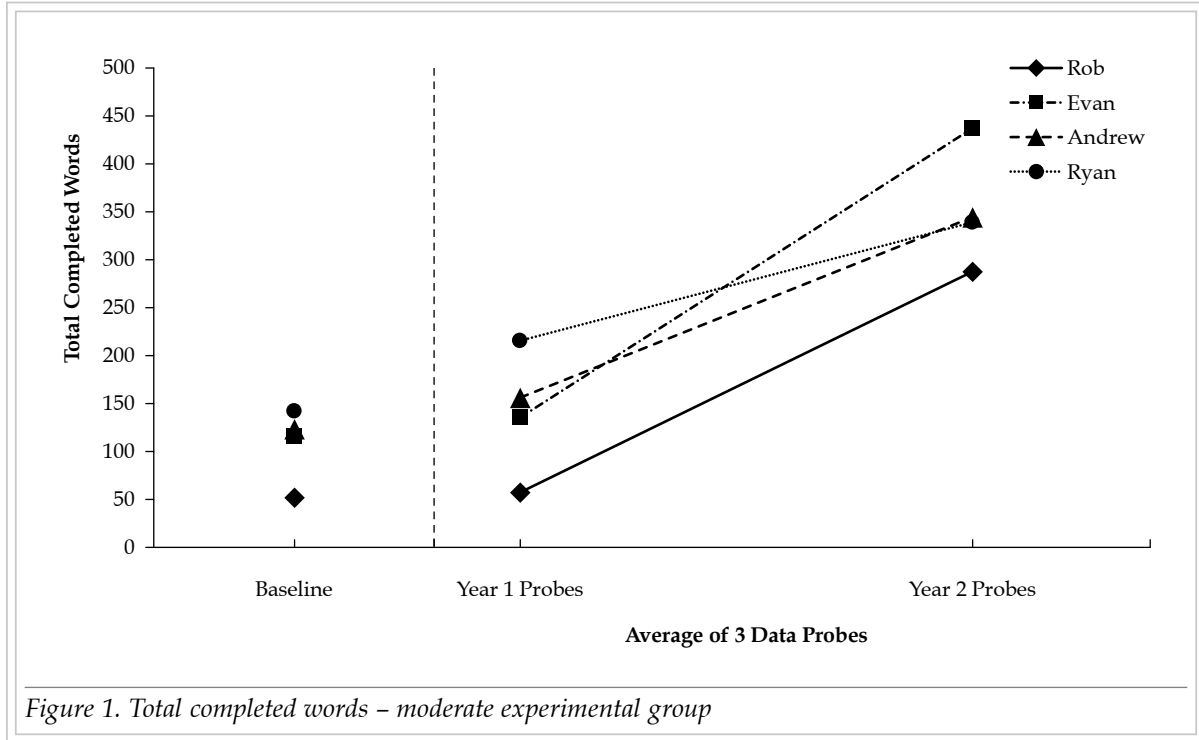*Table 2. Definitions of Systematic Analysis of* Language *Transcripts [SALT] Language Measures*

Dependent Variable	Definition
Total Number of Completed Words (TCW)	The total number of words spoken.
Total Number of Different Words (TDW)	The number of different word roots.
Mean Turn Length (MTL)	The length of the conversational turn in a reciprocal conversation measured in number of words.
Type-Token Ratio (TTR)	A ratio of different words to total words (measures vocabulary variation). The "token" is the total number of words used and the "type" is the number of different words used.

Table 3. Inter-Observer Agreement for Highly Verbal and Moderate Groups.

	Experimental	*Control*	*Experimental & Control*
Highly verbal group	83.1%	85.5%	84.7%
Moderate group	82.5%	93.8%	86.6%
		Total Agreement:	85.7%

group (Figure 2) did not show the same increasing trend from baseline to year two probes. All four of the comparison group showed an increase from year one probes to year two probes for TCW, albeit not as pronounced.
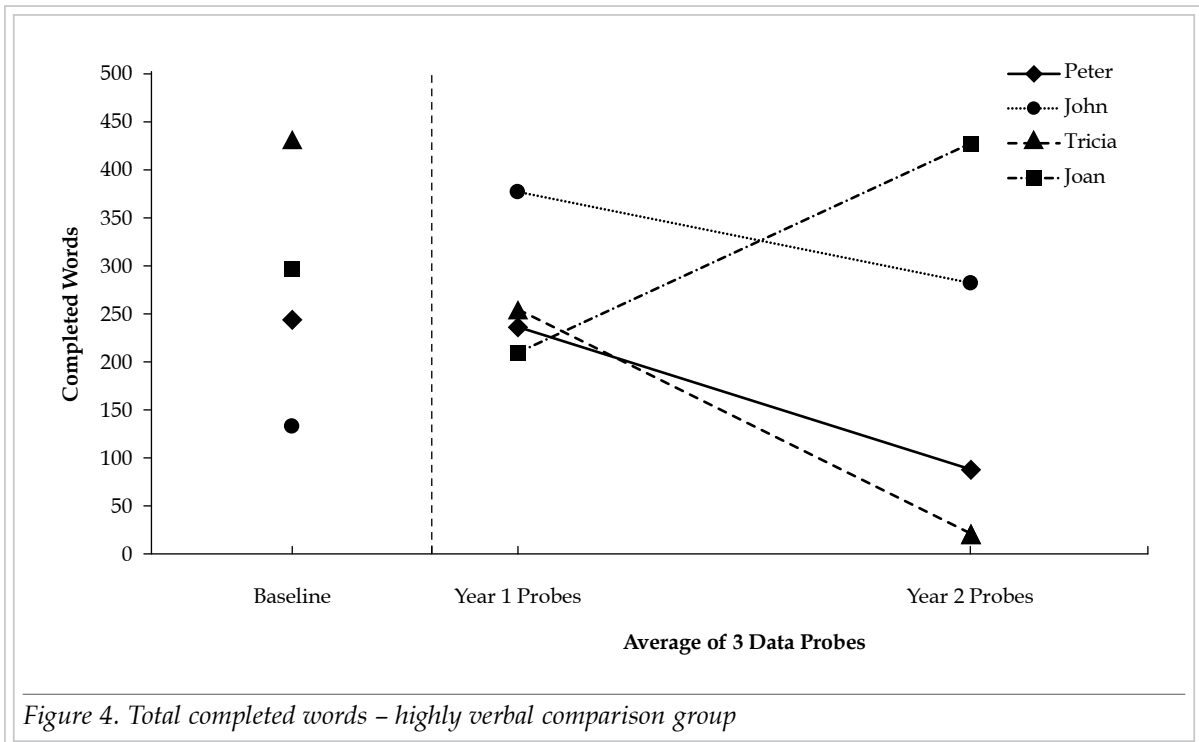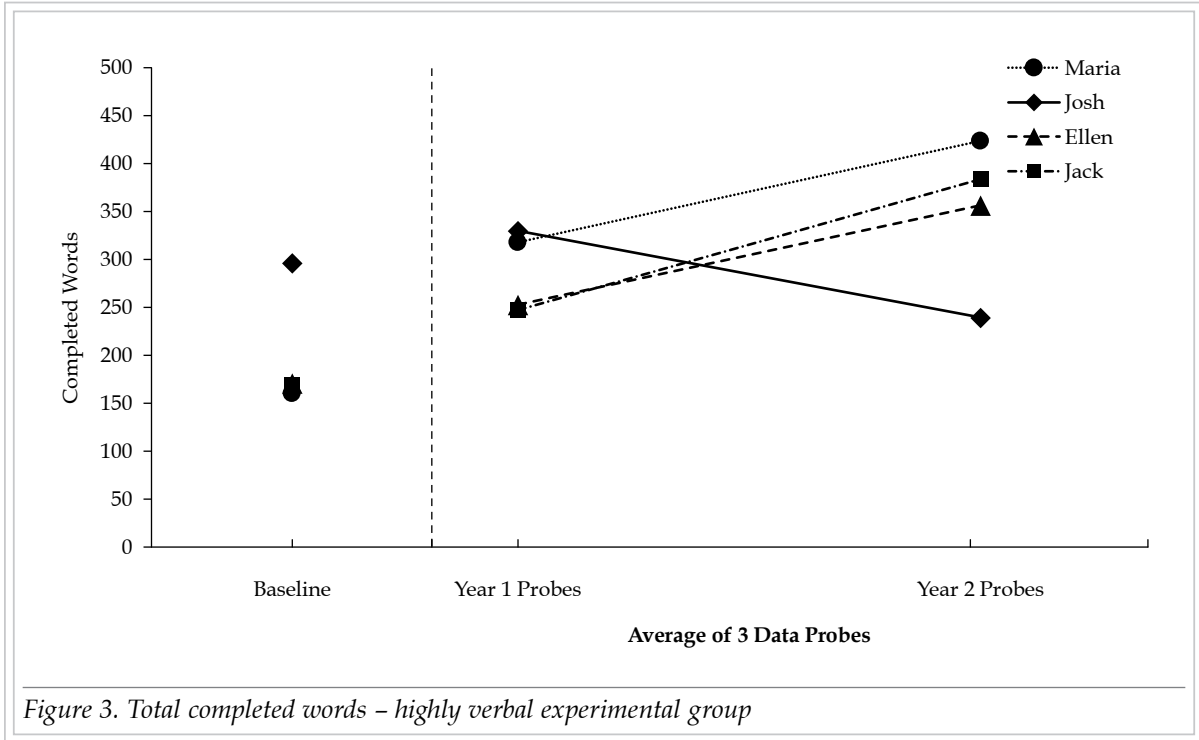
For highly verbal participants, data for TCW are represented in Figures 3 and 4. Figure 3 indicates the highly verbal experimental group showed a similar pattern to the moderate group for TCW, with three participants showing an

Figure 1. Total completed words – moderate experimental group

Figure 2. Total completed words – moderate comparison group

increasing trend from baseline through year two probes. The highly verbal comparison group exhibited variable results for TCW (see Figure 4).

Total Number of Different Words

For the moderate groups, data for total number of different words (TDW) is represented in Figures 5 and 6. With the exception of one

Figure 3. Total completed words – highly verbal experimental group

Figure 4. Total completed words – highly verbal comparison group

participant, all participants in the moderate experimental group showed the same increasing trend from baseline to year one probes and from year one to year two probes. In the moderate comparison group, only one student showed an increasing trend.

For the highly verbal groups, data for TDW is represented in Figures 7 and 8 on the following page. Figure 7 illustrates that Maria and Jack both showed an increasing trend from baseline all the way through the year two probes. Both Josh and Ellen showed an increase from baseline to year one probes but then decreased from year one to year two probes; however, their year two probes remained higher than baseline levels. The highly verbal comparison group again showed variable patterns among the participants (see Figure 8).

Type-Token Ratios

For the moderate participants, type-token ratios (TTR) are summarized in Table 4. In the moderate experimental group both Rob and Andrew increased TTR slightly in the year one probes
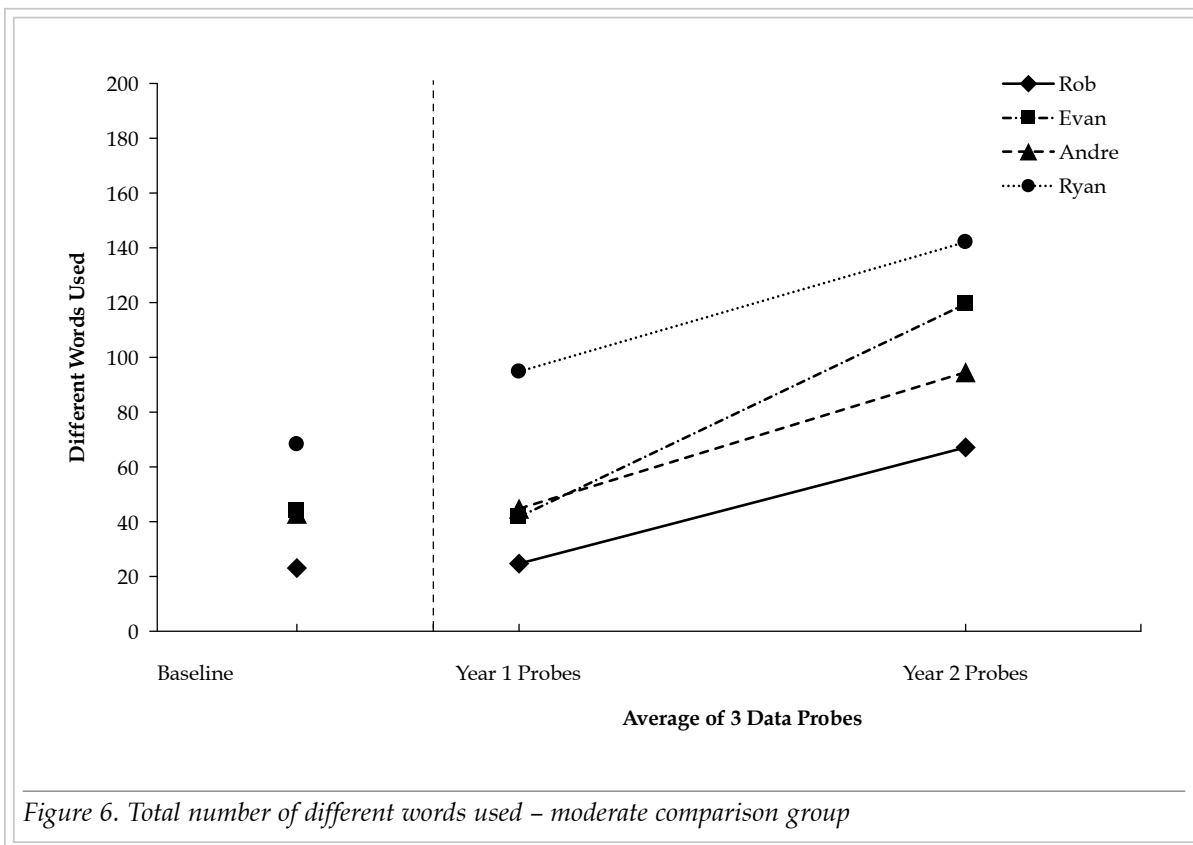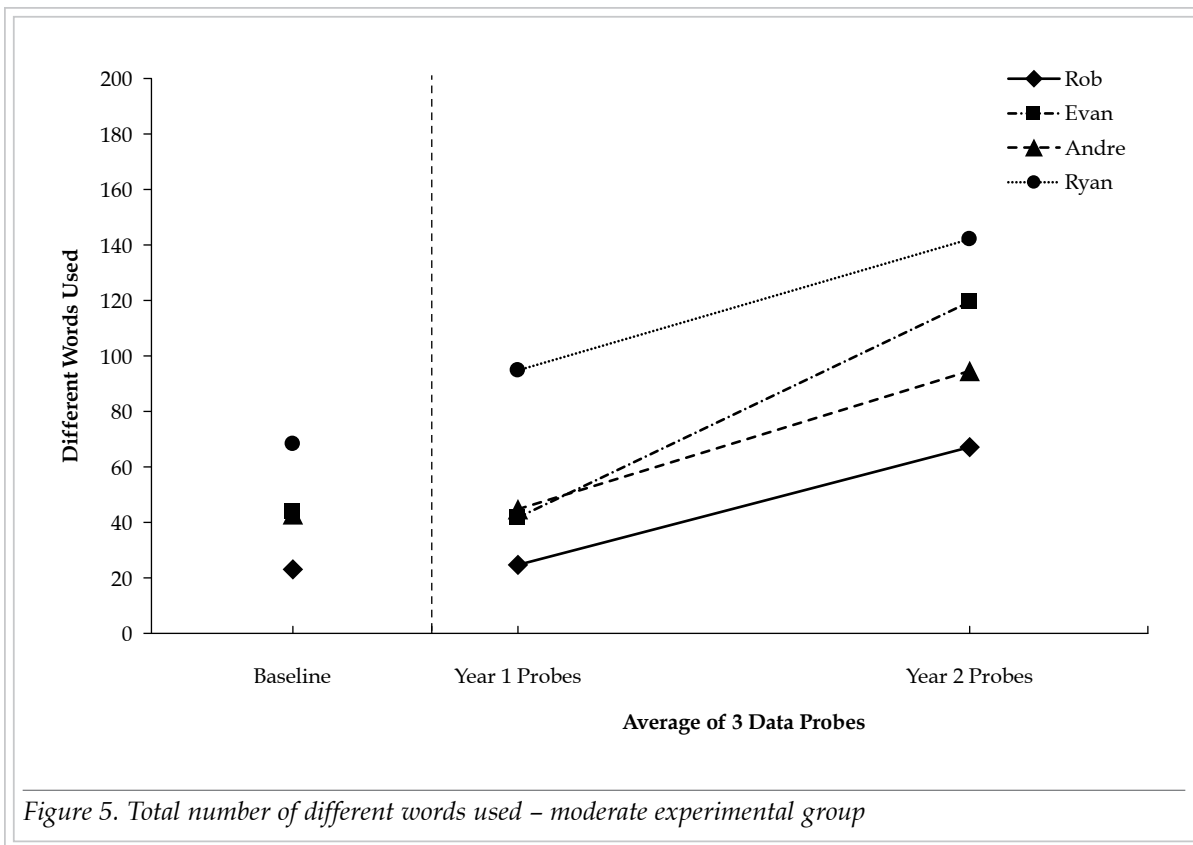
compared to baseline levels but then decreased in the year two probes. Evan made no change from baseline levels to year one probes and Ryan decreased. Both Evan and Ryan's TTR decreased from year one probes to year two probes. A similar trend was found in the moderate comparison group. All participants in this group increased TTR in the year one probes from baseline levels, yet decreased from year one probes to year two probes.
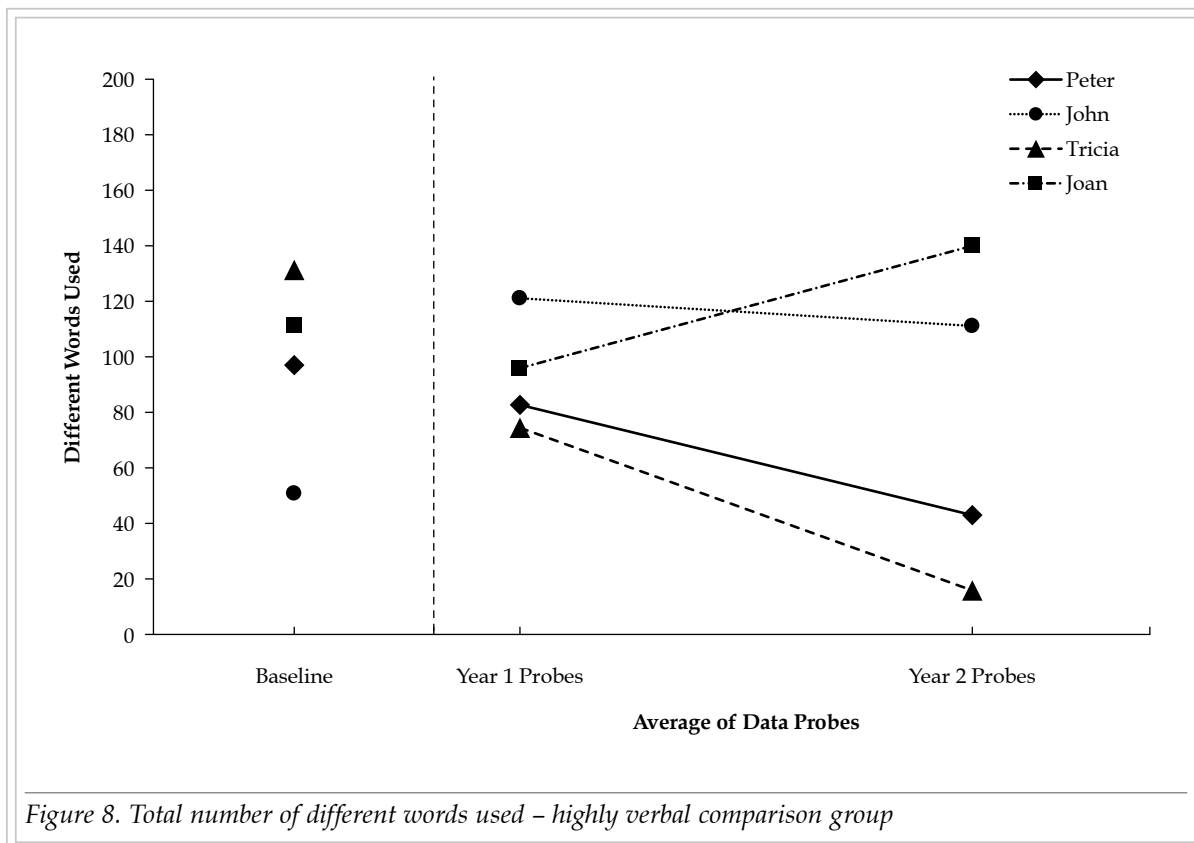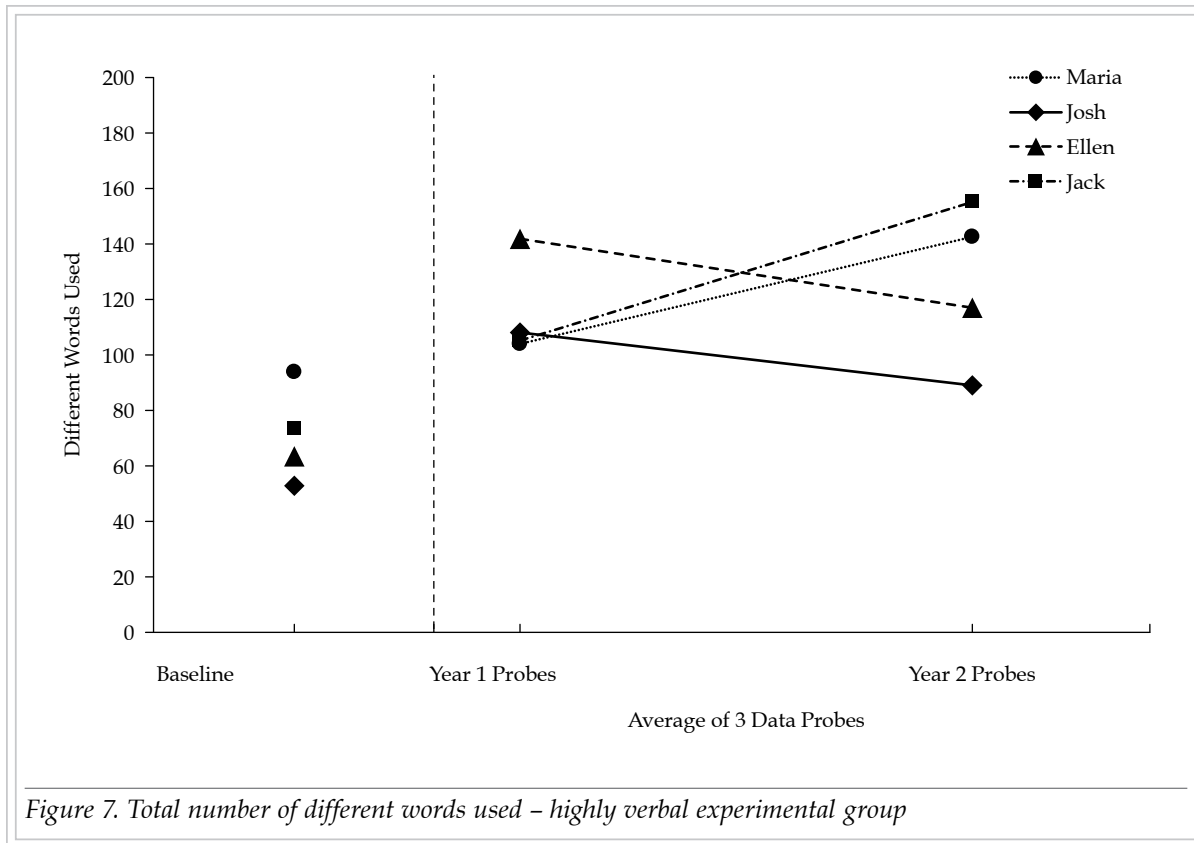
For the highly verbal participants, TTR data are summarized in Table 5. In the highly verbal experimental group, Josh and Ellen increased their TTR in the year one probes from baseline and Maria and Jack decreased. All participants in this group had a decrease from year one to year two probes except for Josh. For the highly verbal comparison group Tricia and Joan made no change in the year one probes from baseline levels and John and Peter decreased. During the year two probes two students increased from the year one probes. John made no change and Joan had a decrease in her TTR.

Table 4. Moderate Group

Participants	Total Number Completed Words				Total Number of Different Words				Type Token Ratio				Mean Turn Length			
	B	*Yr 1*	*Yr 2*	*% +/-*	*B*	*Yr1*	*Yr 2*	*% +/-*	*B*	*Yr1*	*Yr2*	*% +/-*	*B*	*Yr1*	*Yr2*	*% +/-*
Experimental																
Rob	52	57	287	452	23	25	67	191	.62	.69	.30	-52	26	4	4	-85
Evan	116	135	438	277	44	42	120	172	.48	.48	.34	-29	4	3	7	75
Andrew	124	156	345	178	43	45	95	121	.55	.57	.43	-22	4	3	6	50
Ryan	142	216	339	138	68	95	142	109	.56	.50	.47	-16	9	7	10	11
Comparison																
Joe	115	128	139	21	58	71	61	5	.44	.59	.45	2	23	4	3	-87
Anne	121	141	256	111	58	63	107	84	.62	.63	.50	-19	3	4	4	33
Bill	164	97	153	-67	62	46	68	10	.53	.74	.56	6	4	3	4	0
Mark	82	54	114	39	39	28	40	3	.59	.66	.56	-5	3	3	4	33

Notes: Baseline (B) and Treatment 1 (Yr1) is the average of three data points and Year 2 (Yr2) is the average of two data points.
% +/- is the percent change from baseline to year two.

Figure 5. Total number of different words used – moderate experimental group

Figure 6. Total number of different words used – moderate comparison group

Figure 7. Total number of different words used – highly verbal experimental group

Figure 8. Total number of different words used – highly verbal comparison group

Mean Turn Length

For the moderate groups, mean turn length (MTL) is represented in Table 4. The trend indicates little change in the moderate experimental group from baseline to year two probes. Rob exhibited an extremely high MTL in baseline but then remained at much lower levels during year one and year two probes. The other three participants made very slight improvements when comparing year two probes to baseline. The moderate comparison group's data present a similar trend. Joe had an extremely high MTL in baseline but decreased to much lower levels in year one and year two probes. There was almost no change in MTL for Anne, Bill, or Mark.

For the highly verbal groups, MTL is represented in Table 5. Similarly to the moderate groups, both the highly verbal experimental and the comparison groups showed very little change in MTL from baseline to year one probes and from year one to year two probes. The most substantial change is seen in Tricia's data from year one to year two probes, increasing from an average of 5 words per conversational turn to 21 words per conversational turn.

Discussion

This pilot study sought to explore discrete changes in language development of peer networks intervention participants. The specific questions that guided this study focused on how participation in the peer networks intervention might impact participant's language as compared to a control group (RQ1) and moderately verbal participants' language as compared to highly verbal participants (RQ2). Four primary findings emerged from data analysis: (1) differences were found in observed language variables between experimental and comparison groups, (2) participants in the moderate experimental group made greater gains than those in the highly verbal experimental group, (3) gains observed for all experimental groups for the TCW and the TDW variables were greater, in general, from year one to year two than from baseline to year one, and (4) measures of TTR and MTL showed no noticeable changes across groups and conditions.

The experimental groups made more gains in the observed language variables than the

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Table 5. Highly Verbal Group

Participants	Total Number Completed Words				Total Number of Different Words				Type Token Ratio				Mean Turn Length			
	B	Yr1	Yr2	% +/-	B	Yr1	Yr2	% +/-	B	Yr1	Yr2	% +/-	B	Yr1	Yr2	% +/-
Experimental																
Maria	161	318	424	163	94	104	143	52	.43	.38	.36	-16	13	6	8	-38
Evan	116	135	438	277	44	42	120	172	.48	.48	.34	-29	4	3	7	75
Andrew	124	156	345	178	43	45	95	121	.55	.57	.43	-22	4	3	6	50
Ryan	142	216	339	138	68	95	142	109	.56	.50	.47	-16	9	7	10	11
Comparison																
Joe	115	128	139	21	58	71	61	5	.44	.59	.45	2	23	4	3	-87
Anne	121	141	256	111	58	63	107	84	.62	.63	.50	-19	3	4	4	33
Bill	164	97	153	-67	62	46	68	10	.53	.74	.56	6	4	3	4	0
Mark	82	54	114	39	39	28	40	3	.59	.66	.56	-5	3	3	4	33

Notes: Baseline (B) and Treatment 1 (Yr1) is the average of three data points and Year 2 (Yr2) is the average of two data points.
% +/- is the percent change from baseline to year two.

comparison groups for both the moderate and the highly verbal groups. The most significant changes were seen in the TCW and the TDW dependent variables. This indicates participants receiving the peer networks intervention communicated with their peers in a naturalistic social setting using a larger total number of words and larger total number of different words than before receiving intervention. These results suggest that the specific social communication skills taught in the peer networks intervention (requesting, commenting, play organizer etc.) could have resulted in changes for participants in the experimental groups. Additionally, these findings provide some evidence that skills acquired during intervention may have generalized to a non-instructional setting. This finding is promising in general, given that a noted concern in the literature is a lack of generalization of social skills learned during intervention (Bellini, Peters, Benner, & Hopf, 2007; McConnell, 2002; Rao, Beidel, & Murray, 2008), and for the peer networks intervention specifically, since the true efficacy of any social skills intervention is the generalization of skills to novel settings (Bellini, et al., 2007).

Findings also suggest that gains in TCW and TDW, both in the moderate and in the highly verbal experimental groups, were stronger after the second year of intervention. This underscores the importance of continuous, comprehensive social programs for children with autism in the early elementary years and beyond. We do not claim the peer networks intervention becomes more effective over time. Indeed, it could be the case that participants are simply developing naturally and their language abilities are developing concurrently. However, most individuals with ASD do not independently develop social competence (Krasny et al., 2003). Research indicates that a lack of these skills can lead to negative outcomes in adulthood (Gutstein & Whitney, 2002; Howlin, 2004), such as an inability to secure and maintain employment (Taylor & Seltzer, 2011), live independently (Szatmari, Bartolucci, & Bremner, 1989), and have intimate relationships (Howlin, Mawhood, & Rutter, 2000), as well as a number of other risk factors (Howlin, 2004). In order to ameliorate these potential problems, it is imperative that social competence programming becomes a central and ongoing focus in the educational planning for students on the autism spectrum. However, future research would benefit from a better understanding of the contexts and conditions under which the gains here were made.

The second research question looked at differences in observed language variables between participants in the moderate and the highly verbal groups. Our findings showed that the moderate group made more substantial gains overall than the highly verbal group. The difference in gains may be due to the language deficits of the moderate group being more appropriately matched to the design of the intervention. In the future, in order to increase intervention outcomes for participants considered "highly verbal," the peer networks intervention might consider screening language capabilities before intervention so that more individualized instruction could be created to meet specific needs. This consideration is in line with research on individualized instruction as a best practice for educating students with autism (Iovannone, Dunlap, Huber, & Kincaid, 2003; McConnell, 2002; National Research Council, 2001; Stichter, Randolf, Gage, & Schmidt, 2007).

A final finding was that very little change was observed in the TTR and MTL measures. As noted in Table 2, TTR is a ratio of the measure of vocabulary variation. The "token" is the total number of words used and the "type" is the number of different words used. The higher the variation in vocabulary, the higher was the ratio. MTL is the length of the conversational turn measured in number of words. There may be several reasons that gains were not evident in these two variables. First, language variability is not *specifically* targeted in the peer networks intervention. The goal is to increase social interaction with peers *in general*. Second, the scripted social group lessons used in the peer networks intervention used specific language scripts to prompt language use. Children with ASD can be very literal in their interpretation of social information and may not have deviated from the provided scripts. This could account for both the lack of variability (TTR) and the lack of growth in the MTR.

This pilot study was limited primarily by its design and small sample size. Because the study took place within a larger research pro-

ject, data analysis occurred after the experiment was completed and assessment procedures were standardized to monitor social outcomes, without specific language variables. Data collection limitations were particularly problematic during the end of year two; only two video probes were collected. All other data collection periods consisted of three video probes, therefore impacting the comparison of data between these time periods. Future studies would benefit from using a more rigorous research design, with a larger number of participants. Finally, researchers could not control for maturation effects on language development over the two years of intervention.

In summary, this study reports the outcomes of a pilot study using a subset of participants enrolled in the peer networks project. The focus of the study was to explore the impact of the peer networks intervention on advanced and moderate language ability. Unlike other studies investigating social competence with individuals with ASD, we adopted a language sample analysis approach (SALT) that would afford a more discreet analysis of the change in participant's verbal behaviour. Results indicated differences between experimental and comparison groups as well as between moderate and highly verbal groups. The greatest differences were found in participant's total number of verbalized words and number of different words spoken. These findings suggest the utility of this method of analysis. Future research might consider this level of language assessment in social competence intervention planning and evaluation.

Key Messages From This Article

People with disabilities. Peer networks are an intervention strategy that has proven effective in improving social communication skills for children with autism spectrum disorder. You deserve to have meaningful social relationships. Peer networks may be able to provide the skills necessary to form and maintain these social relationships.

Professionals. Peer mediated interventions have proven effective in improving social communication skills for children with autism spectrum disorder.

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