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A Peer Interaction Package for Students with Autism Spectrum Disorders who Use Speech-Generating Devices

Yun-Ching Chung[1] · Karen H. Douglas[2]

Abstract Three elementary-aged boys with autism spectrum disorder who used speech-generating devices (SGD) and their paraprofessionals participated in a multiple baseline design study. This research evaluated the impact of an intervention package on interactions between the focus student and peers in three inclusive classrooms. Each paraprofessional received 35–50 min of training on strategies (e.g., identifying opportunities, prompting initiations) and self-monitoring procedures. Observational data were collected on students' peer interactions, use of SGD, and paraprofessional prompts. Information on social validity was gathered through student interviews and staff questionnaires. Results showed increased reciprocal interactions between focus students and their peer partners and increased students' use of SGD and gestures during peer interactions. Spillover interactions with other peers were observed in two of three classrooms. All paraprofessionals provided additional prompts to further facilitate initiations between focus students and peer partners. Social validity responses from participating students, peers, and school personnel strengthened the social importance of this study. Implications and recommendations will be provided for practitioners and researchers who wish to improve social outcomes of students who use SGD.

Keywords Inclusion · Peer interactions · Augmentative and alternative communication · Paraprofessionals

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Over the past decade, students with severe disabilities have gradually increased their access and presence in general education classrooms following the mandate of the Individuals with Disabilities Education Act (Williamson et al. 2006). For many parents and educators, inclusion is embedded with rich opportunities for increased peer interactions, enhanced diversity awareness, improved communication skills, and expanded social networks that can benefit both students with and without disabilities (Carter et al. 2012; Jackson et al. 2008). Not only has inclusion been advocated as a fundamental human right, a range of research also demonstrated positive impacts and documented the social importance as a result of the implementation of inclusion practices (Carter et al. 2010; Hudson et al. 2013). However, despite these philosophical and experimental supports, educational teams continue to encounter challenges in promoting meaningful inclusive experiences for students with severe disabilities. One particular issue having drawn attention among practitioners and researchers is the lack of peer interactions for students with severe disabilities in inclusive classrooms, especially for those who use augmentative and alternative communication (AAC; Chung et al. 2012).

AAC, a system consisted of aided (e.g., pictures, speech-generating devices [SGD]) and/or unaided (e.g., sign language) communication, is often used by students with severe disabilities as a means to support or substitute their speech (Beukelman and Mirenda 2013). The ultimate goal of AAC systems is to promote self-determination and enhance quality of life for students with severe disabilities (van der Meer et al. 2011). Through the use of AAC, students with communication challenges are empowered by having a voice to express what they want, need, and feel. However, students with severe disabilities tend to be socially isolated despite the provision of AAC. Literature indicated that AAC users reported feeling loneliness, wanting peer acceptance, and having poor self-images (Beck et al. 2000; Lilienfeld and Alant 2005). Even when attending general education classrooms, students who use AAC primarily interacted with their support personnel and had few interactions with their classmates without disabilities (Chung et al. 2012). Chung and her colleagues conducted four observations for each of the 16 students who used AAC in inclusive classrooms (e.g., art, science) and reported 89.4 % of the students' interaction exchanges occurred solely with adults. In addition, four students were never observed interacting with their peers during these observations.

Researchers and advocates have argued that inadequate training and support for paraprofessionals may contribute to students' limited peer interactions in inclusive classrooms (Broer et al. 2005). Many students with severe disabilities receive one-on-one support from paraprofessionals throughout the day. This service delivery model is intended to enhance student learning through direct support and to increase students' access to the general education curriculum through team collaboration (Minondo et al. 2001). However, substantial concerns are raised as many paraprofessionals often received limited training and supervision from licensed educators (Giangreco et al. 2010). In addition, paraprofessionals oftentimes lack training in specific support strategies such as promoting the use of AAC or increasing communication (Bingham et al. 2007).

Several unintended consequences have been associated with the misuse and/or overreliance of paraprofessionals (Ghere and York-Barr 2007; Giangreco and Broer 2005). According to self-reports and observations, students with disabilities experienced

learned helplessness, stigmatization, and few opportunities to engage in interactions with classroom teachers (Giangreco 2010; Malmgren and Causton-Theoharis 2006). In addition, the position of students with disabilities in a separate area, coupling with the close proximity of paraprofessionals, could adversely impact social interactions among students with and without disabilities (Malmgren and Causton-Theoharis).

Clearly, there is a significant need to better prepare paraprofessionals for promoting meaningful inclusion outcomes of students with severe disabilities. Several studies have documented positive outcomes following paraprofessionals receiving training and feedback (Giangreco et al. 2010). Across content areas and training formats, participating paraprofessionals acquired new knowledge and effectively applied strategies to facilitate student learning and interactions. Despite the promising findings from their review, Giangreco et al. concluded that paraprofessional training remains an area that needs additional research. Specifically, only two intervention studies have involved paraprofessionals in increasing peer interactions for students with severe disabilities who use AAC in general education classrooms (i.e., Causton-Theoharis and Malmgren 2005; Chung and Carter 2013).

Causton-Theoharis and Malmgren (2005) delivered individual training to paraprofessionals supporting four elementary school boys with severe disabilities in inclusive settings. The students' communication profiles ranged from single words to short phrases. Two students used sign language. The training activities lasted 4 h, including "(a) enhancing perspective, (b) establishing the importance of peer interaction, (c) clarifying the paraprofessional's role in facilitating interactions, and (d) increasing the paraprofessional's knowledge base of strategies for facilitating interactions" (p. 434). Following the training, all paraprofessionals demonstrated more facilitative behaviors, such as ensuring that the student was next to his peers, teaching classmates to use sign to communicate with the student, and establishing a partner system for the student. Increased social interactions were observed for all four students. Furthermore, compared to the baseline condition, the rate of students' peer interactions per min increased 25 times across the four students.

In another study, Chung and Carter (2013) evaluated an intervention combining paraprofessional and peer training with two students with an intellectual disability who used SGD in four general education classrooms. Each paraprofessional received a total of 2 to 2.5 h of training over three or four individual meetings and was taught the PACKERS facilitative strategy adapted from previous research: "(a) proximity to peers, (b) access to device, (c) create opportunity, (d) keep monitoring, (e) encourage students, (f) reduce support, and (g) score interactions" (p. 97). Paraprofessionals provided specific verbal praise to encourage future interactions. In addition, the researchers asked classroom teachers to recruit one to two peer partners from each inclusive classroom. In a 45-min meeting, peer partners received information on the student's SGD, strategies to interact with the focus student, and confidentiality issues. As a result, students' peer interactions increased in three classrooms and SGD usage slightly increased across four classrooms.

Building upon the success of previous intervention research involving paraprofessionals, this present study was designed to expand the knowledge base of the impact of paraprofessional facilitation in inclusive classrooms. Our research questions included: (a) Is there a functional relation between the intervention package and the peer interactions of students with autism spectrum disorder (ASD) who use SGD in the

general education classroom? (b) Will paraprofessionals increase their facilitative behaviors following training? and (c) How will students, peers, paraprofessionals, and teachers perceive the social validity of the intervention?

Method

Participants

Table 1 summarized participant information for the three focus students, three paraprofessionals, six peer partners, two general educators, two special educators, and one speech language pathologist (SLP). The focus students with disabilities attended a Midwestern elementary school and met the following criteria: (a) received special education services under the ASD or intellectual disability category, (b) used a SGD to communicate and could activate messages independently or with prompts, and (c) attended at least one general education class regularly with one-on-one paraprofessional support in addition to recess and lunch.

Three boys with ASD, Sean, Casey, and Adam, attended inclusive library, art A, and art B classes, respectively. According to their individualized education programs (IEPs), no formal cognitive assessment had been administrated. Both Sean and Adam were estimated as having an IQ that is significantly below average. Casey has intellectual disability and received scores of low levels in the communication, daily living skills, and socialization domains on the Vineland Adaptive Behavior Rating Scales-II (Sparrow et al. 2006). These three focus students participated in the statewide alternate assessment and received speech-language services for 90 min weekly. All used Proloquo2Go with SymbolStix symbols on their SGD with an adult female (Sean and Adam's SGD) or a young boy (Casey's SGD) voice output. Both Sean and Adam used shoulder straps to carry their SGD. Casey wore his iPod Touch on his left wrist due to his left-side hemiplegia. While Sean and Adam used their SGD as their primary communication mode, Casey used fingerspelling and simple signs in addition to his SGD.

Jane, Todd, and Patricia were the paraprofessionals supporting the focus students in the inclusive classrooms. Jane was the only paraprofessional who reported having a K-9 elementary teaching license and receiving training on communication devices prior to the project. None of the paraprofessionals had training on strategies used to promote peer interactions. For each general education class, the homeroom teacher was asked to invite two peers whom they thought would have appropriate skills to serve as peer partners. No other specific criterion was provided to the teacher. A total of six boys were invited and all provided permission to participate. Each focus student's general educator, special educator, and SLP were also invited to participate in the study by completing a social validation questionnaire following the intervention.

School and Classrooms

The elementary school enrolled about 500 students with a racial/ethnic distribution of 65 % European American, 20 % Asian, 6 % African American, 5 % multi races/ethnics,

Table 1 Participant Information

Classroom	Library	Art A	Art B

Focus students
  Race/gender
  Speech
  Current SGD
  Previous SGD
  FRM eligibility
  IEP goals[a]
	Sean, 10 years old, 5th grade
	  African American male
	  Single words
	  Proloquo2Go on iAdapter4
	  DynaVox
	  Yes
	  Responding to Wh-questions and sharing information
		Casey, 12 years old, 4th grade
		  European American male
		  Nonverbal
		  Proloquo2Go on iPod touch
		  Not applicable
		  No
		  Responding to Wh-questions and sharing information
			Adam, 10 years old, 5th grade
			  Indian male
			  Nonverbal
			  Proloquo2Go on iAdapter4
			  Tech/Speak 32
			  No
			  Making requests

Paraprofessionals	Jane
	  European American female
	  Bachelor degree
	  5 years of experience
		Todd
		  European American male
		  Master's degree
		  2 years of experience
			Patricia
			  European American female
			  Associate degree
			  5 years of experience

Peer partners	Nelson and Jeffery, 5th grade
	  European American males
	  A and B grades
		Alex and Jared, 5th grade
		  European American males
		  A and B grades
			Logan and Josh, 5th grade
			  European American males
			  C and B grades

General educators	Joanna
	  European American female
	  Master's degree
	  33 years of experience
		Paige
		  European American female
		  Bachelor degree
		  21 years of experience
			Same as Art A

Special educators	Lisa
	  European American female
	  Master's degree
	  5 years of experience
		Leah
		  European American female
		  Bachelor degree
		  First year of teaching
			Same as for Casey

SLP	Nicole
	  European American female
	  Master's degree
	  5 years of experience
		Same as for Sean	Same as for Sean

FRM free and/or reduced-price meals; *IEP* individualized education program; *SGD* speech-generating device; *SLP* speech language pathologist

[a] Social communication goals that involved SGD use

and 4 % Hispanic. About a quarter of the students received free/reduced-price meals and 1 % of students received special education services. Sean's library, Casey's art, and Adam's art classes had an average of 30, 30, and 28 students, respectively. Casey and Adam attended their art classes in the same physical setting on different days. The full class period was 50 min. However, all focus students were scheduled to attend the last 15 to 20 min of the class period once a week. Thus, we observed each student during the time when he was scheduled to be in the inclusive classroom.

Dependent Variables

Both interval and event recording systems were used to collect data through direct observations. We used 1-min partial interval recording to record the occurrence of students' peer interactions and communication modes. For each interaction exchange, we used event recording to record the number of turns taken by the student or peers to determine if the interaction was reciprocal. We also recorded the number of SGD uses and paraprofessional prompts for initiations. Contextual variables related to proximity and instructional format were also noted using momentary time sampling. Definitions of the dependent variables are listed below.

Peer Interaction Behaviors We defined a peer interaction behavior as any initiation or response provided by the focus student toward a peer or a peer toward the focus student, which may include a range of verbal (e.g., speech, SGD outputs) and/or nonverbal (e.g., gestures, sign language) behaviors. For each peer interaction exchange, we recorded (a) the number of turns (i.e., initiations or responses) and (b) the person (i.e., the focus student, peer partners, or other peers) who took turns. A new peer interaction exchange was coded when (a) there was a 5-second pause between two initiations, (b) a different peer initiated to the focus student, or (c) the focus student initiated to a different peer. A reciprocal peer interaction exchange was defined as at least one response from the focus student or a peer following an initiation from a peer or the focus student. One interval may include multiple peer interaction exchanges that were initiated by the focus students or peers. On the other hand, one peer interaction exchange may occur across intervals.

Use of SGD and other Communication Modes When a peer interaction occurred, we also coded the type of communication mode used by the focus student to initiate or respond to peers. These modes included gestures, sign language, speech, vocalizations, or SGD. If the focus student used his SGD during peer interaction, we also recorded the number of SGD messages produced for each observational period.

Contextual Variables For proximity, we coded if the focus student was in a reachable distance to (a) his SGD, (b) a peer partner, (c) other peers, (d) a paraprofessional, and (e) a general educator. For instructional formats, we coded if the focus student (a) received large-group instruction (i.e., with seven or more classmates), (b) received small-group instruction (i.e., with one to six classmates), (c) received individual instruction, (d) did not receive instruction (e.g., transition or free time), or (e) was absent (e.g., had not yet arrived or left the classroom).

Design and Study Conditions

A non-concurrent multiple baseline design across three student and paraprofessional pairs from three classes was used to evaluate the impact of the intervention (Gast and Ledford 2014). A staggered introduction of the intervention was implemented in a given class when we observed (a) a desirable data pattern (i.e., no trend or low variability) with at least three baseline data points on reciprocal peer interaction (for

Sean, Casey, and Adam), and (b) an immediate increase on the focus student's reciprocal peer interaction sustained over three observations following the intervention in the previous tier (for Casey and Adam). Due to attrition (an original participant moved), Adam was recruited after the intervention began in Sean's class showing a delayed baseline. In addition, we were only able to collect two intervention data points for Adam because of school and class cancellations and his absences.

Baseline Condition No changes were introduced during the baseline condition. We asked paraprofessionals to continue their typical instruction while supporting the focus students during class activities. All focus students sat at separate tables from their peers. The focus students had access to their SGD with messages of greetings, requests (e.g., food or break), and common vocabulary (e.g., colors, animals, and preferred items).

Intervention Condition Upon completing baseline observations, an intervention package consisting of changes in proximity, SGD enhancement, peer awareness, and paraprofessional training was introduced during the intervention condition. This package was designed to enhance the reciprocal peer interactions through a combination of strategies. First, we asked the art teacher to rearrange the class seating to allow the focus students to sit with their peer partners. In library, there was no assigned seating. We simply informed the teacher that the focus student would be sitting with his peer partners. Second, we asked the SLP to check for appropriate peer interaction messages programmed into Proloquo2Go on the SGD for each focus student. The SLP ensured that each SGD had a variety of task-related messages (e.g., "I want to read this book. Turn the page.") and social-related messages (e.g., "What's up? What do you like to do for fun?"). Third, we informed the peer partners about the seating changes and simply told them that the focus student's paraprofessional will help them talk to the focus student. No additional information was provided to the peer partners. Finally, both authors, former special educators and special education faculty, conducted paraprofessional training.

Each paraprofessional received a total of 35 to 50 min training, through a range of one to three individual meetings taking place at a convenient time and place. Jane decided to meet in a conference room during her lunch break and Todd and Patricia chose to meet at a table in the hallway prior to school starting. During the meeting(s), we followed a written outline to (a) share the purpose of the project, (b) provide an overview of facilitative strategies (e.g., arriving to class on time, ensuring the student's proximity with peers, making sure the SGD had appropriate messages, and ensuring the student was using the same materials), (c) identify opportunities for peer interaction, and (d) introduce a self-monitoring sheet (adapted from Chung and Carter 2013). All paraprofessionals received a copy of the information sheet with facilitative strategies and potential messages, and a self-monitoring sheet (available upon request).

During the training, we discussed potential messages of task-related and social-related messages that the paraprofessional may prompt peers and the focus student to initiate toward each other during the particular class (e.g., greeting upon arrival, requesting colored markers, and commenting on peers' art works). For example, in Sean's library class, we suggested that Jane could prompt Sean to greet his peer partners using his SGD and peer partners could ask Sean "What do you want to read today?" We

asked each paraprofessional to self-monitor prompting the focus student and peer partners to initiate toward each other at least three times during each class and to praise the focus student and peer partners periodically. No limit was set for maximum amount of prompts. We also discussed with paraprofessionals how to identify prompts that would elicit responses from the focus students. We then modeled how to use verbal and/ or gestural prompts and the self-monitoring sheet.

Following the training, each paraprofessional began to implement the strategies in the general education classroom. Given Todd and Patricia were not familiar with the students' SGD, they asked the SLP for additional training on how to operate the SGD. We placed a self-monitoring sheet on the table for the paraprofessional prior to their arrival in the general education classroom. Once the focus student and paraprofessional arrived, the paraprofessional began to prompt peer interactions and recorded the number of prompts using the self-monitoring sheet. We collected data on all of the dependent variables in the same manner as during baseline. Following each observation, the researcher briefly met with each paraprofessional to provide specific feedback on his/her prompts and answer questions. Given that the purpose of the self-monitoring sheet was to serve as a reminder, our feedback focused on whether the paraprofessional provided prompts, not on how accurately the paraprofessionals self-recorded their own prompting behaviors.

Classroom Observations and Interobserver Agreement

The first author served as the primary observer for all focus students. The second author and a special education doctoral student served as the secondary observers. Prior to collecting reliability data, both secondary observers reviewed the coding definitions through videos and reached a minimum of 90 % agreement on two consecutive in vivo classroom observations. For each student, interobserver agreement (IOA) was checked during an average of 25 % (range: 20–27 %) of the observations.

We calculated IOA using three approaches, occurrence and non-occurrence agreement (i.e., reciprocal peer interactions), total percent agreement (i.e., number of SGD messages), and point-by-point agreement (e.g., contextual measures). Across the three students, observers reached an average IOA of 88 % for occurrence and non-occurrence of reciprocal peer interactions; 78 % for number of SGD messages generated; 72 % for number of paraprofessional prompts for initiations; 95 % for proximity to SGD, peer partners, and other peers; 93 % for communication modes used, and 86 % for instructional formats. When IOA was below 80 %, observers received additional training to review and clarify definitions. For example, lower IOA for paraprofessional prompts resulted from one observer coding prompts for both student initiations and responses.

Treatment Fidelity

To ensure the training was provided to paraprofessionals as planned, the interventionists used a checklist to record the steps completed. All trainings were delivered with 100 % completion. Across baseline and intervention conditions, we also collected data on paraprofessionals' facilitative behaviors. We recorded the number of paraprofessionals' prompts for initiations from the focus student toward peers or from a peer

toward the focus student. In addition, we used contextual variables to indirectly monitor if paraprofessionals demonstrated additional facilitative behaviors (e.g., arriving to class on time or ensuring the student's proximity with peers).

Social Validity

To gather information on social validity, we conducted brief individual interviews with each focus student and peer partner upon the completion of the observations. While questions were presented verbally, the focus students were encouraged to respond using their AAC systems (i.e., SGDs or signs). We also distributed a post-intervention questionnaire to the paraprofessionals, general educators, special educators, and SLP to gain their perceptions on the social importance of the study.

Data Analysis

We hypothesized that, after implementation of the intervention package, paraprofessionals would demonstrate more prompting behaviors following the training, and student's peer interactions and SGD use would increase. To evaluate the impact of the intervention package, we analyzed changes in levels, trends, and stability between baseline and intervention phases (Gast and Ledford 2014). We also calculated the percentage of non-overlapping data (PND). We used descriptive statistics to summarize contextual variables using the intervals in which the focus students were present in the classrooms. To analyze findings from social validity measures, we identified themes associated with the goals, procedures, and outcomes of the study.

Results

Peer Interactions

Reciprocal Interactions Figure 1 displays the percentage of intervals during which reciprocal peer interactions occurred (i.e., closed squares). The focus students had relatively low levels of reciprocal peer interactions during the baseline condition. Following the intervention package, both absolute and relative level changes were observed for all three students. In addition, changes in trend direction were observed across three classrooms, from no trend in all three classrooms to an accelerating trend in library, a slightly decelerating trend in art A, and an accelerating trend in art B. Furthermore, changes in variability were noted between conditions. The data points were stable in library and art A during the baseline condition, changing to variable during the intervention condition. In art B, the trend changed from variable to stable. The PND between phases was 100 % across the three tiers.

SGD and other Communication Modes Figure 1 also indicates the percentage of intervals during which the focus students used their SGD to interact with peers (i.e., open circles). Prior to the intervention, none of the focus students used their SGD to interact with peers. Changes were observed in level, trend, and stability during the intervention condition. Table 2 includes the percentage of intervals in
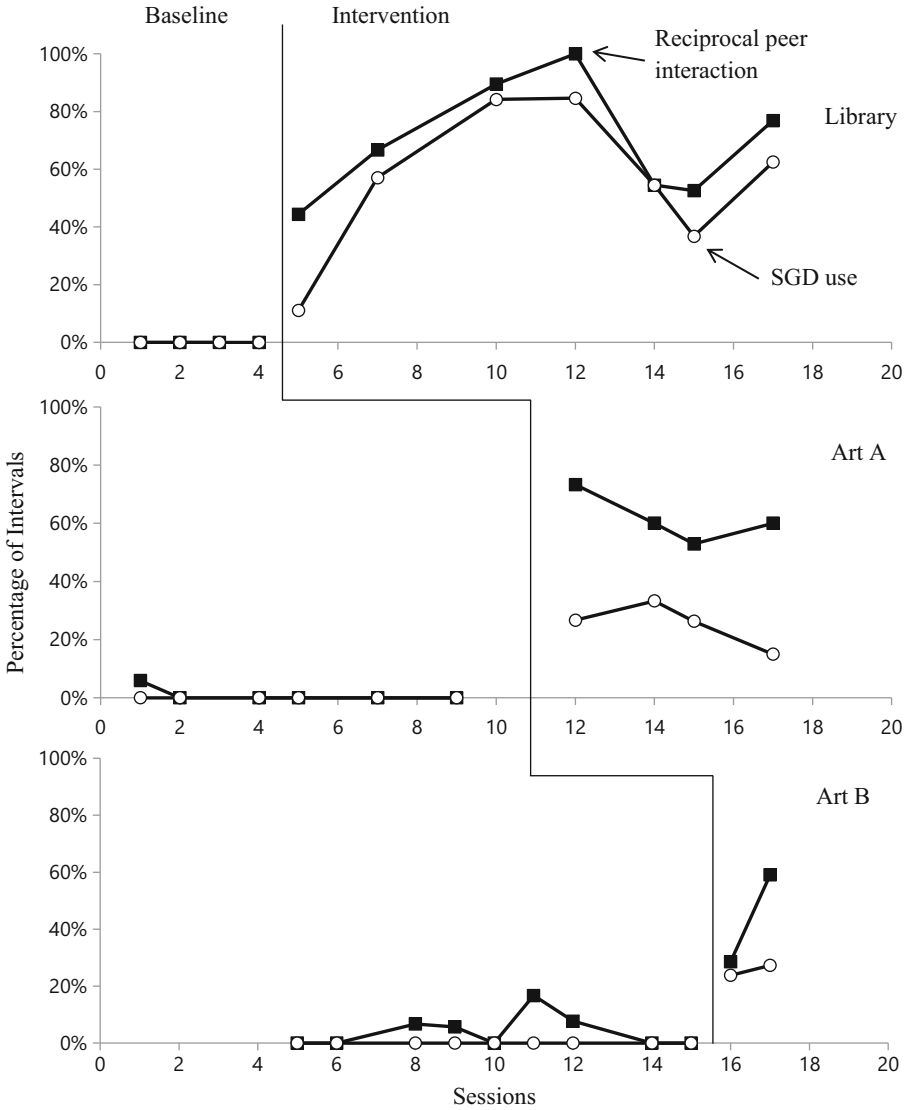
Fig. 1 Reciprocal peer interactions and SGD use

which focus students used different communication modes as well the total number of SGD messages generated during peer interaction. Increases in the use of gestures and the total number of SGD messages were observed for all three students. Slight increases in speech, signs, and vocalizations were noted for Sean, Casey, and Adam, respectively.

Initiations from Students and Peers Figure 2 shows the percentage of intervals during which the focus students initiated toward peers (i.e., closed squares) and peers initiated toward the focus students (i.e., open circles). Both level and trend

Table 2 Peer Interactions, Communication Modes, and Paraprofessional Prompts by Condition

Measures	Library (Sean)		Art A (Casey)		Art B (Adam)	
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
Peer interactions						
Reciprocal interaction	0 (0–0)	69 (44–100)	1 (0–6)	62 (53–73)	4 (0–17)	44 (29–59)
Student-initiated	0 (0–0)	28 (11–54)	0 (0–0)	10 (0–20)	1 (0–6)	28 (14–41)
Peer-initiated	0 (0–0)	64 (37–100)	9 (0–31)	50 (41–60)	11 (0–33)	44 (33–55)
With peer partners	0 (0–0)	70 (39–100)	0 (0–0)	70 (65–73)	2 (0–17)	44 (38–50)
With other peers	0 (0–0)	7 (0–15)	9 (0–31)	4 (0–10)	9 (0–18)	34 (14–55)
Communication mode[a]						
Gestures	0 (0–0)	39 (11–85)	0 (0–0)	15 (3–33)	4 (0–17)	16 (14–18)
Signs	0 (0–0)	0 (0–0)	0 (0–0)	3 (0–7)	0 (0–0)	0 (0–0)
Speech	0 (0–0)	4 (0–8)	1 (0–6)	0 (0–0)	0 (0–0)	0 (0–0)
SGD	0 (0–0)	56 (11–85)	0 (0–0)	28 (7–40)	0 (0–0)	26 (24–27)
Vocalizations	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	5 (0–9)
Total SGD messages[b]	0 (0–0)	16 (4–31)	0 (0–0)	6 (2–9)	0 (0–0)	6 (6–6)
Paraprofessionals' prompts[c]						
Total prompts	0 (0–0)	8 (4–13)	0 (0–1)	7 (3–9)	0 (0–0)	8 (7–9)
Prompt students' initiations	0 (0–0)	3 (2–6)	0 (0–1)	3 (0–4)	0 (0–0)	5 (4–6)
Prompt peers' initiations	0 (0–0)	5 (1–8)	0 (0–0)	4 (3–5)	0 (0–0)	3 (3–3)
Proximity						
Proximity to SGD	100	99 (94–100)	100	100	70 (0–100)	100
Proximity to peer partners	0 (0–0)	67 (50–95)	0 (0–0)	100	0 (0–0)	95 (91–100)
Proximity to other peers	0 (0–0)	8 (0–28)	9 (0–56)	8 (0–21)	1 (0–9)	98 (95–100)
Academic engagement	81 (71–100)	81 (55–100)	43 (17–69)	25 (0–47)	32 (8–64)	31 (14–48)
Time present in the classroom	62 (29–100)	88 (68–100)	90 (65–100)	97 (81–100)	70 (30–86)	96 (92–100)

Mean (range) percentage of intervals in which the focus student was present in the class. SGD=speech-generating device

[a] Communication modes used during peer interaction. [b] Total number of SGD messages generated during peer interaction. [c] Number of prompts for initiations provided by paraprofessional toward the focus student and/or peer partners

changes were observed for all three classrooms. Table 2 summarizes the average and range of percentage of intervals during which an interaction behavior (i.e., initiation or response) occurred between the focus student and peer partners and between the focus student and other peers. Despite the majority of students'
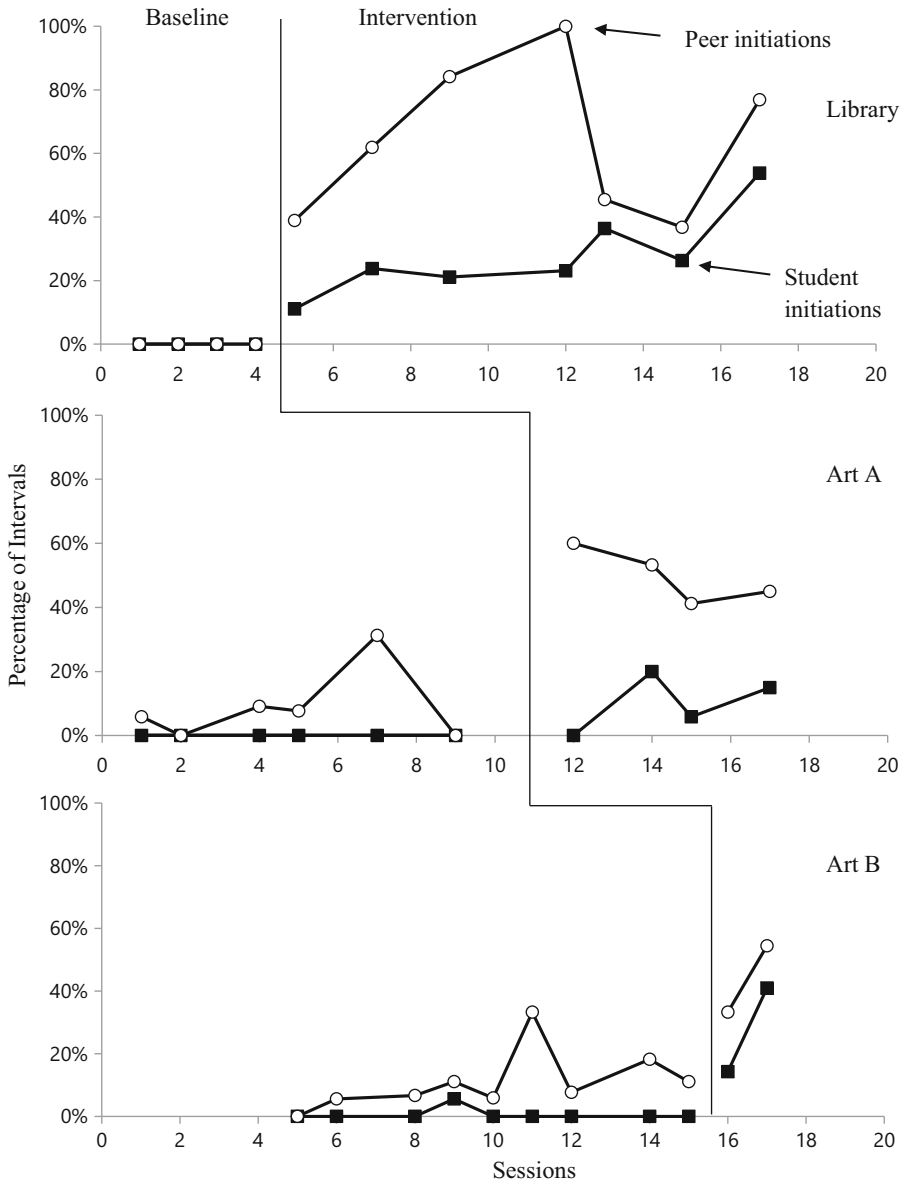
Fig. 2 Student and peer initiations

interactions occurring with peer partners, spillover effects were observed with other peers in the library and art B.

Paraprofessional Behaviors and Contextual Variables

Table 2 shows increased paraprofessional facilitative behaviors and changes in contextual variables across all three classrooms following training. Due to the absence of the

assigned paraprofessional, both Casey and Adam received support from a different participating paraprofessional in two sessions during baseline.

Prompts for Initiations During the baseline condition, nearly no prompts ($M=0$) were provided by any of the three paraprofessionals to direct the focus student to initiate to a peer or direct a peer to initiate to the focus student. Following the intervention, the total number of paraprofessional prompts for initiations from the focus students or from peers increased to an average of 8 (range: 4–13) in library, 7 (range: 3–9) in art A, and 8 (range: 7–9) in art B.

Time Present All focus students spent more time in the general education classrooms during the intervention condition. Percentage of intervals of time present increased from an average of 62 % (range: 29–100 %) in baseline to 88 % (range: 68–100 %) during intervention in library, 90 % (range: 65–100 %) to 97 % (range: 81–100 %) in art A, 70 % (range: 30–86 %) to 96 % (range: 92–100 %) in art B. Data indicated that the focus students and their paraprofessionals either arrived to the class earlier or/and stayed longer compared to the baseline condition.

Proximity Changes were observed in students' proximity to their SGD, peer partners, and other peers. Proximity to SGD was consistently high for both Sean and Casey across conditions. Adam's proximity to his SGD increased from an average of 70 % (range: 0–100 %) of intervals to 100 % of intervals following the intervention in art B.

   None of the focus students were in proximity to their peer partners during the baseline condition. However, all focus students increased their proximity to peer partners during intervention with an average of 67 % (range: 50–95 %) of intervals, 100 % of intervals, and 95 % (range: 91–100 %) of intervals in library, art A, and art B, respectively. It should be noted that Sean's peer partners were usually working with computers in a different area of the library and only joined Sean during the last 10 min of each class period.
   Students' proximity to other peers varied across classrooms. In library, Sean's proximity to other peers increased from 0 % of intervals to 8 % (range: 0–28 %) of intervals. In art A, Casey's proximity to other peers slightly decreased, from 9 % (range: 0–56 %) of intervals to 8 % (range: 0–21 %) of intervals. Although Casey shared the same table with his peer partners and other peers during the intervention condition, he was not coded as in proximity to other peers due to his and other peers' body orientation. In art B, Adam's proximity to other peers increased substantially, from 1 % (range: 0–9 %) of intervals to 98 % (range: 95–100 %) of intervals.

Instructional Formats A variety of changes in instructional formats were observed across classrooms. In library, peer partners joined Sean and read books together during intervention. Thus, the format Sean received changed from individual work ($M=91$ %; range: 80–100 % of intervals) to small group ($M=65$ %; range: 33–95 % of intervals). In both art classes, individual work remained to be the primary instructional format for both Casey and Adam across conditions. A slight increase

in large group instruction was noted, from an average of 0 % of intervals to 7 % (range: 0–21 %) of intervals for Casey and from an average of 1 % (range: 0–9 %) of intervals to 5 % (range: 0–10 %) of intervals for Adam. Anecdotal notes indicated that paraprofessionals began to prompt the focus student to join his peers during large group demonstrations following training.

Social Validity

During interviews, focus students and peer partners responded positively about their experience. When asked if they liked talking to peers, Sean responded "yes" using his device, Casey responded "yes" using sign language, and Adam simply smiled. Peer partners indicated interacting with the focus students was "cool" and "fun," but also different (e.g., "you have to talk a little slower"). Jared said, "[Casey] is just like everyone else." Four peer partners reported talking to the focus students outside the class or in the hallway and all stated they would continue to talk to the focus students in the future.

All paraprofessionals valued the goal of this project, perceived the duration of the training as sufficient, and reported intervention outcomes benefitted students with and without disabilities. Jane observed increased interactions for Sean outside the classroom. Patricia stated Adam and his peers enjoyed talking to each other. When asked to identify a rewarding experience, Todd said "seeing the smile on my student's face from his interaction with peers." Despite reporting challenges such as Proloquo2Go navigation and the ability gap between the students and peers, all indicated they would continue using the strategies. Todd was the only paraprofessional who found the self-monitoring sheet beneficial. Jane and Patricia felt it was not necessary and difficult to accurately collect data while supporting the focus students.

Both general educators were pleased with the project's outcomes. Joanna commented that peer partners looked forward to talking to Sean and other peers showed great interest as well. She indicated she would be willing to receive training on more inclusive practices and suggested involving more peers to interact with students who use SGD. Paige noted that the project was enjoyable for both Casey and Adam. She would continue encouraging proximity between students with and without disabilities to facilitate interactions. The two special educators also observed positive student outcomes, including increased SGD use and awareness toward peers. Lisa stated that the project empowered the paraprofessionals to create successful interaction experiences for the focus students. Nicole, the SLP, said, "Paraprofessionals approach me more often with ideas and are more interested in their ability to program and navigate the devices." She planned to share strategies with staff to facilitate interactions in other inclusive classrooms.

Discussion

Although individual paraprofessional support has become a common service delivery model, substantial concerns continue to overshadow evidence-based strategies

available to equip paraprofessionals for enhancing inclusion outcomes for students with severe disabilities (Giangreco et al. 2010). This study was designed to examine the effects of paraprofessional facilitation on social interaction between students who use SGD and their peers without disabilities. Following 35 to 50 min of training, all paraprofessionals demonstrated more facilitative behaviors that promoted the membership of students with ASD in inclusive classrooms. Increased reciprocal peer interactions were observed for all three students. The students also increased their SGD use and initiations toward peers. Findings from interviews and questionnaires verified the social importance of the project, supported the practicability of paraprofessional training, and validated positive outcomes of the intervention. This study contributed to the knowledge base on paraprofessional training and supporting students with severe disabilities in inclusive classrooms.

This study further confirmed the significance and feasibility of in-service training for paraprofessionals who provide support in inclusive classrooms. Consistent with previous intervention research (Carter et al. 2011; Chung and Carter 2013), our baseline data depicted social isolation that students with severe disabilities often encounter in inclusive classrooms, calling for the need for environmental changes and knowledge enhancement of support personnel. Despite the paraprofessionals working with students with severe disabilities for a range of years, none received training on promoting peer interactions prior to this project. Results from this study indicated adult facilitation can be a promising and cost-effective research-based practice for promoting inclusive outcomes for students with severe disabilities. Following training, all paraprofessionals immediately increased their prompts for initiations, resulting in increased social interactions between students and peers. From our interaction with paraprofessionals, we found that some may benefit from simply being reminded of the purpose of inclusion while others may need to learn about specific prompts and how to operate a SGD with Proloquo2Go. Nevertheless, we are especially encouraged by the results, given that the duration of the training and feedback was shorter compared to the paraprofessional training in previous research (Causton-Theoharis and Malmgren 2005; Chung and Carter 2013).

This study also highlighted the importance of opportunity provision in promoting communication of students who use SGD. Despite all focus students having IEP goals related to device use, our anecdotal observations indicated students primarily used their SGD in response to questions from adults prior to the intervention. Lack of turn taking, limited initiations, and a narrow range of communication purposes are common communication barriers associated with AAC users in inclusive classroom (Chung et al. 2012). To address these barriers, our study targeted the functional use of AAC in inclusive classrooms. During paraprofessional training, we identified and brainstormed messages that the focus students and peers could engage in during task- and social-related conversations. Given these communication opportunities and explicit prompts from paraprofessionals, students became more active communicators who initiated and took turns during conversations. In the post-interview questionnaire, Patricia expressed that the training was helpful because the messages recommended targeted the specific classroom. Therefore, we felt that these context-specific messages and communication opportunities may be the key that contributed to the success of the intervention.

Limitations and Future Research Directions

Several limitations of this study should be considered for guiding future research. First, we encountered several challenges regarding data collection. Due to attrition, Adam, the focus student of the third tier, was recruited after the intervention had been implemented in the first tier, Sean's library. In addition, due to weather-related school cancellations and student absences, we were unable to collect a third intervention data point for Adam to establish a clear ascending trend. As a result, the non-concurrent multiple baseline design, coupled with a partial replication of intervention effects in the third tier, limited the conclusions that can be drawn from the findings. These issues certainly illustrated limitations of the multiple baseline design as well as common challenges for conducting classroom-based research, especially when the students only attend general education classrooms for short periods.

Second, this study was designed to evaluate the impact of an intervention package, which involved ensuring students' proximity to peers, enhancing SGD accessibility, recruiting peers, and paraprofessionals' prompting for initiations. Thus, we cannot separate the effectiveness of the individual components of the package. Given that the focus students were rarely in proximity to their peers during baseline, one may argue that increased peer interactions can simply be a result of reposition of the focus students. Although previous observational research indicated that naturally-occurring peer interactions remained sparse despite students' proximity to peers in inclusive rooms (Chung et al. 2012), future researchers will want to better differentiate the impact of environmental modifications and adult prompts on students' social interactions.

Third, we evaluated the treatment fidelity based on the number of paraprofessional prompts and students' proximity to peers prior to and following the intervention. Future researchers may consider collecting additional data on SGD accessibility, such as new messages added or paraprofessionals' skill levels regarding operating or programming the SGD. Fourth, although all paraprofessionals increased their prompting behaviors, the external validity of this study would have been enhanced by collecting maintenance data on paraprofessional behaviors. For example, will paraprofessionals continue to prompt as needed and will paraprofessionals begin to fade support if the focus students demonstrate spontaneous initiations or responses?

Finally, despite paraprofessionals, classroom teachers, special educators, and the SLP reporting positive outcomes of the intervention, we did not explicitly facilitate collaboration among team members. For example, paraprofessionals could have taken a more active role to inform peers about the intervention or contact the SLP about SGD messages. In addition, both general educators expressed interests in better supporting students with disabilities. To promote long-lasting impacts and strengthen the social validity of classroom interventions, future studies should examine effects of peer interaction intervention within the context of team collaboration. In addition, future researchers should consider using both quantitative and qualitative measures to collect social validity data, such as using peer comparison data and rating scales.

Implications for Practices

This study yielded several recommendations for educators who wish to enhance the social outcomes of students with severe disabilities who use AAC in inclusive

classrooms. First, educational teams should prioritize the goal of inclusion and ensure stakeholders have the skills and support to promote the desirable outcomes. Meaningful inclusion that benefits both students with and without disabilities, often begins and flourishes with deliberate support and ongoing monitoring from educational teams. A physical presence in the classroom, without proximity to peers or opportunities to interact, diminishes the intention of inclusion. Therefore, professionals who want to promote the membership of students with disabilities should be equipped with strategies for facilitating classroom interactions among students.

Next, peers without disabilities can be effective natural support for students who use AAC across school settings. Consistent with previous peer interaction research (Chung and Carter 2013), peers were highly motivated when invited to become the communication partners of students who use AAC. Upon inquiry, we found these six peers were identified through different approaches by their homeroom teachers. One teacher (library and art B) selected students who she thought may be a good fit with the focus student in the particular classroom. The other classroom teacher asked for volunteers to participate in the study.

With minimal information and no training on specific skills, peer partners in this study actively engaged in interactions with the focus students and demonstrated several effective communication skills that were not specifically prompted by the paraprofessionals. For example, Alex would wait and patiently look at Casey after he initiated a question. Following an initial prompt by the paraprofessional, Sean's peer partners, began to ask Sean similar questions without subsequent prompts. In both Sean's library and Adam's art classroom, we observed other peers spontaneously initiating conversations toward the focus students. We encourage educational teams to redefine the role of paraprofessionals and begin to explore peer support as an alternative model for delivering inclusion practices (Carter et al. 2011). For example, instead of providing one-on-one instruction, a paraprofessional can supervise a group of students with and without disabilities while facilitating academic outcomes and social interaction of all students.

Finally, special educators and administrators should consider providing paraprofessional training that is flexible, individualized, and accountable. To motivate paraprofessionals, the training should include differentiated instruction and support and take place at a time and location that is convenient to paraprofessionals. In this study, we noted variations among paraprofessionals' skill levels. Jane was familiar with Sean's device. During the first intervention session, she took photos of peer partners and added their names to Sean's device. In contrast, Todd benefited from additional feedback on SGD content and modeling how to prompt.

To enhance the applicability of the training, information addressed in the training needs to be explicit and target specific students or settings. For example, during the training, we asked each paraprofessional to prompt three initiations from the focus student and from peers. Furthermore, we suggest educators incorporating data collection as part of paraprofessional training to enhance accountability and promote skill maintenance. Through collecting data on either their own or students' behaviors, paraprofessionals are more likely to continue implementing the strategies, assessing students' performance, and making modifications as needed.

As demonstrated by the results of this study, an intervention package with brief training with paraprofessionals can facilitate more social interactions between students

who use SGD and their peers in inclusive classrooms. In addition, increased student initiations and SGD use occurred as the paraprofessionals were empowered with knowledge of the benefits of students spending more time in class, being in closer proximity with peers, and communicating using SGD. While future research should examine individual components and collect maintenance data, this study illustrates initial steps toward promoting class membership and the quality of life for students with severe disabilities.

Compliance with Ethical Standards

Ethical Approval   All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent   was obtained from all individual participants included in the study.

Conflict of Interest   The authors declare that they have no conflict of interest.

References

Beck, A. R., Fritz, H., Keller, A., & Dennis, M. (2000). Attitudes of school-aged children toward their peers who use augmentative and alternative communication. *Augmentative and Alternative Communication, 16*, 13–26.

Beukelman, D. R., & Mirenda, P. (2013). *Augmentative and alternative communication: Supporting children and adults with complex communication needs* (4th ed.). Baltimore: Brookes.

Bingham, M. A., Spooner, F., & Browder, D. (2007). Training paraeducators to promote the use of augmentative and alternative communication by students with significant disabilities. *Education and Training in Developmental Disabilities, 42*, 339–352.

Broer, S. M., Doyle, M. B., & Giangreco, M. F. (2005). Perspectives of students with intellectual disabilities about their experiences with paraprofessional support. *Exceptional Children, 71*, 415–430.

Carter, E. W., Sisco, L. G., Chung, Y., & Stanton-Chapman, T. L. (2010). Peer interactions of students with intellectual disabilities and/or autism: a map of the intervention literature. *Research and Practice for Persons with Severe Disabilities, 35*, 63–79.

Carter, E. W., Moss, C. K., Hoffman, A., Chung, Y., & Sisco, L. (2011). Efficacy and social validity of peer support arrangements for adolescents with disabilities. *Exceptional Children, 78*, 107–125.

Carter, E., Swedeen, B., Walter, M. C. M., & Moss, C. K. (2012). I don't have to do this by myself?" Parent-led community conversations to promote inclusion. *Research and Practice for Persons with Severe Disabilities, 37*, 9–23.

Causton-Theoharis, J. N., & Malmgren, K. W. (2005). Increasing peer interactions for students with severe disabilities via paraprofessional training. *Exceptional Children, 71*, 431–444.

Chung, Y., & Carter, E. W. (2013). Promoting peer interactions in inclusive classrooms for students who use speech-generating devices in general education classrooms. *Research and Practice for Persons with Severe Disabilities, 38*, 94–109.

Chung, Y., Carter, E. W., & Sisco, L. G. (2012). Social interaction of students with severe disabilities who use augmentative and alternative communication in inclusive classrooms. *American Journal on Intellectual and Developmental Disabilities, 117*, 349–367.

Gast, D. L., & Ledford, J. R. (2014). *Single case research methodology* (2nd ed.). New York: Routledge.

Ghere, G., & York-Barr, J. (2007). Paraprofessional turnover and retention in inclusive programs: hidden costs and promising practices. *Remedial and Special Education, 28*, 21–32.

Giangreco, M. F. (2010). One-to-one paraprofessionals for students with disabilities in inclusive classrooms: is conventional wisdom wrong? *Intellectual and Developmental Disabilities, 48*, 1–13.

Giangreco, M. F., & Broer, S. M. (2005). Questionable utilization of paraprofessionals in inclusive schools: are we addressing symptoms or causes? *Focus on Autism and Other Developmental Disabilities, 20*, 10–26.

Giangreco, M. F., Suter, J. C., & Doyle, M. B. (2010). Paraprofessionals in inclusive schools: a review of recent research. *Journal of Educational and Psychological Consultation, 20*, 41–57.

Hudson, M. E., Browder, D. M., & Wood, L. A. (2013). Review of experimental research on academic learning by students with moderate and severe intellectual disability in general education. *Research and Practice for Persons with Severe Disabilities, 38*, 17–29.

Jackson, L. B., Ryndak, D. L., & Wehmeyer, M. L. (2008/2009). The dynamic relationship between context, curriculum, and student learning: A case for inclusive education as a research-based practice. *Research and Practice for Persons with Severe Disabilities, 33*, 175–195.

Lilienfeld, M., & Alant, E. (2005). The social interaction of an adolescent who uses AAC: the evaluation of a peer-training program. *Augmentative and Alternative Communication, 21*, 278–294.

Malmgren, K. W., & Causton-Theoharis, J. N. (2006). Boy in the bubble: effects of paraprofessional proximity and other pedagogical decisions on the interactions of a student with behavior disorders. *Journal of Research in Childhood Education, 20*, 301–312.

Minondo, S., Meyer, L., & Xin, J. (2001). The roles and responsibilities of teaching assistants in inclusive education: what's appropriate? *Journal of the Association for Persons with Severe Handicaps, 26*, 114–119.

Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2006). *Vineland adaptive behavior scales: Teacher rating form* (2nd ed.). Minneapolis: Pearson.

van der Meer, L., Sigafoos, J., O'Reilly, M. F., & Lancioni, G. E. (2011). Assessing preferences for AAC options in communication interventions for individuals with developmental disabilities: a review of the literature. *Research in Developmental Disabilities, 32*, 1422–1431.

Williamson, P., McLeskey, J., Hoppey, D., & Rentz, T. (2006). Educating students with mental retardation in general education classrooms. *Exceptional Children, 72*, 347–361.