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USING SIMULTANEOUS PROMPTING WITH AN IPAD TO TEACH CHOICE MAKING TO ADOLESCENTS WITH DISABILITIES

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USING SIMULTANEOUS PROMPTING WITH AN IPAD TO TEACH CHOICE MAKING TO ADOLESCENTS WITH DISABILITIES

THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the College of Education at the University of Kentucky

By

Seth Littrell

Lexington, Kentucky

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Lexington, Kentucky

2013

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ABSTRACT OF THESIS

USING SIMULTANEOUS PROMPTING WITH AN IPAD TO TEACH CHOICE MAKING TO ADOLESCENTS WITH DISABILITIES

The use of a simultaneous prompting procedure for teaching choice-making skills using an iPad to high-school students with moderate intellectual disabilities was evaluated. The Proloquo2Go application, which is designed for use with the iPad, iPod touch, or iPhone as an augmentative alternative communication system for individuals with communication support needs, was used to communicate choices made by participants during sessions. A multiple-probe design across 3 participants was used to evaluate the effectiveness of the simultaneous prompting instructional procedure to teach independent choice making. Results indicate the procedure was effective for teaching all participants to use an iPad to make choices from foods and drinks available for lunch, and 2 participants generalized choice-making skills to a novel set of stimuli.

KEYWORDS: iPad, Proloquo2Go, Choice Making, Disability, Simultaneous Prompting

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USING SIMULTANEOUS PROMPTING WITH AN IPAD
TO TEACH CHOICE MAKING TO ADOLESCENTS WITH DISABILITIES

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Section 1: Introduction

All people deserve the opportunity to make choices, express preferences, and exhibit control over their lives. Choice making has been recognized as one of the components of self-determination that, along with others such as self-management, self-advocacy, problem solving, and goal setting, improves the quality of life for individuals with moderate and severe intellectual disabilities (Agran, Storey, & Krupp, 2010; Lancioni, O’Reilly, & Emerson, 1996; Snell & Brown, 2011; Wehmeyer, 2005; Wood, Fowler, Uphold, & Test, 2005). Components of self-determination can be operationally defined and measured; however, it is important to interpret the term as more than an outcome an individual can reach, abilities an individual possesses, or something an individual does. A person displays the characteristic of self-determination through volitional actions that maintain or improve her or his quality of life and allow that person to be the primary acting agent in her or his life (Wehmeyer, 2005).

Providing education in self-determination skills for individuals with intellectual disabilities that accurately assessed and defined choice-making behavior and focused on development of choice-making skills was an overlooked domain of instruction until the late 1970s and early 1980s (Lancioni et al., 1996; Wood et al., 2005). Significant research has been conducted regarding choice (i.e., the action of picking from options) in the ensuing decades (Snell & Brown, 2011). Lancioni et al. included studies (n=20) in their review of literature published from 1977-1995 that assessed the ability of individuals to make choices. Studies were organized into three categories by the different stimulus classes of items presented to participants during choice-making opportunities: (a) food and drink items (n=9), (b) stimulatory items or stimulatory responses (e.g., visual,
auditory, tactile, vibratory; n=7), and (c) work activities or work conditions (n=4). Results from most studies (n=17) indicated the participants were making choices when stimuli from the categories were presented in a paired or group choice format. Additional studies (n=10) included in the review by Lancioni et al. were published from 1988-1995 and assessed participants’ ability to make choices when opportunities were presented in a natural setting. Studies were sorted into two categories: (a) meals and leisure opportunities (n=6) and (b) occupational situations (n=4). Results from almost all studies (n=9) found the participants could make choices in a daily context when stimuli from the categories were presented in a paired or group choice format.

Many of the previously mentioned studies (n=12) reviewed by Lancioni et al. (1996) featured a control procedure to determine if participants were making purposeful choices during choice opportunities, a key distinction between choosing and choice making (Agran et al., 2010). Sigafoos and Dempsey (1992) used a withdrawal design across participants to examine choice-making abilities of elementary-school students with multiple disabilities who were nonverbal and nonambulatory. Idiosyncratic behaviors (e.g., eye gaze for 3 s, eye gaze with smile or vocalization) were used to define a choice response when the individual was presented with a choice opportunity featuring food or drink items in pairs. In the first condition, participants were offered the item that the research team believed their behavior indicated. In the second condition, the item that was interpreted as not being chosen was offered to participants. The percentage of trials in which a participant refused the offered item was recorded in all conditions. The consistent emitting of idiosyncratic behaviors during choice opportunities when participants were given the corresponding result of their choice indicated the behaviors
functioned as choice-making acts for communicating preference. A purposeful choice was evidenced by participants’ greater percentage of item refusals when given the non-chosen item during the second condition. Research supports the idea that almost all people are capable of purposeful choice making if they are provided with a functional way of doing so that accurately interprets their behavior (Agran et al., 2010; Lancioni et al, 1996; Snell & Brown, 2011).

Individuals with moderate and severe disabilities often need systematic, targeted interventions to learn self-determination skills (Wood et al., 2005). Choice making is recognized as a basic skill that should be incorporated into instructional programs for individuals with low-incidence disabilities (Snell & Brown, 2011). It is the self-determination skill most frequently selected for instruction by classroom teachers (Wehmeyer, 2005). Wood et al. focused on studies (n=21) in their review of literature that taught self-determination skills to participants with severe disabilities; choice making was the skill measured as a dependent variable in nearly half of those studies (n=10). Systematic instructional procedures were effective for teaching participants choice making skills. Studies featured time delay (n=3) and least-to-most prompting (n=4) as procedures for choice making instruction.

Simultaneous prompting (SP) is a systematic instructional procedure for teaching skill-acquisition to individuals with and without disabilities. In a review examining studies that were published in peer reviewed journals and used SP within a single-subject research design, Morse and Schuster (2004) defined SP as a procedure consisting of training sessions and probe sessions. During training sessions, controlling prompts are delivered immediately after task directions have been presented to learners. This
procedure increases the chance that each instructional session will be error-free because learners only practice correct responses and are not given opportunities to respond incorrectly. Probe sessions, in which no prompts are delivered, are conducted prior to training sessions to test for acquisition of target behavior(s). Studies (n=18) reviewed by Morse and Schuster featured 74 participants with ages ranging from pre-school to adult. Skills targeted for instruction included discrete tasks (n=13) such as word reading (n=6), communication skills (n=3), basic academic skills (n=2), expressive object identification (n=2), receptive occupation identification (n=1), and receptive animal identification (n=1); some studies featured more than one targeted skill. Chained tasks (n=5) such as self-help skills (n=3) and vocational tasks (n=2) were also targeted for instruction. The SP procedure was successful for teaching students with moderate and severe disabilities skills across various domains. Given the documented success of SP and other systematic prompting procedures to teach choice making and communication skills, avenues of further research for skill instruction could focus on how skills might be taught to facilitate generalization to multiple settings and uses (Wood et al., 2005).

Choice making skill instruction that is focused on facilitating generalization could enable more potential choice opportunities to be available for individuals with greater support needs. Individuals deserve chances for choice making whenever and wherever those opportunities might take place, as choice-making skills are of little benefit to an individual if she or he is not provided with opportunities to use them. Agran et al. (2010) noted that individuals with greater support needs are often given fewer choice opportunities than individuals with less severe disabilities, an unfortunate trend given the documented ability of all persons with disabilities to make choices within a natural
context and the potential beneficial effects that promoting choice can provide to individuals (Lancioni et al., 1996; Snell & Brown, 2011). Offering more choice making opportunities to individuals has been shown to reduce problem behaviors and improve occupational engagement and individual levels of performance (Lancioni et al.; Snell & Brown). Embedding choice-making opportunities for students with severe disabilities during naturally occurring routines could allow more choice opportunities to be presented to students throughout the school day. Generalization of the skill to novel uses and settings could be facilitated if the student has been taught using a procedure that encourages him or her to make purposeful choices.

Assistive technology has been used to teach self-determination skills to individuals with severe disabilities (Wood et al., 2005) and to demonstrate the choice making abilities of individuals within this population (Lancioni et al., 1996). Augmentative alternative communication (AAC) devices provide individuals who are nonverbal or possess limited verbal skills with a means of communication. AAC devices range from low-tech devices, such as picture boards, to hi-tech, portable computing devices capable of producing speech and writing (Snell & Brown, 2011). In their review of choice making literature, Lancioni et al. included studies (n=5) assessing the ability of participants to use what could be considered “assistive technology” to make a choice. Studies presented choice alternatives in the following ways: (a) paired presentation format with switches that delivered a form of stimulation (e.g., visual, auditory, tactile, vibratory; n=3), (b) group presentation format with switches that delivered a form of stimulation (n=1), and (c) group presentation format with pictures that represented work activities (n=1). Results indicated choice-making opportunities using presentation of
different stimuli were an effective method of assessing participants’ choice making abilities. AAC devices have been used to teach choice making skills in addition to assessing the capacity of a person to make choices. The literature review by Wood et al. included studies (n=3) that used an AAC device (i.e., microswitch or picture book) to teach choice-making skills to participants. One study included participants with profound disabilities who were taught to use a microswitch to change a stimulus; 3 of 4 participants demonstrated increased engagement with the stimuli after they learned to use the switch. Another study included an individual with profound, multiple disabilities who learned to express choices using a microswitch and continued to use the switch after training was stopped. Additional research concerning assistive technology and choice making might focus on methods for teaching choice-making skills that feature different or newer assistive technologies with the flexibility to promote generalization.

The Apple video iPod, iPod touch, and iPad devices have received growing notice within the media (Bascaramurty, 2010; Juliano, 2011) and the special education community (Blood, Johnson, Ridenour, Simmons, & Crouch, 2011; Cihak, Fahrenkrog, Ayers, & Smith, 2010; Davis, 2011; Flores et al., 2012; Herbert, 2010; Kagohara et al., 2010; Kagohara, 2011; Kagohara et al., 2011; Newton & Dell, 2011; Price, 2011; Pyper, 2011; Schweder & Wissick, 2011; Sennot & Bowker, 2009; Skylar, 2008; van der Meer et al., 2011; Van Laarhoven, Johnson, Van Laarhoven-Myers, Grider, & Grider, 2009) for their potential use by individuals with disabilities for a variety of assistive functions (e.g., self-monitoring device, AAC device) or as a tool for teachers to use during instruction. The video iPod, iPod touch, and iPad were released in October 2005, September 2007, and March 2010, respectively (Apple Press Info, 2005;
Apple Press Info, 2007; Apple Press Info, 2010). Due to the novelty of these devices, there is a small evidence base involving their use in single subject research studies conducted with individuals with disabilities. A video iPod was used as a prompting device to teach independent job task completion in an employment setting to a high-school student with developmental disabilities (Van Laarhoven et al., 2009). Cihak et al. (2010) used a video iPod to deliver video modeling for improving independent transition behaviors of elementary-school students with autism spectrum disorders (ASD). Kagohara (2011) used an iPod touch to deliver video modeling for teaching high-school students with developmental disabilities to watch videos on the same iPod. Video modeling delivered via an iPod touch was also effective for teaching high-school students with developmental disabilities to use the iPod to listen to music (Kagohara et al., 2011).

Studies conducted with single-subject research designs have been used to examine the effectiveness of teaching students with developmental disabilities to use an iPod touch or an iPad as a functional communication device (Flores et al., 2012; van der Meer et al., 2011). Flores et al. compared the use of an iPad and a picture card-based system on the frequency of communication behaviors of five elementary-school students with ASD or developmental disabilities. An application for the iPad was developed and displayed six color photographs on the screen which students could touch to activate voice output for the following items and phrases: “I want,” “more,” “drink,” “pretzels,” “goldfish,” and “cookies.” The participants had previous experience using the picture-based system based on the same photographs and received training in use of the iPad until each had independently used it three times to ask for a snack during training sessions. The frequency of student requests was measured during the snack period under iPad and
picture-card conditions. Three students demonstrated an increase in communication behaviors during the iPad condition and two students demonstrated no change in the frequency of communication behaviors across conditions, indicating some individuals might prefer the iPad as a means of communication but others might not if they currently possess a functionally equivalent method of communication.

Van der Meer et al. (2011) used an iPod touch with the Proloquo2Go application to teach functional communication to individuals with severe intellectual disabilities. The application was configured with three symbols displayed on the screen for requesting a snack, toy, or social interaction. For two of the participants, the target response was snack requesting, with the toy and social interaction symbols present as distractors. For one participant, the target response was snack and toy requesting, with the social interaction symbol as a distractor. No positive reinforcement was delivered if a distractor symbol was touched during a trial. A constant time delay procedure with a 0-s interval was used during the first three acquisition-training trials to ensure students were making the correct response; a 10-s interval was implemented after the third trial with criterion set at three consecutive independent requests. Two participants reached criterion and maintained their rates of item requesting during maintenance sessions conducted 10 weeks after acquisition after the target skill. This study demonstrates one way the Proloquo2Go application and iPod touch technology can be used in conjunction with systematic instruction (i.e., time delay and differential reinforcement) to improve communication abilities for individuals with intellectual disabilities who are nonverbal or have limited verbal communication skills.

While an iPad has been shown to be effective for increasing frequency of
communication behaviors by individuals with developmental disabilities (Flores et al., 2012) and an iPod touch and Proloquo2Go have been used for teaching item requesting to individuals who do not possess communication skills to ask for items (van der Meer et al., 2011), no interventions have been published that feature both the iPad and Proloquo2Go application. Given the need for choice-making interventions to focus on the use of assistive technology that promotes generalization of skills and has the flexibility to be used in different environments, the iPad and Proloquo2Go need examination as potential instructional tools. The present study sought to expand the research literature featuring the iPad and Proloquo2Go through the following research questions: (1) Will the SP procedure be effective for teaching adolescents with intellectual disabilities choice-making skills using an iPad and Proloquo2Go? and (2) Will participants generalize choice-making skills to a novel set of stimuli?

Section 2: Method

Participants

Three middle school students (2 female, 1 male) with moderate or severe intellectual and physical disabilities participated in the study. Students received services in a special-education resource room of the middle school and were enrolled in general education classes for less than 40% of their school days. Students met the following prerequisite criteria before being considered for inclusion in the study: (a) receive special-education services in a middle-school resource room for students with low-incidence disabilities for at least 60% of each school day, (b) receive speech-language services at school, (c) have documented IEP goals for improving communication skills to increase engagement in school activities, (d) have no previous instruction involving use
of an iPad and/or Proloquo2Go as an AAC device, and (e) eat lunch in the school cafeteria for at least 90% of school days.

Students that met inclusion criteria were further screened for prerequisite abilities necessary to complete the study activities: (a) engage in a task for up to 3 min continuously when seated, (b) attend to the iPad and gaze at images displayed on screen, (c) possess independent range of motion of several inches with one hand or finger to interact with the iPad, (d) possess symbolic communication ability through picture recognition, and (e) accept a physical prompt as a controlling prompt.

Three students in the classroom who met inclusion criteria and possessed all prerequisite abilities participated in the study. Dolores, a 6th-grade student aged 12 years 3 months, received special education services under classification of a severe learning impairment and speech/language impairment with 1.5 hrs of pull-out physical therapy and 4 hrs of pull-out speech/language services per month. No functional IQ score was available for Delores. Her expressive and receptive language skills were ranked in the lowest 0.1 percentile compared to same-age peers. Her speech intelligibility rated approximately 80% for single words and 30% for phrases; she was intelligible when speaking common phrases (e.g., “Want food”) but her speech was unintelligible when she became excited; she exhibited frustration when others were unable to understand her verbal communication. She demonstrated engagement and interest in activities throughout her school day and appeared to enjoy most of her time at school. Dolores completed classroom routines consisting of a few steps (e.g., placing belongings in locker prior to entering classroom) with physical independence but occasionally needed a verbal prompt to initiate the routine. She participated in 1:1 and small-group instruction in the
special education classroom with 1:1 assistance provided by a paraprofessional or teacher during general education classes. Dolores could identify 20 sight words, follow two-step simple directions with one repetition with 100% accuracy in 3 of 5 trials, recognize and write numbers 0-9, grasp and carry common school items (e.g., notebook, cafeteria tray), walk safely throughout the school with assistance for navigation from staff or peers, and eat independently with assistance provided for cutting food. Her IEP featured goals based on academic (e.g., sight word identification, number identification), functional (e.g., personal hygiene), and physical (e.g., fine-motor sequencing) skill instruction; it also recommended consideration of an AAC device to increase her participation and engagement in school activities and improve her communication abilities.

Felicity, a 7th-grade student aged 13 years 9 months, received special education services under classification of an ASD and speech/language impairment with 4 hrs of pull-out speech/language services per month. No functional IQ score was available for Felicity. Her expressive and receptive language skills were ranked in the lowest 0.1 percentile compared to same-age peers. She often required verbal prompts to start daily routines and tasks and redirection to complete daily tasks of more than two steps; she was physically able to complete tasks without assistance. Felicity received instruction in small group and 1:1 formats in special and general education settings and willingly participated in all tasks at school. She worked hard when learning new or difficult tasks and could complete functional and daily living tasks of up to 10 steps. Felicity could identify 43 sight words, copy letters and words in large print, initiate tasks from visual and verbal cues in 4 of 5 trials, recognize and write numbers 0-20, recognize and count dollar bills in amounts up to $20, safely navigate the school building, and eat with independence. Her
IEP featured goals based on academic (e.g., word identification, number counting), communication (e.g., initiating interaction, maintaining eye contact), and daily living (e.g., grooming) skill instruction.

Michael, a 7th-grade student aged 14 years, received special education services under a classification of multiple disabilities including a severe intellectual disability, speech/language impairment, and physical disability with 1.5 hrs of pull-out physical therapy and 4 hours of pull-out speech language services per month. Michael used a motorized wheelchair for movement due to his diagnosis of muscular dystrophy, which prevented him from bearing weight on his legs and severely limited range of motion in his arms. He required total physical assistance to move out of his wheelchair. No functional IQ score was available for Michael. Michael’s speech intelligibility rated approximately 50-75% for single words and phrases of less than four syllables in length, and his expressive and receptive language skills ranked in the lowest 0.1 percentile compared to same-age peers. He enjoyed interacting with his peers and worked hard on some activities at school, but exhibited defiance when asked to complete tasks he did not enjoy. He completed classroom routines of a few steps in length with physical independence but required a verbal prompt to begin most routines. He participated in 1:1 and small-group instruction in special and general education settings. Michael could write his first and last name with a pencil using an enlarged grip, independently complete three-step fine-motor tasks when given a task direction, identify 30 sight words, recognize and write numbers 0-20, recognize and count dollar bills in amounts up to $20, independently complete learned functional and daily living tasks of up to 10 steps, safely navigate the school building, feed himself finger-foods, and use a modified fork or spoon.
with enlarged grip to eat other foods with assistance provided for cutting food. His IEP featured goals based on physical (e.g., maintain/improve upper extremity range of motion), communication (e.g., improved speech intelligibility), and academic (e.g., number counting and identification) skill instruction; it also recommended consideration of an AAC device to improve his participation and engagement in classroom routines and lessons and his communication abilities.

Participants in this study lacked consistent choice-making abilities when choosing from a wide variety of objects or when objects could not be presented tangibly. Students’ support needs resulted in fewer self-determination opportunities when eating lunch because participants did not possess a functional method of choosing between food options in the cafeteria that could be selected as part of their lunch or a means to effectively communicate those choices. The layout of the cafeteria impacted participants’ choice opportunities in the following ways: (a) the variety of foods and amount of space between cafeteria lines prevented students from being able to view all options; (b) students could not recognize all food labels displayed on cafeteria lines; and (c) the narrow cafeteria lines and placement of foods prevented Michael from being able to navigate the lines using his wheelchair.

**Investigator**

A paraprofessional at the participants’ school was the investigator who conducted every trial in all sessions for participants.

**Setting**

Participants attended an urban school (grades 6-12) located in the Midwestern region of the United States that served an enrollment of approximately 1,000 students.
The middle school and high school were contained within the same building and classrooms for each were divided into an east and west wing, respectively. The study was conducted in the school cafeteria and in a special-education resource room for middle-school students with low-incidence disabilities. The resource room served 12 full-time students for over 60% of the school day and two students for one instructional period. Eight rectangular tables for small-group and 1:1 instruction were arranged singularly or in pairs around the room. The classroom featured an adjoining private bathroom and instructional room. Baseline probe sessions, SP probe sessions, and maintenance probe sessions were conducted in the instructional room of the special-education resource room; SP training sessions were conducted in the cafeteria; generalization probe sessions were conducted in the special-education resource room.

Presentation of the iPad remained constant across participants and conditions (see Figure 1). The iPad was set on the table in landscape orientation relative to participants. Other students were not present during baseline probe sessions, SP probe sessions, and maintenance probe sessions to control for distractors. Other students from the participants’ classroom, including other participants in the study, were present in the cafeteria during SP training sessions. Other students, including other participants in the study, were present in the classroom during generalization probe sessions but were not seated at the table being used for the session. The investigator held a notebook around the iPad during SP training sessions and generalization probe sessions so that only the student participating in the session could view the iPad screen. The classroom teacher and paraprofessionals were present during generalization probe sessions; classroom and cafeteria staff were present during SP training sessions.
Figure 1. iPad as presented during sessions
Materials and Equipment

The Proloquo2Go application and an iPad2 were used during all sessions. The iPad2 is the second generation of Apple's iPad tablet series. It features a 9.7-inch LED-backlit touch screen, 16 gigabyte hard drive, front and rear facing cameras, and built-in Wi-Fi capability (Apple Press Info, 2011). Proloquo2Go was designed for use as an AAC device to run on an iPod touch or iPhone, and subsequently the iPad, following its release. The application features thousands of pre-programmed vocabulary words and a dynamic display that can be customized with more or fewer buttons visible on each page. Buttons are divided into two groups: (a) vocabulary buttons that cause Proloquo2Go to speak words and phrases, and (b) folder buttons that contain vocabulary buttons as well as other folder buttons. Folders in Proloquo2Go are organized hierarchically. Users can select buttons by tapping them on the screen and can scroll the display to new buttons by swiping the screen in an upward or downward motion of several inches. New vocabulary and folder buttons can be created inside pre-programmed or user-created folders, and users can create folders linked to any existing folder in the application. Pre-existing symbols loaded into the application or pictures taken with the camera or stored on the memory of the device in use (i.e., iPod touch, iPad) can be placed onto new buttons, and the speech and text of the buttons can be individualized. The small size of the iPod touch and iPhone display can prohibit individuals with significant motor or visual impairments from utilizing the program (Sennot & Bowker, 2009), but the larger display size of the iPad provides a method to access the application for individuals with limited fine-motor control.

Toolbar buttons (e.g., “Back,” “Home”) located below the message window and
at the bottom of the Proloquo2Go display allow users to quickly navigate between folders. Selection of the “Back” button on the toolbar returns Proloquo2Go to the previously viewed folder so users can select vocabulary buttons from multiple folders. Choice folders for participants were created in Proloquo2Go by completing the following task-analyzed steps:

1. Select “Options” button on toolbar, select “Restrictions” category, turn “Edit Mode” to “On”

2. Select “Home” button on toolbar, select “Pencil” button on toolbar to enter edit mode, select “Add Folder,” select “New Folder,” name folder with participant’s name (e.g., “Dolores”), repeat to create folders for all participants (e.g., “Felicity,” “Michael”)

3. Select “Dolores” folder, select “Pencil” button, select “Add Folder,” select “New Folder,” name folder “Cafeteria” and add cafeteria symbol to folder button

4. Select “Add Folder,” select “New Folder,” name folder “Classroom” and add classroom symbol to folder button

5. Double-tap “Cafeteria” folder to open while in edit mode, select “Add Folder,” select “New Folder,” name folder “Monday” add Monday symbol to folder button, repeat to create folders for remaining days of week

6. Double-tap “Monday” folder, select “Add Folder,” select “New Folder,” name folder “Main Course” add main course symbol to folder button; and repeat to create folders labeled “Side,” “Fruits and Vegetables,” “Drink,” and “Dessert”

and “Main Course” folders, select “Swap” button

8. Double-tap “Main Course” folder, select “Add Folder,” select “Link to Existing Folder,” select “Link to Folder” = choose “Side” folder created in step (6), select “Text to Speak” type sentence relative to food available for selection (e.g., “I want a cheeseburger.”), add picture of food to folder, repeat to create linked folder buttons for each main course available on Monday

9. Select “Back” button located on toolbar, double-tap “Side” folder, repeat step (8) but link created folders to “Fruits and Vegetables” folder created in step (6)

10. Select “Back” button twice, scroll to “Tuesday” folder created in step (5), repeat step (6) procedure but only add “Main Course” and “Side” folders to “Tuesday” folder, repeat step (8) and (9) procedures to create linked folders containing main courses and sides available on Tuesday

11. Repeat step (10) with “Wednesday,” “Thursday,” and “Friday” folders

12. Select “Back” button three times to navigate to participant’s root folder (e.g., “Delores), double-tap to select “Classroom” folder created in step (4), select “Add Button,” label button with name and picture of task-related stimuli (e.g., printed flashcards), and repeat to create items for additional tasks (e.g., money counting, number recognition)

13. Select “Home” button, repeat steps (3)-(10) with remaining participant folders (e.g., “Felicity,” “Michael”)

Creating buttons using this method enabled participants to select buttons from multiple folders during probe sessions without having to touch the “Back” button to access a new folder after a choice was made. Items in the five food folders (e.g., “Main
Course,” “Side,” “Fruits and Vegetables,” “Dessert,” and “Drink”) were programmed to link the folders in that respective order, so that when participants selected a button in the first folder (e.g., “Spaghetti” in “Main Course”) by touching it on the screen, a button from the second folder (e.g., “Breadstick” in “Side”) was automatically displayed and participants could scroll the display to view additional choices available within the folder. The average time to program participants’ choice sets was 4 min 37 s.

Proloquo2Go option settings remained constant across conditions and participants except the voice output setting, which was kept relative to participants’ gender. Option categories can be accessed in Proloquo2Go by selecting the “Options” button on the toolbar. Table 1 contains changes made to the default Proloquo2Go settings that were used during all sessions. Use of these settings ensured that only one stimulus (i.e., button) was displayed on screen at a time and enabled participants to scroll between stimuli with a vertical finger swipe requiring less than an inch of movement. Turning off the vocabulary repeat function meant students could not select the same task twice in a row during generalization sessions. Turning off various options under the “Restrictions” category reduced the number of buttons displayed on toolbars to promote participants’ attendance to vocabulary and folder buttons. Additionally, visibility of the “Options” button on the toolbar was removed by accessing Proloquo2Go application settings and setting “Option Button Visibility” to “Off.”

Additional materials included tangible items (e.g., cafeteria foods and drinks, academic task materials), data sheets, and an electronic stopwatch used as a delay timer. Appendix 1 contains examples of data sheets used for dependent variable, interrater reliability, procedural fidelity, and social validity data collection.
<table>
<thead>
<tr>
<th>Category</th>
<th>Option Name</th>
<th>Option Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Number of Columns</td>
<td>1</td>
</tr>
<tr>
<td>Appearance</td>
<td>Number of Rows</td>
<td>1</td>
</tr>
<tr>
<td>Appearance</td>
<td>Display Style</td>
<td>Grid</td>
</tr>
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<td>Appearance</td>
<td>Message Window Size</td>
<td>Very Small</td>
</tr>
<tr>
<td>Appearance</td>
<td>Toolbar Size</td>
<td>Small</td>
</tr>
<tr>
<td>Appearance</td>
<td>Show Folder Image</td>
<td>Off</td>
</tr>
<tr>
<td>Appearance</td>
<td>Display</td>
<td>Image Only</td>
</tr>
<tr>
<td>Interaction</td>
<td>Scroll by Page</td>
<td>On</td>
</tr>
<tr>
<td>Interaction</td>
<td>Single Page Swipe</td>
<td>On</td>
</tr>
<tr>
<td>Interaction</td>
<td>Allow Repeat</td>
<td>Off</td>
</tr>
<tr>
<td>Restrictions</td>
<td>Edit Mode</td>
<td>Off</td>
</tr>
<tr>
<td>Restrictions</td>
<td>Share and Add</td>
<td>Off</td>
</tr>
<tr>
<td>Restrictions</td>
<td>Typing View</td>
<td>Off</td>
</tr>
<tr>
<td>Restrictions</td>
<td>Recent View</td>
<td>Off</td>
</tr>
</tbody>
</table>
**Procedures**

**Pre-intervention preference assessment.** Preference assessments were conducted prior to data collection to determine stimuli that would be programmed into Proloquo2Go as items in participant’s respective “Dessert” folders. Preference assessment ensured highly reinforcing edibles were available for selection in at least one trial during probe sessions. Desserts chosen by participants during probe sessions were brought to the cafeteria and provided to participants during lunch. Direct assessment (Snell & Brown, 2011) of each student was conducted with a paired-stimulus presentation method (Lohrmann-O'Rourke, Browder, & Brown, 2000). Participants sampled six dessert foods representing a range of taste and texture options to ensure familiarity with each. Stimuli were then presented in pairs until all possible pairings were offered once. Participants received a small sample of the dessert chosen during a trial, and selections were recorded during each trial and totaled for the session. Participants completed two preference assessment sessions and item selections were totaled with the three desserts selected most often by participants composing the choices available in their respective “Dessert” folders. Michael’s dessert items were chocolate chip cookies, fruit snacks, and Jell-O cup; Felicity’s desserts were chocolate chip cookies, chocolate pudding cup, and fruit snacks; Delores’ desserts were chocolate chip cookies, fruit snacks, and sugar cookies.

**Baseline probe procedures.** Baseline probe sessions began following the completion of preference assessments. Participants started baseline probes concurrently (i.e., on the same day) and baseline sessions began 5 min before lunch period. Participants were probed in a consistent order (i.e., Michael, Felicity, Delores) and exited
Baseline probe sessions were conducted daily with the first participant (i.e., Michael) until baseline data collection indicated a stable trend of less than 50% correct responses during baseline probe sessions for five consecutive sessions; baseline probe sessions were conducted once per week (i.e., every five sessions) for the remaining participants (i.e., Felicity and Delores). Introduction of the independent variable was withheld if data collection demonstrated a therapeutic or unstable trend in the first participant’s baseline data, and the intervention was introduced to the participant only after a stable trend emerged. When the first participant reached criterion during SP probe sessions, the second participant (i.e., Felicity) began daily baseline probe sessions until the same trend became evident while baseline probes continued at a frequency of once per week for the third participant (i.e., Delores). This process was replicated with Delores until all participants had completed at least five consecutive baseline probe sessions with less than 50% correct responses.

**Baseline probe session data collection.** The target behavior of the study was independent lunch choices made by participants using an iPad and the Proloquo2Go application. Data were collected on the number of trials in each baseline probe session in which participants made an independent (i.e., correct) choice within a 5-s delay interval. Baseline probe sessions were conducted in a massed-trial format with five trials in each session. Trials corresponded to the five folders (e.g., Trial 1: “Main Course,” Trial 2: “Side,” Trial 3: “Fruits and Vegetables,” Trial 4: “Drinks,” Trial 5: “Desserts”) into which different foods available for lunch were divided. Participant responses in all trials were recorded as (a) correct (+)—student independently selected an item from the
appropriate folder for the trial by tapping an item on the iPad screen within the delay interval so that Proloquo2Go vocalized the item name, (b) incorrect (-)—student interacted with Proloquo2Go and/or iPad in a manner that did not result in selection of an item from the appropriate folder for the trial within the delay interval, or (c) no response (0)—student did not attempt to interact with the iPad within the delay interval. Participant responses were recorded after each trial. Correct responses were totaled and converted to a percentage correct by dividing the number of correct responses by the number of trials in the session.

Baseline probe session procedures. The instructor completed the following steps prior to the first trial of baseline probe sessions: loaded Proloquo2Go with the “Cafeteria” folder of the participant in the session selected and the folder of the current day displayed on screen (e.g., “Monday”), set iPad on table in landscape orientation, stated attentional cue (e.g., “Delores, come work with me.”), waited for student to sit at table beside instructor, delivered task direction (e.g., “Tell me what you want.”), and began a 5-s delay interval. If participants scrolled the Proloquo2Go screen to display new buttons (i.e., food items available for selection) within a folder, 5-s were added to the delay to provide participants time to scan all buttons. No time was added to the delay if participants scrolled to a page containing buttons that were previously viewed during a trial.

If participants emitted a correct response during a trial, a new trial and 5-s delay interval were immediately started following the correct response. If participants emitted an incorrect response, the instructor waited the 5-s delay interval before starting a new trial. If no response occurred during a trial, a new trial and delay interval were started.
after 5-s. The instructor did not reinforce responses from any student during baseline probe trials. Instructor behaviors to participant responses remained consistent across trials. If no correct responses occurred during the first three trials of a baseline probe session, the session was ended after the third trial; otherwise, all baseline probe sessions consisted of five trials. The instructor removed the iPad from in front of the student at the conclusion of baseline probe sessions.

**Baseline post-probe session procedures.** Items selected by correct responses during baseline probe sessions were subsequently provided to participants after the session was completed. For example, if a participant responded correctly in two trials during a baseline probe session and selected items from the “Main Course” (e.g., pizza) and “Side” (e.g., breadstick) folders, those items were placed on the student’s lunch tray as the student proceeded through the cafeteria line with the instructor or classroom staff for Felicity and Delores; or items were brought on a tray to the student by the instructor or classroom staff for Michael.

Normal classroom procedures were followed for item selection in trials where participants emitted incorrect responses or no responses during baseline probe sessions. Felicity and Delores walked through a cafeteria line with the instructor or classroom staff while the instructor or staff phrased items available on the line as one-word questions (e.g., “Grapes?”) and simultaneously pointed to items. If Felicity or Delores did not verbally or physically respond to a question within several seconds, a different question was posed with an item (e.g., “Pear?”) that was available on the same cafeteria line. If all items on the cafeteria line were offered in this manner and no student responses occurred, the instructor or classroom staff made a selection. Michael was asked yes/no questions
with printed pictures of lunch items (e.g., “Do you want grapes?”) while he was seated at a cafeteria table, and his selected items were retrieved from the lunch lines. When he responded “No” to a question or did not respond within several seconds, a new question was asked with a different item (e.g., “Do you want pear?”). If Michael did not respond to any items, the instructor or classroom staff made a selection.

**SP probe procedures.** The SP instructional procedure served as the independent variable in this study. SP is an errorless learning procedure consisting of separate probe sessions and training sessions (Morse & Schuster, 2004). SP probe sessions began on the day after participants’ final baseline probe sessions. SP probe sessions were conducted according to the same procedures as baseline probe sessions except the following: SP probe sessions were only conducted with the participant currently in SP condition, the participant in SP condition was probed daily, and SP probe sessions continued until the participant met criterion of three consecutive SP probe sessions with a correct response in 100% of trials. This procedure was followed until each participant met criterion and exited SP condition.

**SP training procedures.** SP training sessions began in the cafeteria on the same day as participants’ final baseline probe sessions and were conducted after final baseline probe sessions to ensure participants received correct-response training before beginning SP probe sessions. Subsequent SP training sessions were conducted daily in the cafeteria following SP probe sessions until participants met criterion of three consecutive SP probe sessions with a correct response in 100% of trials. SP training sessions ended after participants reached criterion.

Trials within SP training sessions were conducted in a massed-trial format with a
0-s delay. Participant response data were not collected during SP training sessions because a controlling prompt that ensured correct responses was used in each trial. The controlling prompt remained consistent across participants during SP training sessions. A hand-over-hand physical prompt was utilized because a less intrusive method of prompting (e.g., verbal, elbow-touch physical) was unlikely to ensure correct responses would occur in each training trial due to participants’ lack of previous instruction involving an iPad. The instructor completed the following steps in order prior to the first trials of SP training sessions: ensured student was sitting at table with cafeteria tray on table near student, loaded Proloquo2Go with the “Cafeteria” folder of the participant in the session selected and the folder of the current day displayed on screen (e.g., “Monday”), sat beside student, and presented the iPad in front of the student. A notebook was placed around the iPad screen simultaneously with its presentation if other participants in the study were present in the cafeteria. The instructor stated the task direction (e.g., “Tell me what you want.”) and delivered the controlling prompt with a 0-s delay to start the first training trial.

In the first trials of SP training sessions, participants were prompted to navigate from the “Cafeteria” folder that was open when they were presented the iPad to the “Main Course” folder of the current day. This prompting was only necessary in the first trial of SP training sessions because selection of a button within one of the five folders into which food and drink items were divided caused buttons from a novel folder to be displayed. The instructor prompted participants to select the folder displayed on screen (e.g., “Monday”) by pressing down on the folder button in the center of the iPad screen, then prompted participants to select the “Main Course” folder that appeared on the screen
in the same manner. The instructor waited 5 s to allow participants to scan the button now displayed on screen (i.e., a food item available as a main course) and then guided the participant’s hand to make a small upward swiping motion of several inches on the screen to display a button with a novel food item. An additional 5 s were counted, the participant was prompted to make the same motion, and this process was repeated until each button in the folder was viewed. The participant was prompted to scroll the display to the button containing the food item that was present on his or her tray by making downward swiping motions on the screen and to select that item by pressing down in the center of the button. The instructor slid the participant’s lunch tray in front of her or him and slid the iPad to the side, and a 10-s interval was allowed for item sampling while the instructor offered the selected item to the participant. No verbal reinforcement was delivered during training trials because cafeteria foods and drinks served as natural reinforcers for correct responses. The instructor slid the lunch tray away from the student following the 10-s sampling interval, slid the iPad in front of the student, and a second training trial was started. The scanning and sampling procedure from the first trial was repeated with buttons from the remaining folders (e.g., “Side,” “Fruits and Vegetables,” “Drink,” “Dessert”) until five training trials were conducted and one item was selected from each folder. After the sampling interval of the fifth trial, the participant’s lunch tray was left in front of him or her and the SP training session was ended.

Anecdotal data of item acceptance or refusal were collected on items selected by participants during SP probe sessions to determine if participants were making valid choices through correct responses during SP probe trials. Incidental data were recorded on the same data sheets used for dependent variable data collection during SP probe
sessions. A “/” was marked in the response column of probe trials in the session where a correct response occurred (i.e., probe trials with a “+” recorded). Participant responses to offered foods and drinks were recorded under the “/” as (a) acceptance (+) – student sampled item when offered during 10-s SP training-trial interval or independently during lunch period or (b) refusal (-) – student did not sample item during training-trial interval or independently during lunch period. Participant responses were converted to a percentage of item acceptances by dividing the number of acceptances by the number of acceptances plus refusals; a “/” was marked in the box at the bottom of the response (R) column that contained percentage of correct responses during the SP probe session, and percentage of acceptances was recorded under this mark.

**Maintenance and generalization.** Maintenance probe sessions were started after participants reached criterion on SP probes to evaluate maintenance of choice-making skills learned using the SP procedure. Maintenance probe sessions began on the day following participants’ final SP probe sessions and were conducted daily for five consecutive days and at a frequency of once per 5 days thereafter. Maintenance probe sessions followed the same procedures as baseline probe sessions except that they were only conducted with participants in maintenance/generalization condition.

Participants’ ability to generalize learned choice-making skills to a novel set of stimuli was assessed after participants reached criterion during SP probe sessions. Generalization of choice-making skills to selecting the order of academic tasks to be completed was assessed. Participants completed three academic tasks during the second instructional period of the school day: (a) two math skill tasks (e.g., counting, number recognition) and (b) one language skill task (e.g., sight-word recognition). Choice-
making opportunities using the iPad were provided at the beginning of the period and following completion of the first task to allow participants an opportunity to select task order during the period.

Generalization probe sessions were started on the day following participants’ final SP probe sessions and were conducted according to the same schedule as maintenance probe sessions (i.e., generalization probe sessions and maintenance probe sessions occurred on the same day for participants in maintenance/generalization condition). Generalization probe sessions were conducted in the participants’ primary classroom. Generalization probe session response classes, definitions, and data recording remained constant with baseline probe sessions except an additional behavior for an incorrect response was added: if participants attempted to select a task that had previously been selected during the generalization probe session.

The instructor completed the following steps prior to the first trials of generalization sessions: ensured task materials for the participant in the session were in a bin under the table, loaded Proloquo2Go with the folder of the participant in the session selected (e.g., “Felicity”) and the “Classroom” folder displayed on screen, set iPad on table in landscape orientation with notebook around iPad screen, stated attentional cue (e.g., “Felicity, come work with me please.”), waited for student to sit at table in front of iPad, delivered task direction (e.g., “Tell me what you want to do first.”), and started a 5-s delay interval. An additional 5 s were added to the delay interval if participants scrolled the display to view a button containing an academic task that had not previously been viewed during the session.

If participants selected an academic task during the delay interval by selecting the
“Classroom” folder displayed on screen and then selecting a button within that folder, materials for the chosen task were immediately retrieved from the bin by the instructor. If an incorrect response or no response occurred during the delay interval, the instructor selected the academic task to be completed and provided corresponding materials and instruction to the student. The iPad was removed from in front of the student before the task was begun. Participants completed the task independently or with the instructor or classroom staff providing assistance and instruction as necessary dependent on the task being completed. After participants completed the first task, the instructor removed the task materials, presented the iPad to participants with a notebook placed around screen, delivered a new task direction (e.g., “Tell me what you want to do next.”), and started a 5-s delay interval for the second trial. Turning off the “Vocabulary Allow Repeat” function in the Proloquo2Go application settings ensured that a task could only be selected once during each generalization probe session. Instructor behaviors remained constant for each trial of the session. While no verbal reinforcement was delivered during SP training trials because food and drink served as natural reinforcers, during generalization sessions verbal reinforcement (e.g., “Great job counting today, Michael.”) was delivered after each selected task was completed. No trials occurred for selection of the third task because there was only one choice available to participants after the first two tasks were selected. Materials from the unselected task were presented and the instructor or classroom staff completed the task with the student.

**Experimental Design**

A multiple probe design (Gast & Ledford, 2010; Horner & Baer, 1978) across participants was used to examine the effectiveness of SP to teach choice-making skills
using an iPad. This design was used because it allowed for simultaneous measurement of the same target behavior exhibited by 3 different participants under the same environmental conditions. A multiple probe was selected over a multiple baseline design because it provided adequate pre-intervention data collection to demonstrate a stable trend in data for all participants before the independent variable was introduced without prolonged, continuous probing of participants in conditions where reinforcement was unlikely. A multiple probe design across participants demonstrates inter-subject direct replication of effect through introduction of the independent variable sequentially and in a staggered fashion across tiers (i.e., individual participants). Experimental control is evaluated through pre- and post-intervention data collected across participants. For this study, baseline data were collected until a zero-celerating or decelerating trend was evident for at least five consecutive sessions for the first participant, at which point the independent variable (i.e., the SP teaching procedure) was introduced to that participant. Baseline data were intermittently collected with participants remaining in baseline condition while probe data were collected daily with the first participant in intervention condition until that participant met the number of sessions to criterion. After the first participant reached criterion, baseline data were collected with the second participant remaining in baseline condition until a zero-celerating or decelerating trend was evident for at least five consecutive sessions, at which point the independent variable was introduced to the second participant. This process was repeated with the third participant. Participants entered the maintenance condition after reaching criterion on intervention probe sessions.

Experimental control was demonstrated through evidence of effect at three points
in time: introduction of the independent variable resulted in an immediate change in level and trend in a therapeutic direction for participants while baseline data remained stable for participants in pre-intervention condition. Maintenance data collected after participants reached criterion demonstrated continuation of this therapeutic trend level for all participants. Staggering introduction of the independent variable across students controlled for threats to internal validity due to history (only introduction of the independent variable influenced participant responses), maturation (student behaviors were unlikely to change due to passage of time because of limited duration of pre-intervention data collection conditions and short length of probe sessions), and testing (facilitative or inhibitive effects were avoided by the instructor not prompting correct responses, not correcting incorrect responses, not verbally reinforcing correct responses, and by short length of probe sessions). Instrumentation threats to internal validity (e.g., consistent target behavior definitions, data recording/measurement procedures, observer bias, observer drift, observer independence) were controlled for through interrater reliability data collection; threats to procedural fidelity were evaluated through procedural fidelity data collection.

Reliability

Interrater reliability. Interrater reliability data were calculated using the point-by-point method by dividing the number of agreements on student behavior in trials during a session by the number of agreements plus disagreements and multiplying by 100 to determine the percentage of student behaviors which were agreed upon during the session. Interrater reliability data were collected on the target behavior (i.e., independent choices made using iPad within the delay interval) in all sessions except SP training
sessions because participant responses were always correct during training sessions.

**Procedural fidelity.** Procedural fidelity data were calculated by dividing the number of observed instructor behaviors during a session by the number of planned/possible instructor behaviors and multiplying by 100 to determine the percentage of procedural fidelity (Billingsley, White, & Munson, 1980). The following instructor behaviors were recorded as either occurring (+) or not occurring (−) during sessions: (a) ensured student was attending to instructor (b) presented iPad to student (c) delivered task direction (e.g., “Tell me what you want”) (d) waited correct response interval during probe sessions or delivered controlling prompt during training sessions (e) recorded student responses during probe sessions or student acceptance or refusal of items during training sessions and (f) provided lunch items selected during probe sessions to students after session conclusion.

**Reliability results.** Reliability data were collected during 30% of all sessions and at least once per condition per participant. Interrater reliability and procedural fidelity data were collected simultaneously during sessions. Interrater agreement averaged 100% across participants and conditions, and procedural fidelity data indicated planned/possible instructor behaviors occurred at an average of 99% across participants and conditions. An instructor behavior (i.e., waiting correct response interval during probe sessions) was twice recorded as not occurring during a trial in two separate sessions because the instructor allowed the trial to run past the length of the delay interval.

**Social Validity**

The social validity of the research was assessed at the conclusion of the study. A Likert-type questionnaire (see Appendix A3) was provided to participants’ parents and
teacher that asked individuals to rate the following statements on a 5-point scale: (1) I feel the skill targeted in the study (choice making) was important (2) I believe teaching the skill was a valuable use of school time (3) I feel that providing more choice opportunities to my son, daughter, or student is beneficial to his or her life (4) I consider the iPad and Proloquo2Go technology less expensive compared to other communication devices, and (5) I am interested in learning how to program the Proloquo2Go application or other iPad applications for my son, daughter, or student to use. Parents and the teacher agreed or strongly agreed with all statements on the questionnaire except question (4), which parents of two participants scored as neutral.

Section 3: Results

The SP procedure (i.e., the independent variable for this study) was effective for teaching participants choice-making skills using an iPad and the Proloquo2Go application (see Figure 2). Dependent variable data collected during baseline probe sessions indicated a stable, zero-celerating trend for all participants prior to introduction of the SP procedure. Participants averaged 91% correct responses during SP probe sessions with a range of 60-100% correct responses across participants and a mean of 4.66 sessions across participants to reach criterion. Incidental data were taken regarding consumption of items selected by participants during SP probe sessions to determine if participants would consume those items when offered during SP training sessions or during lunch period; participants’ averaged 81% consumption of items selected during SP probe trials (see Figure 2).

Maintenance probe data collected after participants reached criterion indicated all participants maintained choice-making skills after SP training sessions ended with an
average of 98% correct responses during maintenance probe sessions. Two of three participants generalized learned skills to a novel set of stimuli and used the iPad to make choices regarding the order of academic tasks completed during an instructional period. Participants averaged 69% correct responses during generalization probe sessions.

Duration data recorded during each session indicated mean baseline probe session duration of 15 s, mean SP probe session duration of 47 s, mean SP training session duration of 2 m 31 s, mean maintenance session duration of 49 s, and mean generalization session duration of 13 s.

**Michael**

Baseline probe data for Michael were collected for five sessions with averages of 0% correct responses, 60% incorrect responses, and 40% no responses during baseline probe sessions. Upon introduction of intervention, there was an immediate and abrupt change in level and trend in a therapeutic direction for Michael with a percentage of non-overlapping data (PND) between baseline probe sessions and SP probe sessions of 100. During SP probe sessions, he averaged 100% correct responses and reached criterion in three SP probe sessions. Michael averaged 100% correct responses during maintenance probe sessions. Correct responses during generalization probe sessions ranged from 50% to 100% with an average of 83%.

**Felicity**

Baseline probe data for Felicity were collected for seven sessions with averages of 0% correct responses, 52% incorrect responses, and 48% no responses during baseline probe sessions. Upon introduction of intervention, there was an immediate and abrupt change in level and trend in a therapeutic direction for Felicity with a PND between
Figure 2. Graph of results: percentage of correct responses for lunch choices and academic tasks, and percentage of food items selected during SP probe trials that were consumed
baseline probe sessions and SP probe sessions of 100. During SP probe sessions, she averaged 100% correct responses and reached criterion in three SP sessions. Felicity averaged 100% correct responses during maintenance probe sessions conducted after she reached criterion. Correct responses during generalization probe sessions ranged from 50% to 100% with an average of 71%.

**Delores**

Baseline probe data for Delores were collected for eight sessions with averages of 0% correct responses, 38% incorrect responses, and 62% no responses during baseline probe sessions. Upon introduction of intervention, there was an immediate and abrupt change in level and trend in a therapeutic direction for Delores with a PND between baseline probe sessions and SP probe sessions of 100. During SP probe sessions, correct responses ranged from 60% to 100% with a mean of 85% correct responses during SP probe sessions. Delores averaged 92% correct responses during maintenance probe sessions with a range of 80% to 100%. Correct responses during generalization probe sessions ranged from 0% to 50% with an average of 30%.

**Section 4: Discussion**

Assistive technology devices and systematic instructional procedures have been successfully used in conjunction to teach choice-making skills to individuals with developmental disabilities. This study sought to evaluate the effectiveness of the SP systematic instructional procedure to teach adolescents with developmental disabilities to use an iPad and the Proloquo2Go to make choices. All participants in the study learned to make consistent choices (i.e., choosing from food and drink options available for lunch in the school cafeteria) using an iPad after being taught with the SP procedure, and 2 of 3
participants generalized the skill to selecting between academic tasks.

The results of this study have numerous implications for future practice and implementation by classroom teachers of students with low-incidence disabilities who have limited communication skills. Given participants’ lack of exposure to iPad instruction prior to this study, the results indicate the touch-screen technology of the iPad is intuitive and skills to use the iPad can be rapidly acquired by learners. The target behavior of the study took few sessions for participants to master, as 2 of 3 participants reached criterion in the minimum number of SP probe sessions possible. The PND (i.e., 100%) between baseline probe sessions and SP probe sessions was evidence of the effectiveness of SP for participants’ rapid acquisition of the target skill. Anecdotal data collection indicated that all participants were making valid choices using the iPad because participants consumed the majority of foods selected during SP probe sessions in all but one session, when Delores consumed only 1 of 3 items selected during her first SP probe session. Differences in the percentage of participants’ correct responses during SP probe sessions compared to percentage of selected foods that were later consumed were primarily due to participants not sampling fruits and vegetables that were chosen. In future or related implementation of the procedure used in this study, a “No thanks” button could be added to folders so that students would not be forced to choose a food they do not want to eat. All students maintained the learned skill as evidenced through high percentages of correct responses during maintenance probe sessions after SP training sessions ended. Michael and Felicity were able to generalize learned skills to a neutral set of stimuli (i.e., Proloquo2Go buttons containing academic tasks) different from stimuli with which the procedure was taught (i.e., Proloquo2Go buttons containing foods and
drinks). The procedures used in this study might provide a useful model for classroom teachers for numerous reasons: individual student folders can be created quickly and new vocabulary and folder buttons can be added at any time, multiple students can use the same iPad if there is limited access to technology, probe and training sessions are of short duration to maximize classroom instructional time, students may only require a small number of training sessions to acquire the target skill, students might maintain the learned skill with high rates of correct responses, and there is the possibility students might generalize learned skills to novel stimuli in a novel environment.

During the first trials of SP training sessions, participants were taught to select two folders (i.e., the folder labeled with the corresponding day of the week, then “Main Course”) before an item available for selection for lunch was displayed on the iPad screen to facilitate acclimation to navigation of Proloquo2Go for potentially improving generalization with the application. Due to the small size of the “Back” button, participants with limited fine-motor control (e.g., Michael, Delores) may have been unable to consistently select it in order to navigate between folders in the application. Folders were created so participants would not have to select the “Back” button in order to view a new folder. It is possible that the manner in which buttons were created in Proloquo2Go contributed to participants’ rapid mastery of choice-making skills. After participants navigated to the “Main Course” folder, the items displayed on screen for the rest of the trial were buttons created with individual pictures of foods and drinks. Once participants selected a button in the first folder, items from the next folder were displayed on screen because folders were linked together when created. Essentially, after the first trial of probe sessions, participants were “locked” into the folders containing items
available for lunch choices, making an incorrect participant response due to error in Proloquo2Go navigation unlikely to occur.

It is important to note the limitations of this study. Inter-subject direct replication in this study was limited (i.e., across only three participants) and further replication with additional subjects is necessary to reliably demonstrate the efficacy of systematic instructional procedures for teaching students with intellectual disabilities to use an iPad and Proloquo2Go. Participants were only taught to access one folder (i.e., “Main Course”) in this intervention and did not receive instruction in navigation between folders of the application. Participants in this study all possessed symbolic language skills to be able to recognize pictures of foods and drinks; individuals who communicate largely through pre-symbolic forms of communication might need additional instruction within this domain before the procedure could be implemented. The generalization component of this study could be strengthened prior to further research and implementation of similar interventions. Instead of academic task selection, students could be provided opportunities to select naturally reinforcing activities (e.g., preferred leisure activities). Tasks and activities that are reinforcing to students could be added to folders containing non-preferred tasks to prevent non-reinforcing options from being the only choices available. Generalization probe sessions could contain additional trials to provide students further opportunities for making choices. Data could be collected during probe sessions to determine students’ willingness to complete selected tasks or note changes in behaviors when completing student-selected tasks compared to teacher-selected tasks.

This study adds to the current research base involving iPad use in single-subject research designs by demonstrating the effectiveness of a systematic instructional
procedure (i.e., SP) for teaching students with intellectual disabilities to use the iPad and Proloquo2Go to make and communicate choices. Results of this study are consistent with previous findings (Flores et al., 2012) that indicate individuals with developmental disabilities can be taught to use an iPad application that displays pictures on screen to make choices when those individuals possess symbolic communication abilities. This study contributes to research conducted by van der Meer et al. (2011) by further demonstrating the ability of individuals with disabilities to learn to use an iPad and Proloquo2Go for functional communication.

The procedures and technology used in this study offer many benefits to students compared to choice making using printed pictures as means of communication. Interaction with the iPad might be more intrinsically motivating to students compared to pictures because students are independently manipulating the technology and actively engaging stimuli. The verbal communication support provided by Proloquo2Go and the iPad might also be more reinforcing to students than non-verbally choosing pictures. Once an individual learns to make choices using Proloquo2Go, the skill is generalizable to a variety of environments (e.g., a novel restaurant) and teachers and families can create choice boards for new environments within minutes. The prevalence of touch-screen tablets and smartphones in society might make using an iPad to communicate in a public setting less stigmatizing for individuals with communication support needs.

Future research to expand the evidence base for iPad use in choice-making and communication interventions might alter numerous aspects of this study to examine different research questions. The study could be replicated with students with different support needs or students of different ages than participants in this study to determine the
intervention’s effectiveness with different student populations. The effectiveness of using SP to teach students to use Proloquo2Go as a dedicated AAC device could be evaluated. The use of different instructional procedures to teach students to use Proloquo2Go could be examined. The utilization of a different experimental design (e.g., changing criterion) to expand students’ abilities to interact with various functions of Proloquo2Go and navigate the application could be assessed. Additionally, the many educational applications available and the flexibility of the iPad to be used by both teachers and students for many different functions within the realm of special education offer a myriad of avenues for future research that could be conducted involving single-subject designs and the iPad.
Appendix A

Data Collection Sheets: Dependent Variable, Procedural Fidelity, Social Validity
Appendix A1

**Dependent Variable and Interrater Reliability Data Collection Sheet**

<table>
<thead>
<tr>
<th>Date/Session:________</th>
<th>Student:____________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus</td>
<td>R</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>% Correct</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date/Session:________</th>
<th>Student:____________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus</td>
<td>R</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
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</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>% Correct</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date/Session:________</th>
<th>Student:____________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus</td>
<td>R</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
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</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>% Correct</td>
<td></td>
</tr>
</tbody>
</table>

(+)-Correct  
(-)-Incorrect  
(0)-No Response
Appendix A2

Procedural Fidelity Data Collection Sheet

<table>
<thead>
<tr>
<th>Teacher Behavior</th>
<th>Trial #</th>
<th>Teacher Behavior</th>
<th>Trial #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1. Ensure student attention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Present iPad to student</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Deliver task direction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Wait 5-s response interval (probe trial)/deliver controlling prompt (SP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Record student response (probes only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Deliver consequence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total +:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix A3

*Social Validity Sample Questionnaire*

**Name:** __________________________________________

**Relationship to participant:** _______________________

Indicate your response to the following statements by circling the number in the corresponding box.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel the skill targeted by the study (choice making) was important for my son, daughter, or student to learn.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I believe teaching the skill was a valuable use of school time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I feel that providing more choice opportunities and improving communication abilities of my son, daughter, or student would be beneficial to his or her life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I consider the iPad and Proloquo2Go technology (about $600 combined) less expensive compared to other communication devices.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I am interested in learning how to program the Proloquo2Go application or other iPad applications for my son, daughter, or student to use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
References


Vita

Asbury University: August 2005-May 2009
Bachelor of Arts
Seth Littrell