

Handheld “App” Offering Visual Support to Students with Autism Spectrum Disorders (ASDs)

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Abstract. iPrompts® is a software application for handheld devices that provides visual support to individuals with Autism Spectrum Disorders (ASDs). Caregivers use the application to create and present visual schedules, visual countdown timers, and visual choices, to help individuals with ASDs stay organized, understand upcoming events, and identify preferences. The developer of the application, HandHold Adaptive, LLC, initially introduced iPrompts on the iPhone and iPod Touch in May of 2009. The research team from the Center of Excellence on Autism Spectrum Disorders at Southern Connecticut State University conducted a study of iPrompts in 2010, investigating its use by educators working with students with ASDs. Among other findings, educators indicated a desire to present visual supports on a larger, “tablet”-sized display screen, leading the developer to produce an iPad-specific product, iPrompts® XL. Described in this paper are the research effort of iPrompts and subsequent development effort of iPrompts XL.

Keywords: autism spectrum disorder, ASD, iPad, iPhone, smartphone, tablet, handheld device, application, app, iPrompts.

1 Introduction to the Technology and Supporting R&D Effort

In May of 2009, HandHold Adaptive introduced the iPrompts application [1] for sale as the first special education application available on Apple’s iTunes App Store. The founders of HandHold Adaptive, themselves the family of a young boy on the autism spectrum, designed a tool that would provide customizable, portable visual supports using the iPhone and iPod Touch. Subsequent to the introduction of this early version of iPrompts, the company received in 2010 a Phase I research award from the U.S. Department of Education’s Institute of Education Sciences Small Business Innovation Research (SBIR) program in collaboration with a research team from the Center of Excellence on Autism Spectrum Disorders at Southern Connecticut State University (hereafter, SCSU Autism Center).

iPrompts® XL is an iPad-specific version of iPrompts®, an “app” that provides a suite of visual supports for individuals with autism spectrum disorders (ASDs) and other developmental delays. The application allows users to create visual supports, including visual schedules, visual countdown timers, and visual choices, to present to individuals with ASDs. Both iPrompts and iPrompts XL include four main features: Schedules, Countdown, Choices and Library. Each feature is customizable, allowing educators and related personnel to respond quickly to unexpected situations that arise in educational settings. Using the Schedules feature, educators present sequences of images, which can help explain to individuals with ASDs any routines or multi-step tasks occurring during the day (e.g., a schedule for “Tuesday’s Classes”). The Countdown feature includes both graphical and numeric timers that are presented alongside any image, to help convey to students that the pictured activity will soon occur (e.g., “In two minutes, it will be time to pack your book bag”). The Choices feature is used to present choices between any two or more images (e.g., “Would you like pretzels or yogurt for a snack?”), and allows users to highlight their choice. Images used in these visual supports are accessed from a Library of stock illustrations, which users can expand and customize by: 1) taking pictures with the built-in camera, 2) transferring digital pictures from a personal computer, and/or 3) downloading images from the Internet using a search tool available within the application. Thus, millions of images are rapidly available, ranging from familiar images from the proximate environment to abstract images downloaded from the Internet.

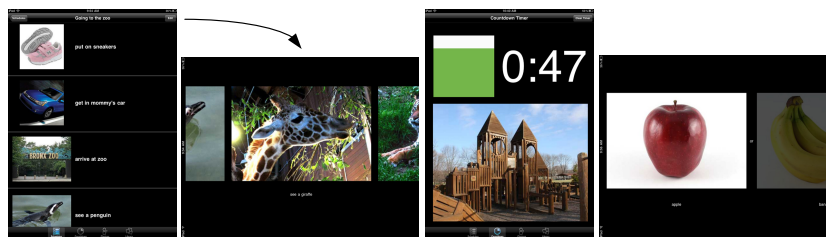


Fig. 1. Screenshots of iPrompts XL (from left to right: Schedules in portrait orientation, Schedules in landscape orientation, Countdown Timer in portrait orientation, and Choices in landscape orientation)

The goal of the Phase I study (hereafter, the “Feasibility Study”) was to investigate using iPrompts in an education setting. iPrompts XL was the direct result of the collaborative research and development effort between HandHold Adaptive, LLC (the developer and commercial rights owner of the application), and a team of researchers from the SCSU Autism Center. As described further below, educators enrolled in the study were each provided with either an iPhone or iPod Touch pre-loaded with the iPrompts application. Among other findings from the study, educators indicated a desire for a larger, “tablet”-sized display screen when presenting visual supports in academic environments. This, combined with the launch of the iPad earlier in 2010, led the developer to hasten production of an iPad-optimized software application (iPrompts XL).

2 ASDs and the State of the Art in Visual Supports

The most recent prevalence estimates for ASDs from the US Center for Disease Control and Prevention (CDC) is 1 in 88 children [2]. ASDs comprise a triad of challenges, encompassing difficulties in social competence, communication, and restricted and repetitive behavior, all of which compromise an individual’s ability to function effectively and independently. There are now many evidence-based treatments that capitalize on the visual strengths of individuals with ASDs, such as visual supports [3], visual activity schedules [4], video modeling [5], and Social Stories™ [6]. However, these treatments are currently made and delivered using mostly low-tech devices. Low-tech visual supports are typically created by teachers and parents using a personal computer, which involves printing the visual supports onto paper, cutting out the supports, and laminating the visual supports to increase durability. This process can be time consuming, and produces large physical products (e.g., notebooks containing printed symbols) that may be cumbersome to carry and stigmatizing to use. Moreover, these visual supports often use graphics that are generic, rather than representative of the actual social or physical environment in which the student is expected to function. While research has validated the use of low-tech visual supports [7], little has been done to analyze the utility and appropriateness of high-tech assistive technology, which are being used more frequently in education settings [8].

Since the introduction of iPrompts in May of 2009, a variety of handheld applications designed to provide visual supports have become available, including *First Then Visual Schedule*, *iCommunicate*, and *Time Timer*. iPrompts has differentiated from these offerings through its unique blend of features, enabling users to create many visual supports, including visual schedules, visual timers, and visual choices. As shown by Fig. 2, commercial iPrompts users have accessed each of these core features with regularity over a period of nearly two years. Users can access the unique mix and presentation of these features by performing just one application download, and by learning a single user interface.

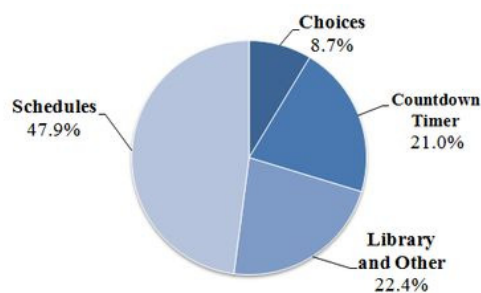


Fig. 2. While the Schedules feature is most popular (48% of occurrences), users of iPrompts® access each of its four major features with regularity. (Source: *Flurry Analytics* application data, contributed by author, 12/10 through 3/12).

3 The Feasibility Study and Its Methodology

3.1 Research Questions

Beginning in June of 2010, the research team from the SCSU Autism Center conducted the Feasibility Study. The goal of the research was to analyze the general feasibility and promise of using iPrompts in educational settings. Specifically, the Feasibility Study evaluated the following research questions:

1. What professional development is needed for teachers to gain the knowledge necessary to use iPrompts appropriately with their students in educational settings?
2. Can teachers use iPrompts to support students with ASDs feasibly within the confines of a typical school setting?
3. When used by teachers in educational settings, do students show interest in the application and are changes in student behavior evident after its use?
4. When used by teachers in educational settings, can the iPhone or iPod Touch platform be used to deliver visual supports for students with ASDs?

3.2 Sample

Twenty-nine teachers used the iPrompts application with 88 students (ages 5- to 16-years-old) with ASDs in Bridgeport Public Schools and Connecticut Region 15.

3.3 Measures

The research team from the SCSU Autism Center developed four measures to evaluate the feasibility and promise of using iPrompts in authentic educational settings. The *Professional Development Evaluation Index* was a nine-question evaluation of the teachers' knowledge of the different features of iPrompts. The *Self-Reflection on Teaching Index* was a self-report measure created to capture the teachers' reflections on using iPrompts in educational settings. The *Observation Rubric* was used during direct observation to evaluate teachers' use of iPrompts and the students' behavioral responses. Finally, a *Focus Group Protocol* was administered to the teachers to foster a group discussion among participants about their experiences using iPrompts.

3.4 Procedures and Results

All participants evaluated the Schedules, Countdown Timer and Choices features. Hands-on training sessions were provided for all teachers, and the *Professional Development Evaluation Index* was administered at the end of the training. The results showed most teachers strongly agreed that (1) the training was effective (94%), (2) assistive technology is a tool that can be used to help students with ASDs (88%), (3) the training demonstrated teaching strategies that are relevant to the backgrounds and skills of their students (71%), and (4) the training demonstrated teaching strategies that can be easily implemented in educational settings (71%).

After the training, the teachers were videotaped and/or observed using iPrompts with their students. Sixty-one observations were scored using the *Observation Rubric*, which showed very few system defects were encountered. In over 65% of the observations, the student was rated as using the application as intended and 87% of the sessions showed the students to have shown a keen interest in the device by moving closer to it or making an effort to handle it. The data from the observations also provide strong support that the application had a positive impact on the learning and development of the students. Eighty-two percent of observations identified a positive impact on student behavior with respect to both on-task behavior and attentiveness.

Results obtained from the *Observation Rubric* also suggested that while teachers were able to correctly use iPrompts, some had difficulty determining when and under what conditions to implement assistive technology with their students (only 23% of teachers were rated as having used the Choices feature correctly and 12% of teachers were rated as having used iPrompts correctly to prepare a student for a transition). Thus, while teachers felt they had received the knowledge necessary to use iPrompts, the observational data highlight the need for better training with respect to general assistive technology strategies. Specifically, the teachers needed training targeted toward helping them to understand situations in which it is appropriate to use the iPrompts app, situations in which it is inappropriate to use the app, and which tools within the app might be most appropriate in given situations. This training to knowledge gap was also apparent during the *Focus Group*, in which two additional opportunities for future training were identified: (1) training on implementing assistive technology in general in the classroom, and (2) training on the difference between the device (i.e., iPod Touch or iPhone) on which the app runs and the iPrompts app.

The *Self-Reflection on Teaching Index* was administered to the teachers during the final week of the Feasibility Study. Every teacher (100%) felt iPrompts was not too complex to set up and that he or she had figured out how to use iPrompts. Most teachers (81%) felt there was enough time to set up iPrompts for use with students and a majority of teachers felt their students liked the Countdown Timer (94%) and Choices features (59%). However, the teachers acknowledged that they occasionally did not have enough time to set up iPrompts. Forty-five percent agreed that in the middle of their educational activities “It takes too much time to set up iPrompts and I have to give my attention to the students,” although this finding could be an artifact of student behavior, as 45% of teachers also noted that there was not sufficient time to set up iPrompts because “The student does not have enough self-control over his/her behavior.” Collectively, these data suggest that teacher discretion in determining when and whether to use the app is important, both to the success of the use of the app and the success of the student.

Responding to the *Focus Group Protocol*, teachers commented on the ease of using the Schedules feature, the amount of time and effort that was saved using iPrompts to create Schedules, and the convenience of creating Schedules “on the fly” as needs arose. The teachers indicated a preference for using the iPrompts Schedules feature over a computer program such as Boardmaker to create hard copy visual schedules. Teachers indicated that being able to take photos and incorporate them into the iPrompts app was an important feature, and for this reason, they preferred using

the iPhone to the iPod Touch (newer iPod Touch models, released after the Feasibility Study, now include cameras). The teachers also commented during the Focus Group Protocol on the utility of the Countdown Timer feature, which they reported to be the most used feature during the feasibility study. This tool was utilized to help with both whole group transitions and for transitions for individual students. The Countdown Timer tool helped students to stop working at an appropriate time and also to keep working until the allotted time had elapsed. Several teachers commented on the effectiveness of the Countdown Timer tool in helping with group transitions.

4 Impact of the Feasibility Study

4.1 Iterative Software Development

After considering the results of the Feasibility Study, requests from iPrompts customers, and the introduction of the iPad in April of 2010, HandHold Adaptive expedited development of an iPad-optimized product in hopes of introducing a tool that accommodated educators' desire for visual supports presentable via a larger, "tablet"-sized handheld device. The development process included several modifications to the software, such as adjusting layouts, type sizes, image sizes, and allowing the screen to be rotated or oriented in any direction.

The results at market have been positive. Since its introduction, iPrompts XL has outsold iPrompts by a unit sales ratio of 3:1; since its release, iPrompts XL has accounted for 75% of iPrompts sales. The historic composition of iPrompts sales (including both iPrompts and iPrompts XL) reveals that within 2 months after the release of iPrompts XL, it had surpassed iPrompts in sales. Sales of iPrompts XL through Apple's Volume Purchase Program (which provides discounts and a large-scale software deployment option for educational institutions) have also exceeded sales of iPrompts through this mechanism, demonstrating demand for tablet compatibility in the realm of visual supports for students with ASDs. But if not for the results of the Feasibility Study (specifically, the strong recommendations of teachers responding to the *Focus Group Protocol*), HandHold Adaptive may not have hastened development of a tablet-specific product, and may have lost an opportunity to capture share of this market. Thus, the research effort behind iPrompts helped guide broader software development priorities for HandHold Adaptive, and might serve as a model for other software developers seeking to align their products with consumer demand.

4.2 Contributions to the Research Field

There are hundreds of thousands of apps available for iOS devices like the iPhone, iPod Touch and iPad. Many of these apps may be useful to individuals with ASDs and their caregivers. A keyword search in February of 2012 revealed more than 580 autism-related apps available on the Apple iTunes Store and 250 on the Android market, many of which have been developed by parents of individuals with ASDs, and without the guidance of research [9]. However, very few empirical studies documenting the effects of these apps have been published to date. Thus, HandHold Adaptive

and the research team from the SCSU Autism Center have made a unique contribution to the field by researching the efficacy of iPrompts in authentic education delivery settings. The Feasibility Study was one of the first ever to investigate handheld visual supports on Apple handheld devices (including the iPhone and iPod Touch). As described above, our research has confirmed that iPrompts can have a positive impact on the behavior of students with ASDs, and has features which are well-liked by individuals with ASDs. Additionally, our research has confirmed that teachers can use iPrompts within the confines of a school setting to positively impact student behaviors that support academic and other important school related outcomes. Given these positive findings, we feel more research on how best to use smartphone and tablet applications in educational settings is highly warranted.

In addition to documenting the positive effects that can be achieved by using iPrompts, we feel that our Feasibility Study contributes a template for future research endeavors investigating the effectiveness of smartphone and tablet applications. We also hope to guide small businesses toward utilizing local research expertise, and feel that an iterative research and development process involving a combination of private industry and public research expertise can produce better-informed product development efforts for smartphone and tablet applications serving individuals with ASDs.

5 Conclusions and Planned Activities

Collectively, it is clear from the data obtained during the Feasibility Study that iPrompts is feasible for use in educational settings. Teachers were able to incorporate iPrompts into their classroom, iPrompts was preferred by the teachers, and the application was of great interest to the students. The data also indicated that iPrompts had a positive impact on students’ behavior, including time-on-task and attentiveness, which are two prerequisite skills for learning. Finally, the majority of teachers agreed that they would use iPrompts in their classrooms, clearly demonstrating the feasibility and promise of the product for use by teachers in educational settings.

Since the conclusion of the Feasibility Study in 2010, HandHold Adaptive and SCSU Autism Center have been awarded Phase II follow-on research award from the U.S. Department of Education’s IES SBIR program. With the goal of increasing the application’s utility, usability, and commercial potential, HandHold Adaptive intends to improve iPrompts the following ways: (1) extend the brand onto new platforms (e.g., the Android operating system), (2) addition of enhanced features (e.g., Visual Checklists, cloud storage and syncing), (3) make the software accessible outside of the handheld device itself (e.g., through projectable and/or printable screens), and (4) production of training materials for using the product and assistive technology in classroom settings. New technologies will be developed and tested iteratively in authentic education delivery settings to ensure the product operates as intended, is easily incorporated into educational practices, and effectuates positive outcomes in students with ASDs. If research indicates that these goals are achieved, the software improvements may be released (via online marketplaces for handheld applications, such as the iTunes App Store and Google Play), and supported by marketing initiatives.

HandHold Adaptive has also begun development of a Beta version of StoryMaker, an application for iOS devices which will allow teachers and other caregivers to create and present narrative visual supports (e.g., Social Stories [6]) using large pictures and editable text (e.g., a teacher creates a multi-page story explaining how to eat lunch in a cafeteria, explaining the nuances of how to stand in a lunchline, order food, sit down at a table in a cafeteria, and make appropriate conversation with friends). In addition to using pictures taken with the built-in cameras of iOS devices, StoryMaker will allow user to download images from other sources, such as Facebook, Flickr, Google, and Bing. The research team from the SCSU Autism Center is currently completing a Feasibility Study on teachers' use of StoryMaker in schools, which, will help refine and guide the development of the commercial release.

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