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Using Fixed Interval-Based Prompting to Increase a Student's Initiation of the Picture Exchange Communication System

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This report describes an AB case study in which a fixed interval-based prompting procedure was used to support a child's spontaneous approach to a Picture Exchange Communication System (PECS) book for selecting icons to request preferred items. The participant was a 6-year-old student with autism spectrum disorder. Preferred items were determined through formal preference assessments prior to the onset of the study. Performance was monitored based on the percentage of spontaneous approaching and requesting behaviors emitted during 10-min intervals throughout each day. Results revealed an increase in requesting of preferred items from a mean of 12% during baseline to 43% during intervention and 83% at a 6-month follow-up.

Keywords: autism spectrum disorders, PECS, prompting, communication, requesting

Autism spectrum disorders (ASD) are characterized by impairments or delays in social interactions, communication, and restrictive repetitive behaviors (American Psychiatric Association, 2000). Children with ASD can exhibit a wide range of impairments in language development. Some individuals with ASD use speech, and others communicate through nonvocal means. However, language is often not used to initiate communication spontaneously, even by those who speak (Howlin, 1981). For example, an individual with ASD may answer, "I want cookie" in response to the question "What do you want?" but not request a cookie spontaneously in the absence of the question.

Many individuals with ASD use augmentative or alternative communication (AAC). Some use low-tech (i.e., nonelectronic) modalities, such as the Picture Exchange Communication System (PECS; Frost & Bondy, 1994, 2002) and others use electronic options such as the Dynavox (Mirenda & Iacono, 2009). The participant in the current study used PECS (Frost & Bondy, 1994), which is an iconic AAC system developed to increase functional communication with emphasis on requesting and initiating. As a background to the description of this study, we provide an overview of the traditional PECS training protocol, limitations to the success of this protocol, and an introduction to fixed interval-based prompting (FIBP).

Traditional PECS Training Protocol

The goal of PECS training is to teach learners the functional value of communicating requests to access desired items (Frost & Bondy, 2002; Charlop, Malmberg, & Berquist, 2008). By using preferred items to "tempt" communication, instructors can teach children to initiate requests for preferred items (reinforcers), thereby making communication both motivating and rewarding (Charlop et al., 2008; Travis & Geiger, 2010). More specifically, PECS instruction is a systematic method for teaching children to ex-

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change icons to communicate their wants and needs successfully.

PECS training includes six phases. Each phase is summarized in Table 1. During Phase I, the child learns to initiate a request by giving a picture of a desired item to his or her communication partner, who is seated directly in front of him or her. The communication partner then provides the child with the requested item. Phase II is similar to Phase I, except that the communication partner is located at a distance from the child, and the child must learn to travel to the communication partner to initiate the exchange. During Phase III, the child learns to discriminate between pictures for different items (e.g., cookie, juice, swing). At this level, the exchange of the correct picture demonstrates the child's recognition of the correspondence between specific pictures and desired objects, even in the presence of distractors. At Phase IV, the child learns to initiate requests by sequencing icons to form a sentence (e.g., "I want cookie"). At Phase V, the child learns to answer a direct question. For example, if a child is asked, "what do you want?" He or she may reply, "I want puzzle." Finally, at Phase VI, the child learns to participate in comment–comment exchanges, incorporating attribution where appropriate. For example, during play with different sizes of toy cars, if the communication partner says, "I see a little car," the child may use icons to sequence the utterance, "I see a big car."

Across all six phases, the icons (i.e., pictures) are stored on or in a PECS book. In a sense, this book contains a child's lexicon. It provides him or her with the symbols for expressing communicative intent. The child is taught to carry his or her PECS book at all times so that it is available when he or she wants to communicate. As indicated below, recognizing the value of the PECS book as a source of the iconic "vocabulary" for communication sometimes requires training as much as using the icons themselves.

Limitations of the Traditional PECS Training Protocol

Although the six-phase protocol for teaching PECS may be effective for most students (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002), some do not progress through it at an adequate rate (Ganz, Simpson, & Corbin-Newsome, 2008). For example, some students may appear to move through training phases but still require prompting and respond inconsistently in the presence of their PECS book. This may be attributed to a lack of stimulus control or to issues with retention of a learned skill. Other students may fail to approach their PECS books spontaneously in spite of persistent instruction. In these cases, the PECS book itself does not appear to function as a discriminative stimulus (S^D) for access to the icons needed to request and receive preferred items (Cooper, Heron, & Heward, 2007). Simply stated, these students do not see their PECS book as the source of icons needed to communicate with others. Consequently, there is no improvement in the frequency of spontaneous approaches to the PECS book or (by default) to the frequency of using icons for communication. When such situations arise, helping a learner recognize the value of the PECS book can be an important first step in accessing the icons needed to communicate.

The process of approaching a PECS book and selecting icons to communicate can be viewed as a chain of behavior where each step in the chain serves as an S^D for the next step (Cooper et al., 2007). A reinforcer is typically provided at the end of the chain. The reinforcer may be

Table 1
The Six Phases of PECS (Frost & Bondy, 1994)

Phase	Title	Description
I	How to communicate	Exchange a picture and obtain a desirable.
II	Distance and persistence	Child must travel a short distance to select picture and hand it to an adult.
III	Discrimination between symbols	Child must discriminate among different pictures.
IV	Using phrases	Child uses sentence structure "I want ___" using sentence strip.
V	Answering a direct question	Answering simple questions, e.g., "What do you see?"
VI	Commenting	Spontaneous commenting, e.g., "I see ___."

either extrinsic (e.g., child receives preferred edible) or a naturally occurring event (e.g., the child receives a requested item or activity present in the natural environment). In the case of the initial implementation of PECS, access to a preferred (requested) item serves as the reinforcer, while the motivating operation (communicative temptation) serves as the antecedent to the onset of the behavioral chain. For successful independent communication, it is important for the student to initiate the first step in a behavior chain spontaneously.

To date, most of the PECS research has shown that individuals with challenges in communication have demonstrated mastery of PECS (Travis & Geiger, 2010; Ganz, Parker, & Benson, 2009; Carr & Felce, 2007; Charlop-Christy et al., 2002; Frost & Bondy, 1994). However, it has also been shown that not all learners acquire the critical communication skills after having been provided with the traditional PECS protocol (Ganz, Simpson, et al., 2008). For example, using a multiple baseline across participants design, Ganz, Simpson, et al. (2008) taught PECS to three preschoolers with characteristics of ASD. PECS instruction followed the Frost and Bondy (2002) protocol for the first four phases. Two of the three participants reached mastery of PECS. However, the third participant made only five independent picture exchanges during the 31 sessions completed within the study. This participant had not mastered PECS using the traditional framework (Ganz, Sigafoos, Simpson, & Cook, 2008), and modifications to the traditional PECS protocol were required to support further progress. The modifications involved changes in stimulus materials and the use of edible reinforcement contingent upon touching (rather than exchanging) an item. An example of one modification included placing a duplicate of a preferred item (i.e., food) in a plastic container. Upon touching the container, the participant was offered the food item for consumption (Ganz, Sigafoos, et al., 2008). Descriptions of additional modifications were published in a separate work for clinicians who teach PECS (Ganz, Cook, Corbin-Newsome, Bourgeois, & Flores, 2005). Clearly, the research and experiences of these authors confirm our own observations that adaptations to the conventional protocol for teaching PECS are sometimes needed to meet the unique learning needs of some individuals with challenges in communication.

Ganz, Sigafoos, et al. (2008) showed that the modification of materials and variations in reinforcement could be used successfully to increase the remarkably low levels of communicative initiation produced by their participant. More generally, this finding suggests that, if the frequency of spontaneous requesting does not increase after a learner has completed the early phases of PECS training, adaptations to the traditional protocol can be helpful. One adaptation not yet described in the literature is an interval-based prompting procedure to increase the frequency of a learner's initial approach to his or her PECS book.

Fixed Interval-Based Prompting as an Adaptation to the PECS Teaching Protocol

A large body of literature within the field of applied behavior analysis (ABA) addresses the use of intervals. For example, responding can be measured within intervals, and schedules of reinforcement can be designed in relation to fixed and/or variable intervals (e.g., Hammond, Iwata, Fritz, Dempsey, 2011; Pipkin & Vollmer, 2009; Cooper et al., 2007). Often, responding is targeted to occur within an interval, and if it does not, a prompt can be provided. Although prompting is part of current clinical practice within ABA, no studies have systematically addressed the effect of fixed interval-based prompting (FIBP). In the case study reported here, FIBP was used to provide the learner with a high rate of opportunities to practice target responses throughout the day in an effort to promote overlearning. Similar to the effects of fluency instruction (Binder, 1993), it was hypothesized that the consistently high frequency of practice opportunities would increase the learner's fluency and maintenance of target skills over time.

FIBP is a reasonable adaptation to consider for PECS instruction when individuals are not progressing through the traditional teaching protocol. In theory, if FIBP were delivered systematically during predetermined intervals to increase the frequency of a learner's approach to a PECS book, it would provide the learner with many opportunities to select icons for requesting preferred items and it would

strengthen the PECS book as an S^D for access to communication signals.

To date, FIBP has not been reported in the literature as a method for increasing a learner's approach to and use of his or her PECS book. The current study was conducted to address this gap. The goal was to promote the learner's communication while broadening the literature and potentially identifying an alternate prompting approach that could easily be implemented to support other learners with similar challenges.

Below, we describe a case study utilizing procedures designed to increase the learner's frequency of initiating step one in a behavior chain leading to functional communication using PECS.

Method

Participant

The participant in this study was a 6-year, 0-month-old boy (Adam) with a diagnosis of Autistic Disorder (*Diagnostic and Statistical Manual of Mental Disorders, 4th ed.,* [*DSM–IV–TR*]; American Psychiatric Association, 2000). This diagnosis had been established by a neurologist when Adam was 21 months old. Below is a description of Adam's intervention experiences, behavioral profile, and of the specific communication challenges that served as a motivation for this study.

History of interventions. Since the time of his diagnosis, Adam had consistently received intervention based on the principles of ABA (Cooper et al., 2007). Between 21 months and 5 years, he received speech–language therapy and 40 hours per week of home-based intensive early behavioral intervention under the direction of a Board Certified Behavior Analyst (BCBA). In the following year and at the time of this study, he was enrolled in a school program with an individualized educational plan implemented by teaching methods based solely on the principles of ABA.

Adam's classroom included six students, one teacher, one behavior specialist, and one teaching assistant (TA). The teacher was certified in special education and had extensive training in ABA. The behavior specialist held a baccalaureate degree in psychology with training and 2 years of supervised experience in ABA. The TA, who provided Adam with one-on-one support, was also well trained in ABA. In addition, the TA was trained by the teacher and by the speech–language pathologist (SLP), respectively, to implement Adam's specific behavior plan and communicative enhancement program. The TA attended workshops weekly and received frequent performance feedback based on interobserver agreement data regarding Adam's performance on target skills.

Adam lived at home with his mother, father, and sibling. His parents were actively involved in his education, regularly attending team meetings, and reporting carry-over across settings. Throughout his PECS training, services were provided to Adam both in the home and in school to facilitate acquisition of skills across settings.

Behavioral profile. Based on reports provided by Adam's family, the SLP, and his teacher, Adam's history and current performance patterns included marked deficits in cognitive, social, and communication skills. Adam did not engage in concrete or imaginary play skills spontaneously as a preschooler, and he did not do so at the time of this study as an elementary school student. He did not play with typical peers, or with peers who have autism spectrum disorders. Instead, when provided with independent "play" time, Adam engaged in perseverative, stereotypic behavior such as hand flapping and noncontextual vocalizations (i.e., humming).

Adam's receptive language skills were limited at the time of this study. He responded more frequently and accurately to questions and directives provided by adults than from peers within his classroom. When in a structured social group, Adam responded to "yes/no" questions for preferred versus nonpreferred item (usually edibles). He also performed basic receptive language activities such as identifying pictured objects in a field of three and following one- to two-step directives (e.g., "touch head" and "touch feet," "touch belly and clap").

At the time of this study, Adam's range of communicative intentions was restricted to requesting and behavior regulation, and his major communication modality was nonvocal. His vocal repertoire included imitative neutral vowel approximations (i.e., schwa), but he never used these forms spontaneously for requesting. He did engage in crying and tantrum behavior at

times to avoid nonpreferred activities or to obtain desired reinforcers. His preferred items or activities included objects that moved (e.g., cars), as well as books (e.g., picture dictionary), but Adam did not always manipulate these items functionally during spontaneous play. Instead, he incorporated them within his repertoire of stereotypic behavior. For example, Adam sometimes placed one toy car in each hand, but continued to flap his hands while holding these cars. However, when the teacher modeled functional play, Adam's own play became more functional. For example when the teacher demonstrated pushing a toy car, Adam then imitated the teacher and pushed the toy car.

Adam's primary mode of communication was nonverbal. He did not use conventional gestures (e.g., pointing), but he did use contact gestures and PECS paired with highly unintelligible verbal approximations. Contact gestures consisted of leading the teacher to a desired object or activity, or just reaching for a desired item directly. At the time of this study, Adam's PECS repertoire included mastery of communicative exchanges at Phase III (discriminating between picture icons) and emergence of skills at Phase IV (use of the PECS book to structure sentence strips for requesting). Specifically, through exposure to the standard PECS instructional protocol, Adam had learned to create sentence strips for requesting a few highly preferred items (e.g., "I want apple," "I want juice," "I want cookies"), but often only when first prompted to notice the PECS book. Additionally, Adam rarely initiated Phase IV requests spontaneously. These patterns had persisted for a period of 6 months. Therefore, a program modification was needed.

The current study was conducted to determine whether a modified PECS protocol could lead to an increase in Adam's spontaneous use of Phase IV PECS for requesting. Given that Adam could structure sentence strips to request preferred items when prompted to look at the PECS book, it was hypothesized that increased spontaneous attention to the PECS book would lead to more frequent spontaneous initiation of Phase IV requesting.

Setting

This study took place in a classroom of a behaviorally based nonpublic school program serving students with autism in a suburban community. The school's Program Director held a PhD in ABA. Each classroom included a teacher, TA, and behavior specialist. All staff members participated in weekly trainings in ABA provided by the Program Director. The curriculum was individualized for each student, and the SLP was an active participant in this process. Each staff member's implementation of individualized behavior and communication plans was evaluated monthly by the program director and the SLP, respectively.

For this study, teaching procedures were implemented in Adam's regular workspace within his classroom. The classroom held tables, desks, and chairs for the students and instructor, and it contained bookcases and shelving units for student curriculum materials and reinforcers (as determined by preference assessment).

Materials

Adam's PECS book consisted of a 5-in by 7-in three-ring binder. Ten laminated Mayer Johnson icons were attached to the PECS book with Velcro. These icons represented items that Adam would be likely to request based on the results of a previous preference assessment (see below). Included were icons picturing apple, grapes, juice, cookie, car, book, puzzle, radio, koosh ball, and top. Each icon was 1-in by 1-in in size. Additionally, a 1-in by 5-in sentence strip was mounted on the front cover of the PECS book. It began with the "I want," icon and was followed by an empty space where the icon of the requested item would be placed.

Design

An AB case study was used to explore the use of an interval-based prompting procedure for increasing the frequency of Adam's spontaneous production of Phase IV requesting throughout the school day. The study extended over a period of 15 days within a 6½-month time period. Included were 5 days of baseline followed by 5 days of intervention and 5 days of follow-up observation 6 months after the last intervention day.

Each school day included 5½ hours from 9:00 a.m. to 2:30 p.m. Each day was divided into 10-min intervals, and each interval was marked by a vibrotactile stimulus through a device (the Gentle Reminder) worn by an ob-

server. The number of 10-min intervals possible during a 5½-hour school day was 33. However, the actual number of intervals available to Adam for initiating Phase IV communication varied from day to day depending on the time required for reinforcement and intervention procedures (see Independent Variable).

The frequency of Adam's Phase IV requesting was documented each day by using partial interval recording and calculating the percentage of intervals per day during which spontaneous Phase IV requesting occurred. In other words, Adam received credit for an interval if he initiated a Phase IV request spontaneously at any time within the 10-min period, and the total number of such intervals was tallied each day. Then, the percentage of spontaneous Phase IV requesting was determined by dividing the number of intervals tallied by the total number of intervals available. Progress was tracked by comparing the percentages of spontaneous Phase IV requests across days.

Dependent Variable: Spontaneous Phase IV PECS Requesting

Spontaneous Phase IV PECS requesting was defined as the unprompted production of the following complete behavior chain: (a) reaching for the PECS book, (b) opening the PECS book, (c) selecting an icon, (d) adding the icon to the sentence strip on the front of the PECS book, and (e) handing the sentence strip to the communication partner (i.e., the teacher). For a response to be scored as correct, Adam was required to have completed all five steps independently.

Preference Assessment

Prior to the onset of the study, a paired-choice preference assessment (Kang et al., 2013; Cooper, Heron, & Heward, 2007) was conducted to identify items that could serve as potential antecedents to Adam's requesting and therefore be represented by symbols in his PECS book. Twelve items were assessed. Adam was provided with two items to select from during each trial; all of the items were paired against one another by the end of the assessment. The 12 items were chosen based on teacher and parental report. The top 10, most frequently selected items (i.e., apple, grapes, juice, cookie, car, book, puzzle, radio, koosh ball, top) were included in this study.

Procedure

Baseline sessions. During baseline, preferred items were positioned within Adam's sight but out of his direct reach. The PECS book was maintained within sight and reach. No prompting of the target behavior (i.e., spontaneous requesting) was provided. The Gentle Reminder device (see above) was used to define the 10-min intervals. If Adam spontaneously and independently produced the target behavior during an interval, he was given his requested item within 3 sec, and his behavior was recorded within that interval. Baseline was conducted over a 5-day period, broken into 10-min intervals per day. The actual number of intervals varied based on how often Adam produced a spontaneous request. During the few intervals that he did request spontaneously, Adam was allotted time to engage with the requested item. Results showed that Adam's performance level was stable. The trajectory of data points was flat; therefore, intervention was implemented after Day 5.

Independent variable: FIBP. As during baseline, Adam's preferred items were within sight but out of direct reach. His PECS book was in sight and within reach. If he produced a Phase IV request independently, he again received the requested item within 3 sec, and the observer recorded this response within the corresponding interval. If Adam did not make a spontaneous request during an interval, the teacher initiated the prompt sequence when the interval ended.

The prompt sequence began with a physical prompt (i.e., hand-over-hand assistance) for Adam to place his hand on the PECS book (i.e., approach). If Adam then opened the book independently within 3 sec, prompting was removed. If he did not, then he was provided with a prompt to open the book. The same procedure was implemented for selecting an icon, placing it on the sentence strip on the front of the PECS book, and then handing it to his teacher. In other words, prompting was provided either to initiate the sequence, to continue the sequence, or both. If Adam completed the request spontaneously at any point during a prompt sequence, he was provided with the item requested. If Adam did

not complete the request spontaneously, the prompt sequence continued until he completed the Phase IV request with assistance. When a request was made (either spontaneously or with assistance), the requested item was provided within 3 sec.

Each prompt sequence extended over a period of about 2 minutes. When a prompt sequence was required, the next 10-min interval began when the prompted request was completed, and the item was provided to Adam. Therefore the actual number of intervals per day varied depending on the number of intervals followed by a prompt sequence and the number of intervals during which Adam accessed the requested item.

The intervention was planned to be in effect for a minimum of 5 consecutive school days, at which point Adam's educational team was scheduled to convene for a formal review of the data. By the end of the fifth day, Adam initiated Phase IV requests spontaneously during an average of 43% of the intervals. The team agreed that this was substantial enough to discontinue the prompting procedure that required intense staffing resources. The team also agreed to schedule a reassessment of Adam's spontaneous Phase IV requesting performance in 6 months. Because this intervention was limited to only 5 school days, we have classified it as "brief" but intensive.

Six-month follow-up assessment. Data were collected again for 5 days at the 6-month follow-up point, broken into 10-min intervals per day. The actual number of intervals varied based on whether or not Adam spontaneously requested. When he request spontaneously, Adam was allotted time to engage with the requested item before the next 10-min interval began. The environment was set up exactly as during the initial baseline. Preferred items, based on the most current preference assessment (i.e., truck, stress ball, interactive book), were within sight but out of Adam's reach. Adam's PECS book was within sight and within reach. No prompting was provided. If Adam produced the target behavior spontaneously, he received his requested item within 3 sec and the observer recorded this response within the designated interval.

Interobserver agreement. Due to the intensive nature of this intervention, additional staffing for an entire day was required. The educational team (i.e., classroom teaching staff, speech therapist, and program director) recorded Inter-Observer Agreement (IOA) for one full day during each phase (i.e., 20% of total days per phase). IOA was recorded on the dependent variable (spontaneous requesting), as well as integrity of the implementation of the independent variable (FIBP). IOA was computed by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100.

IOA for delivery of reinforcement was 100% during all phases of this study. IOA were also collected on implementation of the prompt sequence. During the baseline and 6-month follow-up, prompting was not part of the intervention protocol. However, data were still collected on all three phases with the following results: baseline 100%, intervention 95% (range 90–100%), and 6-month follow-up 100%. Finally, IOA data were collected for spontaneous requesting by Adam, resulting in 100% during baseline, intervention, and the 6-month follow-up.

Results

The percentage of intervals during which Adam used Phase IV requesting spontaneously during baseline, intervention, and 6-month assessment is shown in Figure 1. This figure indicates that Adam used Phase IV requests spontaneously at an average rate of only 12% (range = 10 to 20%) per day during baseline. However, during the first five treatment sessions, his spontaneous use of Phase IV requesting increased to an average rate of 43% (range = 20% to 55%) Note that the number of intervals across baseline and treatment sessions ranged from 27–30 when the extra time needed for prompting and reinforcement were subtracted from the total number of minutes in the school day (See Table 1). When observed during the 5 days of the 6-month follow up, Adam used Phase IV requesting at an average rate of 83% (range = 75% to 95%).

Across all phases, the time spent within a prompt sequence and/or engaged with a reinforcer affected the overall number of intervals available to Adam. Therefore the number of intervals conducted varied per day depending on the percentage of intervals in which prompting and/or reinforcement were provided. The

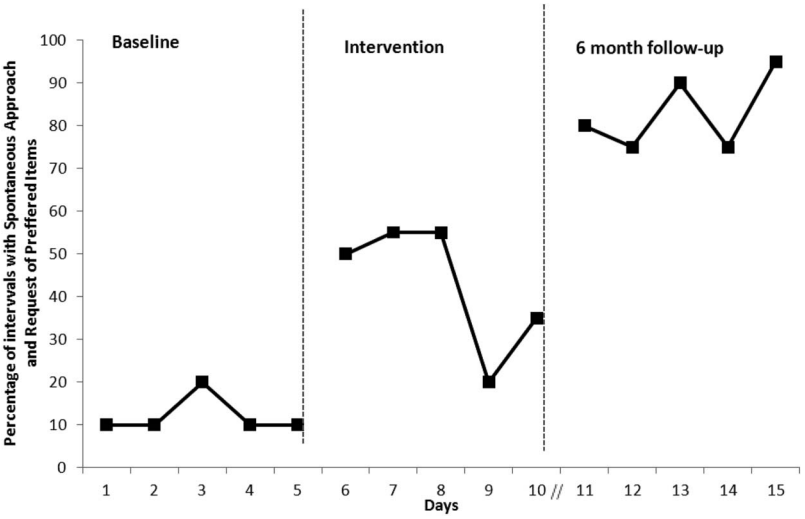

Figure 1. Percentage of intervals during which spontaneous approach and request occurred using PECS.

time spent either within the prompting sequence or engaged with a reinforcer reduced the number of possible intervals implemented within a day. For example, during baseline, prompt sequences were not implemented; however, reinforcers were provided following spontaneous requests. Therefore due to the low levels of spontaneous requesting emitted during baseline, Adam was afforded 32 of the 33 intervals that day (See Table 2). However, during intervention, the impact of both the delivery of a prompt sequence and engagement with a reinforcer had a greater cumulative effect on the number of intervals available to Adam, thereby reducing them to a range of 25–27 per day. Finally, during the 6 month follow-up phase, there were more intervals available due to the higher rates of spontaneous requesting and subsequent delivery of reinforcers and the lack of prompting due to the condition protocol. Therefore Adam participated in 30 intervals per day during this phase.

Table 2
Number of 10-min Intervals Conducted Per Day

Baseline		Intervention		6-month follow-up	
Session#	Intervals	Session#	Intervals	Session#	Intervals
1	32	6	27	11	30
2	32	7	27	12	30
3	32	8	27	13	30
4	32	9	25	14	30
5	32	10	27	15	30

Discussion

This case study demonstrates an association between increased spontaneous use of Phase IV PECS with implementation of a fixed interval-based prompting (FIBP) procedure as an adaptation to the traditional PECS training protocol. Prior to implementation of FIBP, the participant (Adam) rarely used his PECS book to locate icons for making spontaneous requests. During the intervention, and 6 months after the intervention, his use of the PECS book to find and use such icons for Phase IV requesting had increased considerably.

Previous studies have shown that while some individuals can learn to initiate PECS independently when provided with the traditional teaching protocol (Gordon et al., 2011), others do not (Ganz, Lashley, Rispoli, 2010). The participant in this study belonged to the latter subgroup. The traditional PECS protocol includes steps for teaching the independent use of PECS after an individual has learned to initiate, but Adam had difficulty initiating. The FIBP adaptation was implemented to increase the likelihood that Adam would initiate Stage IV PECS requests by

spontaneously accessing his PECS book to find the icons needed to emit his requests. At baseline, he did not approach his PECS book to select communication signals. However, throughout his exposure to FIBP, his spontaneous use of the PECS book to select communication icons increased.

Once the intervention was introduced, it was interesting to note how rapidly Adam began to use the PECS book spontaneously for selecting icons to request items throughout the day. Perhaps the rapid increase reflected a combination of negative and positive reinforcement. For example, if Adam was attempting to avoid the prompts, it is possible that the target behavior was negatively reinforced by the expectation of prompting and positively reinforced by access to the requested item. Additionally, exposure to a consistent prompt sequence may have helped Adam to master the behavior chain leading to a successful request for a desired item. And once the target behaviors increased, Adam experienced reinforcement with increasing frequency. This too may have contributed to the increase in his use of PECS and to the maintenance and increase of the target behaviors 6 months postintervention.

The FIBP adaptation may also have supported Adam's performance to the extent that it offered the high rate of learning opportunities needed to overlearn a target skill. Often when a treatment procedure is faded for students with autism, the level of responding decreases somewhat. When a skill is overlearned, the level that then persists is a level that tends to be more socially acceptable. Overlearning has been shown to be an effective strategy for retention, even though the effects may diminish over time (Krueger, 1929; Rohrer, Taylor, Pashler, Wixted, & Cepeda, 2005).

A final strength of the intervention was the degree of collaboration that emerged among members of the educational team. Merging principles of applied behavior analysis (ABA) with communication processes associated with the field of speech-language pathology (SLP) led to an individualized and innovative intervention procedure. Perhaps Adam's performance was positively influenced by the extent of this collaboration. All members of the team supported the intervention.

Despite the positive results for the participant in this study, the study also has several limitations. Most importantly, although improvements in the use of PECS can be associated with the FIBP adaptation, it cannot be concluded that the FIBP adaptation caused these improvements. The current study followed a single-case AB design without control conditions. Although Adam demonstrated high levels of spontaneous requesting at the 6-month follow-up, factors other than FIBP, such as maturation, may have accounted for this pattern. As a corollary, the nature of case study design, even under the most ideal conditions, limits generalization to the broader population.

Second, although there was an increase in spontaneous requesting from baseline to intervention, there was a decrease in spontaneous requesting on Day 9 (to 20% of intervals) followed by an increase on Day 10 (to 35% of intervals) during the intervention phase. Ideally, the intervention phase should have been continued longer to demonstrate greater stability in the data with a more consistent upward trend overall. Thus, the brevity of the intervention, while attractive in the face of limited instructional resources, can also been seen as a limitation.

A third limitation is actually related to the increase in the participant's performance levels. At the 6-month follow-up, Adam made requests during 83% of the 10-min intervals throughout the day. Depending on the nature of the requests, this could be viewed as disruptive in some classrooms.

Despite the limitations to this case study, the positive changes associated with Adam's performance in relation to the FIBP adaptation to PECS training warrant further investigation through controlled single-subject designs. A multiple-baseline design across participants would be appropriate to show the functional relationship between such an intervention and the dependent variables of approach and spontaneous requesting.

It would also be interesting to know what level of prompting might be necessary to gain the effects that were achieved with Adam. In the present study, the entire school day was divided into 10-min intervals for continuous implementation of FIBP. It is possible that if the procedure had been used for only 10 min each hour the participant may have continued to initiate PECS without prompting during the remainder of each hour.

In conclusion, this single-subject case study demonstrated that a fixed interval-based prompting (FIBP) adaptation to the traditional PECS was associated with an increased frequency in the use of PECS by one student with ASD who was not successful in learning these behaviors under the traditional PECS training protocol. Moreover, the target behaviors were retained over a 6-month period. However, this was a case study without control conditions, and further research is needed to assess the effect that can be attributed to the FIBP adaptation.

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