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Teaching Caregivers to Implement Speech-Generating Device-Based Mand Training: Evaluating the Efficacy of Behavioral Skills Training

Rachel Suberman
University of South Florida, resuberman@gmail.com

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by

Rachel Suberman

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Major Professor: Catia Cividini-Motta, PhD, BCBA-D
Nicole McMillan, PhD, BCBA-D
Raymond Miltenberger, PhD, BCBA-D

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Key words: Applied behavior analysis, parent training

DEDICATION

I dedicate this thesis to my family, friends, teachers, and colleagues who displayed tremendous support as I completed this project. I also dedicate this project to families who give their children a voice when traditional means of spoken language are ineffective.

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I would like to acknowledge Dr. Catia Cividini-Motta for her guidance and encouragement throughout the process of completing this project. She has contributed to the field of Applied Behavior Analysis in many ways and I thank her for her dedication to her students and the field.

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ABSTRACT

Many individuals with developmental disabilities do not develop vocal repertoires. Thus, teaching the use of an augmentative and alternative communication (AAC) device is imperative. A speech-generating device (SGD) is an example of an AAC that is universally understood. Individuals with developmental disabilities have been taught to communicate using such device. Teaching caregivers to conduct communication training with their children may be one to way to foster communication in an individual's natural environment. Thus, the purpose of this study was to extend previous research by using behavioral skills training (BST) to teach caregivers to implement SGD-based mand training using an adapted training sequence. Additionally, we evaluated whether training caregivers to implement mand training with their children resulted in an increase of independent mands in their children. This study found that BST was effective in teaching caregivers to implement SGD-based mand training with their children. Additionally, independent mands increased from pre-training to post-training observations for two children.

Key words: caregiver training, mand training, Proloquo2Go™, speech-generating devices

INTRODUCTION

Approximately, 25% to 30% of individuals with autism spectrum disorders (ASD) are likely to have deficits in communication (Lord & Jones, 2012). Those with a limited communicative repertoire may engage in problem behavior to access social reinforcers, such as preferred items or attention (see Beavers, Iwata, & Lerman, 2013 and Hanley, Iwata, & McCord, 2003 for reviews), thus impairing the individual's independent functioning and social development (Darrou et al., 2010). Despite the development of various teaching procedures to promote vocal communication, many individuals with developmental disabilities do not acquire functional vocal repertoires (National Research Council, 2001). Thus, the use of augmentative and alternative communication (AAC) aids may be necessary (Durand, 1993; Mirenda, 2003).

Augmentative and alternative communication aids either enhance an individual's current vocal speech repertoire (i.e., augment), or act as the individual's sole modality of communication (i.e., alternative; Mirenda, 2003). Augmentative and alternative communication aids include manual signs, picture exchange, and speech-generating devices (SGDs). Manual signs are classified as a topography-based mode of communication as each manual sign is clearly unique to the verbal response (Sundberg & Sundberg, 1990). Manual signs have also been referred to as unaided communication modality (Mirenda, 2003). Many individuals have learned to communicate using manual signs and some learners have indicated a preference for this communication modality (Couper et al., 2014; van der Meer, 2012). Although an advantage of manual signs is that the individual does not require extraneous materials to communicate (Mirenda, 2003), one drawback is that few community members understand signs, thus limiting

the number of individuals with whom the person can communicate (Durand, 1993). In addition, the need to modify signs due to the person's limited motor skills can further restrict his or her verbal community (Durand, 1993; Mirenda, 2003).

Picture exchange and SGDs are selection-based communication modalities (also referred to as aided communication, Mirenda, 2003), as the learner's physical response is the same (e.g., pointing to or exchanging a picture) for every verbal response (Sundberg & Sundberg, 1990). Selection-based communication modalities involve the use of equipment (e.g., a picture book or an electronic device) containing symbols representative of stimuli in the individual's environment (Bondy & Frost, 1994; Mirenda, 2003; Schlosser, 2003). Although picture exchange and SGDs may be more easily understood than manual signs (Durand, 1993), both communication modes require extraneous stimuli. Thus, they are dependent on the availability of the communication aid.

To determine the most preferred and effective AAC modality, multiple studies have compared acquisition and preference for AAC modalities. Results of studies have found that over 75% of participants preferred SGDs to manual signs (van der Meer et al., 2012), and over 88% of participants preferred SGDs to both manual signs and picture exchange (Couper et al., 2014; McLay et al., 2015). Additionally, results of some studies have indicated that acquisition of SGDs required less teaching trials than manual signs (Achmadi et al., 2014; van der Meer et al., 2012), or both manual signs and picture exchange (Couper et al., 2014). These results provide support for teaching individuals to communicate using SGDs.

Speech-generating devices are found in a variety of platforms, ranging from modern devices, such as smartphones and tablets, to equipment specifically designed for AAC voice output functions, such as Dynavox® and GoTalk® (King et al., 2014; Shane et al., 2012).

However, devices such as Dynavox® and GoTalk® have been known to be heavy, expensive, difficult to use, and stigmatizing for the user, potentially decreasing access and likelihood of use (Shane et al., 2012). Due to advances in technology, household electronics such as iPads® and smartphones can now be used as SGDs simply by downloading speech-generating applications. These devices are less stigmatizing for the user (Durand, 1993; Shane et al., 2012), user friendly, and more cost effective than the previous SGD models. Thus, leading to greater access and potentially increased use (King et al., 2014; Kagohara et al., 2013; Shane et al., 2012).

Research has shown that individuals can be taught to use SGDs to emit a variety of communicative responses including mands (e.g., King et al., 2014; Waddington et al., 2014; Xin & Leonard, 2015), and intraverbals (e.g., Lorah et al., 2015; Waddington et al., 2014; Xin & Leonard, 2015). Moreover, the acquisition of SGDs is sometimes associated with an increase in vocal speech (e.g., Gevarter, et al., 2016; Kasari et al., 2014; Roche et al., 2014). In addition, a variety of teaching procedures have been employed for teaching individuals to use SGDs such as discrete trial training (DTT; e.g., King et al., 2014; Sigafoos et al. 2004), naturalistic training (Sigafoos et al., 2004; Xin & Leonard, 2015), and an interrupted chaining procedure (Sigafoos et al., 2013). However, behavior analysts usually are responsible for completing communication training in clinics, schools, or homes, and during therapy hours. Thus limiting the opportunities for the learner to practice using SGDs. In fact, parents are often not directly involved in language interventions (Smith, 2011; Hong et al., 2016; U.S. Department of Education, 2014), which potentially hinder the acquisition, maintenance, and generalization of AAC use. Furthermore, Smith et al. (2011) suggested that training parents to promote their children's communication skills may result in a decrease in the children's problem behavior.

Therefore, one potential way to promote communication acquisition in individuals with developmental disabilities is to involve caregivers in communication training (Hong, Ganz, Neely, Gerow, & Ninci, 2016). Limited studies have attempted to teach caregivers to facilitate SGD-based communication in the natural environment (Hong et al., 2014; Sigafoos et al., 2004). For instance, Sigafoos and colleagues (2004) taught three caregivers (i.e., mother, sister, and family friend) to implement SGD-based mand training with an adolescent at home. In this study, written and verbal descriptions of the target responses combined with observation of sessions completed by the researchers was effective in training the caregivers to teach SGD-based communicative responses to the adolescent. Similarly, Hong and colleagues (2014) trained four caregivers to implement mand training with an adult SGD user through instructions, modeling, and practice. In both studies caregivers learned to accurately implement SGD-based communication training. However, the learner's independent SGD-communication increased after the caregivers learned to implement training in Sigafoos and colleagues, but not in Hong and colleagues. Nevertheless, both studies only included one SGD user, used different teaching procedures, and did not assess for generalization of the skills. Furthermore, only one study assessed if caregiver training led to an increase in SGD use. Therefore, additional research in this area is warranted.

A standardized training protocol that may be effective in teaching caregivers to implement SGD-based mand training with their children is behavior skills training (BST). Behavioral skills training employs instruction and modeling provided by an expert, rehearsal of the skills by the learner, and feedback from the expert (e.g., Miltenberger et al., 2004; Sarokoff & Sturmey, 2004). Behavioral skills training has been shown to be effective in training caregivers a variety of skills including teaching parents to conduct functional assessments

(Shayne & Miltenberger, 2013) and teaching caregivers to implement pedestrian safety skills training with their children (Harriage, Blair, & Miltenberger, 2016). Furthermore, BST has been effective in teaching communication partners to correctly implement levels 1, 2, and 3 of the Picture Exchange Communication System (PECS; Homlitas, Rosales, & Candel, 2014; Rosales, Stone, & Rehfeldt 2009). Therefore, BST is likely to foster the caregivers' acquisition of the procedures involved in teaching children to mand using SGDs.

To date, there is limited research on procedures for teaching caregivers to conduct SGD-based communication training with their children. Although previous research has employed components of BST (e.g., modeling and rehearsal) when teaching caregivers to implement mand training, the efficacy of BST in teaching caregivers to conduct SGD-based communication training is unknown. Therefore, the purpose of this study was to extend previous research by using BST to teach caregivers to implement SGD-based mand training using an adapted training sequence.

METHOD

Participants, Setting, and Materials

Three caregiver-child dyads participated in the study. All children were diagnosed with an ASD and communicated with a SGD consisting of an iPad® with Proloquo2Go™. Participants were recruited from local ABA service providers in the Tampa area. Dyad 1 consisted of a 39-year-old female and her 9-year-old daughter. The child of dyad 1 communicated with manual signs and a SGD that she had for 2 years. At the time of enrollment in the study, her caregiver reported that she often selected pictures of preferred items to request her wants in the home. Dyad 2 consisted of a 35-year-old female and her 12-year-old son. The child of dyad 2 communicated with manual signs and he had had a SGD for approximately 2 years. His caregiver reported that he rarely used his SGD in their home but that his therapists had him practice communicating with the SGD during his ABA therapy. Dyad 3 consisted of a 42-year-old female and her 10-year-old son. The child communicated with vocal approximations and with his SGD, which he had used for approximately 6 months. His caregiver reported that he rarely used his SGD in their home but that it was occasionally used in his classroom. None of the caregivers had ever received formal SGD communication training. Sessions were conducted in the caregivers' homes.

Materials included a video camera to record sessions, an iPad® with the application Proloquo2Go™ used during BST, printed instructions for implementing mand training, several items identified as preferred for each of the participating children, and data sheets.

Measurement and Interobserver Agreement

The primary dependent measure was the percentage of steps implemented correctly on the task analysis detailing the caregiver target responses for the adapted training sequence for SGDs (Appendix A, B, C; Bondy & Frost, 1994; King et al., 2014). Each session consisted of five trials and the task analysis was used to score caregivers' performance during baseline, BST, assessments, and probes. The percentage of correct steps was calculated by adding the number of steps performed correctly, dividing it by the total number of applicable steps, and then multiplying by 100%. Data were also collected on the duration (time spent in training) of BST. Caregiver 1 spent 115 min in BST, caregiver 2 spent 130 min in BST and 45 min in BST booster, and caregiver 3 spent 125 min in BST.

Data were also collected on mands emitted by the children throughout the structured observation, baseline, and post BST assessments. These data were summarized as the percentage of independent mands emitted by each child. An *independent mand* was defined for each child based on his or her performance during baseline. An independent mand consisted of the child independently selecting the correct picture sounding the item's name on the device. Child 2 was observed to repeatedly select the icon on the device. If this occurred, the caregiver was instructed to not provide any consequence, remove access to device and continue to the next trial. A *prompted mand* was defined as the child not emitting a response within 5 s to complete any part of the mand sequence. An *error* was defined as the child emitting an incorrect response. During the structured observation, an *opportunity to mand* consisted of any of the following: the child requesting an item using any mode of communication (vocal, signs, iPad®, gestures), the caregiver showing a preferred item to the child independently of whether the child then requested the item using any mode of communication, and the child gaining access to an item without requesting it.

Interobserver agreement was calculated for at least 33% of sessions for each caregiver-child dyad across each of the assessments and phases. Graduate student observers were trained to collect interobserver agreement and treatment integrity data by having them review and collect data on a practice video until their data matched the data collected by the primary observer on at least 80% of the trials. The observers independently scored sessions by directly observing the session or by reviewing recorded footage of the sessions. Interobserver agreement was calculated by totaling the number of agreements from each observer's data sheet, dividing it by the total number of agreements and disagreements, and multiplying by 100%.

Interobserver agreement was calculated for 44% of all sessions for dyad 1. Interobserver agreement for dyad 1 was 98% for the preference assessment, 100% for the pre-training structured observation, 99% (range 97%-100%) for baseline assessments, 94% (range 87% to 98%) for post-BST assessments, and 89% (range 80% to 97%) for generalization probes. Interobserver agreement was calculated for 39% of all sessions for dyad 2. Interobserver agreement for dyad 2 was 100% for the preference assessment, 100% for the pre-training structured observation, 92% for baseline assessments (range 84% to 100%), 95% (range 92% to 98%) for post-BST assessments, 96% for post-booster BST assessments, and 87% for generalization probes. Interobserver agreement was calculated for 41% of all sessions for dyad 3. Interobserver agreement for dyad 3 was 100% for the preference assessment, 89% (range 86% to 94%) for baseline assessments, 92% (range 87% to 96%) for post-BST assessments, and 87% for generalization probes.

Trained observers assessed treatment integrity by reviewing 33% of sessions across caregivers. A treatment integrity checklist (Appendix D, E) was used to score session videos or directly observe sessions. The checklist measured the researcher's fidelity in implementing the

different phases of the study, including baseline, the components of behavioral skills training such as providing instruction, modeling the correct responses, allowing the caregivers to rehearse the skills, and providing feedback to the caregivers, post-BST assessments, and probes. The treatment integrity score was calculated by totaling the number of steps performed correctly, dividing it by the total number of steps, and multiplying by 100%. Treatment integrity was 100% across all phases for dyads 1, 2 and 3.

A social validity questionnaire was administered to the caregivers at the end of the study (Appendix F). The questionnaire contained four questions evaluating the caregivers' opinions about the study. Each question was answered using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Caregivers 1 and 2 reported agreement or strong agreement with each question on the social validity questionnaire.

Experimental Design

The experimental design was a nonconcurrent multiple baseline across participants with generalization probes. The implementation of behavioral skills training was staggered across caregivers upon stability of data during baseline.

Procedure

Preference assessment. A paired-stimulus preference assessment (Appendix G; Fisher et al., 1992) was conducted with the participating children to identify preferred edible items (child 1 and 2) and preferred tangible items (child 3). Prior to beginning the assessment, the children were provided with a small piece of each edible item or allowed to interact with each tangible item for up to 30 s. During the preference assessment the items were presented with every other item once on the right side and once on the left side. During each trial the first item reached towards by the child was scored as the selected item on that trial and the other item was

immediately removed from the table. If after 5 s of presenting the edible or tangible items, the child had not made a selection, the items were removed for 5 s and the trial was represented a second time. If on the second time the child did not make a selection, the trial was scored as no response. The items selected in approximately 70% or more of trials were selected for mand training. A list of the preferred items identified during the preference assessments was included on the instructions for mand training presented to the caregivers.

Structured observation. A structured observation of the caregiver-child dyad was conducted both pre- and post-BST to measure the frequency of independent mands emitted by the child using his or her SGD (see Appendix H). Preferred items identified during the preference assessment were within the child's eyesight but out of reach to set the occasion for the child to mand. In addition, the child's SGD was available and functioning. Prior to beginning the session, the child had the opportunity to use the restroom and the caregiver was instructed to respond how they normally would to their child's requests. At the beginning of the session, the research assistant provided a general verbal prompt to the child (e.g., "if you want something, please let us know"). Throughout the session, all mands (with or without iPad®) emitted by the child resulted in access to the requested item. If at any point during the session the child independently accessed a preferred item without requesting it, he or she was allowed to consume it or play with the item. Sessions continued until the child had 10 opportunities to mand. The post-training session was conducted approximately 6 weeks following the generalization probe conducted post-mastery of level 3a.

Baseline. During baseline, each caregiver was given a copy of the task analysis (Appendix A, B, C) to review for 5 min. Then, they were instructed to demonstrate how they would encourage their child to request preferred items using their SGD. Each caregiver's performance was scored across a session consisting of five trials. No feedback was provided to caregivers during the baseline sessions.

Behavioral skills training. The steps of BST as described by Miltenberger and colleagues (2004) were used to train caregivers to implement levels 1, 2, and 3a of the adapted training sequence for SGD. The researcher first reviewed the correct implementation of the steps of SGD-mand training and provided written instructions to the caregivers (see Appendix A, B, C). The researcher then modeled the correct responses with a training assistant while the caregiver observed. Training assistants were provided with a script (Appendix I) detailing their performance during the role-play to ensure that the researcher had a chance to model the correct caregiver response to each of the following potential child performances: independent responses, responses requiring a gestural point, responses requiring full physical guidance, and incorrect responses (i.e., selecting the picture of a neutral item). After the researcher modeled each response, the caregivers were given the opportunity to rehearse the responses. Each response was practiced at least once. If a step was performed incorrectly or the caregiver requested more opportunities to rehearse, additional trials were conducted. The lead researcher provided positive and corrective feedback to the caregiver after each trial. Once the caregiver had performed the response to each scenario correctly in at least one trial, the researcher asked the caregiver if they felt comfortable conducting these steps. If they stated they felt comfortable, no additional trials were practiced and their performance was assessed. If they stated they wanted more practice, we conducted more trials until they reported that they felt comfortable conducting the steps.

Behavioral skills training assessment. During each session of the BST assessment the training assistant emitted each of the different potential responses at least once. If the caregiver completed less than 90% of the steps correctly, additional BST training and BST assessment sessions were completed until the caregiver met mastery criterion by scoring 90% in a session.

Post-behavioral skills training assessment. Following the mastery of implementation of SGD mand training during BST, the researcher conducted an assessment to evaluate the caregivers' implementation of SGD mand training with their children. Items identified by the preference assessment were available to the caregiver. Caregivers' performances were evaluated on at least three sessions. If the caregiver completed all steps correctly across the three sessions, no additional sessions were completed. If the caregivers' performances were variable but reached 90% on the last session, additional assessment sessions were completed. If the caregivers' performances were on a decreasing trend, or stable but below 90%, a BST booster session was conducted with their child in the natural environment followed by a post-BST booster assessment sessions

Behavioral skills training booster session. During the BST booster session, the same procedures outlined for BST were implemented. However, training included the caregiver's child instead of a training assistant. The lead researcher first discussed with the caregivers their performance in the previous assessment sessions. Then, the BST components of instruction, modeling, rehearsal, and feedback were completed until the caregiver correctly conducted the different responses at least once and upon being asked, stated that she felt comfortable with the steps.

Post-BST booster session assessment. Upon completion of a BST booster session, the caregiver's performance (caregiver 2 only) was reevaluated across three assessment sessions. If the caregiver scored at least a 90% across three consecutive sessions, no additional sessions were completed. If the caregiver's performance was variable but reached 90% on the last session, additional assessment sessions were completed. If the caregiver's correct performance was on a decreasing trend, or was stable but below 90%, additional booster sessions were conducted and

performance was reassessed. If necessary, this process continued until the caregiver scored 90% across three consecutive sessions or for a maximum of 10 BST booster training sessions.

Generalization probe. To test for generalization of the caregivers' skills, after meeting mastery criterion during the assessment sessions, the dyads were observed in a novel setting. The generalization probe consisted of one session following the same procedures as the post-BST assessment. The generalization probe occurred approximately 1 week after completion of the post-BST assessment for each level.

RESULTS

Table 6 displays the results from the preference assessments. Child 1's highest preferred edibles were Slim Jims®, Jimmy Dean® breakfast sausage, Li'l Smokies®, salami, bologna, chocolate milk, and orange juice. Child 2's highest preferred edibles were Pirate's Booty®, Veggie Straws®, Oreos®, Skittles®, and Rice Krispy Treats®. Child 3's highest preferred tangibles were train videos on his iPad, two dinosaur books, a light-up ball, and Bunchems®. These items were included during all subsequent assessments as items the child could access contingent on a mand.

Figure 1 depicts the caregivers' performances during baseline and post-BST training assessments sessions for levels 1, 2, and 3a of instruction. During baseline caregivers correctly completed 75% or less of the steps for level 1 and 60% or less of the steps for levels 2 and 3a. During the post-BST assessment sessions, caregivers completed at least 87% of the steps correctly across all levels during post-BST assessments suggesting that BST was effective in increasing their performance of SGD mand training. Finally, caregivers completed at least 80% of the steps correctly during the generalization probes conducted in a novel setting.

Three baseline sessions were conducted for caregiver 1 for each level of instruction and following BST caregiver 1 met mastery criteria for all three levels of SGD-based mand training. Following BST, four post-BST assessments were conducted to demonstrate mastery criterion for level 1, five for level 2, and three for level 3a. Generalization probes were conducted once mastery criterion was reached for each level and this caregiver scored above 90% in all three

generalization probes conducted in a novel setting. Caregiver 1 spent 35 min in BST for level 1, 45 min for level 2, and 35 min for level 3a, totaling 115 min spent in BST.

Five baseline assessments were conducted for caregiver 2 for each level of instruction. Caregiver 2 met mastery criterion for levels 1 and 3a following BST and three post-BST assessment sessions were needed to demonstrate acquisition of these skills. Following BST, however, caregiver 2's performance of the steps for level 2 remained below criterion thus a booster BST session was conducted for level 2. Following the booster BST session, caregiver 2 met mastery criterion for level 2. Caregiver 2 scored 90% in the generalization probe for level 1 and 95% in the generalization probe for levels 2 and 3a. Caregiver 2 spent 60 min in BST for level 1, 65 min for level 2, 40 min for booster BST for level 2, and 45 min for level 3a totaling 210 min spent in BST for all levels.

Finally, seven baseline sessions were conducted for levels 1 and 3a, and eight sessions were conducted for level 2 for caregiver 3. Following BST caregiver 3 met mastery criterion for all three levels of SGD-based mand training and mastery of the skills was demonstrated in three post-BST assessment sessions. Caregiver 3's generalization probe scores were between 83% and 88%. Caregiver 3 spent 45 minutes in BST for level 1, 50 min for level 2, and 30 min for level 3a totaling 125 min spent in BST for all levels.

Figure 2 depicts the percentage of independent mands emitted by each child throughout all phases of the study. Child 1 emitted independent mands in less than 40% of the opportunities across the structured observation pre-BST, baseline, post-BST assessments, and generalization probes however independent manding increased to 80% of opportunities during the post-BST structured observation. Child 2 emitted independent mands in less than 33% of the opportunities across the structured observation pre-BST, baseline, post-BST assessments, and generalization

probes however during the structured observation post-BST he manded independently in 90% of opportunities. Child 3 emitted independent mands in less than 33% of opportunities across the initial structured observation, baseline, post-BST assessments, and generalization probes. The post-BST structured observation has not been conducted for dyad 3. Overall, the data on independent mands emitted by the children throughout all phases of the study show that independent manding was low throughout the first five phases of the study and increased during the structured observation conducted post-BST for child 1 and 2.

DISCUSSION

The current study evaluated the effectiveness of BST in teaching caregivers to conduct mand training with their children who communicated with a speech generating device consisting of an Ipad ® with Proloquo2Go™. The results of the study showed that following behavioral skills training, caregivers correctly implemented mand training with their children. Additionally, only one of the caregivers, caregiver 2, required a BST-booster session to learn to correctly implement the mand training protocol. Finally, independent mands increased for child 1 and 2 as observed during the structured observation completed following BST. These results are consistent with previous research on BST and caregiver training that has shown that BST is effective for teaching caregivers a variety of skills, such as how to conduct functional assessments (Shayne & Miltenberger, 2013) and how implement discrete-trial teaching (Lafasakis & Sturmey, 2007) and pedestrian safety skills with their children (Harriage et al., 2016). However, the increase in independent mands observed during the final structured observation was unexpected. Both child 1 and 2 emitted independent mands in over 80% of opportunities during the post-BST structured observation even though responding during the other phases of the study remained at levels similar to the pre-BST structured observation. Given that the post-BST structured observation was conducted at least 6 weeks following the completion of the post-BST assessment for level 3a, it is plausible that caregivers may have continued to implement the mand training steps with their children, leading to an increase in independent responding.

This study adds to previous research evaluating the effectiveness of BST in teaching adults without behavioral analytic training to implement mand training. For instance, Rosales, Stone, and Rehfeldt (2009) used BST to teach graduate students and Homlitas, Rosales, and Candel (2014) taught teachers to implement mand training with individuals communicating using PECS. Similarly, Sigafoos and colleagues (2004) and Hong and colleagues (2014) successfully taught caregivers to implement mand training with an adolescent and an adult, respectively, whose communication modality consisted of a SGD although these studies did not use BST as the intervention. The current study, however, used BST to teach caregivers to implement mand training with their child who communicated with SGDs. In addition in our study the steps for mand training were adapted from the standardized PECS instructions (Bondy & Frost, 1994). Our study thus replicates previous research using BST to teach adults to implement mand training and extends previous research by being the first to use BST to teach caregivers to implement SGD-based mand training with their children.

It is important to consider the variables responsible for the current results. Behavioral skills training consists of instruction, modeling, rehearsal and feedback (e.g., Miltenberger et al., 2004; Sarokoff & Sturmey, 2004). During baseline, the caregivers were provided with the instructions yet access to instructions alone did not result in mastery of the skills thus suggesting that modeling, rehearsal, and/or feedback was necessary. Previous studies have used components of BST to teach caregivers to implement SGD-based mand training. For instance, Sigafoos and colleagues (2004) employed instruction and modeling in their training which resulted in caregivers successfully implementing the mand training steps with their child. Additionally, Hong and colleagues (2014) used instructions, modeling, and practice to effectively teach caregivers SGD-based mand training. Thus it is possible that in the current study caregivers may

have acquired the skills through modeling alone or modeling plus rehearsal however because we evaluated BST we can not draw any conclusions about the efficacy each of its components alone.

Furthermore, each child's history with a SGD may have impacted the results. All children had access to an SGD but only child 1 and 2 received ABA therapy. According to caregivers each of the children used their SGD at least occasionally at school or the clinic where the child was receiving services. Thus it is possible that the children could use their SGD to communicate but did not do so at home, yet by experiencing mand training in the home setting the skills they had previously acquired generalized to this new setting. Future research should assess children's skills across settings and consider selecting children whose manding repertoire is limited across all settings.

Additional limitations of the current study must be discussed. First, caregivers were instructed on how to implement the adapted steps of mand training for levels 1, 2 and 3a. The steps of mand training included instructions on how to arrange the environment, entice with a preferred item, prompt the child to mand, and reinforce the child's correct response. These steps did not include procedures for collecting data, evaluating progress, introducing new items, fading prompts, and providing differential reinforcement for prompted and independent responses. However the purpose of the study was to evaluate the effects of BST on teaching caregivers to implement mand training. Although we did not teach all of the steps, given that BST was effective in teaching caregivers the target skills selected for this study, it is likely that BST would result in the acquisition of these other responses as well. Second, the steps of mand training did not include specific guidelines for addressing problem behavior. Anecdotally, problem behavior in the form of aggression occurred in almost every session for child 2 and 3. We instructed the caregivers to follow their child's clinical program in effect at the beginning of this study. If these

were nonexistent, we instructed the caregivers to follow best practice procedures (e.g., minimal attention, redirection to the task). Anecdotal observation suggests that at least in some cases caregiver performance was lower during sessions in which their child engaged in problem behavior. Thus future research should consider incorporating steps for addressing problem behavior that occurs during sessions. Third, we did not collect maintenance data on the caregiver's performance and generalization data were only collected across settings. Future research should consider assessing maintenance and also variables that may impact long term maintenance of the skills taught to caregivers. Finally, caregiver 3 scores decreased during the generalization probe, possibly because we did not incorporate common stimuli, other than the preferred items, between training and generalization settings (Miltenberger, 2012). Future research should ensure that procedures selected for training are likely to lead to acquisition, generalization, and maintenance of the skills. This could be accomplished by teaching across multiple stimuli in the training environment, ensuring the training incorporates common stimuli from the natural environment, or incorporating stimulus situations that may occur in the natural environment (Miltenberger, 2012).

In conclusion, this study provides evidence that caregivers can learn to conduct mand training with their children who use a SGD to communicate. The intervention also led to an increase in independent mands from the child. This study adds to the body of research on mand training, BST, and SGD-based communication.

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Table 1
Child's Highly Preferred Items

Child 1	Child 2	Child 3
Li'l Smokies	Oreos	Bunchems
Orange Juice	Skittles	Train Videos
Jimmy Dean Sausage	Pirate's Booty	Orange and Blue Light Up Ball
Chocolate Milk	Rice Krispie Treats	Dinosaur Pop-Up Book
Salami	Veggie Straws	Dinosaur Safari Book
Bologna		

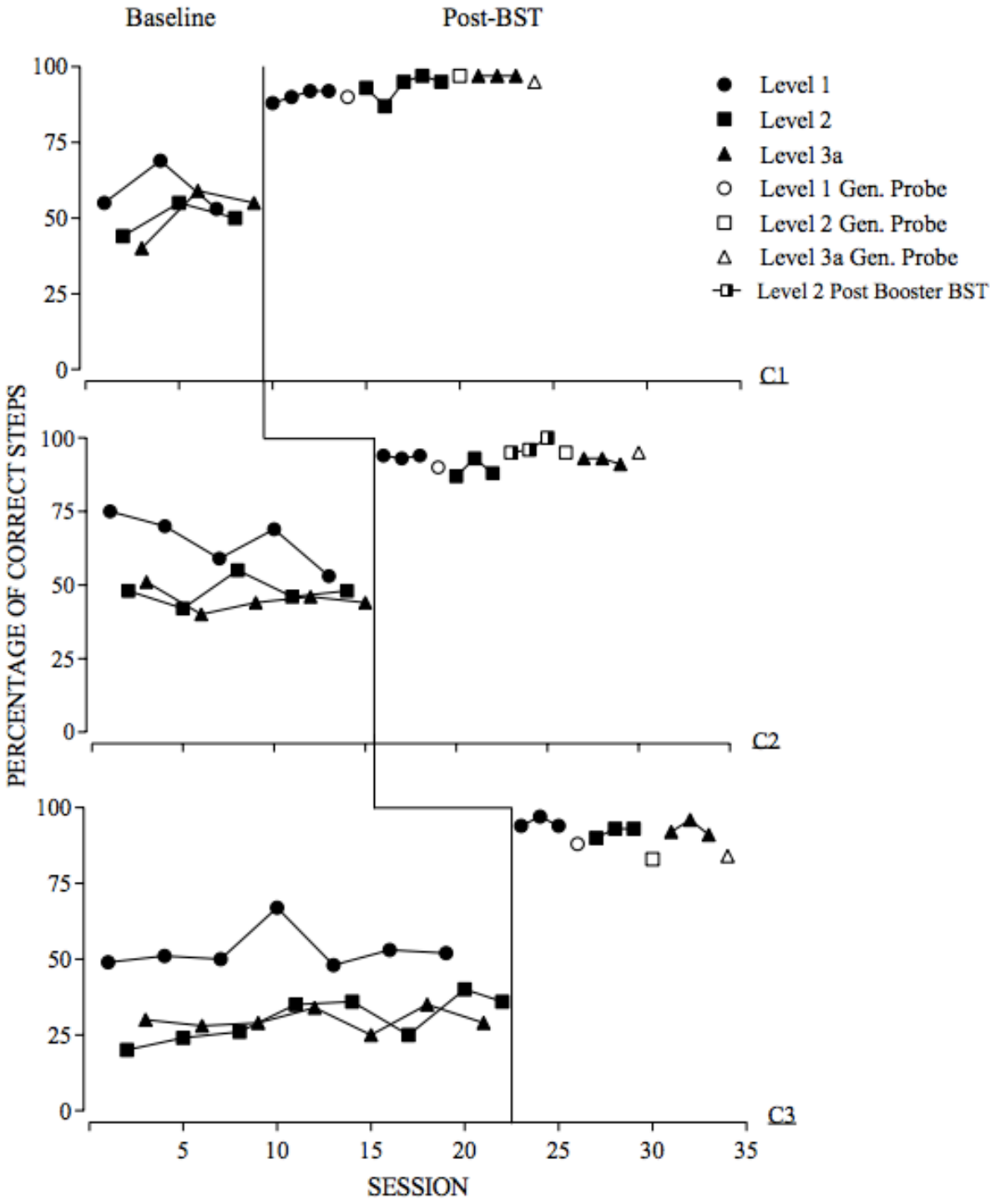

Figure 1. Percentage of steps correctly implemented during all phases across all caregivers.

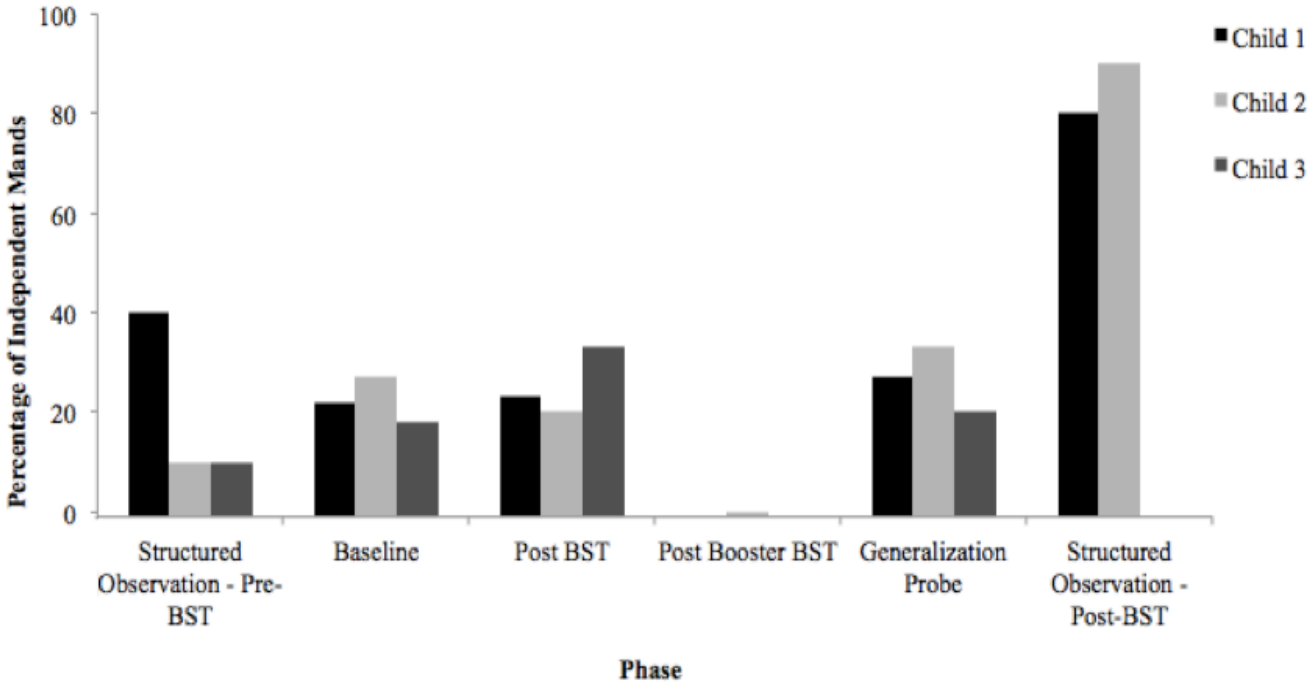

Figure 2. Percentage of independent mands emitted by each child during all phases of the study with each caregiver. BST-booster was only necessary for Caregiver 2 thus data on mands is for that assessment is only available for Child 2.

Appendix A

Task Analysis: Caregiver Implemented Mand Training **Level 1**

Description	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Pre-Session					
1. Ensure materials are ready (iPad is functioning, preferred edibles are available, pictures of preferred edibles are programmed in iPad)					
Session					
2. Place preferred item out of child's reach but within eyesight					
3. Place iPad next to child					
4. Stand/sit next to child					
5. Hold (entice) item in front of child until child looks at or reaches for item					
6. If child independently selects picture of desired item within 5 s of previous step:					
a. Vocally state name of item and praise (e.g., "good job")					
b. Provide larger piece of edible item to child/approximately 20-30 s access to item					
7. If child has not pressed icon within 5 s of step 5:					
a. Provide gestural prompt (e.g., point) towards icon on iPad					
b. If no response within 5 s after gestural prompt, physically prompt by using hand over hand guidance to press icon					
c. Vocally state the name of the item					
d. Provide small piece of edible after prompted response or approximately 5 s of access to item					
TOTAL SCORE					
Child response per trial					

PREFERRED ITEMS:

Appendix B

Task Analysis: Caregiver Implemented Mand Training **Level 2**

Description	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Pre-Session					
1. Ensure materials are ready (iPad is functioning, preferred edibles are available, pictures of preferred edibles are programmed in iPad)					
Session					
2. Place preferred item out of child's reach but within eyesight					
3. Place iPad 3 ft away from child					
4. Stand 3 ft away from iPad and child					
5. Hold (entice) item in front of child until child looks at or reaches for item					
6. If child does not retrieve iPad within 5 s:					
a. Provide a gestural prompt (e.g., point) towards iPad					
b. If no response within 5 s, physically guide child to retrieve iPad and bring it to caregiver's initial location					
7. If child independently retrieves iPad and selects picture of desired item within 5 s of step 5:					
a. Vocally state name of item and praise (e.g., "good job")					
b. Provide large piece of edible item to child/approximately 20-30 s access to preferred item					
8. If after 5 s of retrieving iPad and bringing to caregiver's location child has not pressed icon:					
a. Provide gestural prompt (e.g., point) towards icon on iPad					
b. If no response within 5 s of gestural prompt, physically prompt by using hand over hand guidance to press icon					
c. Vocally state the name of the item					
d. Provide small piece of edible after prompted response or approximately 5 s access to item					
TOTAL SCORE					
Child response per trial					

PREFERRED ITEMS:

Appendix C

Task Analysis: Caregiver Implemented Mand Training **Level 3a**

Description	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Pre-Session					
1. Ensure materials are ready (iPad is functioning, preferred edibles are available, pictures of preferred edibles and neutral items are programmed in iPad)					
Session					
2. Place preferred item out of child's reach but within eyesight					
3. Place iPad 3 ft away from child					
4. Stand 3 ft away from iPad and child					
5. Hold (entice) item in front of child until child looks at or reaches for item					
6. If child does not retrieve iPad within 5 s: a. Provide a gestural prompt (e.g., point) towards iPad b. If no response within 5 s, physically guide child to retrieve iPad and bring it to caregiver's initial location					
7. If child independently retrieves iPad and selects picture of desired item within 5 s of step 5: a. Vocally state name of item and praise (e.g., "good job") b. Provide large piece of edible item to child/approximately 20-30 s access to item					
8. If after 5 s of retrieving iPad and bringing to caregiver's location child has not pressed icon: a. Provide gestural prompt (e.g., point) towards icon on iPad b. If no response within 5 s of gestural prompt, physically prompt by using hand over hand guidance to press icon c. Vocally state the name of the item d. Provide small piece of edible after prompted response or 5 s access to item					
9. If child selects picture of incorrect item, vocally state "no, we don't have that" and use hand over hand guidance to prompt child to press correct item					
10. Do not provide edible item if incorrect picture chosen					
TOTAL SCORE					
Child Response					

PREFERRED ITEMS:

Appendix D

Treatment Integrity Checklist: BST, BST Booster Training Session

	Step	Description	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
1.	Materials present	iPad, data sheets, designated "preferred items"/children's preferred items					
2.	Materials set up	Items at least 3 ft away					
3.	Researcher provides written instruction	TA provided to caregiver					
4.	Researcher provides verbal instruction	Verbal review of TA					
5.	Researcher model trial	Researchers implement a trial with the training assistant per the steps of the TA while the caregiver observes					
6.	Research instructs caregiver to practice responses						
7.	Caregiver practices trial	With training assistant or child					
8.	Researcher provides feedback on performance	Researcher reviews with caregiver all steps implemented correctly and incorrectly					
9.	Caregiver asked if he/she wants more practice						
10.	Caregiver given more practice trials						
11.	Researcher reviews performance in previous assessment						
	TOTAL SCORE						

Appendix E

Treatment Integrity Checklist: Baseline, BST Assessment, Post-BST Assessment, Post-Booster Assessment, Generalization Probe

	Step	Description	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
1.	Materials present						
	1a. iPad functioning						
	1b. TA	TA present during baseline only					
	1c. Data sheets						
	1d. Preferred items						
	1e. Timer						
2.	Materials set up						
	2a. Preferred items	At least 3 ft from child					
	2b. Researcher has data sheets, pen						
3.	Researcher provides TA for 5 min	Given to caregiver; TA for level being assessed; only baseline					
	3a. Researcher sets timer						
	3b. Researcher removes TA	After 5 min					
4.	Researcher provides instruction	States “encourage you child to request preferred item”					
5.	Researcher scores performance	Using appropriate TA					
6.	No feedback provided	Researcher does not discuss caregiver performance					
	TOTAL SCORE						

Appendix F

Social Validity Questionnaire

1. I enjoyed learning how to help my child communicate with his or her iPad.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. I am going to use the skills I learned in the training with my child.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. I think that these communication training procedures will improve my child's communication.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. After training I feel comfortable implementing communication training with my child.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. I would recommend this training to other parents whose children use iPads to communicate.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Appendix G

Paired Stimulus Preference Assessment Data Sheet

Stimulus Items:	Overall Rank (highest % is #1)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

		Treatment Integrity					
Trial	Items (Response)	Correct item placement	Researcher stated "choose one"	Non-selected item removed after selection	If no response within 5 s, re-present items	If no response after second presentation, score as no response (NR)	If both items selected, block and re-present items/instruction
1	7 8 NR						
2	4 6 NR						
3	5 7 NR						
4	7 3 NR						
5	6 8 NR						
6	2 3 NR						
7	1 8 NR						
8	3 4 NR						
9	8 6 NR						
10	2 1 NR						
11	7 4 NR						
12	5 1 NR						
13	1 4 NR						
14	6 3 NR						
15	2 6 NR						
16	2 4 NR						
17	5 8 NR						
18	4 1 NR						
19	5 6 NR						
20	4 2 NR						
21	8 7 NR						
22	7 2 NR						
23	1 6 NR						
24	6 1 NR						
25	1 3 NR						

26	3	7	NR						
27	7	1	NR						
28	6	7	NR						
29	1	2	NR						
30	3	1	NR						
31	1	7	NR						
32	5	3	NR						
33	2	8	NR						
34	8	4	NR						
35	3	2	NR						
36	6	2	NR						
37	7	6	NR						
38	8	1	NR						
39	3	5	NR						
40	1	5	NR						
41	8	3	NR						
42	4	8	NR						
43	8	2	NR						
44	4	5	NR						
45	4	3	NR						
46	5	2	NR						
47	3	6	NR						
48	6	4	NR						
49	5	4	NR						
50	4	7	NR						
51	7	5	NR						
52	2	5	NR						
53	8	5	NR						
54	3	8	NR						
55	6	5	NR						
56	2	7	NR						

Appendix H
Structured Observation Procedures

Description	Pre-session	1	2	3	4	5	6	7	8	9	10
Pre-Session											
1. Ensure iPad is available and functioning											
2. Ensure at least 10 preferred items are within child's eyesight but at least 3 ft from child											
3. Ensure child has had opportunity to use restroom (e.g., verbally offer bathroom to child; walk child to bathroom door and offer access)											
Session											
4. RA vocally prompt caregiver to respond as he/she normally would to child's manding											
5. RA provides general vocal prompt to child (e.g., "if you want something please let me know")											
6. RA starts timer											
a. RA only stops timer after child has 10 mand opportunities or child requests restroom											
b. RA restarts timer after child returns from bathroom											
7. If child independently mands for item on iPad, provide small amount of edible or 1 min access to tangible											
a. Score as independent mand											
8. If after 2 min with no mand opportunity, RA prompts caregiver to show item for 5 s to child											
a. If child responds after prompt, deliver small amount of edible or 1 min of access to tangible											
b. Score as prompted mand											
9. If child does not respond within 1 min of caregiver prompt, score as no response											
Child Response											

Appendix I

Sample Script for Training Assistant

Session 1: Researcher modeling caregiver observes

1.	Independently touch correct icon on iPad to sound name of desired item	
2.	Require physical guidance (HH) to touch correct icon on iPad	
3.	Require gestural point to touch correct icon on iPad	
4.	Require physical guidance (HH) to touch correct icon on iPad	
5.	Independently touch INCORRECT icon on iPad	

Session 2: Alternating between researcher modeling and caregiver practicing

6.	Require physical guidance (HH) to touch correct icon on iPad	
	Caregiver practice & receives feedback	
7.	Require gestural point to touch correct icon on iPad	
	Caregiver practice & receives feedback	
8.	Independently touch correct icon on iPad	
	Caregiver practice & receives feedback	
9.	Independently touch INCORRECT icon on iPad	
	Caregiver practice & receives feedback	
10.	Require gestural point to touch correct icon on iPad	
	Caregiver practice & receives feedback	

Session 3: Alternating between researcher modeling and caregiver practicing

11.	Require gestural point to touch correct icon on iPad	
	Caregiver practice & receives feedback	
12.	Independently touch correct icon on iPad	
	Caregiver practice & receives feedback	
13.	Require physical guidance (hand-over-hand) to touch correct icon on iPad	
	Caregiver practice & receives feedback	
14.	Independently touch INCORRECT icon on iPad	
	Caregiver practice & receives feedback	
15.	Require gestural point to touch correct icon on iPad	
	Caregiver practice & receives feedback	

BST assessment (to terminate BST) no feedback for caregiver

1.	Require shoulder prompt to touch correct icon on iPad	
2.	Require forearm prompt to touch correct icon on iPad	
3.	Independently touch correct icon on iPad to sound name of desired item	
4.	Require hand over hand prompt to touch correct icon on iPad	
5.	Independently touch INCORRECT icon on iPad	
6.	Independently touch correct icon on iPad to sound name of desired item	
7.	Require shoulder prompt to touch correct icon on iPad	
8.	Independently touch INCORRECT icon on iPad	
9.	Require forearm prompt to touch correct icon on iPad	
10.	Require hand over hand prompt to touch correct icon on iPad	