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The Apple iPod Touch as a vocational support aid for adults with autism: Three case studies

Tony Gentry[a,*], Stephanie Lau[b], Alissa Molinelli[b], Amy Fallen[c] and Richard Kriner[d]
[a]*Department of Occupational Therapy, Virginia Commonwealth University, Richmond, VA, USA*
[b]*Rehabilitation Research and Training Center, Virginia Commonwealth University, Richmond, VA, USA*
[c]*Career Support Services, Richmond, VA, USA*
[d]*Virginia Department for Aging and Rehabilitative Services, Richmond, VA, USA*

Abstract. Personal digital assistants (PDAs) offer task management and organizational features that may be utilized to help people with autism spectrum disorder (ASD) function more successfully in the workplace. Additionally, onboard video cameras and add-on software applications provide rich opportunities for the implementation of personalized vocational supports for individual workers. This article reports on three cases of workers with ASD who have been trained to use Apple iPod Touch PDAs as vocational supports in the workplace, resulting in improved functional performance and reduced behavioral challenges.

Keywords: Autism, assistive technology, cognition, occupational therapy, personal digital assistant, vocational rehabilitation

1. Introduction

Adults with autism spectrum disorder (ASD) face daunting challenges in seeking to enter the American workforce. Recent studies show that only 15% of working age individuals with ASD have some form of paid work [11] and only 6% are competitively employed [13]. These statistics are often attributed to functional difficulties related to cognition, behavior, communication and sensory-processing that can impact work performance [12]. At the same time, it is clear that adults with ASD often have valuable assets and strengths that are sought after in the workplace. Some individuals demonstrate remarkable logical and mathematical ability, exceptional computer skills, or photographic memory. They may also possess important personal traits that foster productivity in the workplace, such as honesty, reliability and perseverance. The limited interest in interpersonal relationships that is characteristic of many people with ASD may sometimes be seen as a positive quality, because a worker with ASD may be less likely to engage in unnecessary social interactions with co-workers, allowing for increased work productivity [2, 5, 16].

Because most of the focus in autism research is on the identification, assessment and treatment of children, few studies examine interventions and outcomes in adulthood. As a result, evidence-based programs of workplace support are limited. Strategies that provide enlightened workplace supports are clearly needed in order to help people with ASD find useful work and perform successfully on the job.

2. PDAs as assistive technology

Since their emergence in the late-1990 s, researchers and clinicians have explored the use of personal

*Address for correspondence: Tony Gentry, PhD, OTR/L, Associate Professor, Department of Occupational Therapy, 2nd Floor, 730 East Broad Street, Richmond, VA 23298, USA. E-mail: logentry@vcu.edu.

digital assistants (PDAs) as cognitive aids for populations ranging from brain injury [8] and multiple sclerosis [10] to intellectual disability [4, 7] and ASD [6, 9, 14, 15]. Because PDAs are pocket-sized, durable, easily accessible and designed to offer basic task organization features, they have been shown to help people with cognitive-behavioral challenges manage everyday tasks at home, at school and in community settings. These devices may be especially appropriate for people with ASD, since research suggests that many of these people may prefer instruction and support provided by computers to that offered directly by another person [1, 3, 17].

Over the past few years, as PDAs and smartphones have developed into multi-functional appliances capable of incorporating advanced task management applications, augmentative communication tools, wayfinding supports, video cameras and video editors, behavioral modeling programs and a rapidly growing library of educational media, opportunities to leverage these devices as assistive technology have outpaced the efforts of researchers to assess their efficacy with any disability population. Research on their use by workers with ASD is scarce.

In order to address this issue, the Virginia Commonwealth University project entitled Vocational Rehabilitation Service Models for Individuals with Autism Spectrum Disorders, under the direction of VCU's Rehabilitation Research and Training Center and in collaboration with the Virginia Department for Aging and Rehabilitative Services, is conducting a multi-year study of the Apple iPod Touch PDA as a vocational support for people with ASD.[1] The iPod Touch was chosen for this project, because at the time the study was designed it was the only pocket-sized PDA available. These devices can be carried in a pocket, on a belt clip or on a necklace lanyard, making them appropriate for workers who must use their hands on the job. The iPod Touch, which costs $190, includes task organization applications, such as an electronic calendar, address book, to do list, and a reminders program. The device also includes still and video cameras. At this writing, nearly 600,000 add-on applications are available for download from the Apple iTunes Store, allowing for a diverse range of customization approaches for individual users. No other currently available device seemed to match the iPod Touch in its combination of affordability, portability, and flexibility.

[1] This project is funded by the National Institutes of Disability and Rehabilitation Research (NIDRR).

3. Intervention

Presented here are three case studies of adults with autism who have been successfully trained to utilize Apple iPod Touch PDAs as cognitive-behavioral aids in support of vocational goals. The people profiled here are participants in a 4-year randomized trial examining the use of these devices as job coaching aids in the workplace. In each case, a DRS-funded job coach identified an adult with ASD who was scheduled to begin a job coach-supported vocational placement, consents were obtained from the participant, a parent and the job coach, and an OT from the ATC Lab scheduled an assessment interview and work observation, during which the participant and job coach described vocational challenges that required vocational support on this particular job. The OT then programmed an iPod Touch with an individualized suite of applications intended to provide elements of support that have included: (1) task reminders, (2) task lists, (3) video-based task-sequencing prompts, (4) behavioral self-management adaptations, (5) way-finding tools, and other supports. The OT then trained the participant and job coach in using the device as a vocational aid, and provided follow-along support, as needed, during a six-month trial of device utilization on the job. Participant names have been changed to protect their privacy.

4. Strategies for success: Three case studies

4.1. Jeffrey – basic task-prompting in a custodial job

4.1.1. Participant characteristics and history

On initial interview, Jeffrey presented as a 21-year old with autism, who had completed a high school certificate program. Shy and withdrawn around others, Jeffrey rarely spoke, and then in monosyllables or in parroted speech. He preferred not to make eye contact and displayed little social awareness. When anxious, Jeffrey tended to display stereotyped calming behaviors, which involved spinning slowly in place and humming to himself while staring at the ceiling, or standing facing a nearby wall and shifting from foot to foot while humming. Jeffrey joined the study two weeks after finding work as a ten-hours/week daytime custodian, earning $8/hour, at a Hardee's fast food restaurant in Midlothian, Virginia, under the close supervision of a DRS-sponsored job coach. Jeffrey lived with his mother,

a retired educator. He had previously worked for one year part-time as a book-stocking clerk at a public library, but had lost that job when the library down-sized.

Jeffrey's responsibilities included: (1) emptying garbage cans, (2) cleaning and wiping down tables, (3) sweeping the dining area, (4) stocking condiments, and (5) cleaning and stocking the bathrooms. He was expected to rotate among the first four duties during the morning and finish his five-hour shift by cleaning both bathrooms. After two weeks of training, he was capable of performing each of his tasks with close supervision, but his job coach did not see how he might grow to independence in performing them, because of autism-related challenges. He often failed to switch from one task to another, endlessly wiping down a table or sweeping an area of the floor, until the job coach intervened. He appeared to have difficulty remembering the multiple steps involved in retrieving and stocking condiments and in cleaning the bathrooms. The job coach had provided Jeffrey with a checklist of job duties, but he did not refer to the checklist unless verbally reminded to do so. Additionally, the job coach had to frequently intervene when he began to display his characteristic calming behaviors, spinning and humming in the middle of the dining room or stamping his feet in a corner. Because of these behaviors, the job coach had received complaints from the restaurant manager and feared that Jeffrey's job trial would not succeed.

4.1.2. ATC intervention

The OT met with Jeffrey and his mother at their home for initial training and setup of an iPod Touch. After a brief training session, Jeffrey demonstrated competence in navigating the device interface and responding to alarm reminders posted using the *Clock* application. He consented to utilize the device on the job for three months, and was provided with the iPod Touch and a protective case with a belt clip. The OT loaded the iTunes application on Jeffrey's home computer, synchronized the device with the computer and set alarm reminders on the *Clock* application to plug the device in for charging at night and to take the device to work in the morning.

Initially, the OT transferred step-by-step task lists from a paper-based list the job coach had been using to the *Notes* application on the iPod touch. A different note was created for each of Jeffrey's task stations, and titled appropriately for easy access. The OT then set reminder alarms, using the *Clock* application, to cue Jeffrey to move from task to task during the morning shift (see Fig. 1). This application allows different alarm sounds to be set for different tasks. Jeffrey participated in selecting the sounds linked to each task and agreed to follow the device directions, switching tasks as cued. In an effort to help him learn and retain the steps of his job duties, a *Clock*-based alert sounded before work each morning, cueing him to review his task notes. The OT added digital tape recordings of these task notes (using the *Voice Memo* application) that he could listen to as a second option.

4.1.3. Employment outcomes

Jeffrey readily adopted the iPod touch as a vocational tool, keeping it fully charged and wearing it to work on his belt. Within one week of using the device on the job, he was successfully responding to the reminder cues, switching from task to task and rotating among his work stations without other prompting throughout his shift. He was frequently observed checking notes on the device to be sure of completing the steps of his tasks. The OT had planned to add additional prompts to the device, including a video clip modeling the steps of bathroom cleaning and another that would have cued him to go to the closet area in the back of the restaurant for a self-calming routine when feeling anxious, but these prompts were not needed. Because Jeffrey now moved through his work routine successfully, he ended his day with enough time to thoroughly clean and stock the bathrooms. He utilized a task list on the *Notes* application to assure completion of all steps. Surprisingly, Jeffrey no longer demonstrated self-calming stereotyped behavior in the restaurant. His supervisor surmised that having prompts and reminders on the iPod Touch reduced his anxiety, so it was not necessary to resort to those behaviors.

Over the following six weeks, Jeffrey continued to rely on the iPod touch prompts and successfully managed his workday without the need of direct supervision. The job coach discharged him ahead of schedule (see Table 1). One year later, Jeffrey continues to use his iPod touch on the job. He is recognized as a reliable employee at the restaurant, and his co-workers seem to like him. As his manager says, "he's methodical, hard-working, thorough, and we've even caught him sharing a smile with the line cooks now and then".

4.1.4. Reflection

This intervention utilized an iPod Touch and onboard task organization applications that are sold with the device. In this case, no other application was needed. Intermittent reminder alarms served to alert Jeffrey to switch tasks and to review his task duties list in order to

successfully complete job duties. A digital tape recording of task steps served as an alternative task support, which Jeffrey listened to before work as a rehearsal for his workday. The OT spent a total of 14 hours in assessment and intervention, and the job coach spent 41 hours in direct onsite supervision, discharging Jeffrey from direct onsite vocational support within ten weeks. Jeffrey has continued to maintain the device successfully and to utilize it as needed for one year, while maintaining employment.

4.2. Grace – clerical support

4.2.1. Worker characteristics and history

Grace is a 60-year old woman with a diagnosis of autism, mild cerebral palsy and epilepsy that is controlled by medication. She sought the support of a job coach at the VCU-RRTC after losing a part-time clerical job she had held for 28 years, due to office automation. During a situational assessment trial, Grace's job coach recognized that she worked best in a quiet, climate-controlled environment performing routine clerical tasks without undue distractions or changes in daily routine. Under those conditions, she successfully categorized and catalogued information, working consistently and thoroughly.

Grace was offered a part-time clerical position at the Virginia Employment Commission where she earns $9.65 an hour, and works 15 hours a week. In this position, Grace's main responsibility is to sort and process incoming mail. Grace's routine requires collection of the mail from the mailroom, opening and stamping each piece of mail with the date, and processing the mail using the VEC's mainframe computer database. Correctly processing the mail means that Grace has to inspect each piece of mail for proper search terms (name, social security number, and address). Often, most of this information is missing, so that she must undertake a time-consuming process of double-checking names on a computer database, searching for docket numbers and return addresses.

4.2.2. ATC intervention

Initially the job coach, working with Grace and her supervisor, adapted the work environment for success. Because Grace is easily distracted by busy office settings, she was provided with a cubicle in a quiet corner of the office. Labeled desktop baskets were provided to help organize her workflow and to allow her supervisor to assess her work progress. To expedite the learning process, decision flow charts were created, laminated and posted on the wall of Grace's cubicle. Grace is able to refer to these charts and keywords as necessary.

Following consent, the OT from the VCU ATC laboratory assisted Grace and her job coach in utilizing an iPod Touch to help Grace manage her work. Alert reminders were set, using the *Clock* application, to remind Grace to transition from one task to another during the day. For instance, alarms cued her to check the mail, retrieve faxes, go to lunch, take her medications, fill out her timesheet, and clean up her workstation at day's end (see Fig. 2). The *Notes* application was utilized to provide guidance in the form of brief instructions on the management of workplace situations, such as what to do if Grace could not locate a file or how to call her supervisor if she was going to be late or absent from work (see Fig. 3). The iPod touch video camera was used to record short videos showing Grace how to find her way from one station to another in the office building. To help Grace manage anxiety, a relaxation and meditation-coaching application, *Simply Being*, was downloaded from the *iTunes Store*. Grace was encouraged to use this application for anxiety-management at lunch and at the end of a busy workday. Within one week, Grace had learned to utilize these iPod Touch-based supports independently, and to rely on the device to help her complete daily tasks.

The iPod Touch was then utilized to help Grace manage the challenges of getting to work. Grace relies on a specialized transportation bus to get to and from work, which means that she is given a 30-minute pick-up window. To help Grace manage this situation, the iPod Touch *Clock* application was programmed to notify her to call her supervisor if the bus was late in picking her up for work. At the end of the workday, Grace faces an additional challenge, because her office is located on a busy downtown street corner. Grace's job coach immediately noticed that anxiety over possibly missing her bus would sometimes lead her to leave her purse on a park bench and step into the busy street looking for the bus. The job coach utilized Grace's iPod Touch to address this dangerous situation in the following ways: (1) reminder alerts to remind Grace to go to the bus stop and to phone the transportation company if the bus had not arrived on time; (2) contact information (using the *Contacts* application) for the bus company and a taxi company; (3) podcasts of some of Grace's favorite radio shows and music (using the *iTunes* application) to help alleviate her anxiety while waiting for the bus; and (4) a custom-made video (using the *Camera* application and the device's onboard video camera) showing Grace waiting for the bus appropriately, and providing

verbal prompts on how to wait for the bus safely and how to call if the bus is late. Grace was trained to play this video on her iPod touch, as needed.

4.2.3. Employment outcome

Grace has continued to utilize the iPod Touch independently for six months and performs her job duties successfully. She relies on the device to help manage frequent difficulties that arise from late-arriving specialized transportation buses, including strategies for checking bus schedules, phoning her employer if she is late, and safely waiting on the sidewalk. On the job, the iPod Touch reminds her to switch from one task to another, to take lunch breaks, and to clear her desk at the end of the work day. Custom-made videos help her find her way amidst a maze of offices. A relaxation application and downloaded music help her cope with anxiety.

4.2.4. Reflection

Because the iPod Touch is pocket-sized and portable, it offers Grace support from the very beginning to the very end of her workday. Though Grace was initially unfamiliar with handheld devices, she was able to learn how to charge the iPod Touch at home and to use multiple features independently and consistently on her way to work, on the job, and on her way home in the evening. Her job coach believes this has significantly reduced the need for onsite supervision, and her office manager agrees that Grace performs ably and independently. The OT spent ten hours in assessment, device adaptation and training, and the job coach spent a total of 69 hours over seven months in steadily decreasing onsite job support (see Table 2), before discharging her from supported employment.

4.3. Lily – A non-reading hospital worker

4.3.1. Worker characteristics and history

Lily is a 20-year old woman with Downs Syndrome and ASD. Lily can follow a visual schedule to perform work tasks, and she pays attention to detail, particularly when cleaning. Lily does not read, tell time, or navigate a calendar independently. Though generally sociable and friendly, when frustrated she sometimes seeks to avoid work or gain attention utilizing maladaptive behaviors.

4.3.2. Job responsibilities

Lily works on the *Mother Infant Unit* of St. Mary's Hospital in Richmond, VA, where she is responsible for housekeeping duties in the newborn nursery, and where she earns $8/hour during a 5-hour day/5-day workweek. She folds and stocks blankets and t-shirts, cleans the lactation room, sanitizes office equipment (including telephones and keyboards), cleans the refrigerators and microwaves, and sanitizes *Work Station on Wheels* (WOW) computer carts. After a month of training, Lily demonstrated the ability to thoroughly and completely perform each of her tasks on her own. Because she does not have time to complete all of these tasks each day, alternating daily schedules – color-coded as pink or purple days – were provided for her. Because Lily does not read words, these schedules were made up of pictures, which were originally provided on laminated paper. She was able to use these schedules to check her work, though she required direct verbal support to stay on task, to switch tasks, and to know which alternating schedule to follow each day. Because Lily takes pride in her work skills, she often became frustrated when her supervisor or job coach provided these task cues, resorting to behaviors that included throwing soft drinks, stomping, crying and phoning her mother at home. Unforeseen changes in the workday schedule also caused outbursts. These challenges made independent job performance problematic.

4.3.3. ATC intervention

Working with Lily and her job coach, the OT originally provided an iPod Touch with a protective carrying case and belt clip. Lily is a fan of Disney movies and especially likes *The Lion King* film. In order to facilitate her appreciation and sense of ownership of the iPod Touch, the user screen was customized to include photographs from the movie. Because Lily is a non-reader, a verbal reminder application called *VoCal* was downloaded from the *Apple iTunes Store* to provide spoken word alerts for clocking in to work, switching from one task to another, taking rest and lunch breaks, clocking out at the end of the workday, and plugging in the device to charge it before bedtime. In order to cue Lily to her alternating workdays, pink and purple calendars were created using the *iCal* calendar application. These calendars were set up so alternating days displayed nothing but a band of color, either pink or purple, to identify her workday. The *Storykit* application was downloaded from the *Apple iTunes Store* in order to build verbal and picture-prompting task lists, replacing Lily's laminated paper prompts. *Storykit* allows a user to easily create talking picture books. The OT created a pair of picture books, for Lily's pink and purple workdays, adding pages that included: (1) a photo of a task, (2) an

appropriate background color (either purple or pink), and (3) a digitally-recorded spoken-word prompt (see Fig. 4). The last page of both books included a cartoon picture from a Disney movie and a digitally-recorded audio message of congratulations from her job coach, for completing her day's work. Lily was trained to tap an onscreen arrow in the picture books to move from one task to another, doing so when prompted by a *VoCal* audio reminder. In this way, *Storykit* and *VoCal* worked together to support Lily's workflow.

Storykit was also used to help Lily manage unusual transitions in the workplace. For instance, Lily must leave the hospital's lactation room if a mother needs it to feed her baby, yet she had often become frustrated and demonstrated troubling behaviors when asked to do so. A *Storykit* book was created to provide verbal prompts for appropriate behavior when interrupted, encouraging Lily to return to her task when the room comes available again.

Lily's job coach has instituted a personalized behavioral plan that incorporates an application called *iReward*. If Lily completes her work successfully and on time, without a behavioral outburst, she receives a reward. The *iRewards* application allows Lily and her job coach to keep track of her progress in adhering to the plan. Rewards typically include free time to play games or songs stored on her iPod Touch.

Lily takes a specialized transportation bus to work, a trip that sometimes takes two hours. In order to help her manage boredom and anxiety on the bus, games, short videos and songs from Disney movies were downloaded from the Apple iTunes Store to her device.

The OT and job coach spent three weeks in assessment, device setup and on-the-job training with Lily. The OT spent a total of 15 hours and the job coach spent 20.75 hours (6.91 hour weekly average) in direct onsite supervision during these three weeks. The following week, Lily self-managed the iPod Touch on the job, requiring 7 hours of indirect monitoring by the job coach. During the following four weeks, Lily continued to use the iPod Touch, requiring a weekly average of 2.56 hours of indirect monitoring supervision only. This was her most independent level of functioning up to that time.

4.3.4. Employment outcomes

Because Lily was familiar with portable gaming platforms and had a cellphone, she found the iPod Touch easy to use, and she readily agreed to use it as a vocational support. The device led to improved work performance, fewer behavioral challenges, and a marked decrease in telephone calls for help to her job coach or mother during the workday. She completed more of her tasks each day and responded consistently to the reminder alarms for switching tasks and taking lunch breaks. The amount of time Lily's job coach spent in direct onsite supervision decreased.

Unfortunately, however, one month after receiving the iPod Touch, Lily lost it, apparently while traveling on the bus to work. It took a week to acquire and program a replacement device, and another week to retrain Lily in its use. During the week when Lily did not have an iPod Touch, she was again provided with picture prompts on laminated paper to help manage her workflow, and reminder messages were programmed into her cellphone, but these supports proved ineffective. Without the customized iPod Touch, Lily again frequently phoned her job coach for assistance in following her schedule and managing workplace challenges. Coworkers also called her job coach, because Lily was not following her schedule and was disrupting work on the unit. Each day, Lily stayed late at lunch, and she became upset when told that she needed to clean up and leave the cafeteria. Job coaching hours during these two weeks averaged 6 hours/week of direct verbal and gestural prompting.

Once a replacement iPod Touch was programmed and provided, Lily's work performance and behavior improved. Phone calls to the job coach decreased, Lily followed her schedule independently, and she consistently won behavioral rewards. During the following four weeks, Lily's job coach logged an average of 2 hours/week of supervision, including 1.5 hours of indirect monitoring and 0.5 hours of direct verbal/gestural supervision (see Table 3). In replacing the iPod Touch, a lanyard case was provided, so that Lily could wear the device around her neck. It is hoped that carrying the device in this way will help her avoid misplacing it in the future.

4.3.5. Reflection

Adapting an iPod Touch for a non-reader in this case required the download of add-on applications from the iTunes Store (*VoCal* costs $2; *Storykit and iRewards* are free). A combination of picture prompts and audio cues work well in supporting Lily's work efforts and transitions, and the behavioral modeling application *iRewards* helps her job coach track and reward behavioral adaptation. Games, songs and videos stored on the iPod Touch keep Lily occupied during long bus rides and are used as behavioral rewards in the workplace. Lily readily learned to use the iPod Touch as a

vocational aid, improving her functional independence and reducing her need for onsite job coaching support. Lily's work performance suffered after her first device was lost. She quickly regained near-functional independence once the iPod Touch was replaced.

5. Limitations

The three case studies presented here are consistent in their utilization of an iPod Touch as a vocational support aid, an OT to set up the device and train the worker to use it, and a job coach to provide professional personal supports in the workplace. Each of the three workers carries an ASD diagnosis. That said, a wide range of variables in personal characteristics, work setting and duties, make any generalization from these cases inadvisable. Additionally, different job coaches supported each of the three workers, and personal supports provided were individualized to each worker's needs. For these reasons, the three cases are presented as examples of the versatility of PDAs as workplace supports for people with ASD, not as evidence of their overall efficacy within this population (see Table 4). It is important to note that each of the three workers had functional cognition, vision, hearing and manual dexterity sufficient to interact with the iPod Touch without the need of accessibility adaptations. Many people with ASD have cognitive, sensory or motor conditions that would make utilization of such a device problematic. Though each of these workers exhibited difficulty managing transitions in workday tasks, task-sequencing and personal interactions on the job, and though each displayed anxiety-driven behaviors, all were able to perform their job duties with direct job-coaching supervision before the iPod Touch was introduced. In these cases, the device did not serve as a vocational trainer, but as a tool to provide automated supports, allowing improved worker independence and a reduction in the need for direct onsite supervision. It is hoped that the randomized trial of which these cases are a part will provide additional generalizable evidence to the body of literature that explores the use of PDAs in support of people with ASD.

6. Discussion

PDAs and smartphones are essential tools for many students and workers today, offering organizational, task management, educational and leisure applications that can be leveraged readily to support endeavors that range from task scheduling and sequencing to way-finding, guided instruction, behavioral modeling, health monitoring, relaxation and fun. At this writing, 600,000 applications are available for Apple mobile devices and nearly as many are available for Android and Microsoft mobile products. This embarrassment of riches can be challenging to anyone who wishes to utilize a portable device as a job support aid, and for people with ASD or other disabling conditions, that challenge can be especially daunting.

Despite these challenges, we would be remiss in neglecting to consider the use of PDAs as assistive technologies for people with cognitive-behavioral conditions. Though research has not kept up with the dazzling pace of product development over the past few years – in which we have seen the rapid appearance of smartphones, iPod Touches, iPads and Android tablets, among others – the potential for the use of these devices as assistive technology is readily apparent. At the same time, it seems evident that people with cognitive-behavioral challenges may benefit from a judicious assessment, product customization and training process that includes supported utilization and follow-along in the workplace. As these case studies have shown, the partnership of an OT familiar with task analysis, PDAs and applications and an employment specialist onsite can facilitate successful individualized strategies for vocational support using a PDA.

Our current research effort, of which these case studies are a part, aims to assess the efficacy of iPod Touches as cognitive-behavioral aids in the workplace. We hope to identify successful strategies for partnerships among workers, employers, caregivers, employment specialists and therapists, while developing and testing assessment approaches and device applications that may be especially useful for workers with ASD. This is an exciting time for anyone in the fields of education, physical rehabilitation and vocational support, where we are seeing a long-awaited merging of consumer products and assistive technologies for all. Field-based research in real world environments is essential to help us determine how best to use these tools to help our clients lead more fulfilling lives.

Acknowledgments

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Appendices

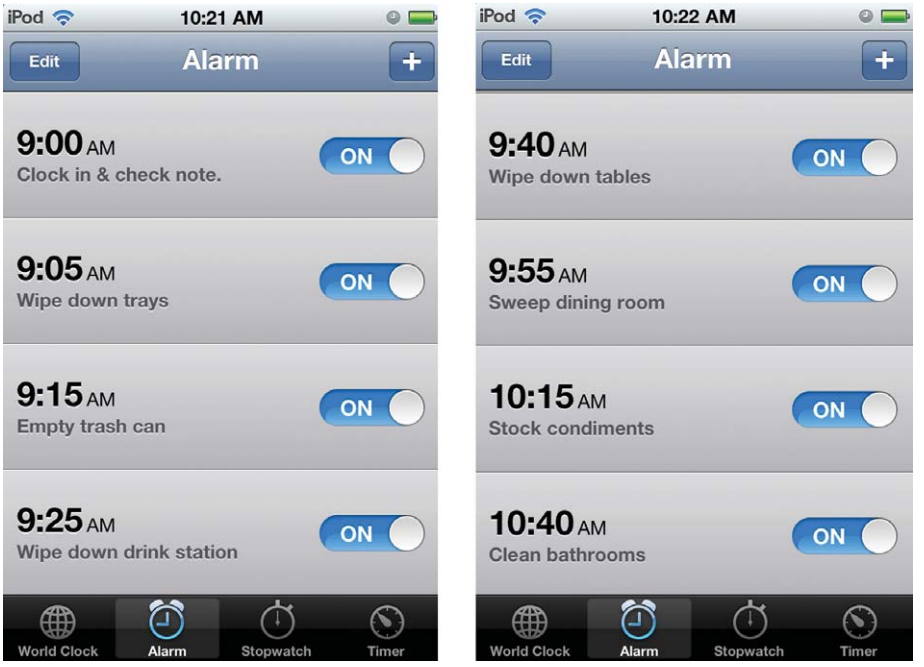


Fig. 1. Task Reminders using *Clock* application on Jeffrey's iPod Touch.

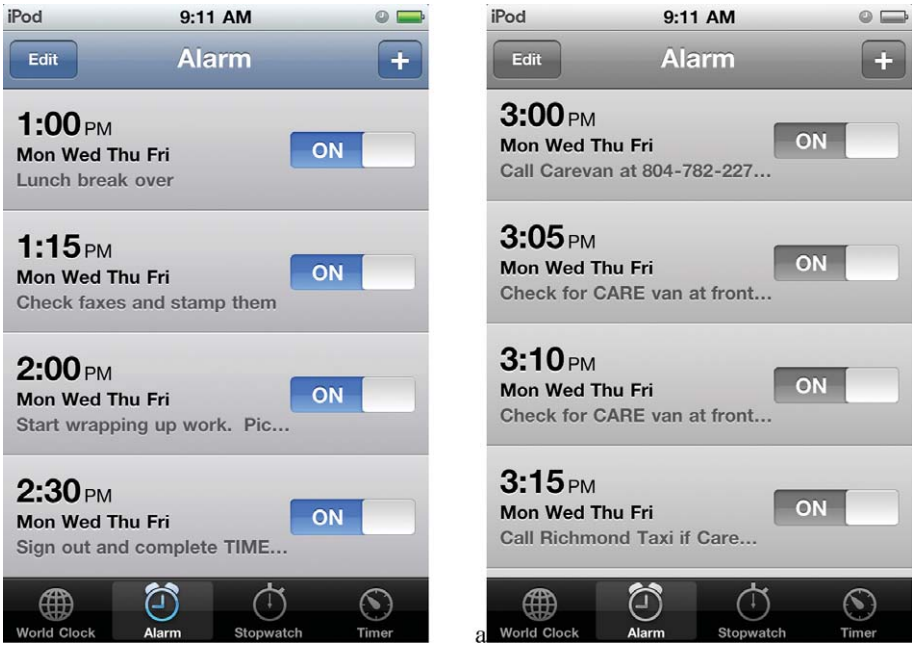
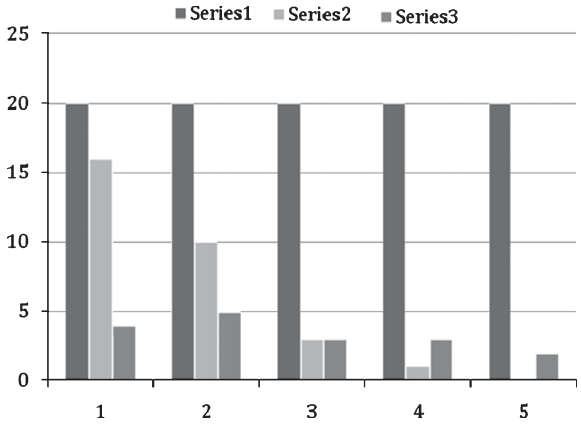


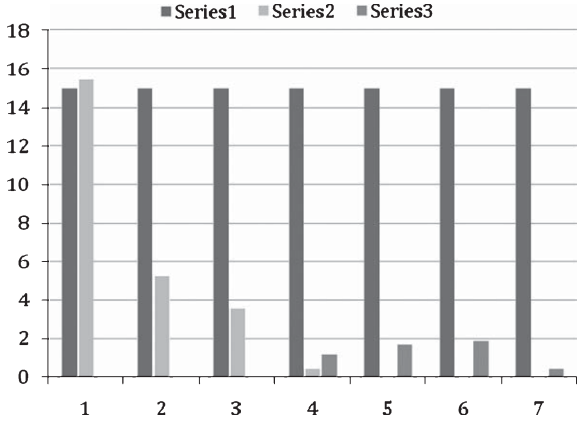
Fig. 2. Reminder alerts programmed on the *Clock* application for Grace's afternoon work schedule.

Table 1
Jeffrey's work history



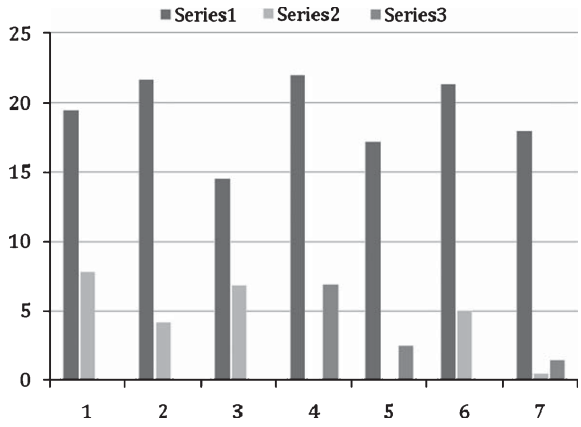
Series 1 denotes average hours worked per week. Series 2 denotes average job coach direct verbal/gestural supervision hours per week. Series 3 denotes average job coach indirect monitoring hours per week. Columns represent work periods, as follows: (1) first 2 weeks, no iPod Touch; (2) iPod training – weeks 3–4; (3) ipod in use, weeks 5–6; (4), ipod in use, weeks 7–8; (5) final weeks of direct onsite job coaching, weeks 9–10.

Table 2
Grace's work history



Series 1 denotes average hours worked per week. Series 2 denotes average job coach direct verbal/gestural supervision hours per week. Series 3 denotes average job coach indirect monitoring hours per week. Columns represent work periods, as follows: (1) first 4 weeks, no iPod Touch; (2) iPod training – weeks 5–6; (3) ipod in use, weeks 7–10; (4), ipod in use, weeks 11–14; (5) ipod in use, weeks 15–18; (6) ipod in use, weeks 19–22; (7) ipod in use, final weeks of job coaching, weeks 23–26.

Table 3
Lily's work hours and job coaching support



Series 1 denotes average hours worked per week. Series 2 denotes average job coach direct verbal/gestural supervision hours per week. Series 3 denotes average job coach indirect monitoring hours per week. Columns represent work periods, as follows: (1) first five weeks, no iPod; (2) no iPod, weeks 5–8; (3) iPod Assessment & Training, weeks 9–11; (4) iPod in use on job, week 12; (5) iPod in use, weeks 13–16; (6) iPod lost week 17 and returned week 18; (7) iPod in use on job, weeks 19–22.

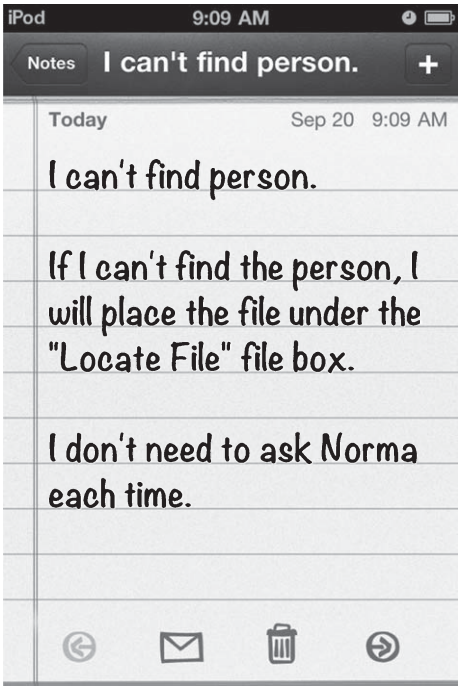


Fig. 3. A person-finding strategy, using *Notes* application, on Grace's iPod Touch.

Table 4
Software applications utilized in the case studies. All applications either are sold with an iPod Touch or downloaded separately from the Apple iTunes Store

Application	Cost	Purpose
Jeffrey:		
Notes	Onboard	Step-by-step task lists for daily custodial responsibilities
Clock	Onboard	Periodic reminder alerts to begin and end workday, switch tasks during workday, plug the device in for nightly recharging
Voice memo	Onboard	Audio version of daily tasks, for rehearsal at start of workday
Grace:		
Notes	Onboard	Instructions for managing unusual events at work and on the bus
Clock	Onboard	Reminder alerts to begin and end workday, switch tasks during workday, plug the device in for nightly recharging
Simply being	1.99	A meditative relaxation application, with music and guided instruction
Camera	Onboard	Videos for wayfinding, safely waiting for the bus
Music	Onboard	Stores music downloaded from iTunes Store for relaxation and enjoyment
Lily:		
Storykit	Free	Audiovisual step-by-step daily tasks list for a non-reader
VoCal	0.99	Voice-recording reminder application
Camera	Onboard	Used to take photographs of work tasks, accessed for Storykit task lists
iCal	Onboard	Calendar application with alternating pink and purple workdays noted
iRewards	Free	Behavioral management application for rewarding positive behaviors
Photos	Onboard	Disney cartoon images downloaded from Internet to personalize device
Toca hair salon	0.99	Her favorite game, played at lunchtime and as a reward for positive work performance

Fig. 4. Screenshots of two audiovisual prompts using *Storykit* application, one for clocking in and one for washing hands, on Lily's iPod Touch. Note that this app allows use of photographs, audio recordings and hand drawing for non-readers.

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