Teaching Community Skills to Two Young Children with Autism Using a Digital Self-Managed Activity Schedule

Yvonne Cheung, Kimberly A. Schulze, Justin B. Leaf & Eric Rudrud

Routledge
Taylor & Francis Group

Teaching Community Skills to Two Young Children with Autism Using a Digital Self-Managed Activity Schedule

Yvonne Cheung[a], Kimberly A. Schulze[a], Justin B. Leaf[b], and Eric Rudrud[a]

[a]St. Cloud State University; [b]Autism Partnership Foundation

ABSTRACT

The current study investigated the efficacy of a self-managed activity schedule to teach 2 participants how to effectively order food items from a local community bakery. 2 participants who were on the autism spectrum were taught to follow a task analysis that was displayed on an iPhone. We used a multiple baseline design across participants to evaluate the effectiveness of the teaching procedure. Results showed that the participants were able to order items, and this skill generalized to a novel bakery. The task analysis and iPhone were immediately withdrawn at a 2 to 5 week follow-up, and both participants were still able to effectively perform the steps of the task analysis without the use of prompts.

Young children diagnosed with autism have several deficits, including deficits in language, social behaviors, and independently functioning within their community setting. To decrease these deficits and improve the overall quality of life for individuals diagnosed with autism, clinicians, teachers, and parents should implement procedures that have been demonstrated to be empirically effective (i.e., procedures based upon the principles of applied behavior analysis) (e,g., New York State Department of Health, 1999). 2 procedures that have been shown to be empirically effective are: self-management (Pierce & Schreibman, 1994) and activity schedules (Mechling, Gast, & Seid, 2009).

Self-management refers to a person's application of any behavior change tactic to change his or her own behavior in a desired direction (Cooper, Heron, & Heward, 2007). Self-management has been used effectively with participants across different ages, from preschool (e.g., DeHaas-Warner, 1992) to high school (e.g., Sweeney, Salva, Cooper & Talbert-Johnson, 1993). Self-management procedures have been utilized for participants who are typically developing (e.g., Sweeney et al., 1993), have behavioral and emotional disorders (e.g., Gumpel & Shlomit, 2000), have learning disabilities (e.g., Dunlap & Dunlap, 1989), have memory-impairment (e.g., Wong, Seroka & Ogisi, 2000), and are diagnosed with autism (e.g., Pierce & Schreibman, 1994). Finally, self-management has been utilized to teach a wide variety of behaviors including: social skills (e.g., Koegel, Koegel, Hurley, & Frea, 1992), classroom behavior (e.g., Coyle & Cole, 1994), daily living skills (e.g., Pierce & Shreibman, 1994), academic skills (Dunlap & Dunlap, 1989), play skills (e.g., Blum-Dimaya, Reeve, Reeve & Hoch, 2010), and reducing stereotypic behavior (e.g., Koegel & Koegel, 1990).

Koegel and Frea (1993) taught 2 children with autism to self-monitor their social communicative behaviors in community settings, including the restaurant and park. The multiple-baseline across behaviors and participants design indicated that the self-management package was effective in increasing social communicative behaviors in community settings. Koegel et al. (1992) taught 4 children with autism to self-manage their responsiveness to others' verbal initiations. The multiple-

baseline across settings design suggested a functional relationship between self-management and improvements in 3 of the participants' social responsiveness in the community settings.

A second procedure commonly implemented to increase a wide variety of behaviors is activity schedules (Mechling et al., 2009). An activity schedule consists of a series of visual cues (e.g., line drawings, photographs and written words) and teaches a learner to follow a sequence of tasks (McClannahan & Krantz, 1999). Activity schedules are generally incorporated in self-monitoring procedures, as the visual cues may serve as antecedent prompts that indicate to the learner which behaviors they should and should not be displaying (Mechling et al., 2009). Activity schedules may be even more beneficial in teaching learners complex skills that require a behavioral chain (i.e., a sequence of discriminated operants such that response during one stimulus is followed by other stimulus that reinforce those responses and set the occasion for the next ones [Catania, 1998]); the activity schedule may make each step of the behavior change more clear to the learner.

Self-managed activity schedules have been effective in teaching people with autism a range of behavior chains, such as daily living (e.g., Pierce & Schreibman, 1994), play (e.g., Blum-Dimaya, et al., 2010) and vocational skills (e.g., Browder & Minarovic, 2000). The majority of previous studies implemented activity schedules utilizing low tech formats such as a poster board (Johnson & Miltenberger, 1996) and booklets (Pierce & Schreibman, 1994). Pierce and Schreibman (1994) taught daily living skills to 3 boys with autism through photographic self-management. Each step of the task analysis for the target skills was depicted by a photo. The photos were placed in the correct sequence in a picture book. The self-management procedure required the participants to open the book, perform the step depicted by the photo on the page, self-monitor the completion of the step by flipping the page, and self-reinforce upon completing all the steps in the book. In phase 1, the participants learned to discriminate among the photos. In phase 2, the therapist taught the participants the chains of behavior in the self-management procedure using forward chaining. In phase 3, the therapist faded his presence by intermittently leaving the room and gradually increasing the time that the participant was alone until covering the entire task time. The multiple-baseline probe design across behaviors (i.e., targeted daily living skills) suggested a functional relationship between the self-management package and the participants' increased engagement in the daily living skills.

Blum-Dimaya et al. (2010) taught 4 children with autism to set up, turn on, play and turn off "Guitar Hero," a video game, using photographic self-management. Each step of the 26-step task analysis was depicted by a photo. The photos were arranged in order in a photographic activity schedule. The trainer used manual prompts with graduated time delay to teach the participants to perform the step depicted by the photo on the page, and to self-monitor the completion of the step by flipping the page and repeating the same procedures until all the steps in the schedule were completed. The multiple-probe across participants design suggested a functional relationship between the intervention and the dependent variables. After the withdrawal of the schedule, all of the participants continued to complete a substantially higher percentage of steps correct (ranged from 80% to 100%) than during baseline.

One set of skills that can be taught to individuals diagnosed with autism are community skills (e.g., making a purchase in a store, using an ATM machine, or putting money in a parking meter). Community skills may be important to teach individuals with autism as it may help the learner function better in their community and may increase their overall quality of life. Researchers have shown that children with autism can learn a variety of community skills, including: checking out a library book (e.g., Blew, Schwartz, & Luce, 1985), crossing the street (e.g., Blew et al., 1985), and purchasing groceries (e.g., Alcantara, 1994). When teaching community skills to individuals diagnosed with autism, the use of high-tech devices (e.g., iPad, iPod, Gameboys) may be advantageous as compared to other methods (e.g., booklet) as these high-tech devices are commonly seen in society, may reduce social stigma, and may promote more natural interactions with people in the community. Although the use of high-tech activity schedules may be beneficial for individuals diagnosed with autism, there have been very few studies that have utilized high-tech based interventions with individuals diagnosed with autism or intellectual

disabilities (e.g., Davies, Stock, & Wehmeyer, 2002). In 2011, Koyama and Wang conducted a literature review on 23 studies that utilized activities schedules as the primary intervention for individuals diagnosed with autism or an intellectual disability. The authors concluded that the use of high-tech activity schedules was limited and that future researchers should explore the use of high-tech devices when utilizing activity-schedules.

Therefore, the purpose of the present study was to expand the research on the use of high-tech self-managed activity schedules for teaching community based skills (i.e., making purchases at local bakeries) for 2 individuals diagnosed with autism. In this study, we taught 2 participants on the autism spectrum to self-manage a digital activity schedule to make food purchases at 2 bakeries. The self-management strategies included self-selection of a reinforcer and self-monitoring of the completion of each step of the target skill. Participants were first taught the skill in a simulated classroom bakery with further teaching in the community bakeries, if needed.

Method

Participants

This study included 2 participants who met the following criteria: (1) have an independent diagnosis of autistic disorder; (2) were able to read short sentences; (3) had previous experience with written schedules; (4) exhibited no self-injury or aggression; and (5) were currently enrolled in a private school in Hong Kong that served students with autism (due to outside referrals).

Bik was an 8-year-old Chinese female who had autism. Bik could read functional verbs and nouns as well as sentences consisting of a subject, verb, adjective, and noun (e.g., "John is playing with a green car"). Bik had approximately 1 year of previous history using a 5-step written schedule (written on a white board). Bik had a Vineland Adaptive Composite Score of 70 (Low Adaptive Functioning Level). Bik could not make purchases independently and had no previous history or training prior to this study.

Chang was a 10-year-old Chinese male who had autism that had a performance IQ score of 75-85, as rated on the Hong Kong Wechsler Intelligence Scale for Children (a standardized intelligence assessment), and a verbal reasoning score of 50–60, as rated on the Hong Kong Stanford-Binet Intelligence Scale-IV Edition: Selected Verbal reasoning Subtests (a standardized and commonly used intelligence assessment). Chang could read functional verbs and nouns as well as sentences consisting of a subject, verb, adjective, and noun (e.g., "John is playing with a green car").

Chang had 1 year of previous history using a 3-step written schedule (written on a white board). Chang could not make purchases independently and had no previous history or training prior to this study.

Settings

Self-managed activity schedule training was conducted in a simulated bakery in a classroom. Before each session, the researcher placed trays of bakery items, a stack of empty trays, and a pair of serving tongs on top of the shelf and a simulated cash card machine on the table. Generalization probes were conducted in 2 bakeries in the community. Each bakery displayed food items on covered trays and provided tongs to select the food item, a tray to place the selected item on, and a cash card machine at the cashier counter to pay for the item.

Materials

Materials included a cash card, a menu of 5 high-preference bakery items, five 6-page activity schedules saved on an iPhone and a lanyard neck strap for hanging the iPhone and cash card on the participants' necks. The researcher identified 5 high-preference bakery items for each participant by interviewing his or her parents. Each page of the schedule included a written instruction for the individual step of the task analysis.

Dependent variable, response definition, and data collection

The primary dependent variable was the percentage of steps performed correctly during the first trial probe (describe below) of the session, as recorded by the primary observer, for making purchases of food items in local bakeries. This skill was selected because typically developing children of the same age, in Hong Kong, were routinely and independently purchasing items in bakeries and the researchers wanted to teach these 2 participants skills that their peers were commonly displaying. The 10-step task analysis included: (1) pick up the tongs and tray; (2) open the covered food tray; (3) pick up the bakery item with tongs; (4) place the selected item on the tray; (5) close the covered tray; (6) walk to the cashier; (7) place the tray on the cashier counter; (8) pay for the item using the cash card; (9) place the food item into a bag and take it; and (10) exit the store. Mastery criterion was 100% of the steps performed correctly across 3 consecutive first trial probes. If a participant met the operational definition of a step, the step was recorded as correct; if the participant did not meet the operational definition or performed a step in the wrong order, then it was marked as incorrect. The observer remained within approximately 3 m of the participant at all times. The percentage of steps displayed correctly was converted into a percentage.

The second dependent variable was the percentage of non-overlapping data which was used to determine if data overlapped between probes conducted in intervention, bakery 1, bakery 2, maintenance, no schedule, 2-week follow-up, and 5-week follow-up conditions to probes conducted in the baseline condition (Scruggs & Mastropieri, 2001). The purpose of this measure was to determine the percentage of probes in all conditions, other than the baseline condition, which overlapped with the highest point during probes conducted in the baseline condition. We conducted this measure on the following: (a) across both participants and all conditions; (b) individually assessing all conditions for each participant; (c) and individually assessing each condition for each participant.

To validate the social validity of the behavior changes, an external observer from the private school who was not involved in the research was asked to observe each participant's performance during a randomly selected session in baseline, maintenance, and no schedule phase and rate the participants' performance using a 5-point likert scale across 3 questions: (1) Was the student effective in making the purchase? (2) Did the participant make the purchase in a timely manner? and (3) Is making purchases in a bakery an important community skill for the participant? For each question, the external observer scored either: (1) strongly disagree; (2) disagree; (3) undecided; (4) agree; or (5) strongly agree for each of the 3 questions.

Experimental design

A multiple baseline design across participants was used to evaluate the effect of the self-managed activity schedule. A multiple baseline design is utilized when a behavior is not reversible or when it would be inadvisable to reverse the behavior. The design can be utilized across settings, participants, or skills. The multiple baseline design begins with all participants or skills in a baseline period, followed by an intervention condition for 1 participant or skill. Intervention for the next participant or skill is implemented in a staggered fashion and should not be implemented until improvement has been shown on the first participant or first skill. Functional control is established when and only when improvement in the behavior occurs during the intervention condition. The multiple baseline design controls for many of the threats to internal validity; however, it does not control for all threats to external validity (Campbell & Stanley, 1963). Determination of the effectiveness of the procedures are typically determined through visual inspection as opposed to statistical analysis.

Procedure

The first author (described as researcher throughout this manuscript) was in charge of setting up and running the study; thus, no training was provided to the researcher throughout the study.

Baseline

Baseline sessions were conducted either once or twice per weekday (depending upon participant availability) in the first bakery. The session started with the researcher standing outside the bakery and asking the participant to select an item from the 5-item menu. The researcher told the participant to buy the chosen item (e.g., "Buy chocolate cake"). If the participant failed to make a purchase within 3 min following the instruction, the researcher ended the session. During baseline the participant did not have access to the activity schedule.

Activity schedule training in the classroom

Activity schedule training sessions occurred once per weekday. Each session was approximately 20 min and began with a probe to assess the percentage of steps performed correctly. During the first trial probe, the participant was asked to choose an item from the menu outside the simulated bakery. The researcher then opened the relevant activity schedule on the iPhone. Next, the researcher asked the participant to hang the iPhone on his/her neck and buy the selected item. If the participant utilized his or her activity schedule correctly he or she would do the following: (a) hold the iPhone in his or her hand; (b) look at the iPhone; and (c) swipe the screen to view the different steps of purchasing (same as task analysis).The researcher stayed outside the classroom bakery throughout the probe and did not provide any prompts. If the participant performed all of the steps correctly, the researcher ended the session and gave the participant a portion of the item purchased. If the participant failed to make a purchase within 3 min, the researcher ended the probe. No instructions were provided to the participant throughout the probe. During subsequent training trials, the researcher provided direct instruction using gesture, verbal, model and physical prompts in a least-to-most 5-s response prompt hierarchy; total task presentation was utilized each trial. Prompts were provided both towards completion of steps and the use of activity schedule. The researcher ran as many trials as possible within 20 min. The self-management procedure required the participants to read the written instruction, perform the step, self-monitor the completion of the step by turning to the next page, and repeat the procedure until the last page of the schedule was completed. The reinforcement for completing all of the steps was a bite of the item bought. The classroom phase continued until the participant demonstrated all the steps correctly during the first-trial probe for 3 consecutive days.

Self-managed activity schedule in bakery 1

Following mastery of the purchasing skill in a simulated classroom, training occurred in a community bakery (i.e., bakery 1). 20-minute sessions were conducted in bakery 1 each weekday. The session began with a first trial probe. Participant correct utilization of the activity schedule was identical to the classroom condition. If the participant responded incorrectly during the probe trial, the researcher implemented training in the bakery; training was identical to the training in the classroom phase. The bakery 1 phase ended after the participant completed 100% of the steps correctly during the first probe trial for 3 consecutive days.

Generalization probe in bakery 2

Generalization consisted of a single probe trial in which the participant had access to the activity schedule in a new community-based bakery. Participant correct utilization of the activity schedule was identical to the classroom condition. Sessions were conducted up to 2 times per weekday and were approximately 3 min long.

Maintenance phase

The participants shopped once a day at bakery 1 on the weekdays, using the schedule for 2 weeks. The sessions were identical to the first-trial probes during the self-management in bakery 1 phase. Participant correct utilization of the activity schedule was identical to the classroom condition. There was no planned training in this condition.

No schedule probe and follow-up

First trial probes without the iPhone and activity schedule were conducted in bakery 1. Withdraw from the use of iPhone was immediate. Follow-up data were taken at 2 and 5 weeks after the no schedule probes. Bik shopped at bakery 1 without the activity schedule. Chang shopped at bakery 1 and 2 without the activity schedule. There was no planned training in these 2 conditions.

Interobserver agreement

Prior to the study the lead researcher (first author) trained 2 observers to become reliability takers. The training consisted of the lead researcher providing the observers with an operational definition of the steps and an example data sheet. Next, the lead researcher had the reliability takers practice scoring the dependent variable in role-play scenarios until the reliability takers reached a mastery criterion of 80% across 3 consecutive sessions.

Probe data IOA was recorded during 41.18% of Bik's and 43.24% of Chang's sessions by an independent observer. Probe data IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements for each step and multiplying by 100. The mean probe data IOA across both participants was 100%. No measures on treatment fidelity were taken.

Results

Skill acquisition

Figure 1 shows the percentage of skill steps Bik and Chang performed correctly across the 8 phases of the study. Probe data for all sessions in the baseline condition, maintenance condition, no schedule condition, and follow up conditions are represented by closed circles as only a probe occurred and no training was scheduled. Probe data in the classroom condition, Bakery 1 condition, and Bakery 2 condition are represented by 2 symbols. Closed squares represent probes that occurred prior to any training in that condition. Open triangles represent probes that occurred once training had begun in that condition. Therefore, the first data point (closed square) represents data prior to any training in the classroom setting, and therefore, the percentage of steps performed correctly is low.

Bik performed none of the steps correctly during any of the 4 baseline probes in Bakery 1. During the first probe in the classroom condition, prior to the implementation of the self-managed activity schedule, Bik displayed 30% of the steps correctly. On the second probe during the intervention condition, Bik displayed 80% of the steps correctly, followed by 2 consecutive probes where 100% of the steps were displayed correctly. Bik reached mastery criterion (100% across 3 consecutive sessions) on the eighth probe in the classroom condition following implementation of the activity schedule training. Bik displayed 80% of the steps correctly on the first probe in Bakery 1, thus showing high levels of generalization from the classroom condition to the Bakery 1 condition; but still requiring training. This was followed by Bik displaying 100% of all the steps correctly during Bakery 1 probes. Bik displayed 100% of the steps in Bakery 2 without any training, thus showing a high level of generalization. Bik displayed 100% of the steps correct during all probes in the maintenance, no schedule, and follow up conditions.

Chang performed none of the steps correctly across all 7 baseline probes in Bakery 1. During the first probe in the classroom, Chang displayed 0% of the steps prior to the implementation of training. Chang displayed 0% of the steps on the first probe following training, but by the third probe Chang displayed all of the steps correctly and reached mastery criterion on the seventh session. Next, probe data was assessed in Bakery 1 where Chang displayed 100% of the steps correctly without training and thus showed a high level of generalization. Thus, no training was provided to Chang in the Bakery 1 condition. Chang also was able to generalize the behavior to Bakery 2 without any training as he displayed 100% of the steps correctly across 3 probes. Chang displayed 100% of the steps correctly during all probes in the maintenance, no schedule, and follow up conditions.
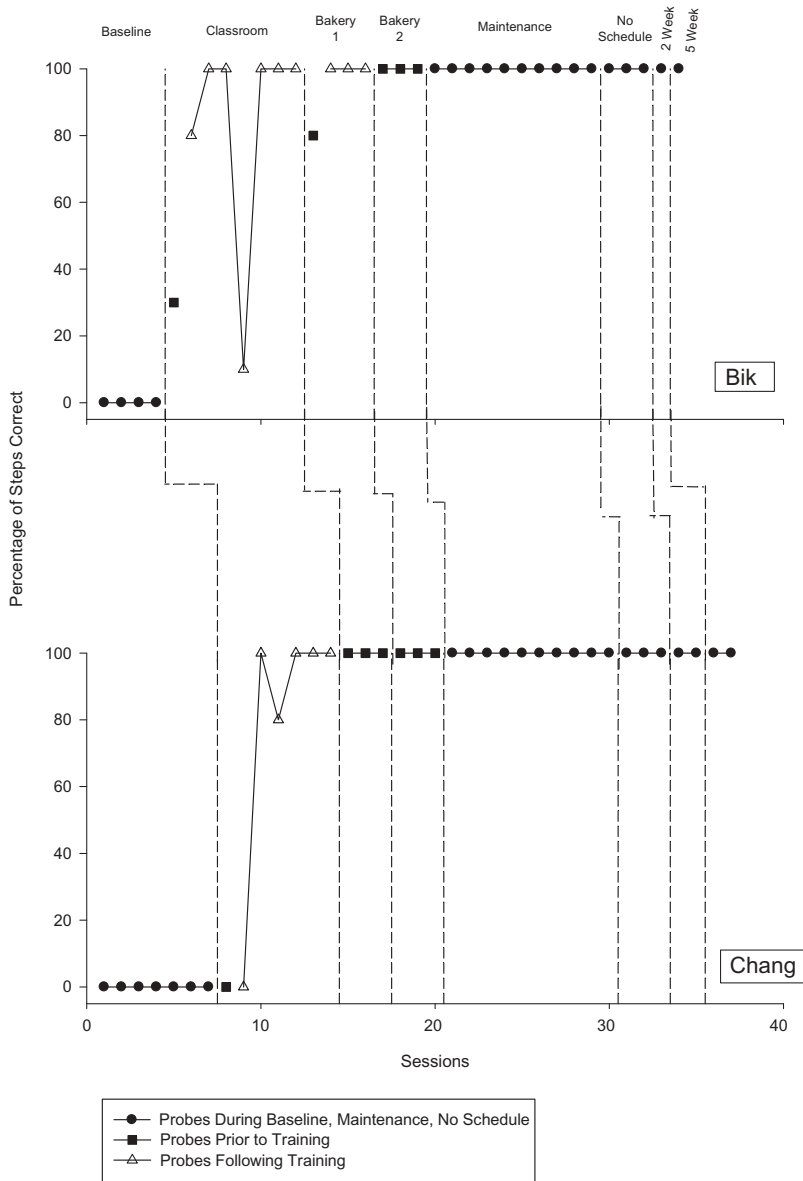
Figure 1. Participants' skill acquisition data.

Percentage of Non-Overlapping Data

An analysis of non-overlapping data was conducted. We first assessed the non-overlapping data across all conditions and both participants. The percentage of non-overlapping data for this measure was 96.67% indicating that the majority of probes across all conditions did not overlap with the highest baseline point across the 2 participants. Thus, the non-overlapping data for this assessment showed that the intervention was effective across both participants.

Second, we assessed the non-overlapping data across all conditions for each participant individually. The percentage of non-overlapping data across all conditions to the highest point during baseline for Bik was 100% indicating that all of the probes across all conditions did not overlap with the highest baseline point across the 2 participants. Thus, the non-overlapping data for this

assessment showed that the intervention was effective for Bik. The percentage of non-overlapping data across all conditions to the highest point during baseline for Chang was 93.3% indicating that nearly all of the probes across all conditions did not overlap with the highest baseline point across the 2 participants. Thus, the non-overlapping data for this assessment showed that the intervention was effective for Chang.

Third, we assessed the non-overlapping data for each condition and for each participant. The percentage of non-overlapping data was 100% for each condition for Bik; showing that the intervention was effective for Bik. For Chang, the percentage of non-overlapping data was 71.42% for the classroom condition; with the only overlap on the first 2 sessions. For all other conditions, the percentage of non-overlapping was 100%.

Social validity

The first question of the social validity questionnaire was: "Was the participant effective in making a purchase in the bakery?" The outside external observer responded to this question using a 5-point scale. During baseline, both Bik and Chang received a score of 1 (strongly disagree). During the maintenance phase and no schedule probe phase, both Bik and Chang received a score of 5 (strongly agree). Thus, according to an outside external observer, both participants were able to increase their ability to effectively make purchases.

The second question of the social validity questionnaire was: "Did the participant make the purchase in a timely manner?" The outside external observer responded to this question using a 5-point scale. During baseline, both Bik and Chang received a score of 1 (strongly disagree). During the maintenance phase, the outside external observer gave a score of 4 to Bik (agree) and a score of 5 for Chang (strongly agree). During the no schedule probe phase, both Bik and Chang received a score of 5 (strongly agree). Thus, according to an outside external observer, both participants were able to increase their ability to be more efficient within the bakery.

The third question on the social validity questionnaire was: "Is making purchases in a bakery an important community skill for the participant?" During baseline, both Bik and Chang received a score of 5 (strongly agree). During the maintenance phase and the no-schedule probe phase, Bik and Chang received a score of 4 (agree). Thus, according to an outside external observer making purchases was an important skill.

Discussion

Both Bik and Chang were able to learn how to make purchases, first in a classroom simulated bakery and then in a community bakery. Furthermore, both participants were able to generalize their purchasing skills to a second community bakery. Finally, both participants were able to maintain the purchasing skills taught to them and were able to demonstrate purchasing behaviors after the digital self-managed activity schedule was withdrawn. Thus, the current study demonstrated that a digital self-managed activity schedule was effective in teaching purchasing at a community-based bakery for 2 children who had autism. Such findings are consistent with previous research which indicated that a self-managed activity schedule can be effective in teaching children with autism a variety of behaviors (e.g., Blum-Dimaya et al., 2010; Pierce & Schreibman, 1994). Although previous research has shown that self-managed activity schedules can be effective, this study expands the literature in 2 important ways.

First, this study demonstrated that a digital self-managed activity schedule was effective in teaching important skills to individuals diagnosed with autism. Research has shown that self-managed schedules can be an effective teaching strategy (e.g., Blum-Dimaya et al., 2010; Pierce & Schreibman, 1994) for individuals diagnosed with autism. However, the research on using high-tech devices has been limited (e.g., Davies, Stock, & Wehmeyer, 2002) and there has been a call for more research on high-tech self-managed activity schedules (Koyama & Wang, 2011).

Thus, this paper provides preliminary support on the use of high-tech self-managed activity schedules. There are several educational advantages to using high-tech devices for individuals diagnosed with autism. For one, high tech devices may be more multi-functional, in that they can be utilized for teaching multiple learning objectives. For example, an iPhone (or similar device) can be used for self-management, can be used for reinforcement (e.g., playing various games through applications), and can be used to teach a variety of different skills. Second, the use of high-tech devices may be more portable than other devices (e.g., fit in a student's pocket). Therefore, the device can be taken with a student throughout various settings and teaching can occur across these various settings. Finally, and most importantly, using a high-tech device such as an iPhone can be less stigmatizing than using a book or an activity schedule. Today, students of all ages are using high tech devices; thus, using a high tech device may result in less social stigmatization and possibly less chance of being bullied.

Second, this study expanded the literature on using self-managed activity schedules for teaching community skills. Researchers have demonstrated that individuals with autism can learn a variety of community skills, such as checking out a library book (e.g., Blew et al., 1985), crossing the street (e.g., Blew et al., 1985), and purchasing groceries (e.g., Alcantara, 1994). Given the importance of teaching community skills to individuals with autism, it is important for researchers to continue to identify effective methods for teaching community skills, which may result in clinicians, teachers, and parents implementing these procedures in clinical settings. This study provides clinicians, parents, and teachers with a method that can be used in naturalistic settings to teach community skills.

The study is not without its limitations. First, the research design did not permit conclusions regarding which operant process accounted for the behavior change. Self-monitoring may affect the target behavior by the reactive effects it produces (Cooper et al., 2007) or serve as a conditioned reinforcer, as the self-recording of appropriate behavior was repeatedly paired with a reinforcer. Second, the current study did not measure possible lateral behavior gains. Previous self-managed activity schedule studies indicated the improvement of behavior not directly targeted in the program (Blum-Dimaya et al., 2010; Stahmer & Schreibman, 1992). Future researchers could collect data on other behaviors that may occur while the participants are engaging in the target skills (e.g., self-stimulatory and off-task behavior).

Third, the current research did not collect any data on treatment integrity. Therefore, it is not known if the procedures were implemented correctly. Anecdotally, the procedures were implemented as planned; however, future researchers should include treatment fidelity as part of research studies. Fourth, the digital self-monitoring activity schedule was used to teach purchasing skills to 2 children with autism and, as such, at the end of the purchase both participants received a primary food reinforcer. Thus, it is not known if the use of this primary reinforcer alone could have resulted in the change of behavior, or if the activity schedule would only be effective when a primary reinforcer is utilized. Future researchers may wish to conduct a component analysis of the procedure that was utilized in this study to determine if all components are necessary. Additionally, future researchers may wish to evaluate the procedure without the use of a primary reinforcer or without any reinforcement at all.

A fifth limitation was that baseline data were not collected in Bakery 2. Although both participants performed all the steps correctly in bakery 2 without additional training, the extent to which the treatment effects generalized remains uncertain. Future research should collect baseline data in all generalization settings. An additional area of future research may be the generalization of purchasing skills to other similar types of store (e.g., convenience store) as well as with the participants' families instead of teachers.

Despite these limitations, this study showed that a digital self-monitoring activity schedule procedure resulted in 2 participants being able to make purchases in a local community bakery, generalize these skills to a second bakery, maintain the skill during long term follow-up, and continue to display the behavior after the activity schedule had been withdrawn. Thus, this study was able to expand upon the previous research and provide clinicians, parents, and teachers with an effective technology to teach community based skills.

References

Alcantara, P. R. (1994). Effects of a videotape instructional package on purchasing skills of children with autism. *Exceptional Children*, 61, 40–55.

Blew, P. A., Schwartz, I. S., & Luce, S. C. (1985). Teaching functional community skills to autistic children using nonhandicapped peer tutors. *Journal of Applied Behavior Analysis*, 18, 337–342.

Blum-Dimaya, A., Reeve, S. A., Reeve, K. F., & Hoch, H. (2010). Teaching children with autism to play a video game using activity schedules and game-embedded simultaneous video modeling. *Education and Treatment of Children*, 33, 351–370.

Browder, D. M., & Minarovic, T. (2000). Utilizing sight words in self-instruction training for employees with moderate mental retardation in competitive jobs. *Education and Training in Mental Retardation and Developmental Disabilities*, 35, 78–89.

Catania, C. A. (1998). *Learning:* Fourth *edition*. Upper Saddle River, NJ: Prentice-Hall, Inc.

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand McNally College Publishing Company.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Self-management. In *Applied Behavior Analysis* (2ⁿᵈ ed.) (pp. 575–612). Upper Saddle River, NJ: Pearson Education, Inc.

Davies, D. K., Stock, S. E., & Wehmeyer, M. L. (2002). Enhancing independent task performance for individuals with mental retardation through use of a handheld self-directed visual and audio prompting system. *Education and Training in Mental Retardation and Developmental Disabilities*, 37, 209–218.

DeHaas-Warner, S. (1992). The utility of self-monitoring for preschool on-task behavior. *Topics in Early Childhood Special Education*, 12, 478–495.

Dunlap, L. K. & Dunlap, G. (1989). A self-monitoring package to teach subtraction with regrouping to students with learning disabilities. *Journal of Applied Behavior Analysis*, 22, 309–314.

Gumpel, T. P., & Shlomit, D. (2000). Exploring the efficacy of self-regulatory training as a possible alternative to social skills training. *Behavioral Disorder*, 25, 131–141.

Johnson, R. R., & Miltenberger, R. G. (1996). The direct and generalized effects of self instructions and picture prompts on vocational task performance. *Behavior Interventions*, 11, 19–34.

Koyama, T., & Wang, H-T. (2011). Use of activity schedule to promote independent performance of individuals with autism and other intellectual disabilities: A review. *Research in Developmental Disabilities*, 32, 2235–2242.

Koegel, R. L. & Frea, W. D. (1993). Treatment of social behavior in autism through the modification of pivotal social skills. *Journal of Applied Behavior Analysis*, 26, 369–377

Koegel, L. K., Koegel, R. L., Hurley, C., & Frea, W. D. (1992) Improving social skills and disruptive behavior in children with autism through self-management. *Journal of Applied Behavior Analysis*, 2, 85–99.

Koegel, R. L., & Koegel, L. K. (1990). Extended reductions in stereotypic behavior through self-management in multiple community settings. *Journal of Applied Behavior Analysis*, 23, 119–128.

McClannahan, L. E., & Krantz, P. J. (1999). *Activity schedules for children with autism: Teaching independent behavior*. Bethesda, MD: Woodbine House.

Mechling, L. C., Gast, D. L., & Seid, N. H. (2009) Using a personal digital assistant to increase independent task completion by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 39, 1420–1424.

New York State Department of Health (1999). *Clinical practice guideline: Report of the recommendations autism/pervasive developmental disorders. Assessment and intervention for young children (ages 0-3)*. Albany, NY: New York State Department of Health.

Pierce, K. L., & Schreibman, L. (1994). Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management. *Journal of Applied Behavior Analysis*, 12, 355–361.

Scruggs, T. E., & Mastropieri, M. A. (2001). How to summarize single-participant research: Ideas and applications. *Exceptionality*, 9, 227–244.

Stahmer, A. C., & Schreibman, L. (1992). Teaching children with autism appropriate play in unsupervised environments using a self-management treatment package. *Journal of Applied Behavior Analysis,* 25, 447–459.

Sweeney, W. J., Salva, E., Cooper, J. O. & Talbert-Johnson, C. (1993). Using self-evaluation to improve difficult-to-read handwriting of secondary student. *Journal of Behavioral Education*, 3, 427–443.

Wong, S. E., Seroka, P. L., & Ogisi, J. (2000). Effects of a checklist on self-assessment of blood glucose level by a memory-impaired with diabetes mellitus. *Journal of Applied Behavior Analysis*, 33, 251–254.