COMPARING SELF-MANAGEMENT STRATEGIES DELIVERED VIA AN IPHONE TO PROMOTE INDEPENDENT GROCERY SHOPPING AND ACQUISITION OF INCIDENTAL INFORMATION

by

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(Under the Direction of Kevin Ayres)

ABSTRACT

Four students with moderate intellectual disabilities used electronic lists delivered on an iPhone to assist them in skills related to grocery shopping. An alternating treatments design was used to compare the effectiveness and efficiency of three different types of lists (text only, audio + text, and picture + text). Data gathered during the initial investigation indicated that the use of pictorial lists delivered via the iPhone interface appeared to be the most effective and efficient prompting system for all participants. This prompting system was further evaluated to determine whether or not it would assist students to incidentally learn to read the words after multiple presentations of the picture and text. Data gathered during study 2 indicated that two students learned the target words incidentally as a result of using the iPhone based system alone while two other students required use of a computer-based instructional program with simultaneous prompting to assist them in learning the words.

INDEX WORDS: self – management, electronic device, functional skills, incidental learning, simultaneous prompting

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DEDICATION

To my loving husband, Scott, thank you for making this dream possible and supporting me through the journey. To my grandfather, the late Dr. Irving Lee Hutcherson, I knew I could do this because of you.

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CHAPTER 1

INTRODUCTION

Research over the past few decades demonstrates the benefit and effectiveness of using direct instruction to teach individuals with moderate to severe intellectual disabilities skills needed to function more independently throughout life (cf. Ayres, Lowrey, Douglas, & Sievers, in press). The use of a functional curriculum implemented with evidence-based practices is likely to improve the outcomes for these students in a variety of post-school settings (Snell & Brown, 2006; Westling & Fox, 2004). Functional skills such as independently brushing teeth, washing dishes, crossing the street, maintaining a job, and shopping for groceries all have been taught to students with cognitive processing deficits using systematic instructional methods. However, for many of these functional skills, individuals adequately learn key components of a given task, but still may need assistance to complete components that rely on academic or memory intensive parts of the task. For example, there is extensive research on teaching students to locate items in a grocery store (e.g., Langone, Shade, Clees, & Day, 1999; Mechling, 2004; Morse & Schuster, 2000) and make purchases (e.g., Alcantara, 1994; Ayres, Langone, Boon, & Norman, 2006; Haring, Kennedy, Adam, & Pitts-Conway, 1987), but few studies have taught students to make a grocery list (Aeschleman & Schladenhauffen, 1984; Gaule, Nietupski, & Certo, 1985; Giere, Rudrud, & McKay, 1989; Sarber, Halasz, Messmer, Bickett, & Lutzker, 1983). Research also suggests that students oftentimes benefit from a video prompts or models (Van Laarhoven, Johnson, Van Laarhoven-Myers, Grider, & Grider, 2009; Van Laarhoven, Van Laarhoven-Myers, & Zurita, 2007), but someone else creates the video and uploads it to their portable device for them. With today's technology, some electronic devices allow the user to shoot and save their own videos and photos all on one device. In order for students to live independently or with limited support, students need to be taught as much of the entire process as possible and learn how to compensate for their disability on their own. The use of technology may be the answer in getting students to participate in entire tasks to a greater extent.

Technology & Functional Skills Instruction

Technology can be particularly useful when one considers that people with intellectual disabilities often experience working memory, selective attention, cognitive processing, and generalization difficulties (Beirne-Smith, Ittenbach, & Kim, 2006). Specifically, the functional use of electronic technologies could help compensate for some areas of weakness such as significant memory deficits and increase the ability of persons with disabilities to live and work independently. Portable electronic devices are becoming commonplace as a quick and efficient way to access information for people with and without disabilities. Digital cameras instantly show how a picture turns out which can be used later to remember something of importance. Global positioning systems (GPS) provide directions to any location, and in conjunction with mapping software, can provide examples of nearby restaurants, gas stations, or hotels. Laptop computers continue to get smaller while increasing memory capacity and battery life. Cell phones, iPod Touches, and personal digital assistants (PDAs) can now act as all three of these technologies allowing access to email, the Internet, books, and video. Devices are also being designed specifically for students with disabilities. The *Cyrano Communicator*, *Pocket Endeavor,* and *Community Integration Suite* are portable electronic devices that provide pictorial and audio prompts along with other capabilities. The portability, affordability, flexibility, and ease of use of all of these technologies hold infinite possibilities for all people including those with intellectual disabilities (Carey, Friedman, & Bryen, 2005; Hart, O'Neil-Pirozzi, & Morita, 2003).

In an effort to determine the potential effectiveness of these technologies, Mechling (2007) reviewed studies where students with intellectual disabilities used assistive technology prompting systems (i.e. pictorial, auditory, tactile, and computer-aided systems) as a self-management tool to complete multi-step tasks or follow a daily schedule. Her analysis of the literature determined that individuals with disabilities were able to learn to independently use computer-aided systems (i.e. PDAs) with audio and visual prompting to successfully complete vocational tasks (Cihak, Kessler, & Alberto, 2007, 2008; Davies, Stock, & Wehmeyer, 2002a, 2002b, 2003; Furniss et al., 1999; Riffel et al., 2005) and daily living tasks (Hersh & Treadgold, 1994; Lancioni, O'Reilly, Seedhouse, Furniss, & Cunha, 2000; Lancioni et al., 1999a; Lancioni, Van den Hof, Boelens, Rocha, & Seedhouse, 1998a; Lancioni, Van den Hof, Furniss, O'Reilly, & Cunha, 1999b). Mechling's review analyzed studies that used one or more audio and visual supports created by others. Further research seems to be warranted that investigates which if any supports are more effective as well as the effectiveness of the combination of supports. Other important questions appear to require studying whether or not students with disabilities can use their electronic devices to create their own supports by recording voice memos, taking pictures for a to-do list, or shooting videos to act as a model.

If fewer electronic supports/tools are as equally effective as multiple supports to a user with disabilities, then less time would be required to program the device to meet the individual's needs and more time can be spent creating an extensive bank of items, schedules, or task analyses that are incorporated within one device. Also, if one support is as effective as using multiple supports, then students may be able to create their own prompting systems without having to rely on someone else to do it for them. With an iPhone, iPod Touch, or iPod Nano, students could record their own voice memos, take pictures, and record videos to prompt themselves in any setting. To date, limited research has evaluated the usefulness of hand-held electronic systems with only a single type of support such as pictorial only or audio only for students with intellectual disabilities (Cihak, Wright, & Ayres, 2010; Ferguson, Myles, & Hagiwara, 2005; Taber-Doughty, 2005). Even though there is a plethora of research on these two separate supports with no or light technology, the use of one individual support with an electronic device appears to require more extensive investigation. Regardless of the support or combination of supports used, text continues to be an important component in terms of input and output of most systems. Because of this fact, individuals with disabilities will need to be able to interact with text at some level if they are to get the most function out of these technological tools.

E-Text & Functional Skills

Electronic devices not only can be used as a prompting device, but they can serve as a way for people to interact with text electronically. Any text appearing on a computer screen or electronic device is considered e-text (Anderson-Inman & Horney, 2007). The benefit of e-text over print-based text is that e-text can be more easily paired with additional supports (e.g., sound), so people of all cognitive and physical abilities can access the text and increase the likelihood that they will gain meaning from it (Brochner, Outhred, & Pieterse, 2001; Koppenhaver, Coleman, Kalman, & Yoder, 1991). Researchers and practitioners have tested and identified a number of supports that allow users to better interact and gain meaning from e-text.

For example, Anderson-Inman & Horney (2007), as part of their work with the National Center for Supported eText, outlined a taxonomy of technology supports. Different e-text supports include text-to-speech options, video primes, hyperlinks to a pictorial glossary or website with additional information, summary tools, and changes in font size, color, or style. When supported e-text is used in conjunction with a hand-held electronic device, many students are more likely to independently access literacy material. These sets of tools have considerable potential for helping individuals with disabilities. Since many people now use e-text books such as those offered through Audible, Amazon, and iTunes, the use of this form of literacy immediately provides individuals with disabilities a status level equivalent to others in their communities. The use of supported e-text can potentially open doors for people with intellectual disabilities by providing opportunities to explore text in an alternative format that was previously not available to them and by improving reading skills in natural contexts.

Although research on the use of supported e-text for students with more severe intellectual disabilities is just surfacing (Douglas, Ayres, Langone, Bell, & Meade, 2009), researchers have examined a broad array of assistive technology supports to improve comprehension for populations of students with milder disabilities (Dolan, Hall, Banerjee, Chun, & Strangman, 2005; Foulds & Foulds, 2003; Higgins & Raskind, 2005). Improvements in text comprehension were apparent when text-to-speech was used by struggling readers (Leong, 1995; Oakley, 2003; Wise & Olson, 1994) and reading accuracy scores also increased (Elkind, 1998; Hecker, Burns, Elkind, Elkind, & Katz, 2002). Elkind and Elkind (2007) reviewed the research on text-to-speech, stating that the majority of studies demonstrated promising effects on reading speed and comprehension. In addition to providing struggling readers with access to text they may find hard to read, text-to-speech was found to provide a less stressful reading experience. Hopefully with the current push for integrating all students into the general education curriculum, researchers will consider expanding the research base of e-text to include students with more severe disabilities.

There exists a host of functional tasks or skills that can be enhanced when paired with e-text and technology supports. For example, a grocery list presented on an electronic device is one functional use of the combination of e-text and other technology supports (e.g., video to provide examples of where items are located on shelves) that allow people with intellectual disabilities to independently shop. Such an electronic tool can provide audio, graphic, video, or a combination of all three supports to assist students who are non- or low-level readers. After students have been taught specific location strategies through in vivo, simulation, or computer-based instruction, electronic tools can provide ongoing support to assist them in maintaining and generalizing the learned skills (e.g., create new grocery lists as additional items are needed or new items are desired).

A number of research studies investigated the effectiveness of adapted grocery lists using picture books (Alcantara, 1984; Horner, Albin, & Ralph, 1986; McDonnell & Horner, 1985), picture lists (Morse & Schuster, 2000), and individual pictures presented one at a time (Hutcherson, Langone, Ayres, & Clees, 2004; Wissick, Lloyd, & Kinzie, 1992). Morse and Schuster (2000) presented students with a picture of the aisle sign and a picture of the target item located on that aisle on a sheet of paper. The grocery list only contained two items which means a grocery list of 10 items would require 5 sheets of paper. This could be cumbersome and difficult for students with disabilities to manage just as the picture books require organizational and fine motor skills. Aeschleman and Schladenhauffen (1984) replaced reliance on someone else to develop a list by having students draw pictures representing items from different food categories. This method was effective for the four participants, but it would be difficult if students draw poorly, are physically unable to draw, or want a specific brand or size of an item that is difficult to depict in a drawing. Students who have the ability to independently grocery shop, but lack the necessary reading and writing skills, need alternative tools to help them create and manage their own lists. The use of electronic devices could help with the storage, retrieval, and prompting problems in addition to enabling the person to blend in with the rest of society. It is also possible for students to start transferring stimulus control from the support (i.e., audio or picture) to the text. After multiple presentations of the supported text, students may learn to read the words incidentally.

Advanced Technology & Functional Skills

Students can be successful using the paper-based adapted lists mentioned above to locate items, but those methods do not have the same capabilities as the use of an electronic device. The use of electronic devices is advantageous over paper-based systems for many reasons. Electronic devices can provide audio and video supports in addition to pictorial support. Auditory prompts can not only tell students what to do, but they can periodically provide reminders to stay on-task, ask for help, or encourage students to keep working (Lancioni & O'Reilly, 2001; Montgomery et al., 1996). Video prompting has also been shown to be effective on portable devices (Sigafoos et al., 2005, 2007; Van Laarhoven et al., 2009). In addition to integrating different types of prompts, electronic devices provide easy and convenient storage, while allowing quick retrieval of pictures, lists, and task analyses. Students can be taught how to access recipes, schedules, and task analyses on their device, and how to create their own shopping and to-do lists without assistance from another person. Electronic devices also provide unlimited opportunities for the repetition of steps or items needed when presented with audio or video supports (Mechling, 2007) which again decreases the reliance on another person available to provide the prompts. The use of electronic devices such as iPods, iPhones, and PDAs makes repetition much easier than when using cassette players or VCR tapes. Students are also not as likely to lose their place as they are with manual systems (Furniss et al., 1999; Lancioni et al., 1998a, 1999b) since electronic devices are capable of displaying the same screen for an extended period of time.

The extant literature includes many examples of how technology can assist learners with disabilities. For example, three studies support the use of Palmtop personal computers with picture prompts as being more effective than the manual use of picture cards when completing daily living tasks (Lancioni et al., 2000; 1998a; 1999a). Video supports provided by a portable DVD player have also been found to be more effective than static picture prompting in cooking-related tasks (Mechling & Gustafson, 2008, 2009; Mechling & Stephens, 2009). These studies support the need for more research on the use of various electronic devices to assist with other skill sets in order to expand the repertoire of assistive technology tools available to people with intellectual disabilities. In addition to researching the use of PDAs with individuals with intellectual disabilities, other electronic devices such as iPhones, iPods, Apple Tablets, and devices specifically designed for people with disabilities (e. g., *Cyrano Communicator* and *Independent Living Suite*) should be evaluated. As tasks related to independent functioning become more complex and varied, there will be a continued need to increase the number of effective tools that improves independence for persons with disabilities. The number of different devices for providing different options for people who have varying needs and abilities will increase in availability.

The use of technology enables people needing audio supports or tiered levels of supports to be successful at a variety of daily living tasks while also increasing their independence and decreasing their reliance on others. In addition, electronic devices help people with organizational issues because it is one device that contains multiple lists, schedules, and task analyses in one place. Finally, the class of technology tools discussed here also has the potential to assist individuals with disabilities to a smoother integration into society in a non-stigmatizing way with the use of devices common to the general public that are capable of making calls, taking pictures, listening to music, logging onto the Internet, and using GPS.

Purpose of the Present Research

The purpose of the present study was to determine which type of support was most effective and efficient in assisting with item location in a grocery store for students with moderate intellectual disabilities and if they learned to read the grocery items incidentally. As the emphasis on literacy continues to be a focus in our educational system, students with intellectual disabilities will need additional supports to benefit from text-based materials. The use of supported e-text displayed on an electronic device could assist students who are non or low level readers without the stigma of carrying picture books or lists, or always needing another individual close by to help with reading or to tell them what to do next. E-text presented on electronic devices is more age appropriate, independently accessible, and less stigmatizing. Finally, the power of electronic devices in terms of memory and the ability to present tier levels of supports make them potentially more efficient and effective than traditional materials (e.g., paper-based calendar).

Two investigations similar in nature attempted to assess the utility of an iPhone for students with moderate intellectual disabilities. The first study evaluated the effectiveness and efficiency of an iPhone incorporating student-created e-text lists supported with audio or pictures to assist students while grocery shopping. Students were assessed on their ability to use the e-text with and without supports to locate grocery store items. The selection of the target behavior was based on the ability to measure comprehension without a verbal response from the student, functionality and importance of the skill, and the gap in the literature integrating electronic devices and e-text. Presumably, if students were successful with the supported e-text within this context, then students could create and store multiple lists within one device. The device will not only increase independence in reading lists electronically with supports, but it could provide a medium for students to actually learn the words in a natural context through incidental learning. The second study evaluated the transfer of stimulus control from the students' most effective and efficient support (determined in Study 1) to the text. If students did not transfer control incidentally, then simultaneous prompting delivered via a computer program was implemented to teach the words. Finally, students returned to the grocery store to determine if reading the words generalized to the natural setting. The iPhone was the electronic device for these studies because of its versatility for many other tasks (e.g., surfing the Internet, listening to music or an electronic book, following a task analysis, or watching a video) which expands the assistive technology options for students with intellectual disabilities and opens the door leading to greater independence and ownership in their work. The iPhone delivered the e-text grocery lists in both of these investigations to evaluate the different types of lists and the transfer of stimulus control to the text alone.

Research Questions

After an extensive review of the literature on e-text, support strategies, and electronic devices (presented in the next chapter), several questions came to light that guided the design of the present research studies. Study 1 was designed to answer the following questions:

1. Will students with moderate intellectual disabilities independently locate items when presented with self-created lists on an iPhone in a grocery store setting?
2. Will students locate grocery items more efficiently with audio or picture lists?
    a. Will one type of list lead to fewer errors to criterion?
    b. Will one type of list lead to shorter duration sessions?
    c. Will one type of list lead to fewer prompts after the initial antecedent prompt?

Study 2 built upon the foundation established by Study 1. The research questions for Study 2 included:

1. Will students incidentally learn to read the text when the text is paired with audio or pictorial support over multiple sessions that incrementally increase in number?
2. Will using a computer-based program with simultaneous prompting and the student's "best" support as the controlling prompt transfer stimulus control to the text?

These investigations should expand the literature base by investigating supports previously untested on an iPhone and guide future researchers to explore other uses for assistive technologies and e-text.

CHAPTER 2

LITERATURE REVIEW

The independent variables and methodology of this dissertation were decided upon after two thorough reviews of the literature related to self-management strategies and the instruction of grocery shopping skills (i.e., locating items) for individuals with intellectual disabilities. Specifically, the first review analyzed studies incorporating self-management strategies during community and vocational based activities. These two skill subsets of functional life skills were reviewed together since they implemented similar self-management strategies. Subsequently in the second review, studies incorporating the location of items while grocery shopping were evaluated in terms of their prompting strategies, list generation, incidental learning measure, and research design. This review exposed weaknesses in design elements that did not meet the standards as set forth by Horner et al. (2005). Some studies overlapped into both reviews because they included self-management strategies while grocery shopping and they met the inclusion criteria for each review.

In order to achieve community integration with enhanced independence, students with intellectual disabilities require additional supports while completing tasks in these settings (Carey et al., 2005). The need for additional investigations using high-tech, self-operated management systems with individually created prompts to assist with functional life skills such as grocery shopping was revealed by the combination of these reviews. The following section reviewed the literature on self-management strategies incorporating different levels of technology.

Self-Management

Enabling students to self-manage their behaviors increases their autonomy and decreases the need for supervision or prompting from others. Specific to this review, antecedent self-management strategies include auditory or pictorial cues that serve as the discriminative stimuli for the occurrence of a particular behavior (Harchik, Sherman, & Sheldon, 1992). Cues can be provided through no technology (e.g., paper-based pictures), low technology (e.g., walkmans), or high technology (e.g., handheld computers, MP3 players, iPods, cell phones). Students with disabilities can potentially become more self-sufficient using self-prompting systems to complete multi-step tasks. This section presents a synthesis of the research on audio- and picture-based self-management systems as it is implemented in conjunction with community and vocational skills.

Studies chosen for this review met the following criteria; (1) participants were diagnosed with an intellectual disability, (2) incorporation of a self-operated management system to assist with the completion of functional living skills that take place in a community setting, (3) use of an experimental design, and (4) publication in an English language, peer-reviewed journal. An electronic search of the ERIC and PsycINFO databases were conducted to locate studies using the following key words: visual prompts, picture prompts, auditory prompts, antecedent prompts, self-prompting, self-management, electronic devices, iPod, PDA, Palmtop PC, and assistive technology. In addition, a manual search was conducted as a backup strategy by examining the table of contents for the following relevant journals (this search included issues published between 1995 and 2008): *Education and Training in Developmental Disabilities, Journal of Applied Behavior Analysis, Journal of Special Education,* and *Journal of Special Education Technology.* Lastly, an archival search was conducted by scanning all of the reference lists of the identified articles during the primary search. Articles using teacher-directed prompts (i.e., teacher handed pictorial cards one at a time, delivered verbal cues, or operated the prompting device) that did not require participants to independently interact with the assistive technology were excluded from this review as were articles evaluating students' ability to transition between tasks or follow an activity schedule. This search identified 27 articles and 3 literature reviews between 1995 and 2008.

Articles were categorized according to the type of self-management system used to complete functional tasks. Five articles used pictorial prompts presented in a book or list format, 9 articles involved self-operated auditory systems, 3 articles compared audio supports to picture supports, and 10 articles used a combination of audio and picture prompts (see Table 1). There was one review of literature on auditory prompting (Post & Storey, 2002) and two reviews on self-management strategies (Lancioni & O'Reilly, 2001; Mechling, 2007). Each article was discussed in terms of the level of technology involved in delivering prompts, the amount of supervisor support, and the impact of the results on the existing literature base.

Pictorial prompts. Antecedent cues can be presented in the form of pictures to provide a visual representation of the stimuli. Pictorial prompts include photographs, line-drawn pictures, hand-drawn pictures, or symbols that can be presented in books, paper or poster board lists, or digital slideshows. The presentation and use of picture prompts do not require technology, even though technology can be incorporated by using digital cameras to take photographs, or using computers or electronic devices as the format to deliver the pictures. Five studies were identified as using photographic prompts to complete community-related tasks between 1995 and 2008.

Picture lists and books have been a common prompt for students working on community or vocational skills. Students who are nonreaders may need visual prompts to remind them of what to shop for or how to carry out a task. Picture lists are similar in format to traditional written grocery lists or step-by-step instructions, but they often require managing where you are on the list so you know what to do next. Morse and Schuster (2000) made additional adaptations to a pictorial grocery list by adding a picture of the aisle sign above the target item. This helped guide students to the aisle where the item could be located. Only two target grocery items were presented on the list at a time. In Mechling, Gast, and Langone (2002), a picture list was provided until students learned to read the words and then only a typed list was used.

Picture books require fine motor skills to turn the pages, but students are less likely to lose their place if one picture is displayed per page. Picture books have provided antecedent prompts for what items need to be located and purchased in a store (Bates, Cuvo, Miner, & Korbeck, 2001) or they have provided a pictorial task analysis of how to complete vocational tasks such as cleaning tasks (Bates et al., 2001; Copeland & Hughes, 2000; Steed & Lutzker, 1997), laundry tasks (Bates et al., 2001), and packaging tasks (Johnson & Miltenberger, 1996). As long as the user of the pictorial prompts understands what the picture represents or can match it to the actual item, the type and format of the pictures can be left up to individual preference.

Each of these studies increased students' ability to independently shop for groceries and perform vocational tasks without prompting from another person. Copeland and Hughes (2000) not only taught students to use the picture prompts but they also incorporated self-monitoring strategies to initiate the task and to indicate task completion. In Steed and Lutzker (1997), the one participant noted as having a profound intellectual disability not only increased the percentage of task completion and maintained the skills after the introduction of the picture prompts, but he was also able to generalize the use of picture prompts to different vocational tasks. In Bates et al. (2001), students with mild intellectual disabilities had a greater increase in level using the picture prompts than students with moderate disabilities. The results of this study also indicated a slight decrease in level on janitorial skills during follow-up probes for both populations of students.

As shown in this review, pictorial prompts provided a visual reminder of what steps come next when working through a multi-step task. Their portability allowed individuals to access the prompts in multiple settings. For example, a student could use their picture prompts for washing dishes in their classroom after snack, at home after dinner, and at work in a restaurant. For people with deficits in receptive language, picture prompts were an alternative to verbally presented instructions. Since visual prompts were an effective self-management strategy, the proposed study included a picture prompt with text for each target item presented one at a time on an iPhone. The use of an iPhone was less stigmatizing than a picture book or paper list and potentially not very difficult to navigate after receiving history training.

Auditory prompts. Auditory prompting is one type of self-management strategy that increases the likelihood of achieving the target behavioral outcome after the presentation of a prerecorded antecedent cue (Post & Storey, 2002). Stimulus control for desired behaviors was provided by auditory prompts which facilitate acquisition, maintenance, and generalization of behaviors (Alberto, Sharpton, Briggs, & Stright, 1986; Briggs et al., 1990; Taber, Alberto, & Fredrick, 1998). Antecedent cues can include a single phase or a multi-word phase. All of the nine articles reviewed incorporating audio prompts used a portable cassette player (e.g., walkman). Walkmans would be considered a low or light form of technology since they are inexpensive, use standard batteries, and are available to the general public.

Students responded to general auditory prompts such as “Get busy, Tim” and “Keep working” (Taber, Seltzer, Heflin, & Alberto, 1999), specific task related auditory prompts such as “Did you wipe the counter?” or “Are you working? (pause), Keep those hands moving” (Grossi, 1998), and a combination of both types of prompts (Alberto, Taber, & Fredrick, 1999; Steed & Lutzker, 1999) in order to improve on-task behavior. Even with music interspersed between auditory prompts, students were successful. When Grossi (1998) removed the prompts and let the music continue, students’ total time working decreased until the prompts were reinstated. Similarly, Alberto et al. (1999) showed a decrease in the percentage of intervals of inappropriate vocalizations in work and community settings and students maintained their target behavior as the interval between prompts increased. Students also decreased their off-task behavior while receiving reinforcement prompts related to attention seeking or escape avoiding behaviors (Hughes, Alberto, & Fredrick, 2006).

Furthermore, students with mild and moderate intellectual disabilities were taught vocational tasks during the acquisition stage of learning using a self-operated auditory prompting device (Lancioni, Oliva, Pellegrino, & Soresi, 1998b; Lancioni, O'Reilly, & Olivia, 2001; Mitchell, Schuster, Collins, & Gassaway, 2000; Steed & Lutzker, 1999). Even though the teacher was present to provide error correction using the system of least prompts or navigation support, their presence was faded out after criterion levels were met (Steed & Lutzker, 1999) and the auditory prompts were eventually faded out completely in Mitchell et al. (2000). These outcomes demonstrate that prompting devices do not have to remain as a permanent aid. Users may self-fadeout the prompting on their own. Prompting devices could just be a tool to help students acquire a new skill.

There are a few characteristics of auditory prompting systems that may contribute to the positive aforementioned results. First, the auditory prompts may help students focus on the relevant stimuli and not be as distracted by the background noise (Davies, Brady, Williams, &

Burta, 1992; Milligen & McLaughlin, 1990; Taber et al., 1999). Second, students may have been motivated by their increased independence and decreased reliance on others to provide prompts. Students were able to complete tasks on their own with acceptable quality after hearing reminders presented in a positive tone (Steed & Lutzker, 1999). It is possible that when students feel pressured by constant prompting from teachers, supervisors, or parents, discouragement and sometimes noncompliance can result. Third, the frequency of delivering the prompts may be linked to the increased fluency in task completion (Davies et al., 1992; Grossi, 1998; Taber et al., 1999).

General prompts reminding students to stay on task were beneficial and efficient in improving task performance across a variety of tasks (Taber et al., 1999). Without providing comments related to a specific task, a variety of general, nonspecific prompts can be recorded and reused across multiple tasks and settings. The majority of the studies reviewed not only generalized auditory prompt use across settings, but also maintained over time (Alberto et al., 1999; Mitchell et al., 2000; Steed & Lutzker, 1999; Taber et al., 1998; Taber et al., 1999). Another benefit of auditory prompting devices was that students could receive prompts with or without music interspersed and easily blend in with the population of adolescents and young adults who regularly wear earphones. Today's current audio devices (e.g., iPods, MP3 players, cell phones, and PDAs), which have virtually replaced walkmans, allow students with disabilities needing a little extra support to receive assistance using a device that does not cause them to stick out from the general population. The combination of music and prompts on electronic devices is potentially less time consuming to program than with cassette tapes. Furthermore, Mitchell et al. (2000) suggested creating a "recipe" box of multiple tapes prompting students through a variety of tasks each individually labeled with text or pictures. Today, the amount of memory available on electronic audio devices provides plenty of storage for verbal task analyses and they can be quickly accessible. Self-operated prompting systems allow students to be less dependent on teachers, parents, job coaches, and other employees for guidance and redirection (Taber et al., 1999). The combination of these benefits for auditory learners warrants further investigations with electronic devices and self-created audio prompts which is why the current study assessed the effects and efficiency of auditory antecedent cues delivered by an iPhone. Each participant recorded items needed in a grocery store so the iPhone could provide the prompts in the natural setting.

Audio versus picture prompts. Three studies compared the effectiveness of using picture prompts versus auditory prompts (Johnson & Miltenberger, 1996; Lancioni, Klaase, & Goossens, 1995; Taber-Doughty, 2005). Line drawn picture prompts were as comparably effective as auditory prompts from a cassette player when used to support independent task completion for 13 year old students with multiple disabilities (Johnson & Miltenberger, 1996; Lancioni et al., 1995). When the participants were asked to select their preferred prompting system, one student selected audio and the other selected pictures in each study. In comparison, the three students with moderate intellectual disabilities in Taber-Doughty (2005) were also more effective and efficient with different types of prompts (auditory, pictorial, and system of least prompts). Audio prompts were delivered via a MP3 player, picture prompts were digital photos in an album, and system of least prompts were administered by the instructor. The student with the highest IQ and a secondary disability of autism preferred the auditory prompts. Given that students with autism are often successful with visuals, this supports results from other studies assessing the use of audio prompts with students with autism (Milligen & McLaughlin, 1990; Taber et al., 1999). These three comparison studies emphasize the importance of considering each student's preferred learning styles when selecting a self-prompting system. If students without disabilities learn new skills more efficiently using their preferred learning modality (Sandrene & Eisenbise, 1997; Yong & McIntyre, 1992), then it may be probable that students with disabilities will too (Taber-Doughty, 2005).

Combination of audio and picture prompts. All 10 studies reviewed used some form of high-tech electronic device to present the simultaneous audio and picture prompts. One study used a Digivox (type of augmentative communication device) while nine studies used a type of hand-held computer. The use of additional electronic devices such as PDAs (Ferguson et al., 2005) and iPods (Cihak, Fahrenkrog, Ayres, & Smith, 2010; Van Laarhoven et al., 2009) are present in the literature, but they did not meet the inclusion criteria for this review (i.e., participant characteristics or prompting system).

Electronic devices have advantages over paper-based systems because they can integrate a variety of supports and still be operated without the assistance of others. Paper-based systems require the presence of another person in order to be supplemented with auditory prompts. When electronic devices have the option of multiple supports, students can utilize the supports that relate to their preferred learning styles. Four comparison studies demonstrated the effectiveness of palmtop computers with audio, picture, and vibration prompts over pictorial card systems when completing vocational tasks (Furniss et al., 1999; Lancioni et al., 2000, 1998a, 1999b). Furniss et al. (1999) presented six case studies where work accuracy and pace increased to higher levels than when using picture books as the prompting system. The Palmtop aid incorporated line drawn pictures for each step of the task (same pictures as the picture book) in addition to auditory prompts and vibration prompts reminding the student when to press the key to initiate the next step. All four studies discussed how the manual picture card systems were cumbersome to manage and results in skipped steps.

What pictures illustrate may need to be taken into consideration when taking or selecting pictures to act as a prompt. Photographs of steps in a task analysis can show a single step or multiple steps clustered together. Results from Lancioni et al. (1999a) showed that pictures of single steps along with audio prompts were effective in prompting the completion of table setting, food preparation, and cleaning tasks. Also they found that pictures of multiple step clusters were effective in maintaining the skills at high levels of accuracy.

Multiple studies demonstrated increased accuracy in completing tasks using electronic devices with both types of supports (Cihak et al., 2007; Davies et al., 2002a, 2003; Mechling & Gast, 1997). Mechling and Gast (1997) used a Digivox to teach the new skills of loading the dishwasher and sorting objects to four students with moderate intellectual disabilities. After history training and the introduction of the device, accuracy increased and error rates decreased for each task. This study was unique in that it used a communication device to provide the prompts instead of a commercially available device used by the general public. Cihak et al. (2007) demonstrated that a handheld computer with supports improved accuracy and generalized across unequal tasks that were increasing in difficulty without needing additional history training with the device. A benefit of providing audio prompts using an electronic device instead of a cassette player is the ease at which prompts can be repeated. In Davies et al. (2002a, 2003), students were allowed to replay steps by pressing “Play” or moving on to the next step by pressing “Done” on the touch screen. Conversely, in Riffel et al. (2005) the number of adult-directed prompts decreased as students independently self-selected using the device, but the total number of prompts and duration to complete the vocational tasks such as rolling silverware and setting tables were variable. During baseline the data were unstable and the trend was decelerating. It was difficult to conclude that the intervention was effective without observing an abrupt change between the baseline and intervention phases. The results of these studies help establish a research base for using electronic devices with multiple supports.

Summary. As the popularity of electronic devices continues to increase with the general public, they should also become more common with people with disabilities. Their optimistic potential, user-friendliness, age-appropriateness, and built-in features allow people with disabilities to participate in community settings to a greater extent and more independently (Davies et al., 2002a). Without calling attention to any additional differences, electronic devices can be tailored to meet individual needs (Ferguson et al., 2005). People with disabilities are most successful with electronic devices or any type of assistive technology when adequate support is provided to the individual, teachers, and parents. In order for the individual to learn how to operate the device, their support team requires training (Mirenda, Wilk, & Carson, 2000). Positive outcomes can result when appropriate measures are taken upfront.

The numerous capabilities of electronic devices make them the optimal self-management tool. Students can receive single, multiple, or tiered levels of supports depending on the task and their preferred learning modalities. This review provides evidence that auditory and pictorial supports delivered separately through no or light technology options or together by a self-operated handheld computer are effective. Now researchers need to assess the effectiveness and efficiency of many different technological tools with varying supports. Besides using a MP3 player (Taber-Doughty, 2005), auditory prompts were only provided by cassette players which do not allow for easy repetition of directions. Today's commercially available electronic devices such as iPods, iPod Touches, iPhones, and PDAs allow for quick and easy recordings and repetition of audio prompts in addition to picture and video prompts. With the research supporting single prompts, it would be beneficial to try incorporating audio or picture prompts on an electronic device. Four studies compared the use of electronic systems to manual systems (Furniss et al., 1999; Lancioni et al., 1998, 1999b, 2000), but the comparison of audio or picture supports presented on electronic devices to electronic devices with multiple supports have not been evaluated. Presenting supports on the same medium would be a beneficial comparison to help students and assistive technology evaluators determine the most powerful type and level of support. The present study used an iPhone to store and deliver auditory and pictorial prompts during separate trials throughout a session. The iPhone allowed students to learn to operate one device that had the capability of providing different types of supports. The following section discusses key elements related to grocery shopping since the iPhone was used to assist students in locating grocery items. The different types of shopping lists and incidental learning measures used in previous studies are discussed in detail.

Grocery Shopping

Learning to function as independently as possible in a variety environments has generally been considered an important goal for individuals with moderate intellectual disabilities. Unfortunately, learning functional skills does not come easily for these individuals because of their learning characteristics and the complex number of stimuli associated with such tasks (Snell & Brown, 2006; Westling & Fox, 2004). Students require systematic instruction to learn new skills (Wolery, Ault, & Doyle, 1992) and they usually benefit from the use of assistive technology to compensate for their areas of weakness (Burgstahler, 2003; Wehmeyer, 1999). When individuals with disabilities become more independent by completing tasks on their own, they need less help from others and become less dependent on their caregivers.

Intervention programs should be designed to teach functional skills (Baer, Wolf, & Risley, 1986) and to promote generalization of the skills across natural environments (Stokes & Baer, 1977). The tasks involved in acquiring functional skills need to be broken down into smaller steps to help students with intellectual disabilities master each critical step (Alberto & Troutman, 1999; White, 1971) and focus on the relevant stimuli to make discriminations more easily. Oftentimes, tasks like grocery shopping are divided up into different skills sets and taught separately (e.g., making a list, getting to the store, locating items, purchasing items, and putting items away). This method of focusing on one skill subset and then building upon it is beneficial as long as all subsets of skills are eventually taught and mastered.

A literature search of single subject studies with empirical data evaluating grocery shopping skills identified 18 studies between 1980 and 2008 (see Table 2). Search terms used to locate these studies included grocery shopping, community skills, community instruction, and consumer skills. Studies excluded from the review were those that did not describe how grocery items were located. Studies solely focusing on purchasing items and not shopping for them were also excluded. The next section discussed how shopping lists were generated and supported the shopper. This was followed by a discussion on incidental learning.

Type of shopping list. The type and construction of shopping lists across studies were also analyzed to determine how students located specific items. Only four studies had students generate their own shopping lists (Aeschleman & Schladenhauffen, 1984; Gaule et al., 1985; Giere et al., 1989; Sarber et al., 1983). One study had students draw symbols representing the items needed while the other three taught students to compose picture books, each teaching a different variation. Gaule et al. (1985) gave students a picture recipe and then the students had to check off items needed from a laminated album full of possible grocery items. After students checked the items needed, they looked in the kitchen for items they already had. Students marked out the items they did not need to buy at the store. Sarber et al. (1983) had a mother with an intellectual disability put picture cards into slots of an album divided by food groups. This process guided the mom in planning nutritious meals. The third study had students select pictures and put them in their small photo album (Giere et al.,1989).

Even though these studies involved students in the process of creating a shopping list, the majority of studies provided students with lists. Typed lists were provided to students in three studies (Mechling, 2004; Mechling & Gast, 2003; Mechling et al., 2002) with the last study assessing students using picture lists and then word lists. Only one study solely used picture lists (Morse & Schuster, 2000) while seven studies provided picture books of items (e.g., Alcantara, 1994; Horner et al., 1986; McDonnell, 1987). Four studies presented students with a picture card one at a time for every item they were to locate (e.g., Ferguson & McDonnell, 1991; Langone et al., 1999).

Incidental learning measurement. When applied researchers add extra information related to topic or skill that is not the primary focus of the study and students learn the nontarget information, this is referred to incidental learning (Stevenson, 1972). Nontarget stimuli are stimuli presented during the instructional sessions, but the stimuli are not directly taught (Wolery, Schuster, & Collins, 2000). Efficiency of the intervention is increased when information in addition to the target stimuli are acquired in the same instructional time period (Werts, Wolery, Holcombe, & Gast, 1995). Nontarget stimuli can be inserted into the attending cue (Alig-Cybriwsky, Wolery, & Gast, 1990; Keel & Gast, 1992; Lee & Vail, 2005; Winterling, 1990; Wolery, Ault, Gast, Doyle, & Mills, 1990), prompt hierarchy (Doyle, Gast, Wolery, Ault, & Meyer, 1992; Gast, Doyle, Wolery, Ault, & Farmer, 1991; Jones & Collins, 1997), antecedent and consequent events (Doyle, Gast, Wolery, Ault, & Farmer, 1990; Fiscus, Schuster, Morse, & Collins, 2002; Gast, Doyle, Wolery, Ault, & Baklarz, 1991; Shelton, Gast, Wolery, & Winterling, 1991; Wolery, Doyle et al., 1991; Wolery, Holcombe, Werts, & Cipolloni, 1993; Wolery, Schuster, & Collins, 2000), consequent feedback (Campbell & Mechling, 2009; Gast, Doyle, Wolery, Ault, & Kolenda, 1994; Holcombe, Wolery, Werts, & Hrenkevick, 1993; Jones & Collins, 1997; Taylor, Collins, Schuster, Kleinert, 2002; Wall & Gast, 1999; Werts et al., 1995; Wolery, Cybriwsky, Gast, & Boyle-Gast, 1991), or discriminative stimulus (Doyle, Schuster, & Meyer, 1996; Roark, Collins, Hemmeter, & Kleinert, 2002).

None of the studies reviewed included an incidental learning measure even though the grocery store presents a natural context for identifying labels and brands on a variety of items. An incidental learning measure was included in the present second study to see if students learned to read the names of the items after multiple presentations of e-text with their most effective and efficient support (either audio or picture). The nontarget stimulus (text) was presented with the discriminative stimulus (audio or picture). Students were evaluated on reading the names of items on the iPhone screen in grocery store probes before and after the implementation of the intervention. If students were successful in transfer stimulus control, then the study expands the literature base on the positive effects of incidental learning and supported e-text increasing reading skills. If students did not learn the words incidentally, they were taught the words using simultaneous prompting (Wolery et al., 1992) on the computer with the researcher giving feedback.

Simultaneous prompting was selected as the instructional strategy because of its effectiveness in teaching sight words to students with intellectual disabilities (Birkan, 2005; Gibson & Schuster, 1992; Griffen, Schuster, & Morse, 1998; Parker & Schuster, 2002; Riesen, McDonnell, Johnson, Polychronis, & Jameson, 2003; Schuster, Griffen, & Wolery, 1992; Singleton, Schuster, Morse, & Collins, 1999) and its ease to program on a computer. All instructional sessions consistently provide the discriminative stimulus with a controlling prompt at a 0 s delay. The number of errors should be very low and reinforcement levels high since the controlling prompt is always presented during instructional sessions (Schuster et al., 1992). Since students never have an opportunity to respond independently during these sessions, a test session needs to be conducted immediately prior to the instructional session. The test session will determine when stimulus control has occurred (Morse & Schuster, 2004).

Research on the benefits of supported e-text with students with moderate intellectual disabilities is just surfacing as this population begins to participate in a general education curriculum to a greater extent and more assistive technology tools are made available. Previously, sight word instruction has been the focus of reading research for individuals with intellectual disabilities (Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006). Even though research on strategies providing direct instruction and remediation has demonstrated that this population can learn both decoding and comprehension skills (Browder, Ahlgrim-Delzell, Courtade, Gibbs, & Flowers, 2008; Cohen, Heller, Alberto, & Fredrick, 2008; Collins, Evans, Creech-Galloway, Karl, & Miller, 2007), it has also documented that it takes considerably longer for students with intellectual disabilities to make these gains (Cohen et al., 2008). Nonetheless, the effects of text-to-speech for students with milder disabilities have shown positive results and have been more widely studied. Elkind and Elkind (2007) reviewed the research on text-to-speech and found that the majority of studies showed improved reading speed and comprehension. These encouraging outcomes warrant further investigations with students with more severe disabilities.

Summary. The 18 studies reviewed revealed a variety of methods for creating and using shopping lists in a grocery store. Depending on the individual student, different types of lists benefit different students. Students need to be evaluated to determine which type of list is most helpful and how students can be involved in the list creation process. Additionally, educators need to consider including information that students could learn incidentally while shopping. The studies discussed above provide support for incidental learning so nontarget information should be included and evaluated whenever possible.

The following section used the single-subject research standards as described by Horner and colleagues (2005) to evaluate the 18 grocery shopping studies found in Table 2. Single subject research was the primary research methodology implemented in these studies so a thorough evaluation is warranted. Single subject research is an appropriate methodology when conducting applied research with a small number of participants.

Single Subject Methodology

Researchers select research designs based on the questions they are trying to answer. When educating students with more severe disabilities, there are usually few participants available within one setting so a research design appropriate for a small number of participants is needed. Single subject research allows participants to serve as their own control (Gast, 2010). It is a powerful design when there are three replications of effect at three different points in time and internal validity is controlled to the greatest extent possible. The following sections discussed the defining features of single subject research (Horner et al., 2005) and evaluated the internal validity of the 18 grocery shopping studies.

Reliability. Collecting and reporting reliability measures are important elements of applied experimental studies (Gast, 2010). Measures such as interobserver and procedural reliability help to confirm that the dependent variables were reliably measured and the independent variables were consistently implemented. Interobserver reliability is determined when two observers agree on the occurrence or nonoccurrence of a specifically defined behavior. Treatment integrity or procedural reliability evaluates the extent to which the procedures are carried out according to the specified plan (Gresham, Gansle, Noelle, Cohen, & Rosenblum, 1993). Failure to collect these measures accurately could cause inappropriate interventions to be applied to situations that warrant immediate and effective change (Vollmer, Sloman, & Pipkin, 2008). To avoid reliability errors, researchers need to provide observer training prior to the study and throughout if maintenance training is warranted from low scores. Also, operationalized definitions of the behaviors and procedures need to be provided to increase the probability of consistent measures.

It is recommended that interobserver agreement (IOA) be collected on each dependent variable across each participant and exceed the minimal standard of 80%. Instrumentation threats to interval validity can be detected through IOA being assessed at least once during each phase of a study and ideally for at least 20 to 30% of the sessions. Studies with clearly defined dependent measures and trained data collectors help to validate the results. All of the identified studies reported IOA and all studies except for one (Wilson, Cuvo, & Davis, 1986) collected IOA during at least 26% of the sessions. The range of mean IOA was from 92% to 100% with only four scores below 80% agreement. The majority of the studies calculated IOA using the point by point method of dividing the number of agreements by the number of agreements plus disagreements.

On the other hand, procedural reliability evaluates the implementation fidelity of the independent variables. Procedural reliability helps to determine if the procedures were reliably carried out as planned which increases the believability that the intervention was responsible for the change in the dependent variables (Gresham, MacMillan, Beebe-Frankenberger, & Bocian, 2000). Only half (50%) of the studies collected procedural reliability data. For these nine studies, means ranged from 93 to 100% with the majority of studies reporting fidelity above 90%. Procedural reliability was collected in 26 to 57% of the sessions.

Social validity. Social validity provides documentation that the change in the dependent variable is socially important and the independent variable is practical (Wolf, 1978). The goals, procedures, and outcomes are socially validated when: a) socially important dependent measures are selected, b) conventional teachers and parents in typically environments can implement procedures with fidelity, c) acceptable, feasible, effective, and efficient interventions are chosen, and d) a need exists for the intervention (Horner et al., 2005).

Social validity was reported in 50% of the 18 studies. Five of these studies asked the students or parents what items they preferred to shop for. The other four studies surveyed parents or teachers on the goals and effects of the interventions. Parents and teachers alike stressed the need for their students to exemplify more effective and efficient shopping skills and both were also excited about the progress made after the introduction of the independent variable.

Participant characteristics. Studies that provide a clear description of their participants help readers understand who specifically benefited from the intervention. When readers can learn about the participants through the descriptive characteristics (e.g. age, gender, disability, test scores, and IEP goals) and prerequisite skills (Wolery & Ezell, 1993), they can determine whether the intervention is likely to be useful with their own students who have similar characteristics. The more detail provided, the more likely the study can be replicated with precision (Horner et al., 2005). Researchers may also want to try the intervention with a slightly different population of students to expand the generality of the intervention.

All of the studies provided a description of the participants, but some were in more detail than other. Sixty-seven percent of the studies reported scores from intelligence tests while the other 33% provided a range of scores across all participants or did not provide any test score data. In addition to intelligence testing, adaptive behavior measures also report data that could allow similarities to be made across students. Twenty-two percent of the studies presented at least one adaptive behavior score. Identifying specific instruments and measures are more sufficient than relying on broad classification descriptors such as students with moderate intellectual disabilities to discuss the make-up of the participants (Horner et al., 2005).

Maintenance and generalization. When studies demonstrate that students maintained the newly learned skill for weeks or months after the instructional phase through follow-up probes, the effectiveness of the intervention is strengthened. Applied researchers advocate for the inclusion of a maintenance phase within a study in order to see if students continue to possess the learned skill or use the prompting system over time. Again, half of the identified studies collected maintenance data. Students were able to continue to effectively grocery shop after the in vivo, simulation, or computer based training subsided. Maintenance data can also show whether the supports used continued to be needed, faded out or were abandoned.

Generalization data illustrate that the skill can be applied to novel settings, materials, or persons that were not part of the instructional phase. Horner, Bellamy, and Colvin (1984) stated that functional generalization should meet two criteria. First, newly acquired responses should only be performed when appropriate, non-trained stimulus situations present themselves. Secondly, students should discriminate when inappropriate, non-trained stimulus situations occur and the acquired skill needs to be withheld. Of the studies, reviewed 78% tested for generalization. These studies assess generalization in different ways. Some students demonstrated their ability to generalize shopping skills to actual grocery stores after receiving instruction through classroom simulations or computer-based programs. Other students generalized their skills to novel stores or items.

Replication of effect. Researchers using single subject research designs want to establish a functional relationship between the independent and dependent variables. They design studies controlling for threats to internal validity to the greatest extent possible so an experimental effect will likely be evident from a visual analysis of the data. Experimental control is demonstrated when at least three replications of effect are demonstrated at three different points in time. When this occurs with only one participant in a study, intra-subject (within-subject) direct replication is demonstrated. When experimental control occurs across multiple participants, this is called inter-subject (between subjects) direct replication. The most powerful studies have both intra and inter-subject replication. Of the 18 studies reviewed, 8 (44%) demonstrated both types of direct replication. Only 1 (6%) study showed intra-subject replication by itself (Sarber et al., 1983) while 9 (50%) studies illustrated only inter-subject replication.

Summary. The quality indicators as set forth by Horner et al. (2005) provide guidelines for developing powerful single subject research methodologies. As described above, consideration of the defining features of single subject research is critical for increasing confidence in the effect. This dissertation tried to incorporate these features to the greatest extent possible. The collection and calculation of IOA throughout the studies helped to detect instrumentation threats which could potentially be corrected by clearly defining the behaviors and observer retraining if necessary. Similarly, calculating high procedural reliability would strengthen the believability that the intervention was responsibility for the change in behaviors. To ensure that the purpose, procedures, and outcomes were socially valid, parents, students, and teachers were surveyed. Including a clear and thorough description of the four participants helps readers have a general idea of other possible individuals the intervention may benefit. In study 2 students receiving simultaneous prompting would be tested for generalization by reading the words on the computer in the classroom to reading the words on the iPhone in the grocery store. Maintenance data would also be collected on the first and second word sets while assessment on the third word set occurred. Visual analysis of both studies would display replication of effect at multiple points in time if a functional relation between the independent and dependent variables existed. The methodology of these two studies noted the importance of accounting for the quality indicators used to judge single subject research.

General Conclusions

While the literature base on grocery shopping contains a fair number of articles, there are gaps in researching the entire grocery shopping experience. Individuals with intellectual disabilities have been taught many components of grocery shopping: to obtain a cart or hand basket (e.g., McDonnell & Laughlin, 1989; Morse & Schuster, 2000); to locate items in vivo (e.g., Ferguson & McDonnell, 1991; Gaule et al., 1985), in simulated settings (e.g., Aeschleman & Schladenhauffen, 1984; McDonnell & Horner, 1985), and through computer-assisted instruction (e.g., Hutcherson et al., 2004; Mechling et al., 2002; Langone et al., 1999); and to purchase items (e.g., Alcantara, 1994; McDonnell, 1987). However, additional research is needed related to student independence specifically in developing shopping lists and effectively using lists without assistance. Given their weaker reading and writing abilities along with deficits in short term memory, students with moderate disabilities need to learn an easy way to generate a list without manipulating hundreds of picture cards or large, bulky photo albums. This skill set can potentially benefit from the use and efficiency of technology. The features available on current electronic devices may be able to assist in increasing the independence, motivation, and abilities of individuals with moderate intellectual disabilities. While the literature supports using pictorial adapted aids, others supports may be effective with the use of technology in addition to pictures.

It is always important to select technological devices that will be most suitable for the individual (Lancioni & O'Reilly, 2001). Considering their needs and preferences and matching them with a viable device will hopefully decrease the probability of technology abandonment (Johnston & Evans, 2005; Phillips & Zhao, 1993; Riemer-Reiss & Wacker, 2000). The purpose of assistive technology is to increase skill acquisition, provide access, and compensate for weaknesses. Through the use of electronic devices, individuals with intellectual disabilities can independently participate in community settings in a non-stigmatizing manner.

Portable, electronic devices increase the ability of students with disabilities to perform functional skills independently in a variety of settings. Supports that best suit the individual can be programmed into the device or the individual can learn to program in their own supports by recording an audio memo, taking pictures, or shooting a video all within one device. The grocery store is a common setting frequented by most people, but it becomes a difficult task for people unable to read a traditionally written list. People who are nonreaders and have memory deficits need adapted lists to shop for groceries.

The purpose of the present studies was to compare the effectiveness and efficiency of three types of self-created lists presented on an iPhone and to assess students' ability to transfer stimulus control to the text. Four students with moderate intellectual disabilities and prior location strategy knowledge will locate items using self-created supports to determine their superior support while grocery shopping and if the inclusion of e-text incidentally increases the number of words read. If students did not learn to read the words incidentally, they were taught using a computer-based instructional program with simultaneous prompting. Generalization measures in the grocery store were collected after the computer instruction. Effectiveness will be measured by the accuracy in locating items using self-created audio or pictorial prompts presented on an iPhone while efficiency will be measured by the number of errors, number of prompts needed after the initial antecedent cue, and the duration to locate items. The next chapter will describe the specific methodology of each study in detail.

Table 1
Summary of Self-Management Studies

	Participant N Age Disability	Independent Variable	Dependent Variable	Experimental Design	Results
Picture prompting					
Bates, Cuvo, Miner, & Korbeck (2001)	40 16-17 MID/MOID	Picture book with photos	% correct photos selected during simulation; % of correct task analysis steps	Multi-factor mixed design	Students with MID were more successful in simulated and community settings than students with MOID
Copeland & Hughes (2000)	2 high school SID	Picture book	% independent task step initiations, % independent step completions, % of pointing to pictures, % of page turning, % of prompts provided by trainer	Multiple probe across students	Picture prompts successfully used to initiate and complete job tasks
Mechling, Gast, & Langone (2002)	4 9-17 MOID	Written and picture list	Number of items located correctly	Multiple probe across 3 word sets and replicated across students	Students generalized reading aisle signs and locating items with picture and written lists in grocery stores after computer-based video instruction
Morse & Schuster (2000)	10 5-12 MOID	Picture list with aisle sign	Correct anticipations, correct waits, nonwait error, wait error, no response	Multiple probe across students	Constant time delay was effective in teaching a chained CBI task; majority of students learned to locate and purchase 2 items, maintained skills for 6 weeks, and generalized to a novel store
Speed & Lutzker (1997)	1 40 PID	Picture book with photos	Percent of correct steps	Multiple probe across tasks	Picture prompts effective as cues for task completion, behavior maintained and generalized

Table 1 (Continued)
Summary of Self-Management Studies

	Participant N Age Disability	Independent Variable	Dependent Variable	Experimental Design	Results
Audio prompting					
Alberto et al. (1999)	2 19 MOID	Walkman with music interspersed between prompts	Percentage of intervals in engaged in aberrant behaviors	Multiple probe across settings with a reversal and replication phase	Aberrant behaviors were eliminated after introduction of prompting device; time between prompts increased and students maintained appropriate behavior
Grossi (1998)	2 26-28 SID	Walkman with music interspersed between prompts	Percentage of intervals observed working, accuracy of work task, and total time spent working	Reversal	Increase in work performance for all 3 measures with auditory prompts
Hughes, Alberto, & Fredrick (2006)	4 16-17 MOID	Walkman	Frequency of off task behaviors	Multiple probe across two time samples with reversal	Functional relationship between independent and dependent variables
Lancioni, Oliva, Pellegrino, & Soresi (1998)	1 18 multiple disabilities	Compact cassette player	Percent of correct task steps	Multiple probe across tasks	Audio prompts facilitated responses on untrained task
Lancioni, O'Reilly, & Olivia (2001)	3 19-22 multiple disabilities	Compact cassette player	Percent of correct task steps	ATD	Maintained task performance with auditory prompts
Lancioni, O'Reilly, Olivia, & Pellegrino (1997)	2 19-25 multiple disabilities	Compact cassette player	Percent of correct task steps and student's preference	Multiple probe across tasks replicated across students	Self-operated audio prompts were effective in increasing independent task performance; generalized to different tasks

Table 1 (Continued)
Summary of Self-Management Studies

	Participant N Age Disability	Independent Variable	Dependent Variable	Experimental Design	Results
Mitchell, Schuster, Collins, & Gassaway (2000)	3 14-16 MID	Portable cassette player	Percent correct on task analysis	Multiple probe across 3 tasks and replicated across 3 students	Auditory prompting effective along with fading technique, generalized to novel setting, maintenance data variable
Steed & Lutzker (1999)	2 37-48 MID/MOID	Portable cassette player	Percent of correct task steps	Multiple probe across tasks	Audio prompts increase independent task completion
Taber et al. (1999)	1 12 MOID & Autism	Walkman	Number of teacher-directed prompts	Multiple probe across settings with withdrawal	Teacher prompts decreased after auditory prompting
Picture v. audio					
Johnson & Miltenberger (1996)	2 13 multiple disabilities	Picture book with line drawings v. audio recordings	Percent of correct steps	ATD	Systems comparably effective; each student preferred a different prompting system
Lancioni, Klaase, & Goossens (1995)	2 13 multiple disabilities	Cassette recording v. picture book with line drawings	Percent of steps completed correctly and student's preference	ATD	Both systems effective; each student preferred a different prompting system
Taber-Doughty (2005)	5 15-21 MOID	Picture book v. MP3 player v. teacher hints	Percent of steps completed independently; duration to complete task	ATD	Each system was effective and efficient with different students; students preferred different systems

Table 1 (Continued)
Summary of Self-Management Studies

	Participant N Age Disability	Independent Variable	Dependent Variable	Experimental Design	Results
Combination of audio and picture prompting					
Cihak, Kessler, & Alberto (2007)	4 18-19 MOID	Axium X30 handheld computer	Percent of correct steps on task analysis	Multiple probe across tasks	Generalized across dissimilar & increasing complex tasks without additional device training
Davies, Stock, & Wehmeyer (2003)	40 18-54 ID	Pocket Compass on Pocket PC palmtop computer	Accuracy in correctly navigating decision points; # of errors during task; number of prompts to complete task	Two-group within subjects	Increase in independence and accuracy on vocational skills
Davies, Stock, & Wehmeyer (2002)	10 18-70 MID-SID	Portable palmtop computer running Visual Assistant	Independence measured by # of prompts needed for each step; accuracy measured by # of errors per task	Two-group within subjects	Multimedia program on portable device improved accuracy
Furniss, Ward, Lancioni, Rocha, Cunha, Seedhouse, Morato, & Waddell (1999)	6 not stated SID	VICAID (simplified palmtop PC)	Percent of correct steps on TA	Multiple case studies	VICAID program effective in getting students to complete task with greater accuracy after intense training with device
Lancioni, O'Reilly, Seedhouse, Furniss, & Cunha (2000)	6 23-47 SID	Palmtop computer	Number of independent steps completed	ATD	Computer system with audio, vibration, and picture supports was more effective than picture card system
Lancioni, O'Reilly, Van den Hof, Furniss, Seedhouse, & Rocha (1999a)	4 19-39 SID	Palmtop computer	Number of independent steps completed; number of computer steps	ATD	3 of 4 participants achieved criteria of 90% accuracy on task completion

Table 1 (Continued)
Summary of Self-Management Studies

	Participant N Age Disability	Independent Variable	Dependent Variable	Experimental Design	Results
Lancioni, Van den Hof, Boelens, Rocha, & Seedhouse (1998)	3 20-36 SID	Palmtop computer	Number of independent steps completed; number of computer prompts; number of prompts responded to independent; student's preference	ATD	Computer system more effective than card system (failed to advance to next card)
Lancioni, Van den Hof, Furniss, O’Reilly, & Cunha (1999b)	4 18-23 SID	Palmtop computer	Number of independent steps completed; number of computer prompts; student's preference	ATD	Computer system more effective than card system and computer use maintained over at least 20 additional sessions
Mechling & Gast (1997)	4 10-13 MOID	Digivox	Number of steps completed correctly; number of sessions to learn to use device; number of minutes per session	ABAB withdrawal	Effectiveness of combination with device for completing untrained tasks; error rates higher without device
Riffel, Wehmeyer, Turnbull, Lattimore, Davies, Stock, & Fisher (2005)	4 16-20 MID-MOID	Portable palmtop computer running Visual Assistant	Total number of prompts to complete the task; amount of time; number of support statements provided	Multiple probe across students	Change in level for 2 students while other 2 students had a decelerating trend during baseline; duration relatively the same

Table 2
Design Components of Grocery Shopping Studies

Reference	N	IOA [1]	Procedural Reliability [2]	Social Validity	Participant Characteristics [3]	Maintenance	Generalization	Inter-Subject Replication	Intra-Subject Replication	Type of List/ Student Generated	Incidental Measure
Aeschleman & Schladenhauffen (1984)	4	29, 96, X	X, X, X	No	X, X	Yes	Yes	Yes	No	Hand drawn symbols, Yes	No
Alcantara (1994)	3	26, 98, 86-100	54, 100	No	IQ, AB	Yes	Yes	Yes	Yes	Picture book, No	No
Ferguson & McDonnell (1991)	6	40, 99, 98-100	X, X, X	No	IQ, AB	No	Yes	Yes	Yes	Picture cards, No	No
Gaule, Nietupski, & Certo (1985)	3	33, 100, X	X, X, X	Preferred meals	IQ, X	Yes	No	Yes	Yes	Picture book, Yes	No
Giere, Rudrud, & McKay (1989)	3	Yes	X, X, X	No		Yes	Yes	Yes	No	Picture book, Yes	No
Horner, Albin, & Ralph (1986)	6	100, 98, 90-100	X, X, X	No	IQ, X	No	Yes	Yes	No	Picture book, No	No
Hutcherson, Langone, Ayres, & Clees (2004)	4	26, 96, 95-100	26, 100	No	IQ, AB	No	Yes	Yes	Yes	Picture cards, No	No

[1] Interobserver Agreement (IOA): The first number is the percentage of sessions data were collected during intervention. The second number is the mean percentage of IOA and last numbers are the range of IOA. An X means no data were provided.

[2] Procedural Reliability: The first number is the percentage of sessions data were collected, the second number is the mean percentage, and the third numbers are the range. An X means no data were provided.

[3] Participant Characteristics: IQ means a specific Intelligent Quotient was provided while AB means a specific adaptive behavior measure was provided. X means no data were stated.

Table 2 - (Continued)
Design Components of Grocery Shopping Studies

Reference	N	IOA	Procedural Reliability	Social Validity	Participant Characteristics	Maintenance	Generalization	Inter-Subject Replication	Intra-Subject Replication	Type of List/ Student Generated	Incidental Measure
Langone, Shade, Clees, & Day (1999)	4	33, 100	33, 100	No	X, X	No	Yes	Yes	No	Picture cards, No	No
McDonnell (1987)	4	100, 92, 75-100	28.5, 94, 88-100	No	X, X	No	No	Yes	atd	Picture book, No	No
McDonnell & Horner (1985)	8	27, 98.9, 90-100	X, X, X	Shopping location & items	IQ, X	No	Yes	Yes	No	Picture book, No	No
McDonnell & Laughlin (1989)	4	73, 98, 69-100	X, X, X	Item preference	X, X	Yes	No	Yes	atd	Picture, No	No
Mechling (2004)	3	33, 98.9, 83.3-100	33, 98, X	item	IQ, X	No	Yes	Yes	No	Typed list, No	No
Mechling & Gast (2003)	3	33, 100, X	33, 99.7, 96.6-100	item	IQ, X	No	Yes	Yes	Yes	Typed list, No	No
Mechling, Gast, & Langone (2002)	4	33, 99.1, 83.3-100	33, 99.6, 96.5-100	performance, outcome	IQ, X	No	Yes	Yes	Yes	Typed and picture lists, No	No
Morse & Schuster (2000)	#	50, 95, 71-100	57, 93, 72-100	goal, performance, outcome	IQ, AB	Yes	Yes	Yes	No	Picture list with aisle sign, No	No
Sarber, Halas, Messmer, Bickett, & Lutzker (1983)	1	42, 98.3, X	X, X, X	important skill	IQ, X	Yes	No	No	Yes	Picture book, Yes	No

Table 2 - (Continued)

Design Components of Grocery Shopping Studies

Reference	N	IOA	Procedural Reliability	Social Validity	Participant Characteristics	Maintenance	Generalization	Inter-Subject Replication	Intra-Subject Replication	Type of List/ Student Generated	Incidental Measure
Wilson, Cuvo, & Davis (1986) exp 2	4	19, 95.3, 92-100	X, X, X	No	X, X	Yes	Yes	Yes	No	Typed list, No	No
Wissick, Lloyd, & Kinzie (1992)	3	30, 95.8, 33-100	X, X, 83-100	performance, outcome	IQ, X	Yes	Yes	Yes	No	Picture cards, No	No

CHAPTER 3

METHODS

Study 1

Participants. Four students with a primary special education eligibility of moderate intellectual disabilities attending a public high school participated in this study (see Table 3 for psychometric characteristics). The selection criteria to participate in this study were based on age, disability, Individualized Education Program (IEP) goals, an inability to read the target words, informed parental consent, and an average daily attendance of at least 90%. All students had daily living and community goals in their IEP which were worked on at least twice a week. Students had mastered strategies for locating items in a store (i.e., walking up and down the aisles, and searching for items from top to bottom and left to right on the shelves), but none of the students had ever used an electronic device such as an iPhone to deliver their shopping list. Prior to this study, students needed a paper-based pictorial list or verbal directions from an instructor or parent while grocery shopping. All students had access to computers where they could type their personal information, play games, search the web, and operate a mouse. Students used a computer for work or recreation at least once a day.

Aiden. Aiden was a 19 year 2 month male student. He worked in the school cafeteria cleaning the tables and floors and he was learning to self-evaluate his work. He was able to express a preference for his next jobsite and requested work in a retail setting. He could tell time to the minute but was working on knowing when his work break started and stopped. Aiden could read 285 Dolch sight words and could recognize survival signs in the community. He used a picture list to shop for items and dollar plus to purchase them.

Miles. Miles was a 17 year 2 month old male student. He helped to clean the school cafeteria after breakfast and lunch, but he had not started to receive vocational training in the community. He used pictorial task analyses to follow a recipe and wash clothes. Miles received instruction on counting mixed coin and dollar combinations, telling time in 5-minute intervals, and increasing his sight word reading. He could read approximately 50 Dolch words and he could verbally label community signs. He used a picture list to grocery shop. He received speech/language services for 30 minutes a week because of his communication difficulties.

Cara. Cara was a 17 year 2 month old young woman. She trained for employment at a retail sports store where she stocked the shelves and cleaned. In the future, Cara wanted to work in a restaurant waitressing, busing tables, cleaning, and washing dishes. She was able to count mixed coins, use a calculator to perform basic math computations, and tell time using an analog watch. Cara was reading at level 1 of News-2-You articles and she could read approximately 250 Dolch words. She worked on having polite and appropriate conversations with peers, adults, and coworkers and independently shopping with a picture list without assistance from another adult.

Rita. Rita was a 20 year 10 month old young woman who hoped to work at a hair salon after she graduated. Currently, she worked hard at her school and community-based vocational sites busing tables and refilling condiment supplies. She had strong domestic skills in the areas of self-care, cleaning, preparing meals, and doing laundry. She was learning to take the city bus to familiar locations from home and school. In addition, she could tell time and knew when her

10-minute break at work was over. Rita had a functional sight word vocabulary of about 25 community words and needed a picture list to shop.

Prerequisite skills. Each student demonstrated the following prerequisite skills prior to the implementation of the study. Students had the necessary fine motor skills of sliding and pressing one finger to make accurate selections to operate an iPhone. These skills were learned and ultimately demonstrated during the time when the students participated in history training on how to use an iPhone. After the history training, all of the participants met this criterion. Gross motor skills were also needed to reach, grasp, and release variously shaped grocery items along with the ability to follow one step directions. Students were also able to comply with teacher requests such as “Bring me a box of pop tarts” or “Go get a loaf of bread” in the community setting (i.e., grocery store). Visual and auditory ability had to be within normal range in order to see and hear the iPhone. This was demonstrated by the iPhone history training and visual and auditory screening at school. Students were tested on their ability to retrieve grocery items displayed on the screen in photographic form or presented in auditory form in a grocery store. These items were different from the items used in the study. Students demonstrated their ability to locate items efficiently if they located items within 2 min of the discriminative stimulus (Hutcherson et al., 2004). Students were also assessed on their ability to match pictures of identity and nonidentity grocery items to the actual object. Finally, students needed to have the ability to attend to a task for at least 40 min (estimated community session length).

History training and screening. To ensure that students could physically operate an iPhone, history training occurred in a conference room across the hall from the student’s classroom before the study began. Students were taught how to navigate through electronic lists using the iPhone touch screen, both with and without additional supports (e.g., navigating from one picture to the next). The materials were e-text lists of grocery items presented on the iPhone and their corresponding physical item. No item used during history training was used during the actual study. Practice lists were composed of five items per level of support (i.e., 5 text only, 5 audio + text, and 5 pictures + text). When presented with an item in a text only format on the iPhone, students had to select the item from an assortment of 10 items on a table within 5 s. This was to ensure that students were attending to the text and could make textual matches. When the item was presented with text and audio support, students had to physically select the correct item after hearing the item read to them. Finally, when pictures were presented electronically with text, the students could view the picture and then select the same item from a variety of items on the table. For every trial, 10 items were presented on the table so 1 item matched the stimuli and 9 items acted as distracters. Students were provided with general praise for correct responses while incorrect responses were ignored. Students participated in history training until they achieved the criteria of at least three sessions at 100% correct across all conditions. Students were also taught to independently navigate to and through the different types of lists on the iPhone by selecting the appropriate application (i.e., Notes, iPod, and Photos) as well as to adjust the volume.

In addition to receiving history training, the students were also screened on their ability to read the list of grocery items prior to the study. A screening list of 131 grocery related items was first sent home to parents/caregivers so they could mark off any grocery items they never purchase (see Appendix A). The screening list was developed from a sampling of items found on different aisles of the grocery store. Items were selected from aisles containing cookies/crackers, condiments, cereal, detergents, and drinks/chips. The remaining items common on each student’s list were presented to the students individually to determine if they could read any of the words. Two prescreening sessions occurred in their classroom on different days during the first hour of the school day. Each word appeared on the laptop through PowerPoint one at a time and the students had 5 s to respond to each word. Finally the list was narrowed down to 90 items (i.e., 18 items from each of the 5 aisles) that each student could not read. This was the final bank of items used in the study (see Table 4). The large number of items was needed so each condition and each session had different items. No items were ever repeated. Each list included one item from each of the five aisles so the distance between items would be similar for each list. Duration data could then be collected and analyzed across conditions since students were always looking for items on the same five aisles during each condition. Items on each aisle were within close proximity to each other. Items were counterbalanced on the lists per condition according to the number of syllables in the name of the item.

Settings and arrangements. All sessions were conducted individually in a local grocery store 1.5 miles from the school. The store had 15 aisles that were approximately 21.34 m x 1.83 m. In addition, there was a large produce, bakery, and meat area along the right side of the store, a dairy section along the back wall, and a pharmacy in the front left corner. The store manager granted permission and arrangements were agreed upon before the start of the study. Sessions were conducted during the students' regular time allotted for community-based instruction. The researcher stood approximately 1 m behind the student and the reliability data collector stood behind her, both needed to be in view of the student and iPhone. The classroom teacher and paraprofessional instructed the rest of class on other skills not related to the study in other parts of the store or in a neighboring store.

Materials and equipment. The handheld electronic device used in this study was a first generation iPhone with Apple earbuds for each student. The iPhone was attached to a lanyard so the students could more easily access and keep up with it. The researcher's laptop computer, a Dell Latitude D830 (Intel Core 2 Duo CPU, T7500 @ 2.20GHz, 1.18 GHz, 3.50 GB of RAM), was used to record, organize, and upload audio and graphic files to the iPhone through iTunes 9. Audio files for each target item were recorded by each individual student through the Sound Recorder program on the researcher's computer. Audio files were between 2 s and 7 s in length. The text that appeared while the audio file was playing on the iPhone was in Times New Roman black font size 12 with a white background. The researcher created this textual image in Adobe Photoshop CS2 and then added it as artwork to each audio icon in iTunes. Figure 1 shows the iPhone display while the audio played through the iPod application. A photograph of each item was either gathered on-line from websites with royalty free photographs or photographed with a Casio Exilim digital camera (4.0 MP). Photos were approximately 5.08 cm x 7.62 cm on a white background. Each photo was labeled with the name of the item using Times New Roman black font size 12 in Adobe Photoshop CS2. Photos were stored in the photos application on the iPhone. Figure 2 displays an example of the picture + text condition on the iPhone. Words in the text only condition were typed into the Notes application on the iPhone so only one word appeared on the screen at a time (see Figure 3 for an example). Additional materials needed were a data collection sheet per participant (see Appendices B-E), two stopwatches, and a shopping cart.

Response definitions and data collection. Each session began with the attentional cue "Are you ready to go shopping?" provided by the researcher. The attentional response was the student saying "Yes" or nodding their head up and down. If the student did not respond to the attentional cue, the researcher repeated the cue every 30 s until the student was ready to work or intervened to determine the problem.

Students were then given the iPhone and the researcher instructed them to turn it on. They were told to find the appropriate application (Notes, Photos, or iPod) and list (e.g., Cara 1). The researcher provided the task direction, “Find all of the items on your list and put them in your cart.” The target behavior for the student was to locate the item that matched the target stimulus and put it in the shopping cart. Students had 10 min to locate all 5 items within a given condition (i.e., text only, audio + text, or picture + text) for a maximum session length of 40 min across all three conditions with time for inter-trial intervals and 2 min between conditions. Event recording was used as the method of data collection, since students had a specific number of stimuli to respond to within each session. Student responses were scored as correct, incorrect, no response, or duration error. A correct response was defined as independently locating the target stimulus and putting it in the cart during the 10 min condition length. An incorrect response was selecting an incorrect item while a no response was recorded if no selection was made because the student gave up looking. A duration error was recorded if the student was looking for the item but the time expired before a selection was made. Data were recorded to show the percentage of items correctly selected and the percentage and type of errors per session per condition.

Intervention efficiency was evaluated by observing and recording three additional measures. First, the total percentage of errors per condition was calculated (Davies et al., 2002a, 2003). Second, the duration for locating each item was recorded (Mechling & Gast, 1997; Riffel et al., 2005). As soon as the student placed an item in the cart, the time ended for that item. Time started again as soon as the student began pushing the cart towards the next item. The duration data not only provided the amount of time needed to locate each item, but it also provided an estimate of the session length per condition. A final measure included interval event recording to record the number of times the student looked at the iPhone for additional prompting while trying to locate each item (Davies et al., 2002a, 2003; Lancioni et al., 1998, 1999a, 1999b; Riffel, 2005). After the initial presentation of the discriminative stimulus, the researcher recorded the number of additional prompts needed to locate each item. The behavioral definition of "looking at the iPhone" was defined as holding up the iPhone and touching the screen or eyes viewing the screen. For example, if the student holding the iPhone looked at the screen, looked away, and then looked back at the screen, this was recorded as two prompts. Reliability data collectors practiced determining what was and was not considered looking at the iPhone during training sessions prior to the study with a student not participating in the study. These three measures helped determine the relative efficiency of audio support versus pictorial support used in conjunction with a handheld electronic device. Specifically, study 1 addressed the following research questions: a) will students with moderate intellectual disabilities independently locate items when presented with lists they helped to create on an iPhone in grocery store settings? and b) will students locate grocery items more efficiently with one type of list over another?

Experimental design. An alternating treatments design (ATD) was used to evaluate the relative effectiveness and efficiency of the treatments across four students (Barlow & Hayes, 1979; Gast, 2010). This design was appropriate given the research questions, reversible behaviors, and fact that the behaviors were not expected to be acquired but to be differentially performed based on the type of support. The behaviors were reversible because of the expectation for students' responses to drop back down to baseline levels when auditory or pictorial supports were not included (Hughes et al., 2006; Lancioni et al., 1995; Speed &

Lutzker, 1997). A general trend of acquisition was not anticipated since the supports were compensatory strategies rather than remedial strategies. This comparison study evaluated a functional relation between the dependent and independent variables using three separate but equal lists of items across sessions. The three lists were deemed separate but equally difficult based on the items making up the lists were equivalent in the same number of syllables (Schuster et al., 1992; Singleton et al., 1999; Wolery et al., 2000). Each list randomly selected one item from each of the five aisle categories to create five item lists.

Threats to internal validity were controlled through several means. One potential threat to internal validity common to multiple treatment designs is the threat of multiple treatment interference. The differences in salient stimuli and counterbalancing the order of conditions daily with no more than two consecutive sessions with the same order helped to control for this threat. Also including a text only (baseline) condition throughout the comparison study helped detect for multiple treatment interference and carryover effects. In addition, conditions required counterbalancing across sessions since three sessions, each with a different condition, were conducted per day (see following section called **Sequencing of conditions** for an explanation). Randomized lists were used during each session to reduce the testing threats of memorizing the order (see section on **Randomization of lists** for further details) and the participants were familiar with the researcher and iPhone prior to the study to reduce adaptation threats. The researcher participated in classroom activities for multiple days before the study began along with providing students with training on how to use the iPhone and prescreening the reading of grocery items. With the rapid, alternating conditions in this ATD, history threats were controlled to a minimal extent. The short time frame necessary to conduct this ATD study helped control for maturation. Attrition was controlled by the inclusion of 4 participants in the study.

Furthermore, the evaluation of interobserver reliability controlled for instrumentation threats while procedural reliability assessed the implementation fidelity of the independent variables (see section entitled **Reliability** for a detailed explanation). High reliability percentages increased confidence that the study was appropriately carried out in a reliable manner. The researcher, time of day, and setting remained constant throughout the study.

Visual analysis of the data helped determine the relative effects of the conditions on the intervention. Effects were demonstrated when one condition illustrated a more therapeutic data pattern for the primary dependent variable (i.e., percentage of correct responses) than the other conditions. If conditions were following similar data paths, then the one with a shorter total duration, lower percentage of errors, and fewer "looks" was considered the more efficient treatment.

Sequencing of conditions. Three sessions, each with a different condition, were conducted each day during the study. Conditions were randomly alternated with no more than two consecutive days with the same condition presented first. Conditions were also counterbalanced across students so all student were not receiving the conditions in the same order. See table 5 for the order of the conditions across sessions and students.

Randomization of lists. After screening parents and students for item familiarity and reading, a bank of 90 items was finalized with 18 items from each of the 5 aisle categories. Lists included five items (1 item per aisle) randomly selected to receive text and audio supports, another five items to receive text and picture supports, and another five to receive text only. Items were grouped according to the number of syllables and then randomly selected to create lists of equal difficulty yet similar in the number of syllables for each student.

Procedures. The sections below discuss the procedures before and during the study. Students helped create their shopping lists and were screened on their ability to read the lists prior to the study. During the study, a comparison phase was conducted to evaluate the text only, audio + text, and picture + text conditions.

Student-created lists. Students assisted in creating their own grocery lists prior to the implementation of the study. First, each student typed their text only lists into the Notes application on the iPhone. Only one word appeared on the iPhone screen at a time in 12 point font. The researcher provided each randomized list of items typed on a sheet of paper so the students could use it as a model to help with spelling. Second, each student recorded the names of their 30 randomly selected items receiving audio and text support using the Sound Recorder program on the researcher's laptop. Each item was saved as a separate file to allow the order of the items to be randomized throughout the study. Students independently typed the name of the item as shown by the researcher to label each file. Third, each student created their own pictorial lists by selecting the picture on the computer that corresponded to the item called out by the researcher. Students dragged each picture into the appropriate folder (e.g., Miles 1, Miles 2) resulting in each folder containing five pictures from the different categories. After the students created their audio and pictorial lists, the researcher uploaded the lists on the iPhone through iTunes 9.

Vocabulary reading pretest. Students were assessed on their ability to read each of the 90 items at the beginning of the study. This pretest was conducted to ensure that students had not learned the words while creating their shopping lists. The items were presented one at a time on the laptop using PowerPoint during classroom instructional time. Students were asked "What word?" and had 5 s to respond to each word. Correct responses were praised while incorrect responses or no responses were ignored. After every 5 words, students were given nonspecific praise for general attending throughout the session. If a student read a word correctly, then that word was replaced with an unfamiliar word in the study.

Comparison. In the grocery store, students were evaluated on their ability to locate the items on each type of list. Their iPhone presented a list of 5 target items from one of three possible conditions (text only, audio + text, and picture + text). The order of the three conditions was randomly counterbalanced across students and across sessions with no more than two consecutive sessions with the same order. The baseline condition of text only was included in the order alternation to evaluate multiple treatment interference. The presentation of all three conditions made up one session and one session was conducted each day with two or three sessions occurring per week.

Once in the store, the researcher gave the attentional cue of “Are you ready to go shopping?” and waited for the student to respond by saying “Yes” or nodding their head. The researcher told the student to turn on the iPhone and locate the appropriate app and list (e.g., Notes Rita 3, iPod Aiden 1, and Photos Miles 6). Then the researcher said “Find all of the items on your list and put them in your cart.” The student had 10 min to locate the items and put them in the cart for their first list of the day. Item selections were scored as correct, incorrect, no response, or duration error with verbal praise given to correct selections. Incorrect selections were placed back on the shelf by the researcher and followed by the researcher saying “What’s next?” No responses were ignored while the researcher said “Times up” when the student ran out of time for a duration error. Students were also praised after every fifth item for on-task behavior and appropriate performance on other related skills (e.g. pushing the cart and location strategies). The researcher concurrently collected duration data and the number of looks after the initial prompt. Students had a two minute break between conditions.

After the first five items in one condition were located or time ran out and 2 min had passed, the process was repeated with a different condition and a different set of five items. This was repeated a third time with the final condition and five items. The study continued for at least six sessions or until data stabilized demonstrating an experimental effect in favor of one treatment. This process was carried out across all 4 participants.

Study 2

Study 2 built on the results from Study 1 and specifically addressed the following research question: will students incidentally learn to read the text when the text is paired with audio or pictorial support over multiple sessions that incrementally increase in number or will using a computer-based program with simultaneous prompting and the student's "best" support as the controlling prompt transfer stimulus control to the text? This study assessed whether students would transfer stimulus control from their most effective and efficient support (e.g., pictures) in Study 1 to the text incidentally. Students were asked to read the word at the beginning of each trial before locating the item. If students did not respond correctly after being presented with the pictures for multiple sessions, students received computer-based instruction using simultaneous prompting (Wolery et al., 1992) to learn the words. Study 2 began one month after the completion of Study 1.

Participants. The same four students in Study 1 participated in Study 2 and they also needed the same prerequisite skills. For this 2nd study, students were prescreened on reading words and verbally labeling items. The reading list included some grocery items from Study 1 and some new items. This study encompassed items from aisles 1, 3, and 5 (cookies/crackers/candy, cereal, and condiments/storage respectively) in the grocery store which is why some new items were added to the list. Lists were individually developed based on the list of familiar items collected from parents in Study 1, student's reading ability and the ability of the researcher to equally counterbalance the items across word sets. Words were counterbalanced on number of syllables and first letter of the word, meaning each word set had two words with the same first letter. See table 6 for the three word sets for each student. Once the lists were finalized, students were shown a picture of each item on the computer with the name erased through Photoshop and asked to state its' name (see Figure 4 for an example). If students' did not recognize the item, they were taught its' name through simultaneous prompting until the student could independently label the item for two consecutive sessions on different days.

Settings. The grocery store in Study 1 was also used in Study 2 due to its close proximity to the school and being on the route of the city bus. Only aisles 1, 3, and 5 of the grocery store were used in Study 2 since each word set included items from one of these aisles. This was done to decrease the amount of movement through the store and to potentially decrease the amount of time per session. The researcher worked individually with the participant while the classroom teacher and paraprofessional worked with the rest of class on skills unrelated to the study.

If students required simultaneous prompting to learn the words, this instructional piece took place in the students' classroom. Students sat at a table in the back of the 9.14 m X 5.49 m classroom with the researcher's laptop in front of them and the researcher next to them one at a time. Students used their earbuds to listen to the PowerPoint slideshow while the rest of class worked on individually assignments at their desk with support provided by the classroom teacher and paraprofessional.

Materials. Students continued to use the first generation iPhone in the grocery store. The only applications needed in this study were Notes (text only) and Photos (picture + text) since the most effective and efficient support for all four students as identified from Study 1 was the picture + text support. The pictures and text were created and uploaded to the iPhone in the same manner as stated in the 1st study but this time the researcher completed the task. In order to decrease exposure to the pictures and text, students did not create their own lists in this study.

When students required simultaneous prompting to learn the words, a computer-based instructional program was developed using Microsoft PowerPoint. The instructional program included a test and training session. A test session included the random presentation of one word per slide for each of the five words in a set. Each word appeared at the top of the slide in 44 point Comic Sans MS font. This font matched the font of the text only words on the iPhone. The words were typed in black and the background was solid white. Each word was displayed to the student for 3 s and then automatically went to the next slide with the next word. Figure 5 shows screenshots from a test session. Immediately after the test session, students participated in a training session that contained each of the five words and the corresponding pictorial controlling prompt. The words and pictures were presented for three trials each. A slide with a target word was immediately followed by a picture of the item. Pictures ranged in size from 7.62 cm x 8.89 cm to 12.7 cm x 8.89 cm. The picture was displayed for 3 s so the student could respond before the slideshow automatically moved on to the next word and picture. Figure 6 displays screenshots from a practice session. The researcher sat beside the student during instructional sessions to provide praise for correct responses and to record the students' responses.

Response definitions and data collection. Grocery store and classroom sessions assessed different dependent variables which required different data collection methods. Both types of sessions evaluated the students' ability to read the words while only the grocery store sessions assessed the students' ability to locate the items. The following sections provide a more detailed description of these differences.

Grocery store sessions. The researcher provided the attentional cue "Are you ready to go shopping?" at the beginning of every grocery store session. The attentional response was the student saying "Yes" or nodding their head up and down. If the student did not respond to the attentional cue, the researcher repeated the cue every 30 s until the student was ready to work or intervened to determine the problem.

Students were then given the iPhone and the researcher instructed them to turn it on. They were told to find the appropriate application (Notes or Photos) and list (e.g., Cara 1). The researcher asked "What word?" and gave the student 3 s to respond (Alig-Cybriwsky et al., 1990; Campbell & Mechling, 2009; Mechling, Gast, & Krupa, 2007; Riesen et al., 2003). Event recording was used as the method of data collection, since students had a specific number of stimuli to respond to within each session. A correct response was the student verbally saying the word within 3 s of the task direction. An incorrect response occurred when the student said the wrong word. When the student did not say anything, a no response was recorded. Next, the researcher said, "Find the item" and started the stopwatch. The target behavior for the student was to locate the item that matched the target stimulus and put it in the shopping cart. Students had 2 min to locate each item within a given condition (i.e., text only or picture + text) for a maximum session length of 35 min including inter-trial intervals. Again, student responses were scored as correct, incorrect, or no response. A correct response was defined as independently locating the target stimulus and putting it in the cart within 2 min. An incorrect response was selecting an incorrect item while a no response was recorded if no selection was made. Data were recorded to show the percentage of words correctly read and items correctly selected. Duration data and the number of looks at the iPhone after the initial cue were also recorded similar to Study 1.

Classroom sessions. After the student was sitting in front of the laptop computer, the researcher provided the attentional cue "Are you ready to work?" The attentional response provided by the student was "Yes." If the student was not ready to work, the researcher waited 30 s and then restated the cue. This continued until the student was ready to work or the problem was identified.

Once the student was ready to work, the computer-based test session began. The computer asked "What word?" while presenting the target word on the screen. A correct response was recorded if the student verbally said the word within 3 s. An incorrect response was recorded if the student stated the wrong word. A no response was scored if the student did not say anything at all. This process was repeated for all five words within a word set.

Next, a computer-based training session began. Again the computer displayed a target word while saying "What word?" but then a picture of the word immediately appeared. Student responses within 3 s were correct, incorrect, and no response. The response definitions were the same as the ones during test sessions. This process continued until each of the five target words were presented three times.

Experimental design. A multiple probe design (Gast & Ledford, 2010) across three word sets and replicated across four students was used to evaluate the transfer of stimulus control from the picture to the text incidentally or through simultaneous prompting. This design allowed for intrasubject and intersubject direct replication. Intrasubject replication was possible by including three functionally independent yet similar word sets for each student. The inclusion of four students within the study made intersubject direct replication possible. Experimental control was evaluated by staggering the introduction of the independent variable across three word sets and by consistently observing changes in grocery store probes only after intervention or simultaneous prompting.

Staggering the introduction of the intervention across word sets helped control for multiple threats to internal validity. Covariation, history, and maturation would be more easily detected with the time lagged intervention introduction. The presentation of word sets varied across students to decrease order effects. Items on each grocery lists were randomly presented to reduce testing effects. Also procedural fidelity and instrumentation threats were controlled for through the collection of procedural and interobserver reliability. Observer retraining took place if there were low percentages (i.e., below 90%) of reliability.

Visual analysis of the data was used to determine whether a functional relation existed between the independent and dependent variables. Probe data should remain low and stable prior to intervention and only increase after the introduction of the independent variables. If students' probe data increases after the introduction of the pictures, then simultaneous prompting instructional sessions would not be needed. However, if probe data does not increase after the inclusion of the pictures, then computer-based sessions with simultaneous prompting were implemented until students could read the words. Grocery store probes were then conducted to check for generalization.

Procedures. This study began with grocery store probes before the intervention of picture + text was introduced. If students did not learn to read the word during intervention then computer-based instruction was implemented. Specific procedures for each phase are discussed below.

Grocery store probes. Grocery store probes took place immediately before and after the intervention phase and the computer-based instruction (CBI) phase when it was necessary. Probe sessions lasted for three sessions or until the data stabilized. Data stability was defined as 80% of the data falling within a 20% range. If students returned to baseline levels immediately after the picture + text phase, then only one probe session occurred before the implementation of computer-based instructional sessions.

Probe sessions randomly presented all 15 target words in the text-only condition. Randomization occurred by placing the words in a hat and randomly drawing one word at a time out to create the grocery list. Each student needed at least 12 randomized text only lists. Some students needed 15 lists if they required computer-based instruction to learn the words. The Notes application on the iPhone displayed one target word at a time.

After a student responded to the attentional cue “Are you ready to go shopping?” in an affirmative manner and found the designated list on the iPhone, the researcher asked “What word?” The student had 3 s to respond. If the student said the word correctly, then the researcher provided general praise and said “Find the item.” If the student said the word incorrectly or did not respond, then the researcher ignored the response and said “Find the item.” Students had 2 min to locate and select the item that matched the stimuli. Correct responses were praised while incorrect responses were placed back on the shelf by the researcher. When the 2 min were up and an item had not been selected then the researcher said “Times up. Go on to the next item.” The student then manipulated the iPhone to the next item and the process was repeated. The researcher provided general praise for on-task behavior after every 5 items. Students participated in no more than two sessions a day with at least 1 hr between sessions.

Intervention. After three stable probe sessions, students received the picture + text for items in word set 1. One session contained the 5 target words with a picture of each item presented one at a time. For Word Set 1, the criterion was 100% correct for 3 consecutive sessions with the first two sessions on a continuous reinforcement schedule (CRF) and the third session thinned to a fixed ratio (FR) schedule after five words (Cooper, Heron, & Heward, 2007). If a student required CBI then for Word Set 2, the criterion was incrementally increased to 100% correct for 5 consecutive sessions (CRF for 3 sessions and FR5 for 2 sessions). For Word Set 3, the criteria increased to 100% correct for 7 consecutive sessions (CRF for 4 sessions and FR5 for 3 sessions). The criteria for each word set increased in order to determine if the number of stimulus presentations with a picture made a difference in helping the student transfer stimulus control from the picture to the text. However, if students correctly read the words after intervention which meant they did not need CBI, then the criteria for each remaining word sets were the same as Word Set 1 (i.e., 100% correct for 3 consecutive sessions). This meant that a student learned to read the words after only 3 sessions with pictures + text so there was no need to increase the number of sessions. Words were randomly presented in each session to keep students from memorizing the lists.

Intervention sessions began with the same attentional cue and response as probe sessions. Once the students located the Photos application and selected their appropriate list for the session (e.g., Rita H or Cara D), the researcher said “What word?” while the student saw the word and picture. Students had 3 s to respond. The researcher praised correct responses and said “Find the item.” For incorrect responses or no responses, the researcher ignored the response and asked the student to “Find the item.” Students had 2 min to locate the item and put it in their shopping cart. For correct selections, the researcher followed the reinforcement schedule described above. For incorrect selections, the researcher placed the item back on the shelf. When no selection was made during the 2 min, the researcher said “Times up. Go on to the next item.” This process continued until all five target words with pictures were presented. Students received general praise related to their shopping skills at the end of a session. No more than 2 intervention sessions occurred in one day with at least 1 hr between sessions.

Computer-based instruction. If students did not achieve the criteria of at least 80% correct words read from Word Set 1 during the probe session following intervention, then students received computer-based instruction using simultaneous prompting to learn the words from that set. Computer-based lessons included a daily test and training session. Microsoft PowerPoint was the software delivering both sessions while the researcher provided praise for correct responses and recorded data.

A daily test session was conducted prior to each training session to assess acquisition of the target words without the presentation of the controlling prompt. Each target word was presented one time. The researcher provided the attentional cue “Are you ready to work?” and the student had to provide the attentional response “Yes” before the text-only presentation of the first target word. Students had 3 s to say the word before the slideshow automatically presented the next word. Correct responses were praised on a continuous reinforcement schedule while incorrect and no responses were ignored by the researcher. Criterion was set at 100% correct responding for 3 consecutive test sessions (Fickel, Schuster, & Collins, 1998; Singleton, Schuster, & Ault, 1995; Singleton et al., 1999; Tekin-Iftar, Acar, & Kurt, 2003).

A training session took place immediately after a test session. Training sessions used simultaneous prompting to teach the words with a picture as the controlling prompt. A picture was selected as the controlling prompt because all four students were more effective and efficient grocery shopping with pictorial prompts in Study 1. Each of the five target words were randomly presented three times for a total of 15 trials during a training session. Each word was presented once during the first five trials, a second time during trials 6-10, and a third time during trials 11-15. No words were presented back to back.

The session began with a slide reading the text “Practice.” The second slide presented the first word and immediately a picture of the word was displayed. The student had 3 s to respond to the word. The researcher praised correct responses and ignored incorrect or no responses. After the 3 s, the next word and picture were displayed. This process continued until all 15 trials occurred. Students’ cooperative behavior and attention to the task were praised at the end of each training session. All computer-based lessons were conducted in a 1:1 arrangement with the researcher in the back of the classroom. No more than two computer-based lessons occurred in one day with at least 1 hr between sessions.

Reliability

To protect against instrumentation and procedural infidelity threats to internal validity, data were collected on interobserver and procedural reliability respectively. It is recommended that interobserver agreement (IOA) be collected on each dependent variable across each student in at least one session per phase (Horner et al., 2005). Percentages above 90% are ideal in leading readers to believe that the behavioral definitions were clear defined and consistently measured. When procedural reliability is collected and reported, it provides confidence that the implementation of the procedures and technology were consistent throughout the studies. Researchers can reduce reliability errors by operationalizing behaviors and procedures, providing initial training and re-training during the study if necessary, and reporting fidelity measures for each component within a session (Horner et al., 2005; Vollmer et al., 2008).

Interobserver and procedural reliability data were collected during 30% of all sessions or at least once per phase for all students (whichever was greater). Reliability data were collected by a colleague with a master's degree in special education and the classroom paraprofessional. They were trained on how to collect reliability data for the target responses with a student not participating in the study prior to the start of the study. During this time, they became familiar with the process and data collection sheets. If low reliability was reported (i.e. below 90%) during the study, the observer was retrained on the specific procedures and target behavior definitions.

Interobserver reliability. The point-by-point method was used to calculate interobserver agreement. This method divides the number of researcher and observer agreements by the number of agreements plus disagreements and multiplying by 100 (Gast, 2010; Tawney & Gast, 1984). The mean interobserver agreement in scoring students' accuracy responses, duration per item, and number of looks at the iPhone was reported for each student along with the range. For duration, an agreement was defined as ± 1 s between the two raters. Anything larger than a 1 s difference was scored as a disagreement.

Procedural reliability. The observer also recorded whether or not the researcher reliably followed the procedural protocol clearly stated in the studies (see Procedural Reliability Data Sheets in Appendices F and G). Procedural reliability was calculated by dividing the number of observed researcher behaviors by the number of opportunities to emit the behavior and multiplying by 100 (Billingsley, White, & Munson, 1980). The mean procedural reliability across all phases for each student was reported along with the mean reliability for each step across each student. Furthermore, all lists presented on the iPhone were independently tested and evaluated by a colleague in the special education department who collected IOA to ensure consistent responding and navigation.

Social Validity

Social validity provides documentation that the change in the dependent variable is socially important and the independent variable is practical (Wolf, 1978). Being able to shop with a self-created list is an important independent living skill. The use of an electronic device such as an iPhone can potentially make this process easier and more realistic for students with moderate intellectual disabilities. Parents, teachers, and students were surveyed to ensure that the objectives, intervention, and outcomes meet the needs of the consumers.

Prior to the start of the study, the parents or caregivers of each student were given a list a grocery items (see Appendix A for the list) and were asked to “Mark off any item you never buy at a grocery store.” The remaining items on the lists were combined to develop the prescreening reading list which was later narrowed down to 90 items all four students could not read. Parents and caregivers were involved in this process to ensure that the items in the study were familiar to the participating students and likely to be shopped for in the future.

After the completion of the studies, social validity was collected from the caregiver, teacher, and student on the purpose and outcome of the study. A questionnaire was sent home for the student’s caregiver to fill out and then return to school within a few days (see Appendix H for the questionnaire). The classroom teacher and participating students were individually interviewed (see Appendices I and J respectively).

Table 3
Psychometric Characteristics of Participants

Name	Age	IQ Scores	Adaptive Behavior Measures	Reading Score
Aiden	19.2	Stanford-Binet V Verbal: 43 Nonverbal: 43 Working memory: 48 Visual-Spatial Processing: 50 Full-scale: 40	ABAS-II Composite: 66 Conceptual: 51 Social: 81 Practical: 69	Woodcock Reading Mastery Tests - R Letter identification: 48 Word identification: 50
Miles	17.2	Stanford-Binet V Verbal: 43 Nonverbal: 46 Working memory: 57 Visual-Spatial Processing: 48 Full-scale: 42	ABAS-II Composite: 67 Conceptual: 63 Social: 86 Practical: 78	WRAT-IV Word reading: 55
Cara	17.2	WISC-III Verbal: 52 Non-verbal: 50 Overall: 48	Vineland Communication: 56 Daily living skills: 54 Socialization: 69	Woodcock Reading Mastery Tests - R Letter identification: 48 Word identification: 50
Rita	20.10.	DAS Verbal: 53 Nonverbal: 52 Spatial: 50 Speech nonverbal: 48 General conceptual ability: 46	Vineland Communication: 51 Daily living skills: 59 Socialization: 71 Composite: 58	Woodcock-Johnson III Letter-word identification: <20 Passage comprehension: <20 Brief reading: <20

Age: Chronicological age at start of the study
ABAS-II: Adaptive Behavior Assessment System - 2nd edition
WRAT-IV: Wide Range Achievement Test - 4th edition
WISC-III: Wechsler Intelligence Scale for Children - 3rd edition
DAS: Differential Ability Scales

Table 4
Bank of grocery items

Aisle 1 Cookies/Crackers	Aisle 3 Cereal	Aisle 5 Condiments	Aisle 10 Detergent	Aisle 12 Chips/Drinks
Fudge Stripes	Reese Puffs	Sweet Baby Ray's sauce	Dawn	Fanta
Cheese Nips	Cocoa Krispies	Creamy Buttermilk	Gain	Cape Cod
Toasteds	Mini Wheats	KC Masterpiece	Surf	Fritos
Triscuit	All Bran	Famous Daves Sauce	Purex	Pringles
Sandies	Grape Nuts	Hellman's mayo	Woolite	Fresca
Zesta	Wheaties	Worcestershire sauce	Ivory	Munchos
Town House	Crispix	Miracle Whip	cascade	Fruitopia
Cheez it	Smart Start	Peppercorn Ranch	Ajax	Hawaiian Punch
Snack Wells	Froot Loops	Thousand Island	Planet	Mello Yello
Fig Newtons	Special K	Grey Poupon	Oxi Clean	Mountain Dew
EL Fudge	Golden Crisp	Tartar Sauce	Palmolive	Minute Maid
Teddy Grahams	Fiber one	Poppy Seed	Spray n Wash	Doritos
Nilla Wafers	Product 19	Catalina	Arm & Hammer	Snyder Pretzels
Vienna Fingers	Fruity Pebbles	Creamy Caesar	Finish dish soap	Sierra Mist
Famous Amos	Cracklin Oat Bran	Horseradish Sauce	Auto dish soap	Canada Dry
PepperRidge Farm Milano	Life	Heinz 57	Cheer	Lays
Barnum Animal Crackers	Kix	Kroger Classic Whip	Wisk	Crush
nutter butter crème patties	Trix	Sticky Fingers Sauce	Joy	Utz

Table 5
Order of conditions for each student

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6	Session 7	Session 8
Aiden	Picture	Picture	Audio	Text	Text	Audio		
	Text	Audio	Text	Audio	Picture	Picture		
	Audio	Text	Picture	Picture	Audio	Text		
Miles	Audio	Audio	Text	Text	Picture	Picture	Audio	Picture
	Picture	Text	Picture	Audio	Text	Text	Text	Audio
	Text	Picture	Audio	Picture	Audio	Audio	Picture	Text
Cara	Audio	Picture	Audio	Text	Picture	Text	Picture	Audio
	Text	Audio	Picture	Picture	Audio	Audio	Text	Text
	Picture	Text	Text	Audio	Text	Picture	Audio	Picture
Rita	Picture	Picture	Audio	Audio	Text	Text		
	Audio	Text	Picture	Text	Picture	Audio		
	Text	Audio	Text	Picture	Audio	Picture		

Table 6
Items in each word set across each student

	Word Set 1 from aisle 1	Word Set 2 from aisle 3	Word Set 3 from aisle 5
Aiden	Oreo	Cheerios	Italian
	Fudge Stripes	Crispix	Olives
	Fig Newtons	Wheaties	Plastic wrap
	Triscuit	Granola	Aluminum Foil
	Famous Amos	Great Grains	Thousand Island
Miles	Oreo	Cheerios	Mayonnaise
	Raisins	Rice Krispies	Mustard
	Snickers	Froot loops	Pickles
	Skittles	Frosted flakes	Salsa
	Teddy Grahams	Lucky charms	Ranch dressing
Cara	Oreo	Granola	Saran Wrap
	Twix	Total	Raid
	Snickers	Wheaties	Miracle whip
	Skittles	Great Grains	Foil
	Twizzlers	Reese Puffs	Zip loc bags
Rita	Gold fish	Rice Krispies	Pickles
	Cheez it	Froot loops	Mustard
	Snickers	Cheerios	Ketchup
	Animal crackers	Frosted flakes	Mayonnaise
	Raisons	Lucky charms	Olives

Figure 1. Example of audio + text condition displayed on the iPhone.

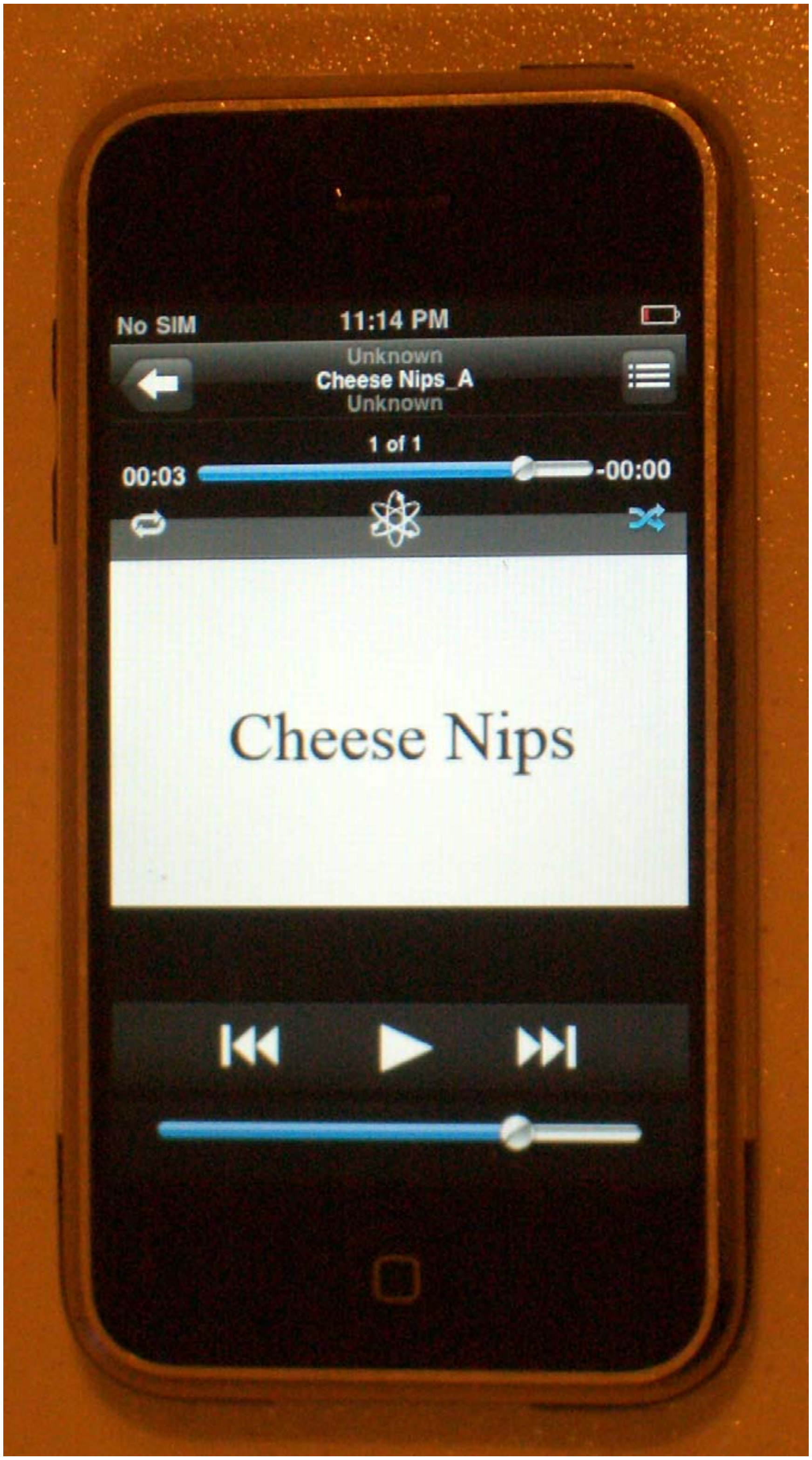

No SIM
11:14 PM
Unknown
Cheese Nips_A
Unknown
1 of 1
00:03
-00:00
Cheese Nips

Figure 2. Example of picture + text condition displayed on the iPhone.

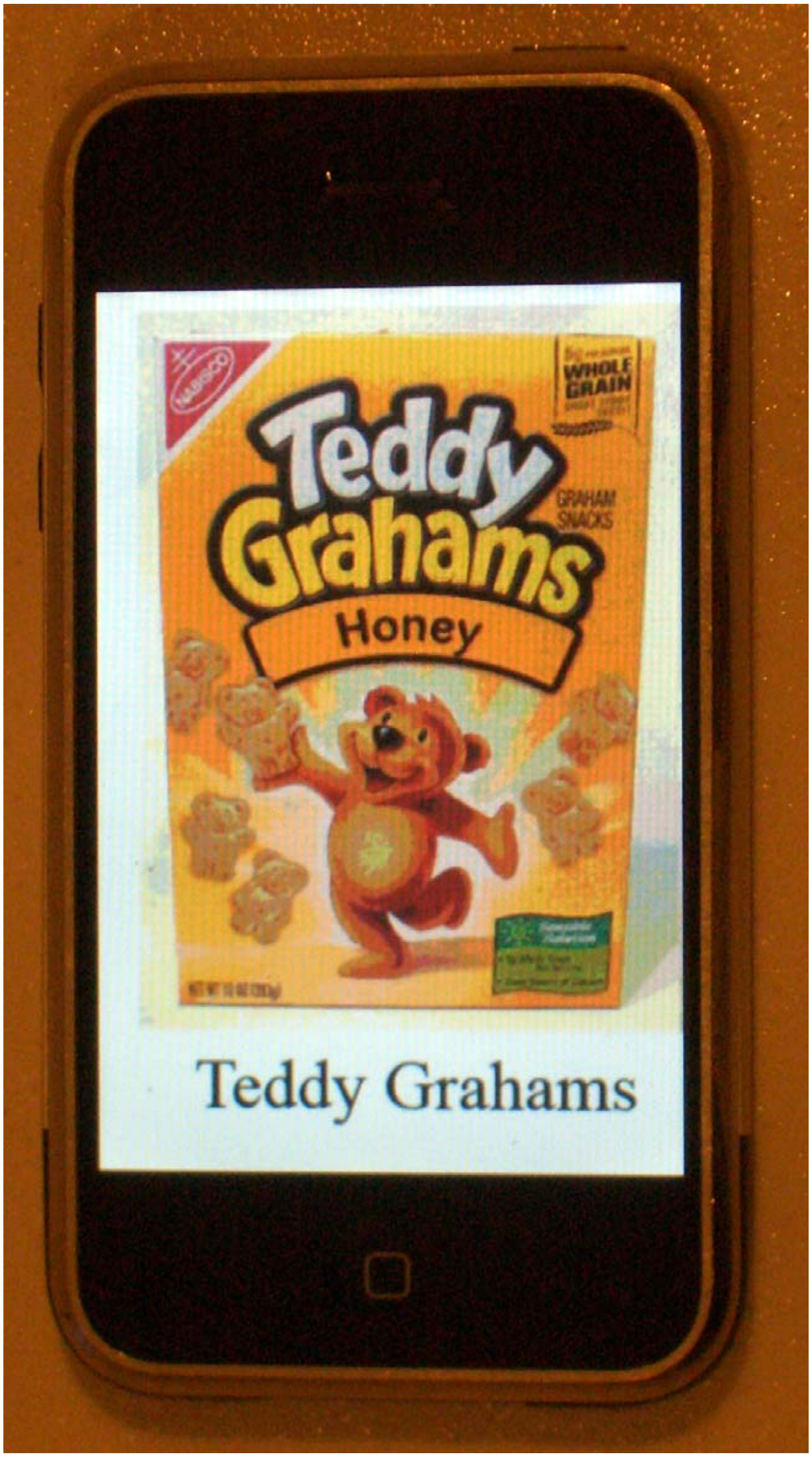

Teddy
Grahams
Honey
GRAHAM
SNACKS
WHOLE
GRAIN
Teddy Grahams

Figure 3. Example of text only condition displayed on the iPhone.

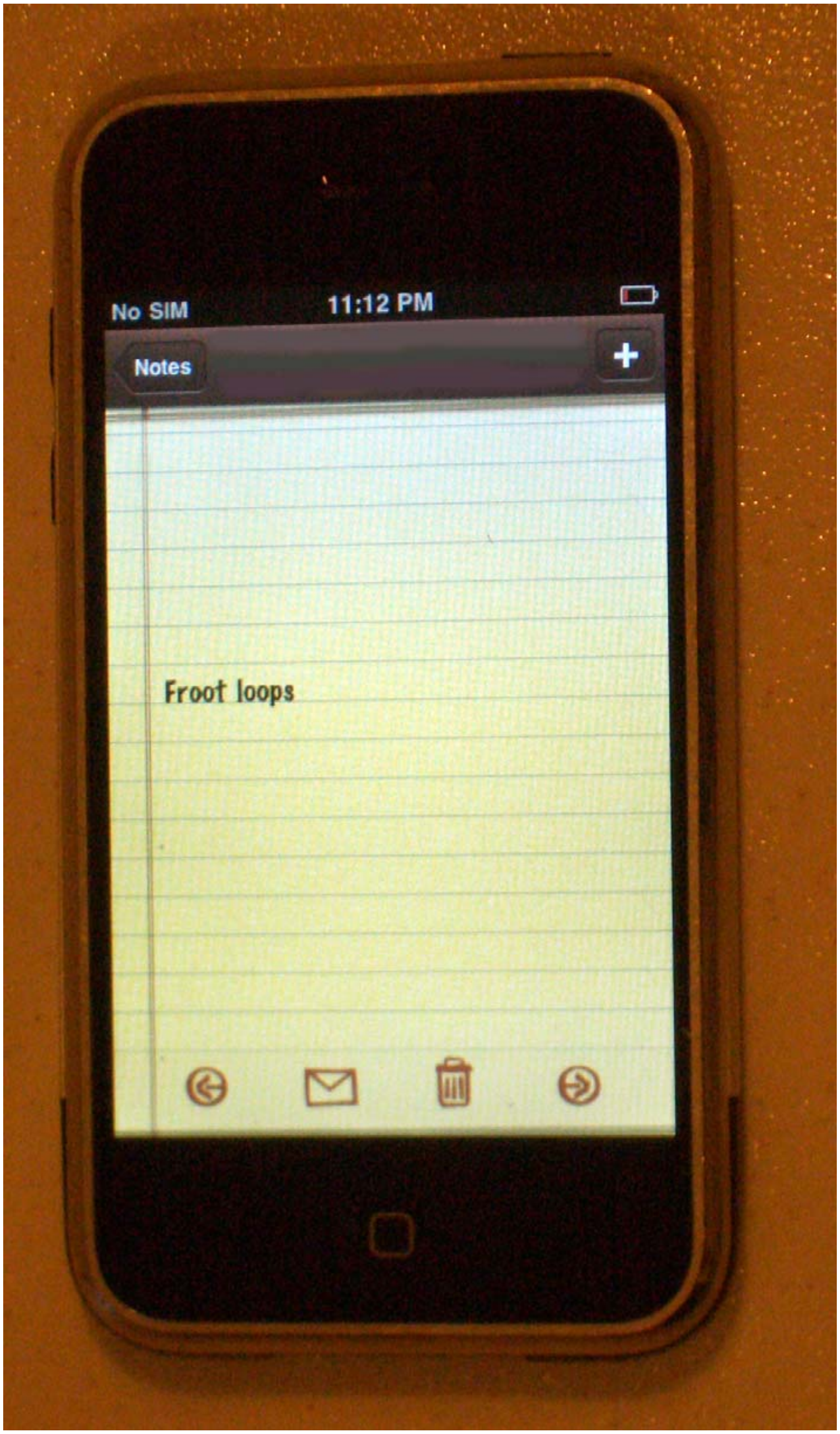
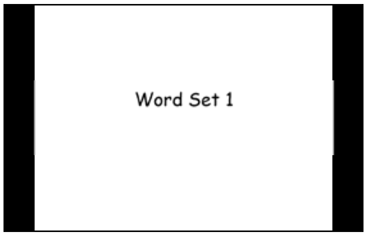
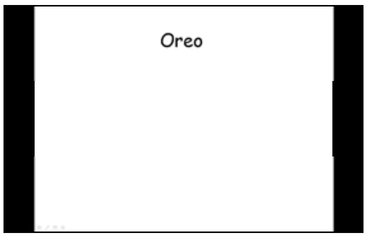

No SIM
11:12 PM
Notes
Froot loops

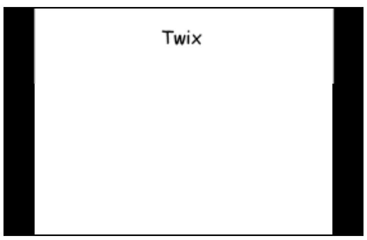
Figure 4. Example of item with name erased to prescreen for item recognition.

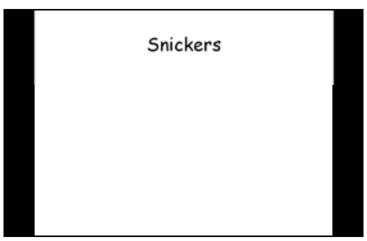

NABISCO
4 paquetes
La galleta más vendida del mundo
La auténtica OREO

Figure 5. Screenshots from a test session.


Word Set 1


Oreo


Twix


Snickers


Skittles

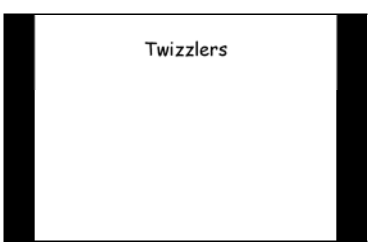
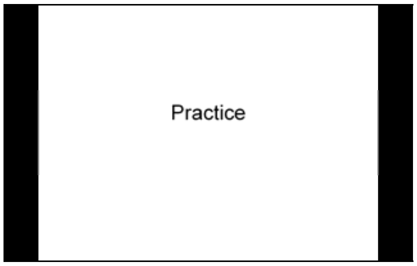
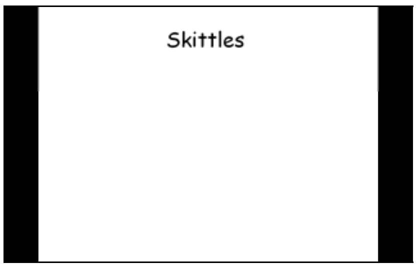
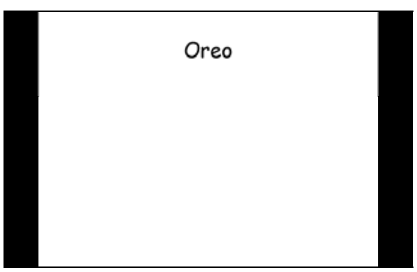

Twizzlers

Figure 6. Screenshots from a training session.


Practice


Skittles


Skittles
Skittles


Oreo


Oreo
OREO

CHAPTER 4

RESULTS

Study 1

The purpose of this study was to compare the effects of three different types of self-created grocery lists presented on an iPhone to locate grocery items. In addition to evaluating accuracy data, the percentage of errors, duration to locate items, and number of extra prompts were evaluated to assess efficiency. The rationale for this study was to determine if students could use an electronic device such as an iPhone to assist with their shopping and which type of e-text supported list was most effective and efficient. The results showed pictures + text providing more support which led to greater accuracy and faster acquisition than audio + text or text only across all four students. The following sections present the results in terms of reliability, accuracy, errors, duration, and extra looks at the discriminative stimulus. Social validity data collected from the parents, teachers, and students are presented at the end of the chapter.

Inter-observer reliability. Inter-observer reliability was collected during 33% of the sessions for Aiden and Rita while Miles and Cara had reliability collected during 37.5% of their sessions. Inter-observer agreement (IOA) was calculated on three dependent measures (accuracy, errors, duration, and looks). IOA equaled 100% on accuracy and errors for each student. For duration, Aiden's IOA was 100%, Miles' was 94.9% (range 84.6 - 100), Cara's was 95.4% (range 92.9 - 100), and Rita's was 91.6% (range 90.9 – 92.3). The low duration agreement for Miles occurred during his last session when the observer was using a different stopwatch from prior sessions. Due to a battery failure in the original stopwatch, the observer used a stopwatch on a cell phone during this final session. The stopwatches were calibrated together, but the start and stop buttons were not as easy to access which resulted in a data discrepancy. Collecting data on the number of additional looks at the iPhone resulted in IOA of 96.9% (range 96.8 - 96.9) for Aiden, 92.6% (range 92.2 – 93.3) for Miles, 84.3% (range 66.6 – 93.3) for Cara, and 92.9% (range 85.7 - 100) for Rita. Cara's low agreement of 66.6% during session 6 was the result of an unusual number of extra shoppers in the store which occasionally blocked the view on one of the observers. The two observers tried to stay in view of the student and iPhone without overcrowding the student or getting in the way of other shoppers.

Prior to the start of the study, one observer checked the iPhone to ensure that the lists appeared and operated in the appropriate manner. Auditory lists needed to be heard in addition to seeing the words. Pictorial lists needed the picture and text to be visible on the screen. Text only lists required one item to be shown at a time. The observer also checked for spelling accuracy and list composition accuracy in relation to the data sheets.

Procedural reliability. The collection of procedural reliability was simultaneous with the collection of inter-observer reliability. Procedural reliability was collected during 33% of the sessions for Aiden and Rita and during 37.5% of the sessions for Miles and Cara. Procedural reliability equaled 100% during each session data were gathered and across all four students. Subsequently, procedural reliability on each individual step also equaled 100% across all students.

Accuracy. Figures 7-10 display the percent of correct item selections across all three conditions in each daily session for the four students to answer research question 1 from Study 1 stated on page 11. Data were collected over 6 sessions for Aiden and Rita and then across 8 sessions for Miles and Cara. Miles and Cara required two additional sessions due to the upward trends and percent of overlap in the auditory condition for each student respectively. On the graphs, open circles represent the text only condition, closed triangles represent audio + text, and open squares represent picture + text.

Aiden. Figure 7 shows Aiden's percent of correct responding after the presentation of the discriminative stimulus across the three conditions. He responded at 100% correct for all but one session in the pictorial condition which went down to 80% correct (mean percentage correct was 96.67%). He could not find his last item, Cape Cod potato chips, within the 3 remaining minutes. Aiden's data paths for the auditory and text only conditions were the same except during the first session (60% and 20% correct respectively). After the first session, the remaining sessions ranged between 20% and 40% correct. The mean percentage correct in the audio condition was 33.33% while it was 26.67% in the text only condition. The percentage of nonoverlapping data (PND) for picture + text to audio + text was 100% and also 100% in comparison to text only. When comparing audio + text to text only, PND was only 17% since all but one data point overlapped.

Miles. The percent of correct item selections for Miles is displayed in Figure 8. Within the pictorial condition, Miles responded at 100% correct across all 8 sessions. During the audio condition, Miles had two upward trends ranging between 40% and 100% correct which resulted in data being collected for two additional sessions. The data did level out with a mean percentage of correct responding at 67.5%. In the text only condition, data ranged between 20%

and 60% correct with a mean percentage at 30%. The PND for picture + text to audio + text was 88% and 100% in comparison to text only. When comparing audio + text to text only, the PND was 88%.

Cara. Figure 9 presents Cara's percent of correct responding across each condition. All sessions except for one (session 2) receiving the text + pictorial support was at 100%. The mean percentage of correct responds equaled 97.5%. Her correct responding in the audio + text condition ranged from 60% to 80% with a mean percentage of 67.5% correct. Her data in the text only condition was more variable ranging between 0% and 60% with a mean of 30% correct. Due to the variable and overlapping data in the first half of the sessions, data were collected over eight sessions. Data did not overlap during the last four sessions. When comparing picture + text to audio + text, the PND was 88% and comparing picture + text to text only, the PND was 100%. The PND for audio + text to text only was 75%.

Rita. Figure 10 shows the data on Rita. She responded at 100% correct across all sessions with the picture + text support. Her percent correct in the audio + text condition ranged from 20% to 60% with a mean of 30%. In the text only condition, she only found two items across all sessions. Her range was 0% to 20% correct and the mean was 6.67% correct. Her PND for picture + text to audio + text was 100% and also 100% in comparison to text only. When comparing audio + text to text only, PND was 83% since only one data point overlapped.

Errors. Table 7 displays the total number of errors in each error category (i.e., incorrect, no response, or duration errors) across students to answer research question 2a on page 11. An incorrect was scored when a student selected an item that did not match the discriminative stimulus. A no response was scored when the item was not found because the student stopped looking or said they could not find the item. When a student was looking for an item and the 10 min ran out, the respond was scored as a duration error. Each student made the most errors during the text only condition while fewer errors were made during the audio + text condition. The picture + text condition had the fewest errors of the three conditions across each student. Two students (Miles and Rita) did not make any errors during the picture + text condition while the other two students (Aiden and Cara) only made one error each.

The majority of Aiden's errors across all conditions were categorized as duration errors at 63% of his overall errors. Only 21% of his errors were categorized as no response and 16% were incorrect responses. The majority of Miles' errors were also duration errors at 44%, but he also had a relatively high percentage of incorrect errors (33%). Twenty-two percent were no response errors. On the other hand, Cara and Rita made more no response errors (64% and 56% respectively) than any other type of error. Cara made 6% of incorrect errors and 30% of duration errors. Rita responded incorrectly for 9% of her errors and time ran out for 35%.

When comparing the percent of correct responses to the percent of errors (see Figure 11), each student had a lower percentage of corrects to errors in the text only condition. The same was true for Rita in the audio + text condition, but for the other three students there was a higher percentage of corrects. In the picture + text condition, all students responded correctly for at least 96.7% of the opportunities which meant the percentage of errors was 3.3% or less. Miles and Rita did not make any errors when the picture support was provided.

Duration. The duration to locate each item was collected to determine the rate of correct responses per minute (see Figures 12-15) and a mean session length across each condition was calculated along with the median and range (see Table 8). These data attempted to answer question 2b stated on page 11. The rate was calculated by dividing the number of correct responses by duration to locate items. Students had a maximum of 10 minutes to locate all 5 items. In figures 12-15, the open circles represent the text only condition, closed triangles represent audio + text, and open squares represent picture + text. All students had a higher rate during the picture + text condition. The mean session length was calculated by dividing the total amount of time spent in one condition by the total number of sessions. Consequently, the mean session length for text only and audio + text were about the same for each student and then all students were faster with picture + text. The median session length was calculated by dividing the two times that fell in the middle of the range by 2. The range was the shortest and longest amounts of time within a condition.

Aiden. Aiden's rates ranged from 0.40 to 0.94 with picture supports and no overlap with the other two conditions (see Figure 12). Sessions were 8.8 minutes long on average. His range with audio supports was 0.10 to 0.46 and with text only 0.10 to 0.20. The average session length was approximately 10 minutes and 9.46 minutes for each condition respectively.

Miles. The picture + text condition ranged between a rate of 0.54 to 1.00 for Miles (see Figure 13). Audio + text ranged from 0.20 to 0.66 and text only ranged from 0.10 to 0.30 with only 1 data point overlapping. His sessions averaged 10 min (text only), 9.47 min (audio + text), and 6.66 min (picture + text).

Cara. Figure 14 illustrates Cara's picture + text rate ranging between 0.62 and 1.66 with an average session length of 5.25 min. Her audio + text rate ranged from 0.30 to 0.73 with an average session length of 8.69 min. In text only, her rate was between 0.00 and 0.45 with a 9.00 min average session length.

Rita. Rita's highest correct response rate was during the pictorial condition with a range of 0.52 to 1.03 (see Figure 15). Her average session length during this condition was 6.62 min.

The average length for text only and audio + text conditions were 10 min each. The audio condition ranged from 0.10 to 0.30 and the text only condition ranged from 0.00 to 0.10.

Extra prompting. The number of additional prompts or "looks" at the iPhone was collected to determine if one type of support required more or less prompting than other type in answering question 2c on page 11. Data were totaled across all sessions within each condition and are displayed in Table 9 along with the number of correct responses and errors. Although the number of looks was variable across conditions, the average number of additional prompts per item was similar. Figures 16-19 display the number of looks per minute across each condition for each student.

Aiden and Cara looked at the iPhone more during the text only condition than any other condition. They also had the most errors and fewest correct responses in this condition. Since students could not read the word, they were trying to match the text on the iPhone to the text on an item. They appeared to be intent on finding a match which resulted in students looking at the iPhone often. Aiden averaged 8 looks per item he tried to locate with text only, 5 looks per item with audio, and 4 looks per item with pictures. Cara averaged 4 looks per item with text only and 3 looks per item with audio + text and picture + text. The average was calculated by dividing the total number of looks during a condition by the number of items attempted to be found. It appeared that both Aiden and Cara required fewer additional prompts as their accuracy increased and their errors decreased.

In a similar fashion, Rita would say the first letter of the word out loud, pick an aisle, and look for that letter on an item during the text only condition. However, she looked at the researcher multiple times for a prompt while walking up the aisle. If by chance she found an item with the first letter she was looking for, she would stop and look at her iPhone to see if it matched. She stayed on that one aisle until time ran out or she gave up and went on to the next word. Rita had the fewest number of looks overall was during the text only condition (averaged out to be 3 looks per item). Her average number of looks per item during the picture condition was also 3 even though more looks were recorded (98) and correctly located. She looked at the iPhone 88 additional times after the presentation of the discriminative stimulus during the audio + text condition. This averaged out to be 4 looks per item.

Miles had 219 looks during the text only condition, 267 during the audio condition, and 183 during the picture condition. This averaged out to be about 7 additional looks at the iPhone per item he tried to find in text only and audio + text. Miles had the fewest looks, fewest errors, and most correct selections when supported with pictures. He averaged 5 looks per item with picture supports.

Study 2

The purpose of this study was to evaluate when students were able to transfer stimulus control from the picture to the text. The rationale was to determine if students would learn to read the target words incidentally after the presentation of the picture and text multiple times or if students would require specific instruction using simultaneous prompting through a computer program to learn the words. The results varied by student. Aiden learned to read the words in each set incidentally while Miles and Rita required simultaneous prompting with a picture as the controlling prompt to learn the words in each set. Cara learned to read Word Sets 1 and 3 incidentally and Word Set 2 through simultaneous prompting. The following sections present the reliability and accuracy data.

Inter-observer reliability. To control against instrumentation threats, inter-observer agreement (IOA) was collected during each phase of the study. In grocery store probe sessions, IOA was collected on the accuracy in recording responses to “What word?” and locating items. IOA on these two dependent measures was collected during 33% of Aiden’s sessions, 47% of Miles’ sessions, 36% of Cara’s sessions, and 27% of Rita’s sessions. The observers agreed on all trials across each session and measure for 100% IOA. During intervention, IOA was evaluated during 33% of the sessions across each student. IOA was 100% for recording students’ accuracy in saying the words and locating the items for each student. During CBI, agreement was assessed on the scoring of students reading the words. One session consisted of a test and training session. Data was collected during 30% of the sessions for Miles, 40% for Cara, and 29% for Rita. There was 100% agreement during all sessions. The high IOA scores help increase the believability of the results from each study.

Procedural reliability. To monitor adherence to procedural protocols, procedural reliability was collected and evaluated throughout the study. The mean procedural reliability for each student across all phases was 100%. The rater observed all of the steps during each session so the mean procedural reliability for each step was also 100%. Reliability was evaluated during at least one session of a phase. Reliability was collected during 33% (Aiden), 26% (Miles), 32% (Cara), and 29% (Rita) of the sessions.

Accuracy. Students were evaluated on their accuracy in reading words and locating items in a grocery store during the 2nd study (see Figures 20-23). The data attempted to answer the two research questions for Study 2 found on page 11. The graphs display the percent of correct items read and located within each word set across all phases of the study (grocery store probes, intervention, and CBI). During grocery store probes with text only, closed squares represent the percent of correct words read and open circles represent the percent of correct items located. During intervention with pictures and text, closed triangles symbolize the percent of words correctly read and open squares symbolize the percent of items correctly located. In CBI with simultaneous prompting, open diamonds denote the percent of correct words read during the test sessions prior to instruction. The results show that Aiden learned the words after three sessions of the picture + text intervention. Cara read two words sets after intervention, but she needed CBI with simultaneous prompting for Word Set 2. Miles and Rita could read the words only after CBI with simultaneous prompting. These four students benefited from different instructional methods to learn 15 new words.

Aiden. Across each word set, Aiden's grocery store probe data for reading words remained at zero until the intervention was introduced (see Figure 20). With the picture support, Aiden immediately read the words correctly at 100% for 3 consecutive sessions. This behavior continued when the pictures were removed and Aiden only saw the text. He continued to read the words correctly in the grocery store probes following intervention.

Similarly, the data on the percent of items correctly selected followed the same data path as the percent of words correctly read. Aiden only located one item (i.e., bottle of Thousand Island salad dressing) one time prior to intervention. During and after intervention, Aiden correctly located all items across each set.

Miles. Prior to the inclusion of pictures in the intervention phase, Miles did not read or locate any items (see Figure 21). When the pictures and text were presented for Word Set 1, Miles read the words and located the items at 100% correct for 3 consecutive sessions (2 sessions with CRF and 1 session with FR5). However, after removing the picture and only presenting the text, Miles' accuracy for both measures returned to zero. He was unable to transfer control from the picture to the text incidentally so he needed additional instruction on the words. He ended up participating in 6 CBI sessions with simultaneous prompting with Word Set 1 to reach the criteria of 100% for 3 consecutive sessions. After achieving this criterion, he returned to the grocery store to check for generalization. He was able to read the words and locate the items in set 1 at 100% for 3 consecutive sessions and then the behavior maintained throughout the rest of the grocery store probe sessions in the study.

Even though Miles could read the words in set 1, he continued to perform at 0% correct for Word Sets 2 and 3. Even after 5 sessions (3 with CRF and 2 with FR5) at 100% correct with the picture and text for Set 2, Miles could not read or locate any of the text only items in Set 2. Again he received CBI with simultaneous prompting. He only needed 4 sessions to reach the criterion. After returning to the grocery store, Miles responded at 100% correct for items read and located for 3 consecutive sessions with Word Set 1 and 2. Word Set 3 remained at 0% correct for both measures. Even after 7 picture + text sessions (4 at CRF and 3 at FR5), Miles still could not read or locate any of the text only items in Set 3. He could read and locate the items with text only in the grocery store, after 7 CBI sessions using simultaneous prompting. Miles read and located all 15 items during the last 3 sessions of the study.

Cara. For Word Set 1, Cara learned to read the words after 3 sessions with the picture and text (see Figure 22). Probes prior to pictures were at 0% correct for reading and locating items. During intervention, she responded at 100% correct for both measures and these behaviors continued during the return to probe sessions while Word Sets 2 and 3 remained at 0. For Word Set 2, Cara responded at 100% correct for 3 consecutive sessions with picture support, but then returned to 0% correct when the pictures were removed. Another picture + text session was conducted to see if Cara would learn the words after one more session, but she returned to 0% correct with text only. So CBI sessions were implemented to teach Cara the words in Set 2. She required 5 sessions to reach criterion at 100% independent corrects for 3 consecutive sessions.

She was then able to read the words and locate the items in the grocery store for Set 2 at 100% correct for 3 consecutive sessions and she maintained her ability to read the words and locate items for Set 1. Set 3 remained at 0% correct. For Word Set 3, Cara responded at 100% correct for both behaviors for 5 consecutive sessions (3 at CRF and 2 at FR5). The number of sessions increased to see if more sessions helped Cara learn the words incidentally. When the pictures were removed, Cara continued to respond at 100% correct for 3 consecutive sessions for words read and located. Word Set 1 and 2 maintained at 100% during these sessions also.

Rita. Like Miles, Rita required CBI sessions to learn to read the words in each Word Set (see Figure 23). Her accuracy remained at zero until pictures were presented with the text. Then her accuracy increased to 100% for 3 sessions for both words read and items located, but returned to 0% correct immediately afterwards in the grocery store probe session. Rita needed 7 CBI sessions using simultaneous prompting to acquire the words and reach criterion. When she returned to the grocery store, she responded at 100% correct for 3 consecutive sessions for both words read and items located in set 1. Set 2 and 3 remained at zero. The pictures and text were presented for 5 sessions (3 session with CRF and 2 sessions with FR5) for Word Set 2. Removing the pictures in the following grocery store probe led to a return to 0% correct for both measures. To achieve the CBI criterion, Rita required 9 sessions to learn the words in Word Set 2 and she was able to generalize reading the words on an iPhone and in the grocery store. She responded at 100% correct for 3 consecutive sessions for the reading and location measures while Word Set 3 continued at zero. For Rita’s final word set, she responded at 100% correct for both measures while being presented with the picture and text (total of 7 sessions with 4 at CRF and 3 at FR5). However, she returned to zero during the text only phase. She had 5 sessions on the computer before she reached criterion and could independently read the words. When she returned to grocery store probe sessions, she responded with 100% correct for 3 consecutive sessions for reading and locating the items in all 3 sets.

Social Validity. Surveys were completed by the parents, teachers, and students to determine the social validity of the skills taught. One hundred percent of the surveys given out were completed and returned.

Parents. Parent surveys were returned on all four students. Three of the four students (excluding Aiden) help their caregiver shop for groceries after being given a verbal list. Cara and Rita's caregiver said their student did not seem to prefer one type of list over the others. Miles' mom thought that Miles preferred the pictorial lists while Aiden's mom thought that Aiden preferred the auditory lists. All caregivers said that they would consider using an electronic device that would help their student become more independent. Currently, Aiden uses a mp3 player, Miles uses a portable CD player, Rita uses a cell phone, and Cara uses a cell phone, iPod, and mp3 player.

Teachers. One teacher and one paraprofessional completed the survey. On a scale of 1 to 10 with 1 being ineffective and 10 being highly effective, both teachers rated the effectiveness of the iPhone as an 8. They stated that they would definitely use this type of technology if it were available to their class. They noticed that pictures seemed to be more effective and preferred by the students. They both thought an iPhone would be useful with task analyses and daily schedules in work and home environments. One teacher said an iPhone would be helpful when students use public transportation.

Students. All four students were individually interviewed in regards to the social validity of the studies. They all liked using the iPhone and Cara said she liked using it "a whole lot." Aiden thought the iPhone was easy to use and fun while the others thought that it was sometimes hard. Rita said it was hard because she could not read the words during the text only condition and Miles said some of the buttons were hard to press. All students knew that the iPhone helped them locate items in a grocery store. They thought the iPhone would help them in other grocery stores, at Walmart, at home, and at work by showing a picture of the needed items. Students thought that the pictures helped them locate items the best. Cara and Aiden said that they liked listening to the items, but the pictures were the most helpful.

Table 7
Number (percent) of errors

	Incorrect	No response	Duration	Total
Aiden				
Text only	2(20)	2(20)	6(60)	10(53)
Audio + text	1(12.5)	2(25)	5(62.5)	8(42)
Picture + text	0(0)	0(0)	1(100)	1(5)
Total	3(16)	4(21)	12(63)	
Miles				
Text only	5(31)	3(19)	8(50)	16(59)
Audio + text	4(36)	3(27)	4(36)	11(41)
Picture + text	0(0)	0(0)	0(0)	0(0)
Total	9(33)	6(22)	12(44)	
Cara				
Text only	0(0)	14(70)	6(30)	20(61)
Audio + text	1(8)	7(58)	4(33)	12(36)
Picture + text	1(100)	0(0)	0(0)	1(3)
Total	2(6)	21(64)	10(30)	
Rita				
Text only	0(0)	12(67)	6(33)	18(53)
Audio + text	3(19)	7(44)	6(37.5)	16(47)
Picture + text	0(0)	0(0)	0(0)	0(0)
Total	3(9)	19(56)	12(35)	

Table 8
Mean (median, range) session length across conditions in minutes

	Text only	Audio + text	Picture + text
Aiden	10 (10, 10-10)	9.46(10, 6.73-10)	8.81(9, 5.30-10)
Miles	10(10, 10-10)	9.47(10, 7.57-10)	6.66(6.1, 4.97-9.25)
Cara	8.98(10, 5.13-10)	8.69(10, 5.50-10)	5.26(5.2, 3.02-7.70)
Rita	10(10, 10-10)	10(10, 10-10)	6.62(5.9, 4.87-9.68)

Table 9
Number (percent) of correct responses, errors, and looks

	Aiden		
	Corrects	Errors	Looks
Text only	8(44)	10(56)	142
Audio + text	10(56)	8(44)	93
Picture + text	29(97)	1(3)	125
	Miles		
	Corrects	Errors	Looks
Text only	12(43)	16(57)	219
Audio + text	27(71)	11(29)	267
Picture + text	40(100)	0(0)	183
	Cara		
	Corrects	Errors	Looks
Text only	12(37.5)	20(62.5)	138
Audio + text	27(69)	12(31)	130
Picture + text	39(97.5)	1(2.5)	134
	Rita		
	Corrects	Errors	Looks
Text only	2(10)	18(90)	59
Audio + text	9(36)	16(64)	88
Picture + text	30(100)	0(0)	98

Figure 7. Percent of correct item selections across conditions for Aiden.

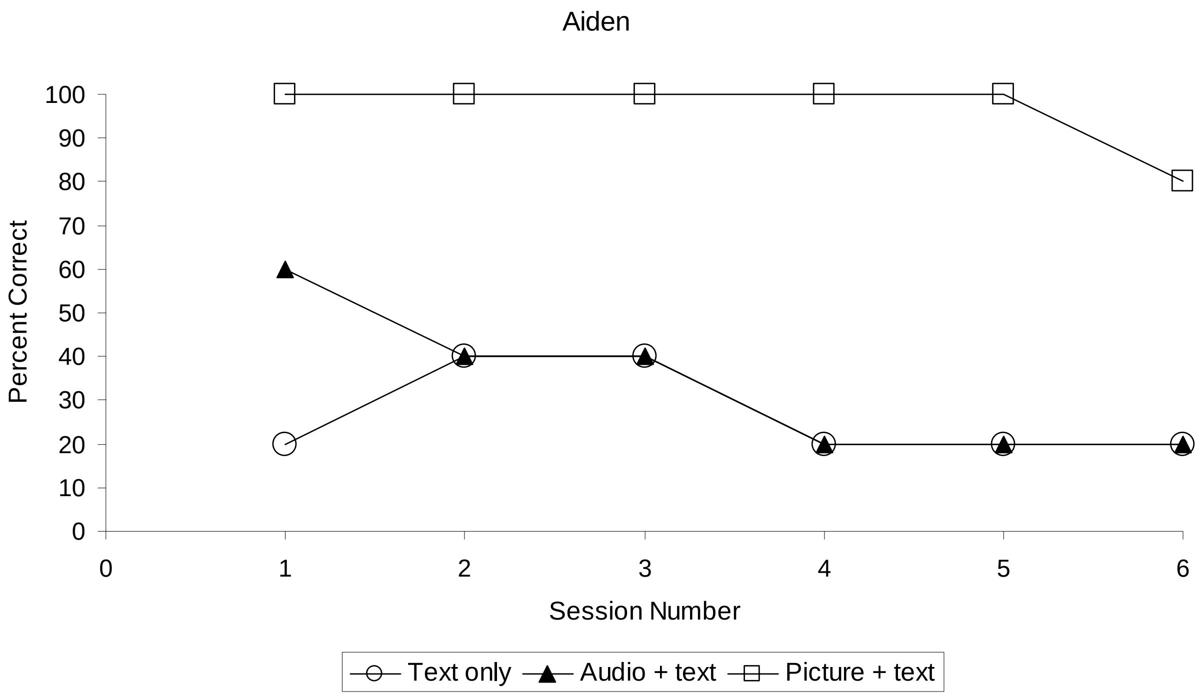

Aiden
100
90
80
70
60
50
40
30
20
10
0
Percent Correct
0
1
2
3
4
5
6
Session Number
Text only
Audio + text
Picture + text

Figure 8. Percent of correct item selections across conditions for Miles.

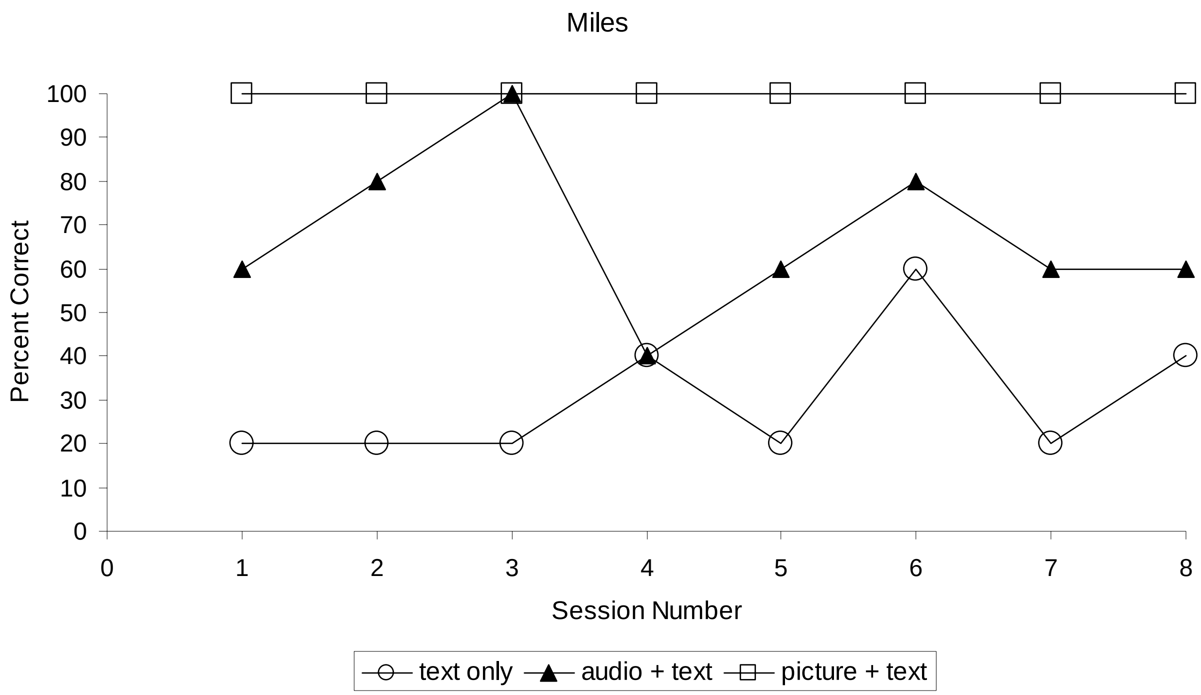

Miles
Percent Correct
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
Session Number
text only
audio + text
picture + text

Figure 9. Percent of correct item selections across conditions for Cara.

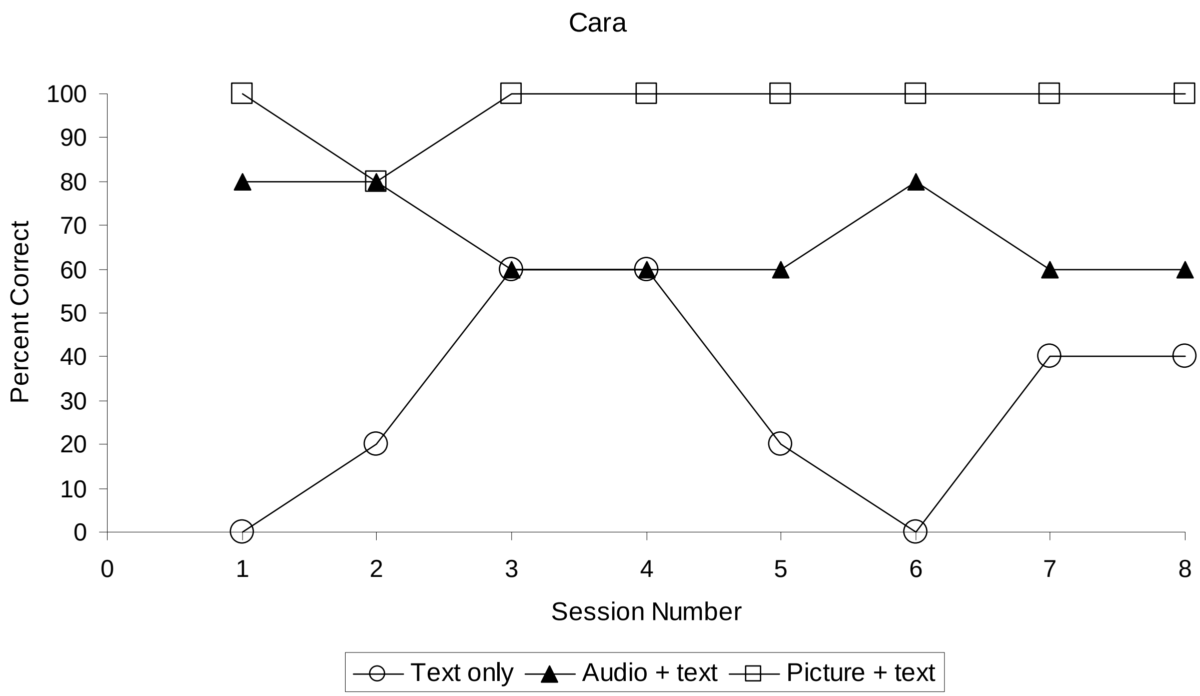

Cara
Percent Correct
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
Session Number
Text only
Audio + text
Picture + text

Figure 10. Percent of correct item selections across conditions for Rita.

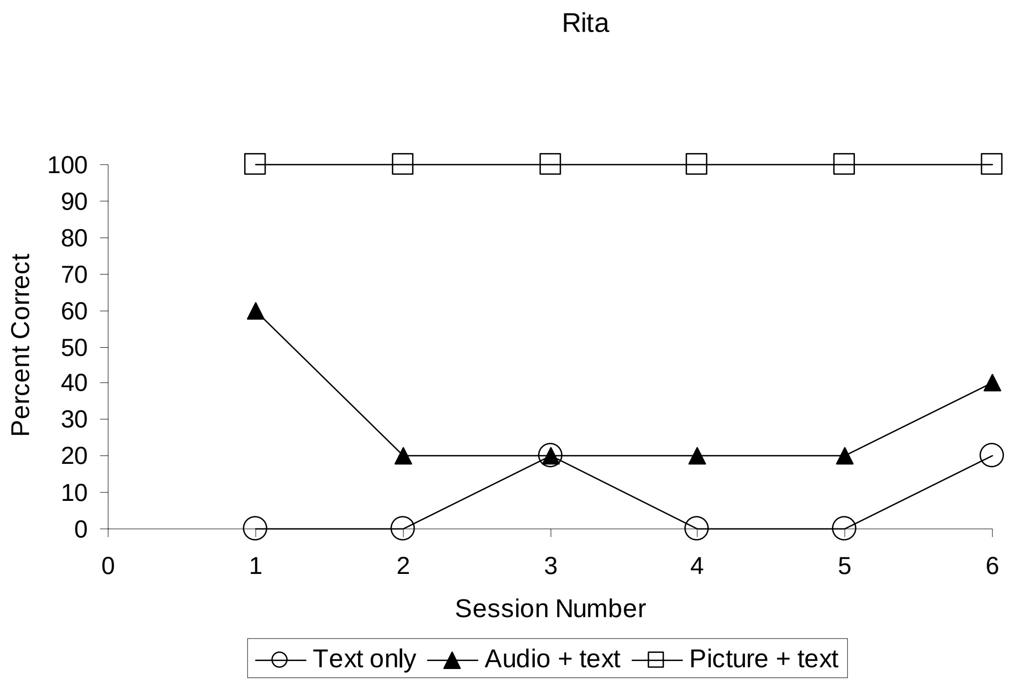

Rita
100
90
80
70
60
50
40
30
20
10
0
Percent Correct
0
1
2
3
4
5
6
Session Number
Text only
Audio + text
Picture + text

Figure 11. Percent of correct responses and errors across conditions for each student.

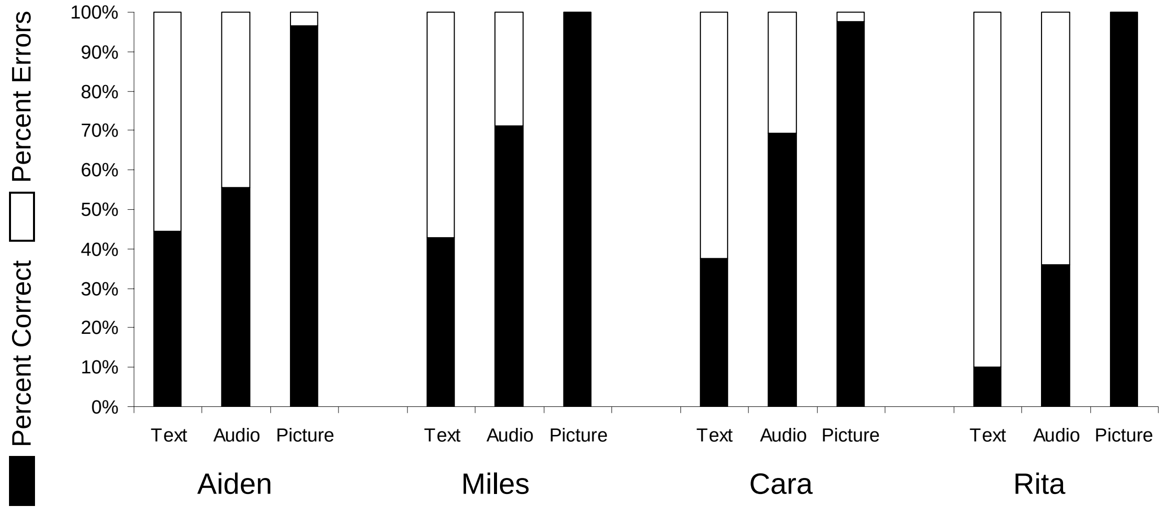

Percent Correct
Percent Errors
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Text
Audio
Picture
Aiden
Miles
Cara
Rita

Figure 12. Aiden's number correct per minute.

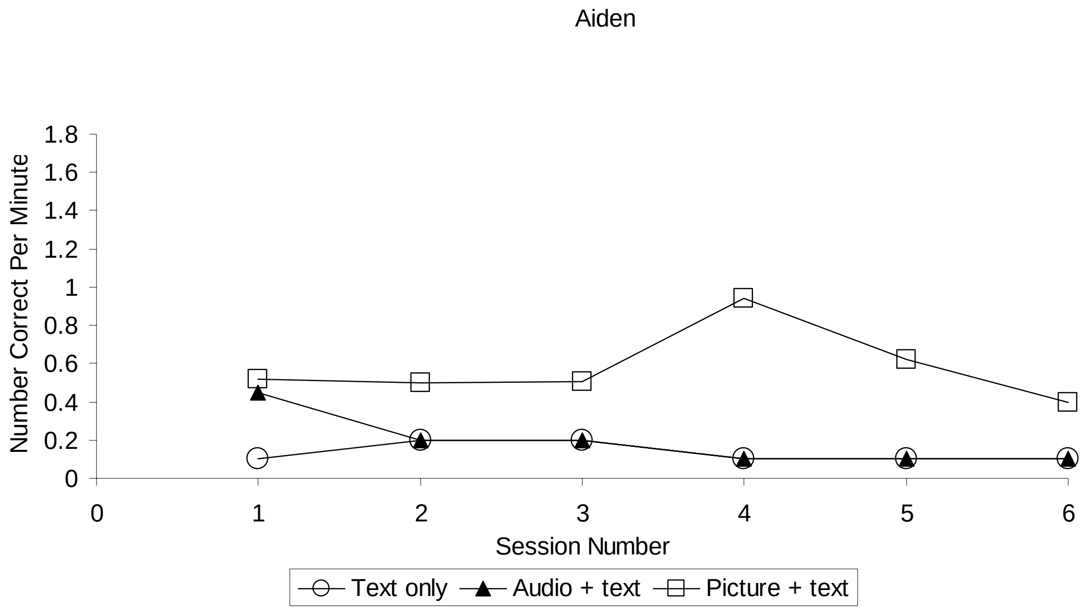

Aiden
Number Correct Per Minute
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
Session Number
Text only
Audio + text
Picture + text

Figure 13. Miles' number correct per minute.

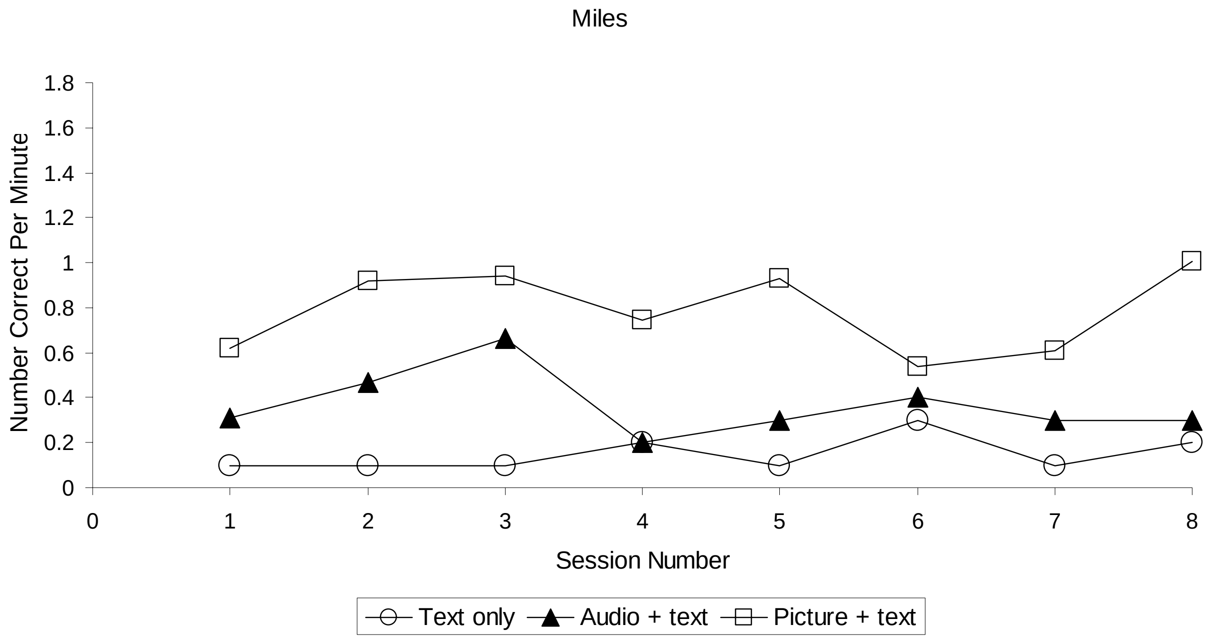
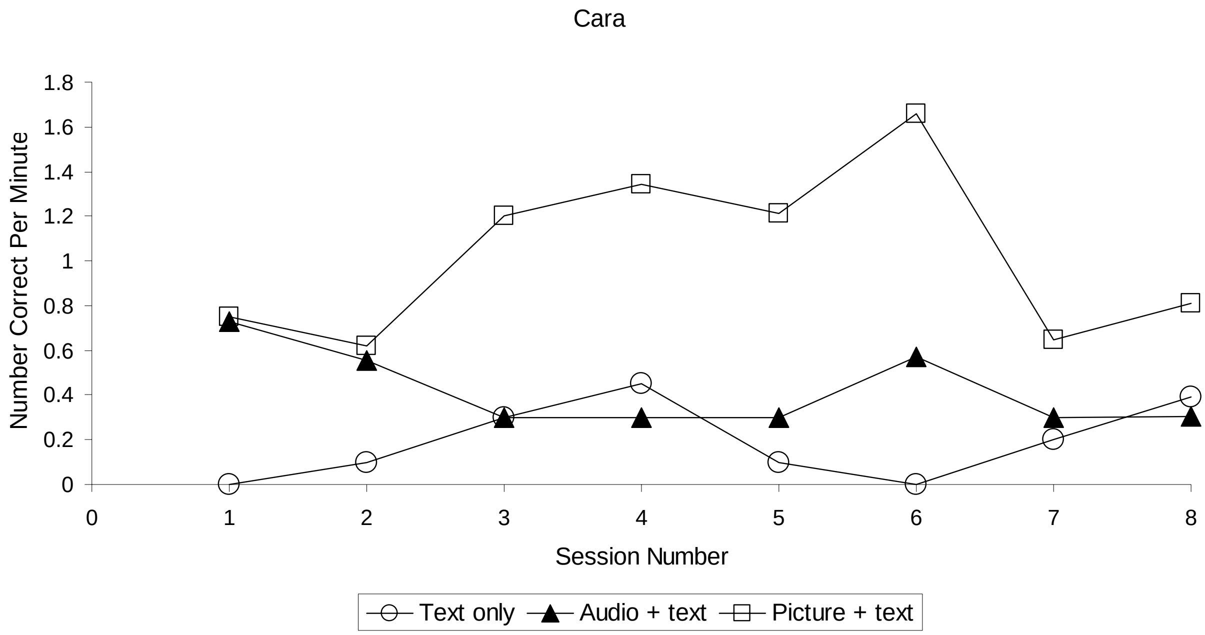

Miles
Number Correct Per Minute
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
7
8
Session Number
Text only
Audio + text
Picture + text

Figure 14. Cara's number correct per minute.



Cara
Number Correct Per Minute
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
7
8
Session Number
Text only
Audio + text
Picture + text

Figure 15. Rita’s number correct per minute.

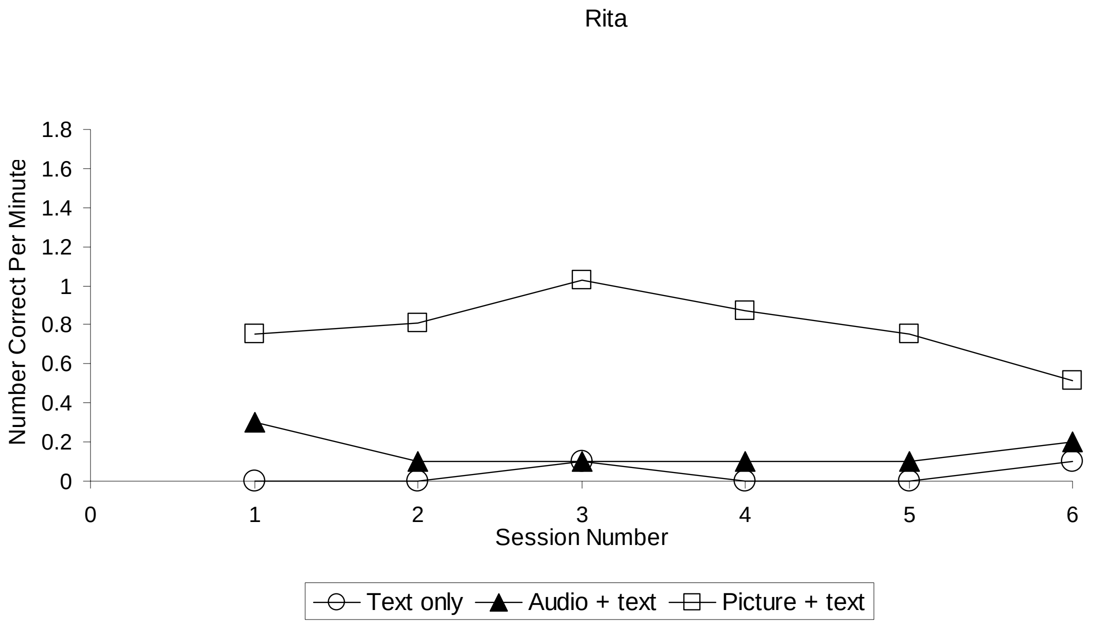

Rita
Number Correct Per Minute
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
Session Number
Text only
Audio + text
Picture + text

Figure 16. Number of looks per minute across conditions for Aiden.

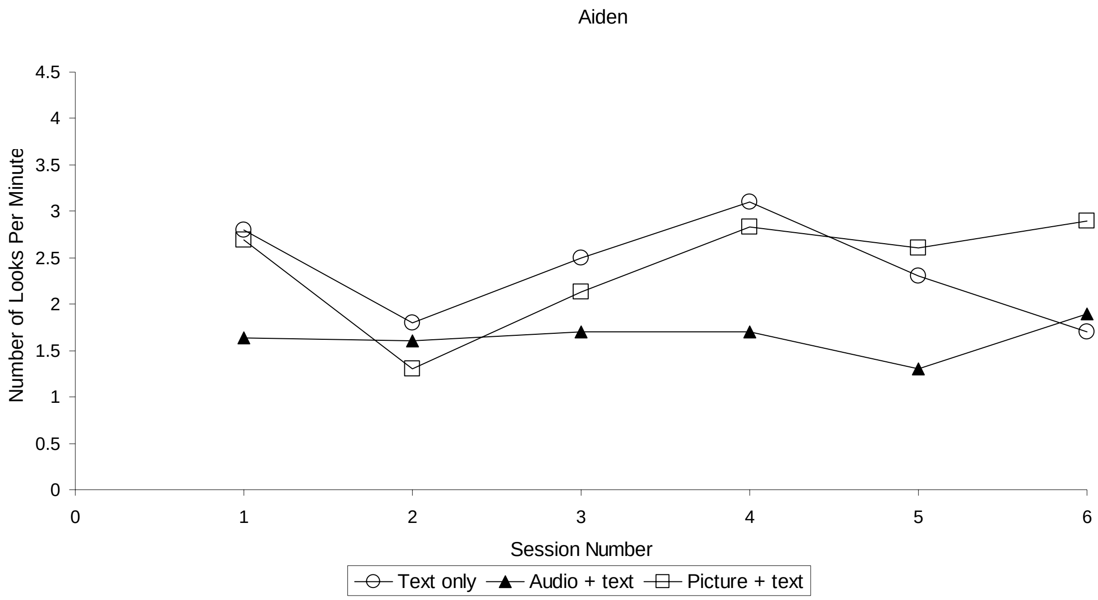

Aiden
Number of Looks Per Minute
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
Session Number
Text only
Audio + text
Picture + text

Figure 17. Number of looks per minute across conditions for Miles.

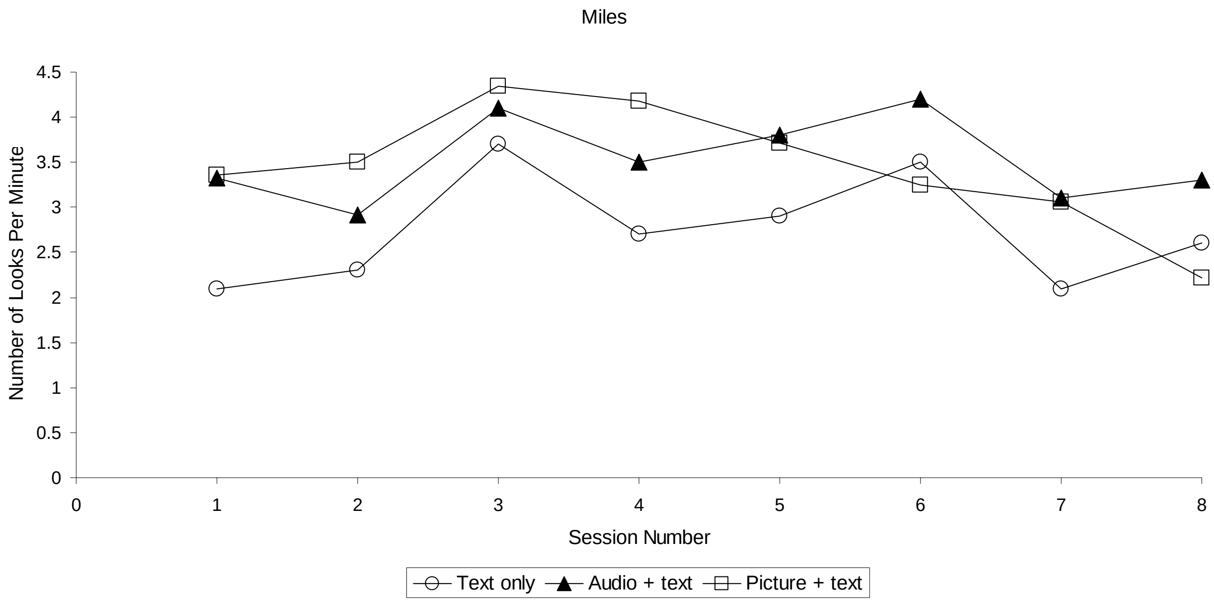

Miles
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Number of Looks Per Minute
0
1
2
3
4
5
6
7
8
Session Number
Text only
Audio + text
Picture + text

Figure 18. Number of looks per minute across conditions for Cara.

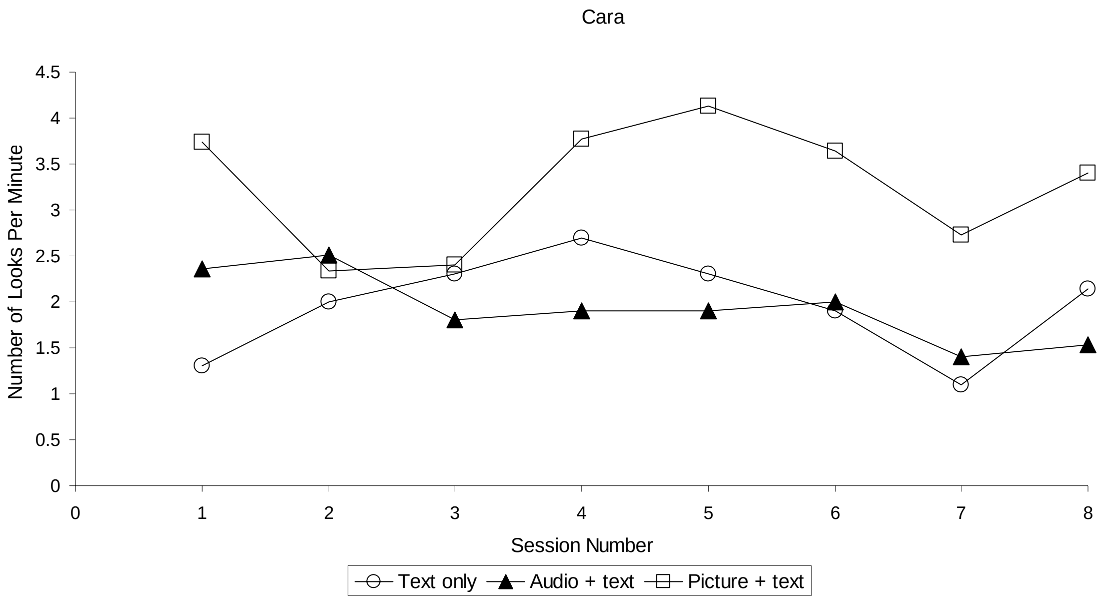

Cara
Number of Looks Per Minute
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
7
8
Session Number
Text only
Audio + text
Picture + text

Figure 19. Number of looks per minute across conditions for Rita.

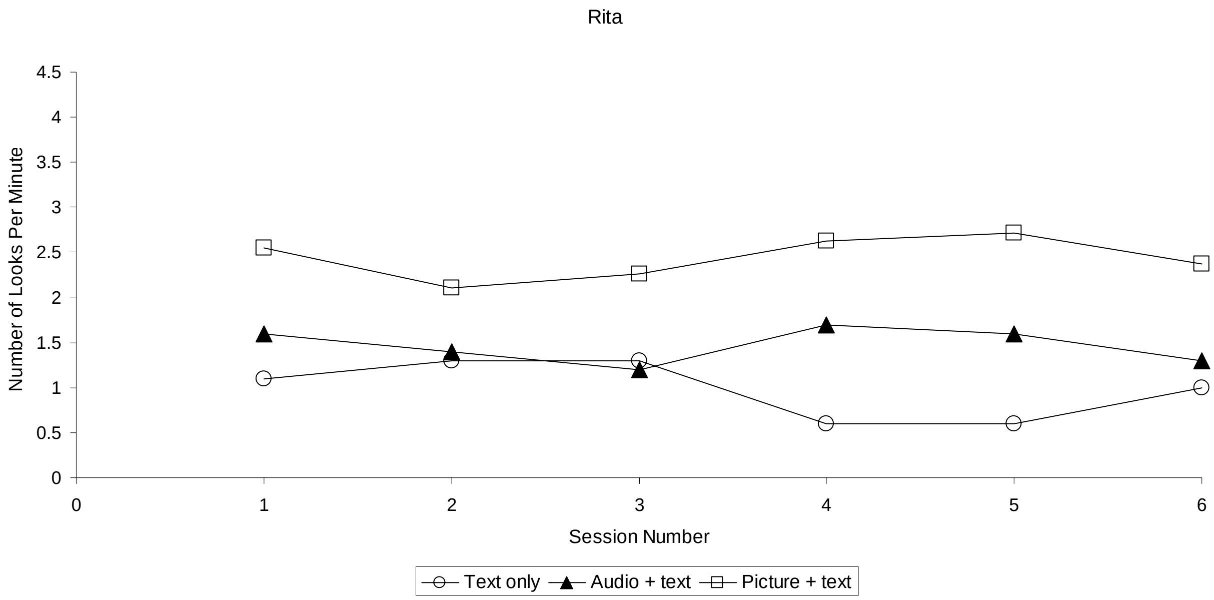

Rita
Number of Looks Per Minute
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
Session Number
Text only
Audio + text
Picture + text

Figure 20. Aiden's accuracy in reading and locating items.

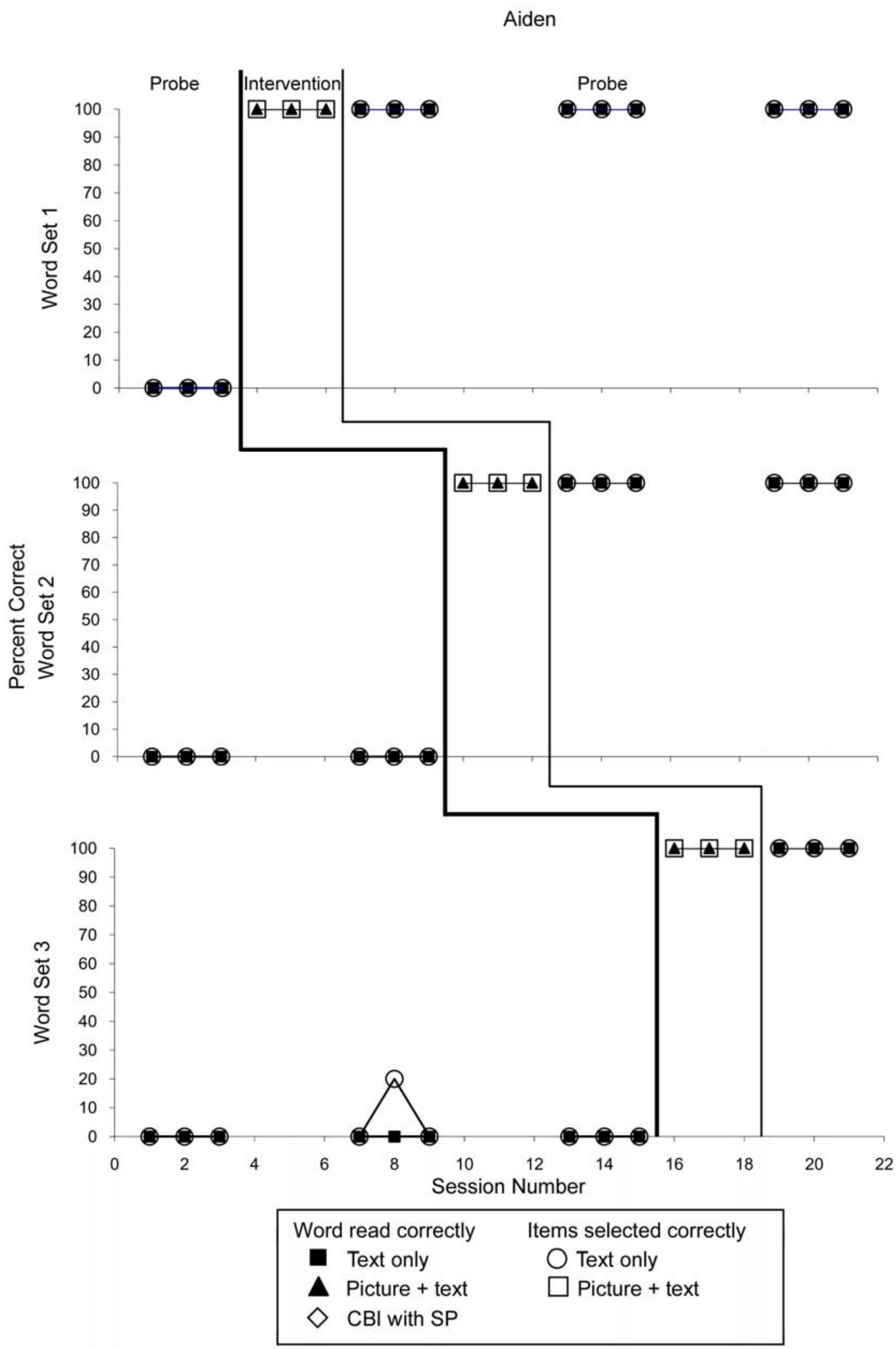

Aiden
Probe
Intervention
Probe
Word Set 1
Percent Correct
Word Set 2
Word Set 3
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
22
Session Number
Word read correctly
Text only
Picture + text
CBI with SP
Items selected correctly
Text only
Picture + text

Figure 21. Miles' accuracy in reading and locating items.

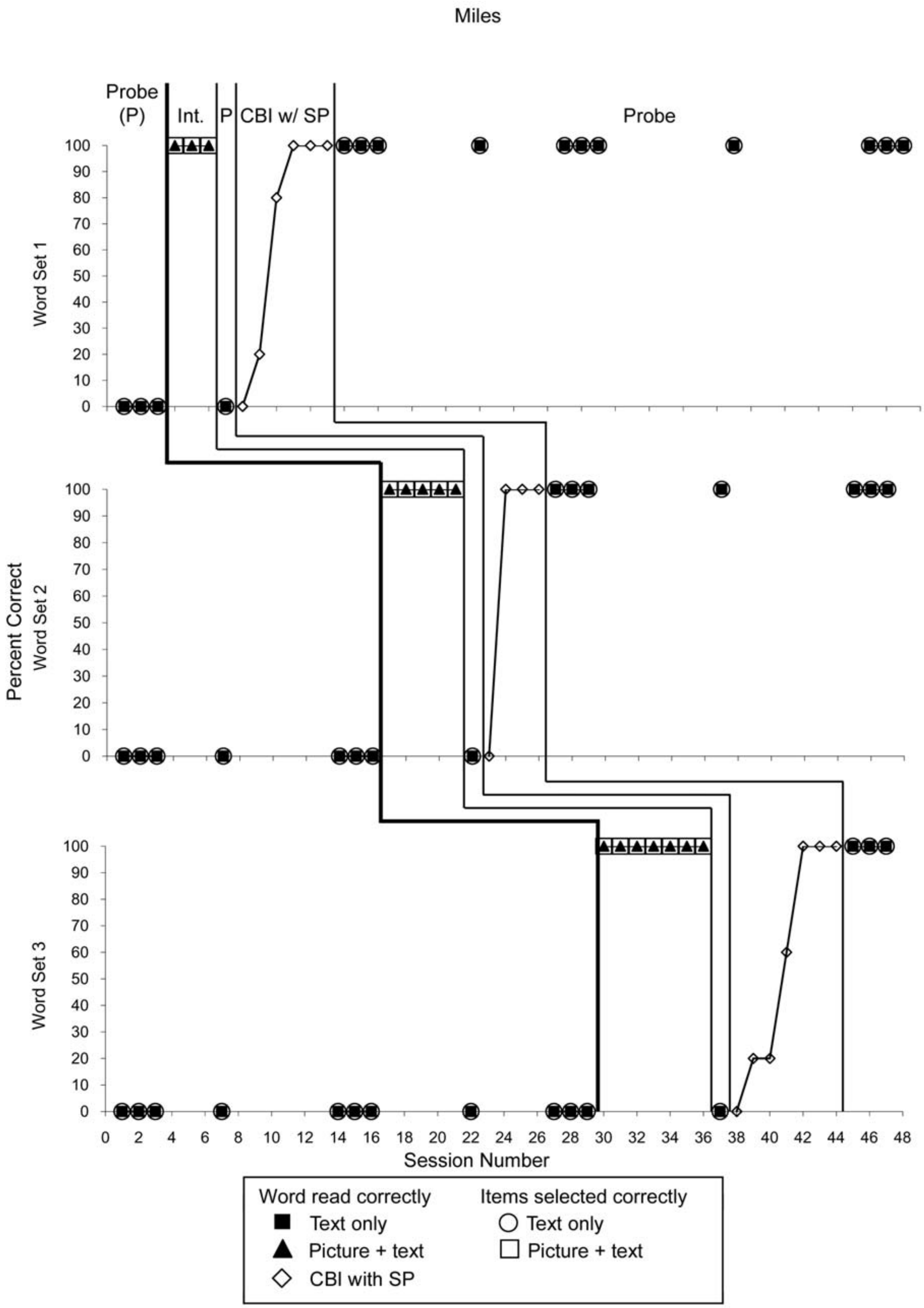
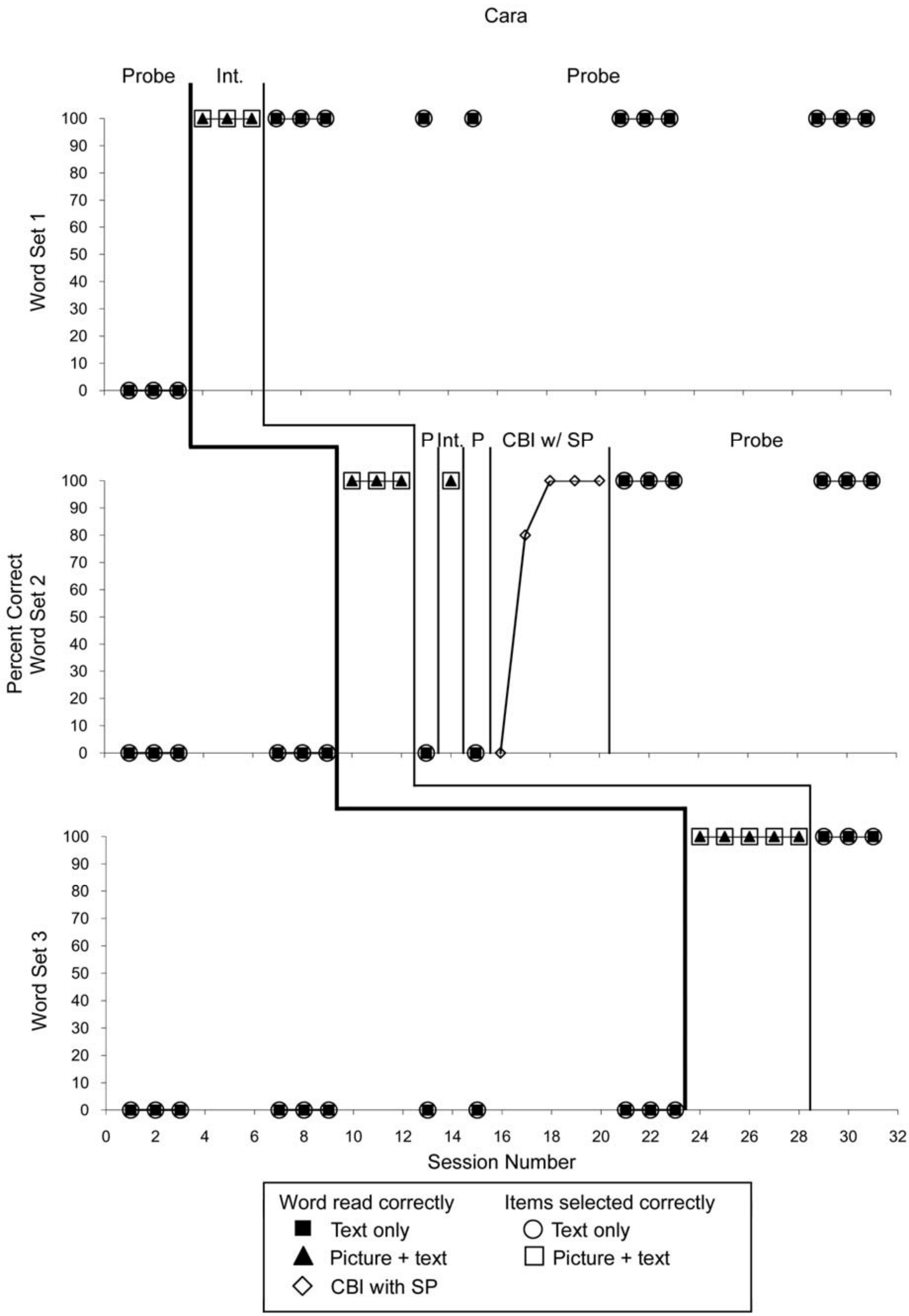
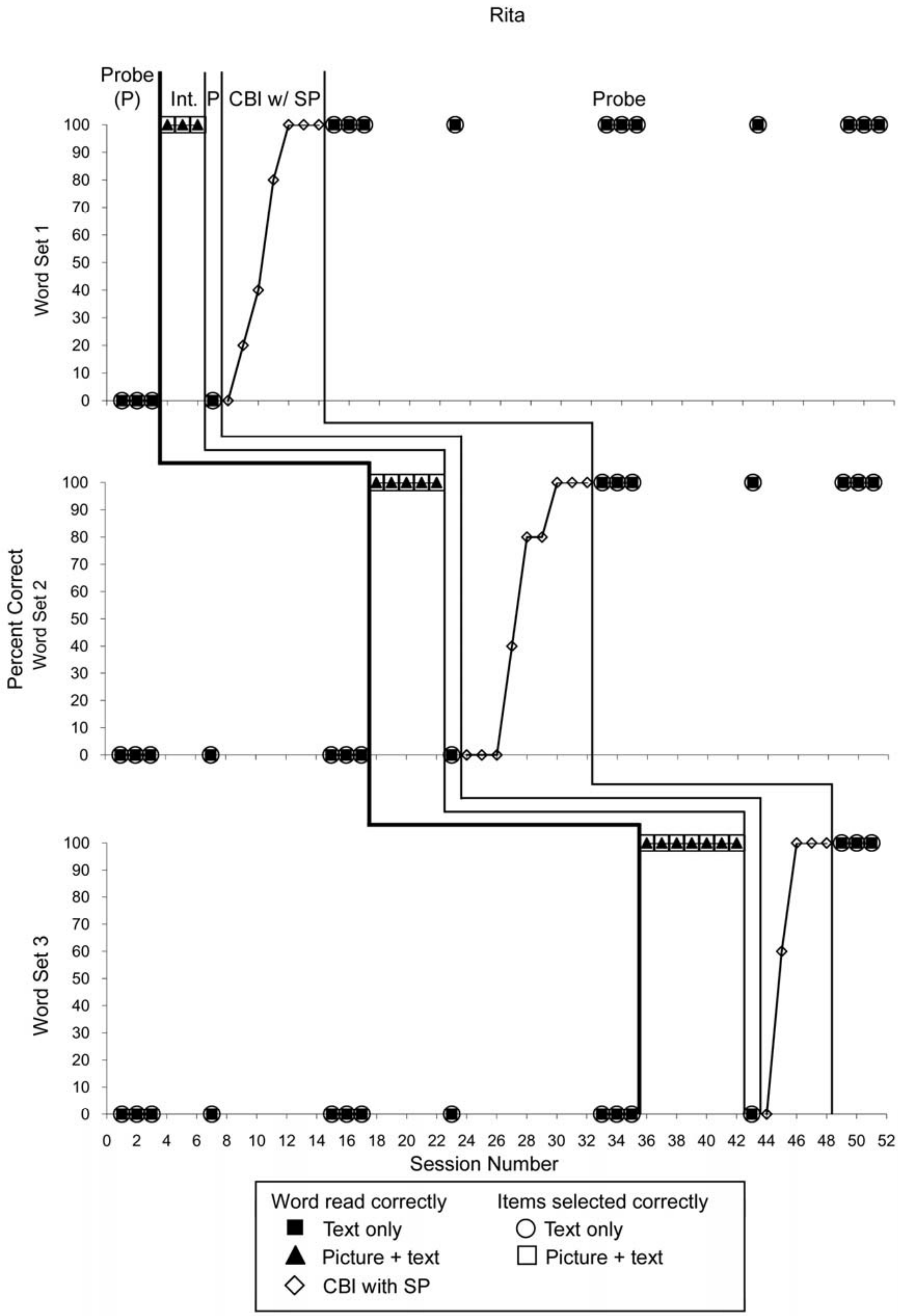

Miles
Probe (P)
Int.
P
CBI w/ SP
Probe
Word Set 1
Word Set 2
Word Set 3
Percent Correct
Session Number
Word read correctly
Text only
Picture + text
CBI with SP
Items selected correctly
Text only
Picture + text

Figure 22. Cara's accuracy in reading and locating items.



Cara
Probe
Int.
Probe
Word Set 1
P
Int.
P
CBI w/ SP
Probe
Percent Correct
Word Set 2
Word Set 3
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32
Session Number
Word read correctly
Text only
Picture + text
CBI with SP
Items selected correctly
Text only
Picture + text

Figure 23. Rita's accuracy in reading and locating items.


Rita
Probe (P)
Int.
P
CBI w/ SP
Probe
Word Set 1
Percent Correct
Word Set 2
Word Set 3
Session Number
Word read correctly
Text only
Picture + text
CBI with SP
Items selected correctly
Text only
Picture + text

CHAPTER 5

DISCUSSION

The results of these studies should expand the literature base relating to the use of electronic technologies for assisting individuals with moderate intellectual disabilities in the acquisition and maintenance of independent living skills. Study 1 presented evidence that supports using one type of list over the others on an iPhone for assisting students with intellectual disabilities while grocery shopping. Specifically, the pictorial lists appeared to be the most effective and efficient for supporting these four students. Rita and Miles found all items with the pictorial supports while Aiden and Cara found all but one item with the pictorial lists. Students also located the items at a higher rate with the picture support than with the audio or text only supports. Study 2 continued to illustrate the effectiveness of using an iPhone while shopping and it demonstrated how students could learn to read words incidentally or through simultaneous prompting delivered via a computer program.

This chapter begins with an overview of the results and limitations of each study. This section is followed by how these studies will potentially add to and extend the extant literature relating to the use of electronic devices for independence. Also discussed in later sections is information related to the research that demonstrates the effectiveness of using simultaneous instructional prompting delivered via a computer. The chapter concludes with a discussion on the future directions of research on the use of everyday electronic devices for supporting students with disabilities.

Results and Limitations

Study 1. In the present study, picture supports were the most effective and efficient accommodation to help all four students independently grocery shop. Students responded at or near 100% correct which meant few errors occurred. Students could also locate the items quicker with the picture supports. Students did respond during the audio + text and text only conditions, but their response levels were not as high as with pictures.

Visuals supports have been shown to be effective across various skill areas especially with non or low level readers (e.g., Copeland & Hughes, 2000; Johnson & Miltenberger, 1996) and individuals with autism (e.g., Dettmer, Simpson, Myles, & Ganz, 2000; Johnston, Nelson, Evan, & Palazolo, 2003; Preston & Carter, 2009; Quill, 1997). Pictures help students comprehend what is being asked of them by providing a visual cue of their target behavior. When used as a compensatory strategy, pictures help compensate for their working memory deficits. An iPhone makes the process of taking and using photos much easier, cheaper, and quicker. Potentially, photos can immediately be used to assist students right after they are taken and added to the library existing on the device. The advances in technology may also assist students with disabilities to be more involved and/or independent with developing and implementing their own accommodations. With electronic devices such as an iPhone, students can create their own visual or auditory supports for the skills needing extra assistance.

A possible limitation of Study 1 that may have affected the data that related to the above gains was the exclusion of a best condition only phase. When using an ATD design, Wolery, Gast, and Hammond (2010) recommended that a best only phase be included after the comparison phase to help detect for multiple treatment interference. When multiple conditions are quickly alternated in a single session, researchers want to ensure that the best only condition remains at the same level after the other conditions are taken away. Even though a phase with solely the best condition was not included, the presentation of the conditions was counterbalanced across sessions so the conditions were not presented in the same order each day (see Table 5 on page 70). This action may have minimized potential negative effects in relation to multiple treatment interference.

Study 2. Even though pictures were the superior support for all four students in Study 1, individual differences between students were more prevalent in Study 2. This study provided an example of how students acquired the same behavior (i.e., reading grocery words) through different methods. Aiden learned to read the target words in each word set after three presentations of the word plus a picture. Miles and Rita could not read the words after multiple presentations of the picture + text, but could after computer-based simultaneous prompting. This demonstrates that pairing does not always result in the transfer of stimulus control. Cara incidentally learned to read the first set of words after the picture support, but for the second word set she needed simultaneous prompting. She returned to learning the words incidentally for the third set. Overall five word sets were learned incidentally after seeing the picture with the text and seven word sets were learned through simultaneous prompting. The differences among the students that may have contributed to these results could have been their overall word knowledge. Aiden and Cara can both read more words than Miles and Rita. For example, Aiden and Cara can read almost all of the 300 Dolch words whereas Miles can only read 50 of the words and Rita cannot read any of them. This difference between levels of familiarity with text may have made the difference for Aiden and Cara learning the words incidentally.

Although the words were not directly taught to Aiden and Cara, the task direction of "What word?" may have acted as the prompt to direct the students' attention to the textual word.

In this case the students may have learned the words through stimulus equivalence instead of incidental learning. Stimulus equivalence is when learning occurs by making relations with previously taught stimuli instead of being explicitly taught (Sidman & Tailby, 1982). The specific term may be debatable, but the key is that the students learned the words in the natural environment without extra instruction.

Study 2 also further confirmed the results from Study 1 since picture support was the intervention implemented after students were nonresponsive to text alone. With text only, students could not read the words or locate the corresponding items. However, when pictures were added to the text, students could label and locate the items at 100% correct for both measures. Educators need to identify what additional supports are needed for students to be successful. Differentiating instruction by taking into account students' learning styles helps to maximize the learning opportunities for each individual student (Bearne, 1996; Tomlinson, 1999). All students should have access to the tools that increases their learning.

The above outlined results may have been affected by certain limitations specifically related to Study 2. In particular, due to time and resource constraints, Study 2 did not include targeted measures of generalization and maintenance. Horner et al. (2005) recommended evaluating students' behaviors in different settings, with different materials, and among different supervisors to check for generalization. The results of this study would be further strengthened if students read the words on a hand written list and located the items in a different grocery store with different adults present. Since students are with different people outside of school and possibly go to different stores, it is important for new behaviors to generalize across settings, materials, and people. The students that received CBI did generalize reading the words on the computer screen to reading the words on the iPhone where the font size was smaller.

By staggering the introduction of the intervention across word sets, maintenance data were collected on the first two word sets while Word Set 3 was being evaluated. However, continuing to collect maintenance data over a longer period of time (e.g., over 3 months or a year) is ideal. This would confirm that the students truly acquired the skill and continue to benefit from it.

Relationship to the Extant Literature

The results of these studies potentially will add to and extend the literature base targeting the instruction of students with moderate intellectual disabilities in skills related to shopping with self-created lists (Aeschleman & Schladenhauffen, 1984; Gaule et al., 1985; Giere et al., 1989; Sarber et al., 1983). In addition, these studies support other work of researchers who investigated the use of electronic devices for assisting with daily living tasks (Hersh & Treadgold, 1994; Lancioni et al., 1998a; 1999a; 1999b; 2000). Students not only need to learn how to locate and purchase items in a store, but they also need to know how to develop a useful list so they can independently complete the entire shopping task. The use of an electronic device such as the iPhone can simplify the list creation process for students who are non- or low-level readers. Even though the researcher provided some assistance with the list creation for the purpose of obtaining randomized lists and including specific items in this study, students could be taught a few additional steps to create their own lists completely independently using the camera or voice memo application. The camera application allows pictures to be taken and automatically stored in a folder under the “Photos” application. Students using the voice memo could record a list of items needed at the store and then play the list back while shopping. Ideally, students would be taught to take pictures or record items as they finish a box of cereal or eat the last banana. Then when they go to the store, they will have their list of needed items.

Iphones along with other electronic devices (e.g., iPod Touch, PDA) provide a medium for students to independently create and access their own supports through the entire shopping experience.

Researchers have stated that paper-based pictorial lists appeared to be difficult to manage and cumbersome for the students with intellectual disabilities (Furniss et al., 1999; Lancioni et al., 1998; 1999b; 2000). Electronic devices help people with organizational issues because it is one device that contains multiple lists, schedules, and task analyses in one place and it shows only one picture until the user is ready to move on to the next. This decreases the likelihood of students losing their place and forgetting what they are shopping for. In addition, the power of electronic devices in terms of memory and the ability to present tier levels of supports make them potentially more efficient and effective than traditional materials (e.g., paper-based calendar). Electronic devices also lessen the stigma associated with carrying picture books or lists, or always needing another individual close by to help with reading or to tell them what to do next. E-text lists presented on electronic devices are more age appropriate, independently accessible, and less stigmatizing. Not only do using devices common to the general public help with grocery shopping and other related skills, they are also capable of making calls, taking pictures, listening to music, logging onto the Internet, and using GPS. All of these capabilities potentially provide a smoother integration into society in a non-stigmatizing way for individuals with disabilities. Students can increase their independence and decrease their reliance on others after being taught how to use a tool that compensates for their weaknesses. Study 1 was one of the first studies to use an electronic device common among the general public while grocery shopping. Specifically, this investigation should expand the grocery shopping literature base by providing an alternative, age appropriate tool that can deliver supports to assist students with moderate intellectual disabilities while shopping.

Even though some electronic technologies may be considered expensive and require time and technology knowledge to personalize, one must consider if the benefits outweigh the drawbacks. Electronic devices have the potential to allow students to complete tasks they could not do independently before. A device such as an iPhone gives students freedom to be more self-reliant. After initially customizing the device, there is little maintenance besides adding additional photos or audio supports for new tasks which individuals with disabilities could do themselves. Devices also provide opportunities for students to work on their responsibility skills by learning to keep up with the device and handling it carefully.

The literature on literacy for students with moderate intellectual disabilities is also expanded with the incorporation of electronic text within these studies. Study 2 demonstrated that some students can transfer stimulus control from the support (i.e., picture) to the text after multiple presentations incidentally. This adds to the work from the National Center for Supported eText, under the direction of Lynne Anderson-Inman and Mark Horney. They have focused their research on determining how supported e-text can benefit students with disabilities (Anderson-Inman & Horney, 2007). When two of the four students learned to read the words after the inclusion of the picture support, this demonstrated the benefit of visual supports in conjunction with reading material. If more literacy materials included pictorial supports above key vocabulary words (cf. Writing with Symbols and Kid Pix), then students could potentially increase their reading skills. Multiple presentations of these select words with a visual may also be a key factor. When students are able to learn new skills incidentally and not require direct instruction, instructional time becomes more efficient and can be spent learning other skills that do require direct instruction (Wolery, Schuster, & Collins, 2000).

Not only was Study 2 a demonstration of transferring control incidentally, it also showed how simultaneous prompting can be used to teach sight word reading. When students do require direct instruction of a skill, like Rita and Miles, simultaneous prompting was an effective instructional strategy which adds to the existing literature base (e.g., Birkan, 2005; Gibson & Schuster, 1992; Griffen et al., 1998; Schuster et al., 1992; Singleton et al., 1995). Students were able to acquire the skill after 4 to 9 sessions in the classroom and generalize the skill to the natural environment (i.e., the grocery store). Word Sets 1 and 2 also maintained until after Word Set 3 was acquired. It is important for educators to consider individual differences between students to know which supports and instructional strategies are most effective.

Another aspect to consider in regards to the simultaneous prompting procedure in Study 2 was that this instructional procedure was delivered on the computer. The computer presented the target stimuli and delivered the pictorial controlling prompts. A benefit of computer-based instruction is its consistency in providing instruction and availability for repetitious use. When using a true controlling prompt with simultaneous prompting, errors are practically nonexistent (Morse & Schuster, 2004; Wolery et al., 1993) which can lead to independent work on the computer for the student. The researcher was available to provide reinforcement and error correction during Study 2, but ideally the classroom teacher could act more as a mentor after the test session. This potentially frees the teacher to instruct other students while the student on the computer is learning independently. Computer-based instruction has been effective in teaching academic (e.g., Bosseler & Massaro, 2003; Davies et al., 2003), vocational (Mechling, & Ortega-Hurndon, 2007), community (e.g., Ayres et al., 2006; Langone et al., 1999; Mechling, 2004), and communication skills (Mechling, & Cronin, 2006; Mechling, Pridgen, & Cronin, 2005) and it becomes more powerful when using in conjunction with an effective instructional strategy such as simultaneous prompting. Additional research needs to continue assessing the combination of CBI and simultaneous prompting.

Future Directions

An important point about using technology to assist individuals with disabilities is that these individuals first need to be taught how to use the technology before it can be a self-reinforcing tool. In addition to having the technology available, individuals with disabilities need to receive systematic instruction on how to operate it. They need to see how using the technology benefits their own lives and accommodates for their weaknesses which means the technological tool should be selected based on the person's individual needs. History training was provided to the students prior to Study 1 to teach them how to operate an iPhone. They quickly learned how to maneuver within the three different applications after receiving verbal directions and gestural prompts. Research is surfacing on how technology (i.e., video modeling) can be use to teach students to use an electronic device such as an iPod (Hammond, Whatley, Ayres, & Gast, in preparation).

Given that the students in Study 1 were able to successfully create three different types of shopping lists on their iPhone, why not have them develop their own task analyses to assist with various areas of their lives? They could create task analyses for their jobsites, chores at home, banking trips, or shopping experiences. They could also develop schedules for morning routines, weekly chores, recreational activities, and daily activities. Depending on the device, students could take photos, record audio prompts or directions, or shoot videos of different tasks. This will allow students to be more autonomous and rely less on other people to do things for them.

As technology continues to advance and create more cutting edge tools, more applications are being developed for the iPhone, many of which are being geared toward individuals with disabilities (e.g., Picture Scheduler, Time Timer, Visules, Speak It, and iCommunicate). The number of applications useful for people with disabilities will likely continue to grow as more people use these devices and the research base continues to grow. As supported by the results of Study 1, students with disabilities can also benefit from common apps that everyone uses (e.g., iPod, Photos, and Notes). In addition, students can be taught to use the phone, Internet, and calculator features to assist with other areas of their lives including their literacy skills.

As the emphasis on literacy continues to take precedence in our educational system, students with intellectual disabilities need additional supports to benefit from text-based materials. The results of Study 1 indicate that students needed additional supports in order to comprehend the text. After a picture was presented in conjunction with the text, then students could locate the grocery item. Similarly, the results of Study 2 demonstrated that two students were able to incidentally learn to read the words after multiple presentations of the picture + text. Today, literacy is more than reading a paperback book, it is exploring multiple forms of media and sites to gather information and gain meaning (Lemke, 2006). Additional research needs to be conducted on how electronic devices can support students in reading and comprehending e-text. Easy access to additional supports would help people of all reading abilities.

Over the years, technology has become more accessible, user-friendly, and convenient. As students with disabilities increase their participating in general education classes with their same-age peers, they need devices and supports that will allow them to fit in socially while also meeting their needs academically. Since there are an increasingly set of possibilities within the world of technology, there is great hope for providing individuals with disabilities tools that will increase their independence and inclusion.

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APPENDIX A

SCREENING LIST OF GROCERY ITEMS

Parents/Caregivers: Please mark out items you never buy at a grocery store.

onion
lettuce
apple
carrot
lemon
orange
strawberries
celery
broccoli
banana
potato
green pepper
red grapes
pineapple
tomato
cucumber
stick butter
block cheese
canned biscuits
strawberry yogurt
chocolate pudding
sour cream
cream cheese
whipped cream
sliced cheese
shredded cheese
biscuits
yogurt
eggs

ketchup
mustard
mayo
pickles
BBQ sauce
hot sauce
relish
syrup
jelly
popcorn
peanuts
chex mix
pretzels
Pringles
cookies
crackers
gold fish
napkins
tissues
hand soap
baggies
dish soap
laundry detergent
paper towels
toilet paper
plastic cups
plastic wrap
aluminum foil

Comet
dryer sheets
rice
tuna fish
soup
Spam
baked beans
pasta sauce
apple sauce
mac & cheese
pop tarts
granola bars
pancake mix
cake mix
brownie mix
flour
sugar
vegetable oil
Crisco
vanilla extract
pepper salt
jello
raisons
paper plates
dishwasher detergent
Windex
chocolate milk
milk

APPENDIX B

STUDY 1 - DATA SHEET

Student name	R						
Session #	1			Session #	2		
Date - Start Time				Date - Start Time			
Items	Response/Item Selected	Duration	# of Looks	Items	Response/Item Selected	Duration	# of Looks
P				P			
Snack Wells				Nilla Wafers			
Froot Loops				Product 19			
1000 Island				Catalina			
Planet				Arm & Hammer			
Mello Yello				Snyder Pretzels			
A				T			
Cheez It				Vienna			
Smart Start				Fruity Pebbles			
Peppercorn Ranch				Creamy Caesar			
Ajax				Finish Dish Soap			
Hawaiian Punch				Sierra Mist			
T				A			
Town House				Famous Amos			
Crispix				Cracklin Oat Bran			
Miracle Whip				Horseradish			
Cascade				Auto Dish Soap			
Fruitopia				Canada Dry			
	Picture	Audio	Text		Picture	Audio	Text
Total #/% Correct				Total # Correct			
Total #/% Errors				Total # Errors			
Total Duration				Total Duration			
Total # of Looks				Total # of Looks			

APPENDIX C

STUDY 2 – GROCERY STORE PROBE DATA SHEET

Student name	C			
Kroger - text only				
Date				
Start Time				
End Time				
Items	Word/Response/Duration/Looks	Word/Response/Duration/Looks	Word/Response/Duration/Looks	Word/Response/Duration/Looks
Oreo				
Twix				
Snickers				
Skittles				
Twizzlers				
Total				
Granola				
Total				
Wheaties				
Great Grains				
Reese Puffs				
Total				
Saran Wrap				
Raid				
Miracle whip				
Foil				
Zip loc bags				
Total				
Comments				

APPENDIX D

STUDY 2 PICTURE + TEXT DATA SHEET

Student name	R		Word Set 3	
Kroger - pic + text				
Date				
Session #				
Items	Word	Response	Duration	Looks
mustard				
mayonnaise				
olives				
ketchup				
pickles				
Total				
Comments				
Date				
Session #				
Items	Word	Response	Duration	Looks
mayonnaise				
ketchup				
pickles				
olives				
mustard				
Total				
Comments				
Date				
Session #				
Items	Word	Response	Duration	Looks
pickles				
mustard				
ketchup				
mayonnaise				
olives				
Total				
Comments				

APPENDIX E

STUDY 2 – SIMULTANEOUS PROMPTING DATA SHEET

Student name	R	SP	Word set 2	Cereal	
Date			Date		
Session #			Session #		
Items	Response		Items	Response	
Froot Loops			Lucky Charms		
Frosted Flakes			Frosted Flakes		
Lucky Charms			Rice Krispies		
Cheerios			Cheerios		
Rice Krispies			Froot Loops		
Total			Total		
Comments			Comments		
Items	Response		Items	Response	
Lucky Charms			Lucky Charms		
Frosted Flakes			Frosted Flakes		
Rice Krispies			Rice Krispies		
Froot Loops			Froot Loops		
Cheerios			Cheerios		
Frosted Flakes			Frosted Flakes		
Cheerios			Cheerios		
Lucky Charms			Lucky Charms		
Rice Krispies			Rice Krispies		
Froot Loops			Froot Loops		
Rice Krispies			Rice Krispies		
Cheerios			Cheerios		
Froot Loops			Froot Loops		
Lucky Charms			Lucky Charms		
Frosted Flakes			Frosted Flakes		
Total			Total		
Comments			Comments		

APPENDIX F

STUDY 1 – PROCEDURAL RELIABILITY DATA SHEET

Procedural Reliability Checklist - Study 1 - Comparison Student name			
Initials of Data Collector/Date			
Researcher gives student iPhone			
Researcher gets students to put on earbuds			
Researcher tells student to press "photo, notes, or iPod"			
Researcher says "find _____ list"			
Researcher says "Find all of the items on your list and put them in your cart"			
Researcher uses stopwatch			
Researcher follows the student through the store			
Researcher records student responses			
Researcher provides praise or puts incorrect items back on the shelf			
Researcher helps student stay on task and navigate iPhone			
Researcher provides general praise after 5 items			
Researcher tells student to press "photo, notes, or iPod"			
Researcher says "find _____ list"			
Researcher says "Find all of the items on your list and put them in your cart"			
Researcher uses stopwatch			
Researcher follows the student through the store			
Researcher records student responses			
Researcher provides praise or puts incorrect items back on the shelf			
Researcher helps student stay on task and navigate iPhone			
Researcher provides general praise after 5 items			
Researcher tells student to press "photo, notes, or iPod"			
Researcher says "find _____ list"			
Researcher says "Find all of the items on your list and put them in your cart"			
Researcher uses stopwatch			
Researcher follows the student through the store			
Researcher records student responses			
Researcher provides praise or puts incorrect items back on the shelf			
Researcher helps student stay on task and navigate iPhone			
Researcher provides general praise after 5 items			
Total #(%) Correct			

APPENDIX G

STUDY 2 – PROCEDURAL RELIABILITY DATA SHEET

Procedural Reliability Checklist - Study 2						
Student name						
Initials of Data Collector						
Date						
T or P + T						
Researcher asks "are you ready to go shopping?"						
Researcher waits for student response						
Researcher gives student iPhone						
Researcher tells student to press "notes list ____" or "photos list ___"						
Researcher says "What word"						
Researcher waits 3 s or less for a response						
Researcher records response						
Researcher says "Find the item"						
Researcher starts stopwatch						
Researcher gives student 2 min to find item						
Researcher follows the student through the store						
Researcher provides praise or puts incorrect items back on the shelf						
Researcher records student responses, duration, and looks						
Researcher helps student stay on task and navigate iPhone						
Researcher provides general praise after every 5 items						
Total # (%) Correct						

APPENDIX H

SOCIAL VALIDITY: PARENTS

1. Does your student ever use a cell phone, iPod, mp3 player or similar devices? If so, which one? ____

____

____

2. How does your student help you shop for groceries? ______________________________

____

____

3. Do you provide them with a list? If so, what type of list such as a verbal, written, or picture list? ____

____

____

4. In this study, your student used an iPhone with either pictures or verbal support to locate items. Did your student seem to prefer one support over the other? ______________________

____

____

5. If an electronic device with auditory, pictorial, or video supports were available to you, would you consider using it to support your student in becoming more independent?_______________

____

____

APPENDIX I

SOCIAL VALIDITY: TEACHERS

1. How would you rate the effectiveness of the iPhone on a scale of 1-10 with 1 being completely ineffective and 10 being highly effective in helping students locate items?____

____

2. Did you notice that one support (audio + text or picture + text) was more effective than the other? If so, which one and describe how you know? ________________________________

____

____

3. Did the students seem to prefer one support greater than the other? If so, which one and how do you know?____

____

____

4. If this sort of technology were available to you to use to teach other skills, how likely would you be to use it on a scale of 1-10 with 1 being you would never use it and 10 being you would definitely use it?____

____

____

5. What other areas or skills do you think the iPhone would be useful for the students with developmental disabilities? ____

____

____

APPENDIX J

SOCIAL VALIDITY: STUDENTS

1. Did you like using the iPhone?

2. Was it easy or hard to use?

3. Why was it hard/easy?

4. What did the iPhone help you do?

5. Where did you use the iPhone?

6. Can you think of other settings or ways to use the iPhone?

7. How did the iPhone help you locate items?

8. Which list did you like better – the audio list or the picture list?