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Effects of Functional Communication Training Using GoTalk Now™ iPad® Application on Challenging Behavior of Children With Autism Spectrum Disorder

Reem Muharib[1], Vivian I. Correa[1], Charles L. Wood[1], and Kathryn L. Haughney[1]

Abstract

This study investigated the effects of a functional communication training intervention consisting of systematic prompting and natural reinforcement on the challenging behaviors of two children with autism spectrum disorder aged 5 and 6 years old. Children who had a history of challenging behavior, consisting of self-injury and disruption, were taught to request preferred stimuli through the GoTalk Now™ application on an iPad®. Using a reversal design, the findings demonstrated a functional relation between functional communication training with the use of the GoTalk Now application and the decreased levels of challenging behaviors. Specifically, one child demonstrated zero levels of challenging behaviors and one child showed a less substantial decrease of challenging behaviors during intervention phases. Directions for future research and implications for practice are discussed.

Keywords

functional communicating training, autism spectrum disorder, speech-generating devices, challenging behavior

Language and communication deficits are among the main characteristics of children diagnosed with autism spectrum disorder (ASD; American Psychiatric Association, 2013). In fact, it has been estimated that 30% of children with ASD never develop functional spoken language (Wodka, Mathy, & Kalb, 2013). Named as an urgent priority for future research (Light & Drager, 2007), interventions designed to support young children with deficits in speech and language skills often rely on alternative means of communication to support competent communication growth (Neidert, Rooker, Bayles, & Miller, 2013). Due to deficits in oral communication and language skills, communication patterns in children with ASD can appear more frequently as challenging behaviors such as aggression, property destruction, and self-injury (Chung, Jenner, Chamberlain, & Corbett, 1995). In a longitudinal study, Sigafoos (2000) found lower levels of communication skills were associated with more severe challenging behaviors in young children with developmental disabilities. A more recent study indicated that 50% of children with ASD have challenging behaviors and that those challenging behaviors are used as a form of expressive communication (Chiang, 2008).

Challenging behaviors can be defined as any repeated pattern of behavior that affects the child's learning or affects her social interactions with other children or adults (Smith & Fox, 2003). Research has shown a relation between the lack of language and speech skills and challenging behaviors (Kaiser, Cai, Hancock, & Foster, 2002; Park, Yelland, Taffe, & Gray, 2012; Schroeder, Schroeder, Smith, & Dalldorf, 1978), putting children with ASD at greater risk than children without a diagnosis of ASD (McClintock, Hall, & Oliver, 2003). Several variables may increase the chances of developing challenging behaviors in this population. These variables include lack of social and communication skills, intellectual disabilities, and accompanied comorbid psychopathological disorders (Matson & Nebel-Schwalm, 2007). In addition, Matson, Wilkins, and Macken (2008) found a correlation between the severity of challenging behaviors and the severity of ASD symptoms.

Children who exhibit challenging behaviors can cause harm to themselves and others which can greatly impede their learning (Sigafoos, Arthur, & O'Reilly, 2003). Moreover, children with challenging behaviors have more difficulties socially

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integrating in school and community (Koegel, Koegel, Hurley, & Frea, 1992; Sigafoos et al., 2003). In fact, children with severe challenging behaviors are also at risk of long-term inpatient care (Emerson, 2000). Recognizing these effects of challenging behaviors, there is no doubt that these behaviors must be a treatment priority (O'Reilly et al., 2010). As challenging behaviors start during the early years of childhood (Einfeld & Tonge, 1996), early intervention becomes necessary.

One way to mitigate challenging behaviors in children with ASD is functional communication training (FCT; Carr & Durand, 1985). The FCT process consists of two sequential steps: (a) assessing the challenging behavior by one or more functional assessments and (b) teaching a new alternative behavior as a communicative response (Durand & Merges, 2001). The theory behind FCT is that challenging behaviors can serve as communicative acts to gain attention/tangibles or avoid aversions (e.g., demands). Therefore, when a child is taught a more appropriate way of communication (i.e., a functional communication response [FCR]) that serves the same function as the problem behavior, the challenging behavior will be ineffective, and hence, stop occurring (Carr & Durand, 1985). In addition, FCT relies on an establishing operation (EO) which is a motivating operation that evokes behavior and increases that value of a reinforcer (Cooper, Heron, & Heward, 2007). In other words, when children are deprived of a reinforcer, they are more likely to engage in behavior, whether appropriate or inappropriate, to access the reinforcer. Thus, identifying the function(s) of the challenging behaviors and the potential reinforcers are key steps for FCT (Neidert et al., 2013).

FCT for children with ASD has strong empirical support (Kurtz, Boelter, Jarmolowicz, Chin, & Hagopian, 2011; Wong et al., 2013). Researchers have examined FCT effects by teaching children with ASD and challenging behaviors to communicate vocally or by using picture cards or manual signs (Falcomata, Wacker, Ringdahl, Vinquist, & Dutt, 2013; Greer, Fisher, Saini, Owens, & Jones, 2016; Neidert, Iwata, & Dozier, 2005; Rispoli, Camargo, Machalicek, Lang, & Sigafoos, 2014). Across those studies, systematic instruction consisting of variations of prompting, time delay, and reinforcement were used to teach children to emit the new communication response(s). Although Neidert, Iwata, and Dozier's (2005) study showed only two demonstrations of an effect, the other studies demonstrated a functional relation and positive impact of FCT on children's challenging behaviors whether those behaviors were maintained by attention, escape, or access to tangibles.

In addition to teaching children with ASD to use appropriate vocal phrases, picture cards, or manual signs as an alternative for challenging behaviors, researchers have examined speech-generating devices (SGDs) for children with no functional speech or with very limited speech skills (Thunberg, Ahlsen, & Sandberg, 2007). SGDs are one form of alternative and augmented communication. SGDs are electronic devices in which the person has to select text or an image depicting the desired item or activity on the screen (Lancioni et al., 2007). In comparison to communication binders, SGDs such as an iPad may be more socially acceptable (Lorah et al., 2013; Muharib & Alzrayer, 2018) and more portable. Additional research to examine various application of SGDs using handheld technologies is needed to provide evidence across the rapidly expanding options available to support SGD communicators (e.g., Ganz, 2015).

To examine FCT with an SGD, Franco et al. (2009) taught a child with ASD, challenging behaviors, and no functional speech to request breaks and preferred tangibles using a GoTalk Now device. The data indicated a decrease in the child's inappropriate vocalizations; however, the study only showed two demonstrations of an effect. Similarly, Olive, Lang, and Davis (2008) evaluated the effects of FCT and an SGD (i.e., Four Button Touch Talk Direct) on the aggressive behaviors, maintained by attention, of a young child with ASD. The child's mother was trained to prompt her child to press a button on the device to request attention and immediately responding to the child's request by giving the child attention. Although the data showed a decrease in aggressive behaviors during intervention, data on independent SGD-based requesting were variable. Additionally, the child was able to generalize requesting in the third and fourth activities before the intervention took place, which jeopardized experimental control. The results suggested a promising direction for future studies to demonstrate an effect for FCT using an SGD.

Sigafoos et al.'s (2013) study was the first to introduce an iPad as an SGD and measure the impact on challenging behaviors of young children with ASD. Sigafoos et al. taught two young children with ASD, challenging behaviors, and no functional speech to request the continuation of toy play via Proloquo2Go® application. In addition to the systematic instruction procedures used in previous studies (e.g., Falcomata et al., 2013; Neidert et al., 2005), the researchers introduced a toy play interruption. In other words, the toy was retrieved from the child after 30 s of play. The results demonstrated an increase in SGD-based requesting; however, the effects on challenging behaviors were less substantial. Furthermore, the researchers did not conduct functional behavior assessments to confirm the challenging behaviors of the children were actually maintained by access to toys, demonstrating the need for subsequent inquiry.

Although the studies reviewed suggested promising results of the effects of FCT using SGDs (Franco et al., 2009; Olive, Lang, & Davis, 2008), neither study showed three demonstrations of the intervention effect (Kratochwill et al., 2013). Additionally, whereas Franco et al. (2009) and Olive et al. (2008) conducted functional behavior assessments to determine the function(s) of children's challenging behaviors, Sigafoos et al. (2013) did not. That is, Sigafoos et al. provided a demonstration of the process, but replications are necessary to incorporate both fundamental steps of FCT. In terms of the use of an iPad, only one study used an iPad as the SGD (Sigafoos et al., 2013). Hence, more studies to determine the effects of FCT using an iPad on challenging behaviors are needed. Therefore, the purpose of this study was to extend Sigafoos et al.'s (2013) study with modifications. First, this study used a different iPad application (GoTalk Now). GoTalk Now (Attainment

Table 1. Participant Demographics.

Pseudonym	Gender/Race	Disability Diagnosis	Age	History With iPad	Challenging Behavior Description
Amy	F/Caucasian American	ASD	6	Games	Head banging, protesting, and grabbing
Jake	M/Caucasian American	ASD	5	Games	Protesting, grabbing

Note. F = female; M = male; ASD = autism spectrum disorder.

Company, n.d.) was chosen because of its affordability compared to Proloque2Go. Although Proloque2Go offers more flexibly such as creating folders and categories unlike GoTalk Now, the researchers wanted to examine an affordable application (approximately US$80.00) so that parents and practitioners could have an affordable option. Second, Sigafoos et al. used a multiple baseline across two participants, which showed only two demonstrations of the intervention effect. This study used a reversal design across two participants as a stronger demonstration of a functional relation between the independent and dependent variables by showing four demonstrations of the intervention effect. Third, the study took place at the participant's school rather than a clinical setting to enhance the social validity of the study (Horner et al., 2005). Fourth, functional behavior assessments were conducted to confirm the challenging behaviors of children were maintained by access to tangibles. Therefore, this study investigated the effects of FCT using an iPad as an SGD on the challenging behaviors of children with ASD. The study answered this research question: What are the effects of FCT using GoTalk Now on an iPad as a SGD on the challenging behaviors of children with ASD?

Method

Participants

The research team obtained institutional review board approval from their local university before conducting the study. The inclusion criteria for this study were (a) a medical or educational diagnosis of ASD; (b) no functional speech or very limited speech skills which were defined as nonfunctional use of words, inability to initiate a vocal request with one or more words, and/or unintelligible use of words; (c) engagement in challenging behaviors that could be aggressive (e.g., hitting, pushing), self-injurious (e.g., head banging), or disruptive (e.g., crying); and (d) no prior history of using an iPad as an SGD. Two participants met the inclusion criteria, whose full demographics can be reviewed in Table 1.

Amy (pseudonym) was a 6-year-old Caucasian female whose individualized educational plan (IEP) indicated she had a medical diagnosis of ASD. She had been attending the same classroom program for 1½ years. The teacher's report and observations suggested Amy was able to produce fewer than 10 one-syllable words (e.g., snack, no, and go) with verbal prompting (e.g., "what do you want?"), but she rarely initiated a request. In addition, Amy spoke at such a low volume that it was difficult to hear what she said after prompting. Amy used one-word utterances after frequent verbal prompting or grabbed what she wanted. Amy's challenging behaviors included protesting and head banging against hard surfaces such as the floor or a desk. For safety, Amy wore a helmet to school every day. At the time of the study, Amy was not receiving speech therapy. In terms of iPad use, Amy used an iPad for educational games in the classroom prior to and during the study. Amy had no history of using any form of SGD.

Jake (pseudonym) was a 5-year-old Caucasian male with a medical diagnosis of ASD as indicated in his IEP. Jake had been attending this classroom program for a half year. The teacher's report and observations revealed Jake was able to produce fewer than 20 one- and two-syllable words (e.g., potty, mine, and no); however, his speech was unintelligible. Jake used unintelligible one-word utterances or challenging behaviors to communicate. Jake's challenging behaviors included protesting, crying, and grabbing. Prior to and during the study, Jake received speech therapy outside of the classroom (30 min a week). Jake used an iPad only for educational games in the classroom. Jake had no prior history of using any form of SGD.

Setting

The study took place during the spring semester at the participants' elementary school located in a rural area in the southeast. One hundred percent of the school's students received free or reduced-price lunch. Both participants attended a self-contained classroom for children with ASD from kindergarten through second grade. The classroom consisted of eight children including the two participants and four adults (a special education teacher and three teacher assistants). The classroom was designed to support different activities (e.g., small group, independent work, play, break, and reading) in which the children rotated throughout the school day. Baseline and intervention sessions were conducted in the participants' self-contained classroom in the play, reading, or small group area depending on which activity occurred during the time of session. The materials and procedures remained the same regardless of the setting. The only difference was that the participant and interventionist sat on the floor in reading and play areas and sat at a table in a small group area. Other children in the classroom were allowed to be in the area in which sessions took place. Other children were only instructed to not touch the iPad used during intervention.

Materials

One iPad (dedicated for the intervention purposes only) was loaded with the GoTalk Now application. GoTalk Now is an augmentative and alternative communication device that

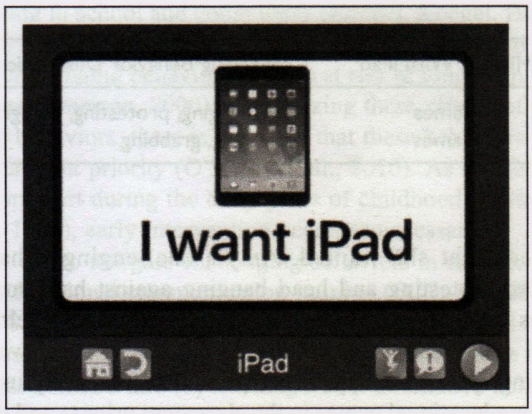

Figure 1. Example of GoTalk now picture button.

allows customization based on the child's communication level and interests. The application generates a speech output upon touching the corresponding picture (e.g., "I want an apple"). Prior to intervention, the interventionist created three pages based on the participants' preferences (i.e., "I want iPad," "I want pump," and "I want book"). Each page contained a corresponding picture to the sentence (see Figure 1). Other materials included an iPad that the participants could request to play with (different from the one used for the communication intervention), a small air pump, and children's books. These materials were the participants' preferred items.

Experimental Design

A reversal design (Bailey & Burch, 2002; Cooper et al., 2007) was used to determine the effects of the intervention on the children's requesting and challenging behaviors. Both children began the first baseline phase at the same time. They remained in the first baseline phase until a stable baseline data path was achieved. Next, both children were introduced to the intervention on the same day. Children were moved to Baseline 2 after achiving two criteria in intervention: (a) requiring no prompts to touch the corresponding icon on the iPad for three consecutive sessions and (b) achiving a data path that was different in level compared to the previous baseline phase. The same procedures were followed in the second baseline and second intervenion phases. Each baseline and intervention session consisted of 10 trials and lasted for approximately 7 min. Sessions were conducted on an average of 3 days a week. No more than one session was conducted on 1 day for each child.

Procedure

Functional behavior assessment. Functional behavioral assessment via antecedent–behavior–consequence (A–B–C) observation was conducted prior to the study to determine the function(s) of each child's challenging behaviors. The A-B-C observations were conducted during the classroom routine for 2 hr for each child. In addition, interviews with the four teachers in the classroom were conducted. Because the analysis of interviews and A-B-C observations clearly revealed the function of the participants' challenging behaviors, experimental functional analyses were determined to be unnecessary. The results of the functional behavior assessments indicated that both Amy and Jake engaged in challenging behaviors to access tangibles.

Preference assessments. Preference assessments included observing the children during free play and break times for 2 days. When it was a child's turn, according to their daily classroom visual schedule, to be in the play area or the break area, the interventionist observed with which item or toy the child played. If the child played with a toy/item for 30 s or longer, it was determined to be a preferred item. In addition, teachers were asked about each child's preferred toys/items. The interventionist did not conduct trial-based preference assessments because the participants clearly showed their preference to certain items. It was determined that Amy liked to play with an iPad and books. For Jake, it was determined that he liked to play with an air pump toy and an iPad.

Baseline. The interventionist (first author) had a small container that held participants' preferred items/toys (i.e., iPad, air pump, and books) within the participant's reach. Both interventionist and child sat on the floor if the child had already been in the play or reading area or sat at a table if the child had already been in the small group area. The interventionist asked the child to play with any item from the box. After the child picked a toy/item, the other remaining items were removed until the end of the session. The child was allowed to play with the toy/item for 30 s. Then, the interventionist took away the child's toy/item (e.g., saying *my turn*). This step was necessary to provoke the EO of the child. Meaning, the child is more likely to request the item after it was taken away. After a 10-s interval, when child did not respond, the item was given back for 30 s. When the child responded within 10 s by vocally saying what they wanted, or engaged in a challenging behavior, the child was given back the item for 30 s. Praise was not provided upon any responses. During these 10 trials, the presence and absence of challenging behavior incidences were recorded.

Intervention. The procedures were the same as in the baseline phase except that an iPad was introduced, and both systematic least-to-most prompting and natural reinforcement were implemented. During intervention sessions, an iPad was turned on, opened to the correct screen page that matched what the participant had picked out of the container, and placed within the participant's reach.

After letting the child play with a preferred item for 30 s, the item was taken away by the interventionist for 10 s. The interventionist pretended to play with the item without looking expectantly at the child. When the child touched the corresponding icon on the iPad independently within 10 s, the interventionist gave the child the requested item immediately. When the child did not touch the corresponding icon on the iPad independently, or engaged in a challenging behavior

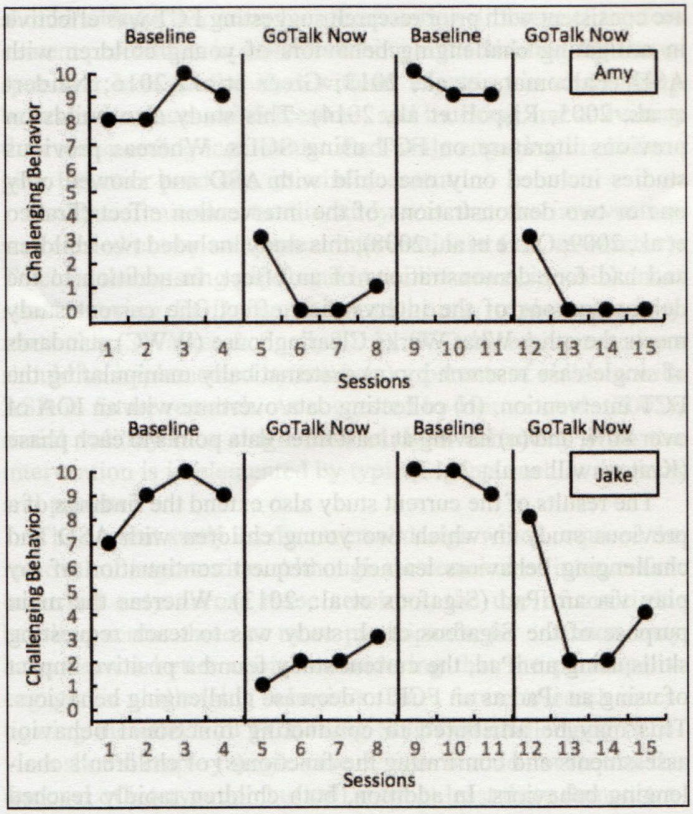

Figure 2. Frequency of challenging behavior for Amy and Jake.

within 10 s, the child was provided a verbal prompt to touch the corresponding icon on the iPad (e.g., saying *if you want your toy back, touch the picture*). If the child did not correctly respond to the verbal prompt within 10 s, the interventionist gave a gestural and verbal prompt by pointing to the icon on the iPad and simultaneously saying *if you want your toy back, touch right here*. If the child did not respond to the gestural and verbal prompt within 10 s, the interventionist gently placed the child's finger on the icon to generate the corresponding voice. Once the child touched the icon to activate the speech output, whether independently or prompted, the interventionist immediately delivered the requested item with a relevant statement (e.g., saying *alright, it's your turn*). Praise (e.g., *I like that you touched the air pump picture*) was not provided upon responses. During 10 trials, the presence and absence of challenging behavior incidences were recorded.

Procedural Fidelity

The fourth author assessed procedural fidelity for 30% of baseline and intervention sessions. She was trained on collecting these data by reviewing the procedural checklist (the checklist can be requested from authors) and discussing the procedures with the interventionist. The fourth author scored the interventionist on the reliability of treatment using a fidelity checklist by being present in the classroom 60% of the time and watching videotapes 40% of the time. Procedural fidelity was 100% across baseline and intervention phases.

Table 2. Number of Systematic Prompts Provided in Intervention Sessions for Amy and Jake.

Session	Amy Number of Prompts	Jake Number of Prompts
5	2	1
6	0	0
7	0	0
8	0	0
12	3	1
13	0	0
14	0	0
15	0	0

Data Collection

Dependent variable. The dependent variable was challenging behavior. The presence and absence of challenging behavior incidences were recorded using an event recording system in each session. Challenging behaviors were grouped per child rather than coding each topography of challenging behaviors separately. For Amy, three challenging behaviors were operationally defined: (a) grabbing was defined as pulling the desired item with one or two hands while or upon the interventionist interrupting toy (iPad or books) play within 10 s, (b) protesting was defined as the occurrence of vocalizations at a volume above normal conversational level while or upon the interventionist interrupting toy play within 10 s, and (c) head banging was defined as forcefully banging her head against a desk, a wall, or the floor while or upon the interventionist interrupting toy play within 10 s.

For Jake, two challenging behaviors were operationally defined: (a) grabbing was defined as pulling the desired item with one or two hands while or upon the interventionist interrupting toy play within 10 s and (b) protesting was defined as the occurrence of vocalizations at a volume above normal conversational level or saying no while or upon the interventionist interrupting toy play within 10 s.

Interobserver agreement (IOA). IOA was assessed on 30% of the baseline and intervention sessions for each participant. The fourth author was trained to collect IOA data by discussing the operational definitions of the dependent variable. She collected IOA data by observing the dependent variable on videotapes 40% of the time, and 60% by being present in the classroom. The formula used to calculate IOA was the number of agreements divided by the number of agreements plus disagreements multiplied by 100 (Kazdin, 1982). Mean IOA of baseline and intervention sessions for Amy was 95% (range = 85–100%), and 98% for Jake (range = 95–100%).

Results

Figure 2 shows the results for each child's challenging behaviors. Table 2 shows the number of systematic prompts provided to each child during intervention phases. As shown in Figure 2 and Table 2, both children demonstrated decreases in

challenging behaviors when the intervention was in place and needed minimal prompting.

Results for Amy

In the first baseline phase, Amy engaged in a range of 8–10 ($M = 9$) incidences of challenging behaviors (i.e., grabbing, protesting, and/or head banging). During the first intervention phase, Amy engaged in challenging behaviors in a range of 0–3 times within the 10 trials ($M = 1$). In the second baseline phase, Amy engaged in challenging behaviors 9–10 times of the 10 trials ($M = 9$). When the intervention was reintroduced, she exhibited challenging behaviors 0–3 times within the 10 trial ($M = 1$). Her challenging behaviors stabilized at a zero level for last three intervention sessions. Visual inspection of the intervention phases, as shown in Figure 2, indicates a change in level compared to baseline phases, immediacy of the intervention effect, no variability, and no overlap. As displayed in Table 2, Amy only needed systematic prompting to touch the corresponding item on the iPad in the first intervention session of both intervention phases.

Results for Jake

In the first baseline phase, Jake exhibited challenging behaviors (i.e., grabbing and/or protesting) in a range of 7–10 incidences ($M = 9$). During the first intervention phase, Jake engaged challenging behaviors in a range of 1–3 times in the 10 trials ($M = 2$). In the second baseline phase, Jake engaged in challenging behaviors 9–10 times within the 10 trials ($M = 9$). When the intervention was reintroduced, Jake engaged in a higher range of challenging behaviors compared to the first intervention phase (range = 2–8). However, the mean of his challenging behaviors was still considerably lower than in either baseline phases ($M = 4$). Visual inspection of the intervention phases for Jake, as depicted in Figure 2, indicates a change in level in both intervention phases compared to the baseline phases; however, less immediate in the second intervention phase. Data in the second intervention phase showed one overlap, a little variability, and an upward trend. Jake required systematic prompting to touch the corresponding icon on the iPad only in the first intervention session of both intervention phases. In short, the data clearly indicated four demonstrations of the intervention effect. Additionally, the data showed strong experimental control with the immediate changes of the challenging behavior levels as an effect of the manipulation of the intervention.

Discussion

The purpose of this study was to investigate the effects of FCT using GoTalk Now on an iPad on the challenging behaviors of children with ASD. The findings of this study suggest a functional relation between the FCT intervention consisting of systematic prompting and natural reinforcement using GoTalk Now and challenging behaviors of both children. The results are consistent with prior research suggesting FCT was effective in mitigating challenging behaviors of young children with ASD (Falcomata et al., 2013; Greer et al., 2016; Neidert et al., 2005; Rispoli et al., 2014). This study also builds on previous literature on FCT using SGDs. Whereas previous studies included only one child with ASD and showed only one or two demonstrations of the intervention effect (Franco et al., 2009; Olive et al., 2008), this study included two children and had four demonstrations of an effect. In addition to the demonstrations of the intervention effect, the current study meets the other What Works Clearinghouse (WWC) standards of single-case research by (a) systematically manipulating the FCT intervention, (b) collecting data overtime with an IOA of over 80%, and (c) having at least three data points in each phase (Kratochwill et al., 2013).

The results of the current study also extend the findings of a previous study in which two young children with ASD and challenging behaviors learned to request continuation of toy play via an iPad (Sigafoos et al., 2013). Whereas the main purpose of the Sigafoos et al. study was to teach requesting skills using an iPad, the current study found a positive impact of using an iPad as an FCR to decrease challenging behaviors. This may be attributed to conducting functional behavior assessments and confirming the function(s) of children's challenging behaviors. In addition, both children rapidly reached the mastery criterion of requiring no prompts to touch the corresponding icon on the iPad across three consecutive sessions. This is consistent with the findings of previous studies in which children with ASD rapidly learned to request preferred items via an iPad-based SGD (Lorah et al., 2013; van der Meer, Sutherland, O'Reilly, Lancioni, & Sigafoos, 2012).

Limitations and Directions for Future Research

This study has limitations that can be addressed in future research. First, generalization measures across different communicative partners were not conducted. Generalizing the skill of using an iPad-based SGD to request desired items across the four teachers in the classroom, for instance, would have strengthened the current results. As indicated by Franco et al. (2009), there still remains a need in the future research to explore the generalizability of the use of SGDs across different communicative partners. Similarly, due to the short time of the study, maintenance data were not collected. Maintaining the challenging behaviors at zero or low levels should be the ultimate goal of any intervention targeting challenging behaviors. Thus, future research should examine whether the use of SGDs to request items continues after the termination of the intervention and whether challenging behaviors maintain at zero or low levels.

In addition, while Amy reached a zero level of challenging behaviors in the second intervention phase, Jake did not. Jake still engaged in some challenging behaviors during intervention phases by keeping his hands on the preferred item and pulling it to himself at the same time he was touching and activating the corresponding icon on the iPad. Future research

should address this issue by incorporating differential reinforcement procedures in which touching and activating the corresponding icon on the iPad without engaging in challenging behavior produces reinforcement, and touching and activating the corresponding icon on the iPad while engaging in challenging behavior produces no reinforcement.

Another limitation to this study was that the intervention was carried out by an atypical interventionist (i.e., researcher). To close the existing gap found in the literature, in which most studies using SGDs were found being implemented by researchers (Walker & Snell, 2013), SGD-based interventions should be implemented by teachers or parents of children with ASD in future research. As suggested by Horner et al. (2005), social validity of a single-case study is enhanced when the intervention is implemented by typical agents such as teachers and parents.

The current study used a reversal design which required the removal of intervention. Although the removal of intervention occurred only across three sessions, the use of multiple-baseline across three or more participants, for instance, may have been a better choice considering that the participants engaged in challenging behaviors. Thus, future research investigating the effects of FCT using SGDs on challenging behaviors should employ single-case designs that do not require the removal of intervention but still show at least three demonstrations of an effect (Kratochwill et al., 2013).

In addition, children were not taught to navigate the iPad to get to the application on their own. To increase independence skills of children with ASD, future research should aim to teach children with ASD to navigate an iPad and open the GoTalk Now application page independently.

A final limitation is that social validity was not measured in this study. Horner et al. (2005) identified social validity as an important measure that enhances the credibility of a single-case study. Future research on FCT using an iPad should include measures of treatment acceptability such as teachers' or other stakeholders' opinions about the usefulness of the intervention.

Implications for Practice

As discussed previously, iPad-based SGD may be a viable option for children with ASD with limited speech skills and challenging behaviors due to the iPad portability and social acceptance (Lorah et al., 2013). iPads are now commonly available for classroom educational purposes (Peluso, 2012). In addition, GoTalk Now is a relatively inexpensive application. Thus, using iPad-based SGD may be doable and feasible in educational settings. In addition to educational settings, family members may be taught to use an iPad as an SGD to support their children's communication at home and in the community (e.g., Olive et al., 2008).

Furthermore, not only did the children rapidly learn to use the iPad to request desired items, but they were also able to navigate the pages on the application. Anecdotally, both children, on several occasions, accidently hit the "next" arrow on the application which went to a different picture/icon. Independently, they correctly navigated the page and requested the desired item. An implication is that children with ASD may be easily taught to use iPad-based SGD and navigate the pages to request specific items.

The last implication pertains to the need of early intervention to reduce challenging behaviors of children with ASD with limited speech skills via the use of SDGs. As indicated by Walker and Snell (2013), SGD interventions are more effective in addressing challenging behaviors when implemented with children compared to adolescents or adults. Therefore, treatment of challenging behaviors of children with ASD via the use of SGDs needs to begin early on. For positive effects, the function(s) of the child's challenging behaviors must be assessed and identified (Walker & Snell, 2013). Then, the iPad-based SGD intervention needs to be designed to address the function(s) (e.g., attention, tangible) of the child's challenging behaviors.

The aim of this study was to examine the effects of FCT using speech-generating GoTalk Now iPad application on the challenging behaviors of two children with ASD. After identifying the function of children's challenging behaviors through functional behavior assessments, children were taught to access reinforcers by touching corresponding icons on the iPad application. The results of this study indicated positive impact of FCT using GoTalk Now application on both of the children's challenging behaviors. This study builds on the body of literature on FCT by introducing GoTalk Now and meeting all WWC standards for single-case research (Kratochwill et al., 2013).

Authors' Note

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The Effects of Text-to-Speech on Reading Outcomes for Secondary Students With Learning Disabilities

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Abstract

This study investigated the effectiveness of text-to-speech (TTS) on the outcomes of reading comprehension and oral reading fluency (ORF) for four secondary students with learning disabilities. The researchers used a single-case A–B–A–B withdrawal design to evaluate the effectiveness of TTS on reading outcomes. All participants scored higher on reading comprehension after using TTS when reading instructional passages and maintained the skills for 4 weeks. Results on participants' ORF also indicated an increased level of words read per min at the end of each accommodation condition. Comparison of pre- and posttest achievement on the Lexile assessment showed that two of the four participants increased their reading scores. Major findings are discussed with implications for practice and recommendations for future research to increase the use of TTS in the classroom.

Keywords

assistive technology, learning disabilities, legislation, secondary, text-to-speech

Reading is a necessary and critical skill. The acquisition of reading substantially impacts educational outcomes, employment success, and personal and professional growth (Strangman & Dalton, 2005). In the United States, roughly 6 million secondary students are reading at a level far below their grade. The National Assessment of Educational Progress (NAEP) from 2017 indicated that 74% of eighth graders do not have proficient-level reading skills even though the data showed an overall slight increase of reading achievement since 2015. However, it should be noted that the growth rate is with students who were higher achieving, whereas students with disabilities remained statistically the same. The NAEP reading achievement scores for students with disabilities in 12th grade across the nation have not increased since 2009, the earliest available data for students with disabilities at that grade level. In fact, the gap between 12th graders with and without disabilities has increased by 3 points since 2009, indicating that those with disabilities are continuing to fall behind their peers without disabilities (U.S. Department of Education, 2015, 2009, 2017).

Students With Learning Disabilities (LDs)

Several legislative actions have focused on evidence-based practices and inclusion of students with disabilities in the general education curriculum; yet as indicated by NAEP results, reading scores have not improved for many students with disabilities over the years. These results are especially concerning for students with LDs who are the highest population of students receiving special education services at 35% (Snyder, de Brey, & Dillow, 2016; Wanzek, Otaiba, & Petscher, 2014). Approximately 80% of students with LD exhibit deficits in the area of reading (Cortiella & Horowitz, 2014). In addition, 90% of students with LD are not able to read material independently (Vaughn & Wanzek, 2014). Students who have difficulties making meaning from text are likely to encounter postschool challenges, such as being unemployed, earning lower incomes, and exhibiting poor health as adults (Snyder & Dillow, 2013). In order to reduce the negative postschool outcomes associated with reading difficulties, addressing adolescents' lack of reading progress in our high schools is imperative.

Students with LD often experience several years of reading difficulties that involve deficits in making meaning from text (Cortiella & Horowitz, 2014). Achieving success in school requires proficient reading skills to understand all content areas (Vaughn & Wanzek, 2014). This gap widens in high school as students struggle to gain information from text that is necessary

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Designing a Wearable Technology Intervention to Support Young Adults With Intellectual and Developmental Disabilities in Inclusive Postsecondary Academic Environments

Anya S. Evmenova[1], Heidi J. Graff[1], Vivian Genaro Motti[2], Kudirat Giwa-Lawal[1], and Hui Zheng[2]

Abstract

In response to the increasing number of young adults with intellectual and development disability (IDD) in inclusive postsecondary settings, a wearable technology application was designed to support students' learning, participation, and independence. This article describes the design research process leading to the development of the technology prototype. An app for a smart watch has been conceptualized, designed, and refined following the two initial phases of the Integrative Learning Design Framework (ILDF; Bannan-Ritland, 2003). The design principles that emerged from the study include multiple prompting and reward systems to encourage students' self-regulation and positive behaviors. The findings identify ways wearable technology can support young adults with IDDs in inclusive college courses without overreliance on the support staff. Having major stakeholders involved in the design research process from the very beginning resulted in high levels of acceptance of the developed technology-based intervention prototype by the target population and by the support staff members. Plans for the next two phases of the ILDF, which are beyond the scope of this publication, are discussed.

Keywords

wearable technology, smart watch, young adults with IDD, inclusive postsecondary education, self-regulation, design research

According to the Higher Education Opportunity Act (2008), students with intellectual and developmental disability (IDD), who desire inclusive postsecondary education (IPSE) in institutes of higher education (IHE), must have access to academic curriculum. However, students with IDD have significant limitations in cognitive and adaptive functioning, affecting all areas of their life (Hadley, 2011; Schalock et al., 2010; Thoma, 2013). They often have comorbid behavior problems, exacerbating their conditions, and diminishing their ability to effectively use education services and resources to maximize their academic potentials (Buntinx & Schalock, 2010). Historically, this limited the quality, depth, and focus of their educational programming in primary and secondary schooling (Newman, Wagner, Cameto, Knokey, & Shaver, 2010). To improve the outcomes for students with IDD in IPSE programs, administrators have traditionally relied on the support personnel to provide individualized services to these students as they engage in learning activities (Grigal et al., 2015). These services include assistance from academic coaches or mentors who attend classes with the students to take notes, prompt them to participate during class activities, monitor their learning and behavior, and affirm use of self-regulation skills. Although the support services provided by academic personnel are invaluable, novel technologies might provide less obtrusive and more consistent support, leading to more independence and further enhancements of educational opportunities (Davies, Schelly, & Spooner, 2013; Shic & Goodwin, 2015). Thus, the aim of this design-based research study was to collaborate with the stakeholders in order to develop an innovative intervention using the affordances of wearable technology, specifically a smart watch, which can potentially support students' participation in inclusive postsecondary academic environments.

Literature Review

Decades of advocacy, policy changes, and reenactment of federal laws have yielded progressive opportunities for individuals with IDD and have led to the increased access to IPSE

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Logging In to Press On: An Examination of High School Dropout and Completion Among Students With Disabilities in Online Courses

Cameron Sublett[1] and **Yi-Chun Chang**[1]

Abstract

Students with disabilities (SWDs) continue to experience rates of high school dropout greater than students not receiving special education services. Furthermore, there is a persistent gap in the rates of high school completion among students with and without disabilities. While criticized for lowering standards and learning, online learning represents a plausible mechanism to both decrease dropout and increase high school completion among SWDs. Drawing on theoretical frameworks advanced by Dynarski et al. and Cavanaugh et al., the current study uses a nationally representative data panel to investigate the association between online coursetaking among SWDs and two dependent variables: high school dropout and completion. Results indicated that online coursetaking was associated with increased probabilities of high school completion among SWDs. Implications and policy recommendations are discussed.

Keywords

online learning, dropout, high school completion, students with disabilities

According to the National Center for Education Statistics (NCES, 2017), roughly 8 of every 10 students completed high school on time and with a regular diploma in 2015–2016. This percentage represents an all-time high in the nation's adjusted cohort graduation rate (ACGR; Kamenetz & Turner, 2016). In fact, the nation's ACGR has climbed from 79% in 2011 to 84.1% in 2015–2016. Moreover, during this same period, the rate at which students dropped out of high school decreased from 7.4% in 2010 to 5.9% in 2015 (McFarland et al., 2017). This is welcome news; dropping out of high school is linked to a number of negative economic and social outcomes (Rumberger, 2011). Students who drop out of high school before graduation work and earn less (Rouse, 2007) and, as a consequence, contribute less to the national economy (Belfield & Levin, 2007). Students who drop out from high school also experience greater social disturbances including increased odds of incarceration (Sum, Khatiwada, & McLaughlin, 2009).

Of concern, however, is the fact that students with disabilities (SWDs) continue to experience reduced rates of high school completion and increased rates of high school dropout relative to students not receiving special education services (Stark & Noel, 2015). In the 2015–2016 academic year, while it was the case that 84.1% of the nation's students earned a high school diploma, the rate of high school completion among SWDs was just 65.5%, a differential of 18.6 percentage points. In 2013–2014, SWDs graduated from high school at a rate of 19.2 percentage points below that of students without disabilities; in 2012–2013, the completion gap was 19.5 percentage points. A similar gap exists with regard to high school dropout. In 2013–2014, just 6.5% of students without disabilities dropped out of high school. In this same year, roughly 18% of students served under the Individuals with Disabilities Education Act dropped out of high school, a rate nearly 3 times that of students without disabilities (McFarland, Stark, & Cui, 2016). Although the proportions of SWDs graduating from and dropping out of high school have increased and decreased, respectively, the persistent gaps in educational outcomes among students with and without disabilities suggest the continued presence of educational inequity in the nation.

It is important to note several caveats with these statistics before moving forward. First, the increase in the high school graduation rate has not gone without criticism (e.g., Heckman & Lafontaine, 2010; Kamenetz & Turner, 2016). A number of policy experts contend that rather than being reflective of

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Enhancing Independent Participation Within Vocational Activities for an Adolescent With ASD Using AAC Video Visual Scene Displays

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Abstract

Adolescents with autism spectrum disorder (ASD) often require support both for learning new skills and for communication. This study used a multiple baseline across activities design to evaluate the effect of videos with integrated visual scene displays (video VSDs), presented using a tablet-based app, on the percentage of steps completed independently within vocational training tasks by an adolescent with ASD and complex communication needs (CCN). Using the video VSDs, the participant met the mastery criterion for completing three tasks (including participation in communication exchanges) in a vocational setting. The results provide evidence that video VSDs may provide an effective support both for learning new skills in vocational contexts, and as a method of augmentative and alternative communication for individuals with ASD and CCN.

Keywords

ASD, augmentative and alternative communication, AAC, visual scene display, video prompting, vocational tasks

Although over 70% of adults in the United States have jobs (Organisation for Economic Co-operation and Development, 2018), only 25–50% of adults with autism spectrum disorders (ASDs) are employed (Hendricks, 2010; Wehman et al., 2014). Many of the individuals with ASD who are employed present with relatively mild forms of ASD, use speech to communicate, and have workplace literacy skills (Howlin, Alcock, & Burkin, 2005; Howlin & Moss, 2012; Wehman et al., 2014). The outcomes for individuals who present with more severe forms of ASD, do not make use of speech, and do not have workplace literacy skills, are markedly worse (Nicholas, Addridge, Zwaigenbaum, & Clark, 2015; Shattuck et al., 2012), with less than 14% employed (Nord, Stancliffe, Nye-Lengerman, & Hewitt, 2016).

Characteristics typically associated with ASD, such as difficulties in learning new skills (e.g., following spoken directions) and working independently (e.g., completing tasks without prompting), can make it difficult for individuals with ASD to participate in the educational and workplace training activities needed to obtain employment (Hendricks, 2010). Support from educational staff is often used to provide an individual with ASD with cues and prompts to complete workplace tasks (Macduff, Krantz, & McClannahan, 2001). However, research suggests that constant adult proximity can create prompt dependence and overreliance on support from others (Giangreco & Doyle, 2002).

In addition to the challenge of learning to perform new skills independently, persons with ASD often struggle with the communication skills (e.g., greeting customers, requesting assistance) that are identified by employers as key to success in the workplace (Bryen, Potts, & Carey, 2007; Higgins, Koch, Boughfman, & Vierstra, 2008). These communication challenges are frequently experienced by 20–30% of individuals with ASD who do not develop functional speech to communicate and who are described as having *complex communication needs* (CCN; Wodka, Mathy, & Kalb, 2013). Unless appropriate communication supports are provided, limited speech can be a severe barrier to communication and participation, especially within vocational settings. It has been estimated that the employment rates for individuals with CCN are even lower (less than 5%) than those for individuals with ASD (Light & McNaughton, 2015; McNaughton & Bryen, 2002). The use of *augmentative and alternative communication* (AAC), such as sign language, picture communication boards, and AAC apps on mobile technology, has been demonstrated to benefit persons with ASD (Foley & Staples, 2003; Ganz, Boles, Goodwyn, & Flores, 2014; Sigafoos et al., 2004); however,

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Creating Positive Classroom Environments With Electronic Behavior Management Programs

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Abstract

Teachers in special education classrooms often struggle with classroom management. In response, many educators are looking for technological solutions to assist in promoting positive classroom environments. Electronic behavior management programs (eBMPs) use strategies based in research that are shown to reduce challenging behavior and encourage positive behavior, such as reinforcement strategies and the Premack principle. This article explains the theoretical efficacies of eBMPs, describes three commonly used eBMPs, and provides procedures on how educators can get started implementing eBMPs with additional tips to consider.

Keywords

eBMPs, behavior, students with disabilities, technology

It is October and Mr. Raines is still struggling to manage the behavior in his classroom. As a novice teacher, he is unsure about his classroom expectations and procedures and feels like his students take advantage of him. He's never taught a self-contained classroom of sixth graders with disabilities and therefore has been dedicating much of his spare time learning the math, reading, science, and social studies academic curriculums. Even though Mr. Raines is becoming more comfortable with the district curriculum materials, he spends much of his day dealing with students who are out of their seats, calling out, goofing off, and not engaged in what he is trying to teach them. Parents have also communicated to Mr. Raines that they would like to receive information about their children's behavior during the school day. Mr. Raines does not know what to do and fears that it is going to be a long and difficult school year.

In the scenario above, Mr. Raines wants to maximize academic learning time, student engagement, and academic progress but struggles to effectively implement classroom management strategies and procedures. He knows that classroom management includes the steps a teacher takes to generate an environment that promotes academic and social–emotional learning (Evertson & Weinstein, 2006; Sugai & Horner, 2002). However, Mr. Raines, like many teachers, struggles with the classroom management skills necessary to support students with disabilities (Gilmour, Majeika, Sheaffer, & Wheby, 2018).

Teachers nationwide report that they are unprepared to manage behavior problems in their classrooms, that student misbehavior negatively impacts their instruction, and that students with serious behavior challenges often take up too much of their instructional time (Martin, Lloyd, Kauffman, & Coyne, 1995; National Center for Education Statistics, 2015). Teacher preparation programs rarely include training on classroom management (Freeman, Simonsen, Briere, & MacSuga-Gage, 2014), likely intensifying challenges teachers face in the classroom. The lack of teacher training in classroom management is particularly troublesome for teachers of students with disabilities as these students may be at greater risk of exhibiting problem behavior than peers without disabilities. Teachers who struggle with classroom and behavior management often supplement their perceived lack of skill by turning to outside resources such as smartphone applications, websites, social media, colleagues, and mentors (Anshari, Almunawar, Shahrill, Wicaksono, & Huda, 2017).

Eating lunch in the teachers' lounge one day, Mr. Raines is talking about his difficulty in keeping students on task. A veteran teacher, Ms. Fisher, speaks up and asks if he has ever considered an electronic behavior management program

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