Integrating the iPad into an Intensive, Comprehensive Aphasia Program

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ABSTRACT

The proliferation of tablet technology and the development of apps to support aphasia rehabilitation offer increasing opportunities for speech-language pathologists in a clinical setting. This article describes the components of an Intensive Comprehensive Aphasia Program at Boston University and details how usage of the iPad (Apple Inc., Cupertino, CA) was incorporated. We describe how the iPad was customized for use in individual, dyadic, and group treatment formats and how its use was encouraged through home practice tasks. In addition to providing the participants with step-by-step instructions for the usage of each new app, participants had multiple opportunities for practice across various treatment formats. Examples of how the participants continued using their iPad beyond the program suggest how the usage of this device has generalized into their day-to-day life. An overall summary of performance on targeted linguistic measures as well as an analysis of functional and quality-of-life measures reveal statistically significant improvements pre- to posttreatment.

KEYWORDS: Aphasia, treatment, iPad, ICAP, interdisciplinary

Learning Outcomes: As a result of this activity, the reader will be able to (1) explain ways in which tablet technology can be used in individual, dyadic and group treatment environments for persons with aphasia; (2) summarize preliminary evidence for language and psychosocial outcomes from an interdisciplinary, intensive, comprehensive aphasia program.

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Use of tablet technology has grown tremendously over the past few years. It is estimated that there are now over 900,000 applications, or apps, available with 375,000 of those being native to the iPad (Apple Inc., Cupertino, CA). This growth trend has also expanded into the field of aphasia rehabilitation. Two years ago, the majority of language-based apps were initially designed for the use of children with developmental disabilities[1]; however, more apps are now available specifically designed for use in aphasia.[1–3] Given the wide array of choices available, using tablet technology can be a daunting prospect for individuals living with aphasia. Barriers to successful tablet use may also exist due to visuospatial difficulties and/or dexterity issues in combination with the language issues inherent in aphasia. Despite these challenges, individuals with aphasia may benefit from tablet use in a variety of ways. It is important to begin by trying to understand how, what, and why technology can support the individual's communication.[2]

Broadly speaking, tablet use can be defined for individuals with aphasia in three different categories: as a rehabilitation tool to practice and remediate language functions, as an assistive or augmentative device to improve functional communication, and as a means to increase independence and participation in the community through the use of native or built-in apps. There are many new tablet-based apps that have been designed to practice discrete aspects of language, such as naming and or writing words in response to pictures. Some applications now have different levels of cueing available to increase an individual's success when practicing independently. These types of treatment apps can allow individuals with aphasia to practice and hopefully improve their language production or comprehension. Some apps incorporate aspects of language theory (word frequency, length, and complexity) and organize stimulus items hierarchically so that the tasks are optimally therapeutic. Apps certainly are quick and efficient to use; however, the downside is that core banks of stimuli are rarely customizable and therefore not individualized to the client's needs. Other tablet applications have been designed to supplement or replace an individual's spoken language. These applications may be considered to be assistive or augmentative communication devices. Many applications are menu based, which can be customized to include pictures and provide speech output ranging from social phrases or basic needs, to personal scripts/narratives. Finally, individuals with aphasia may also wish to use technology to manage their daily lives much in the same way as the larger population, wishing to access the Internet for education, shopping, banking, stay connected to friends and family through e-mail, instant messaging, and social media as well as photograph/image storage.

Given the challenges encountered as a result of the sequelae of stroke-induced aphasia, supports are often necessary to ensure the successful use of tablet technology. Specifically, individuals may need explicit and/or adapted instruction to successfully navigate and understand the available options, as well as a supportive environment in which to practice their developing skills.[4] For a review on considerations for successful use of technology in treatment of aphasia, please see Holland et al,[1] King,[2] and McCall.[4] Resources are also available online that list and review aphasia-friendly apps. Examples can be found at the Aphasia Hope Foundation (www.aphasiahope.org), the National Stroke Foundation (http://www.thestrokefoundation.com/index.php/technology/51-ipad-apps-for-stroke-patients), and the Tactus Therapy Solutions Web site (http://tactustherapy.com/resources/). Given the ever-expanding number of apps available, lists require frequent updating and become quickly obsolete.

Despite the growing number of apps available for individuals with aphasia, little objective evidence exists to support their use. To the best of our knowledge, preliminary studies that describe outcomes from tablet-based applications for treatment of aphasia are only now emerging. This article details the individualized use of the iPad tablet for individuals with aphasia as part of an intensive, comprehensive aphasia program (ICAP). We will describe how the iPad was used to support speech and language goals throughout a variety of treatments and share some preliminary data from three cohorts. Detailed analyses from

multiple-baseline assessments will be presented in a future publication.

ICAPs have emerged as a new treatment approach. Rose et al list the following components as central to ICAPs: is intensive, is completed by a cohort, and addresses individual and group therapy as well as patient/family education.[5] *Intensive* is described as more than 15 hours per week, 5 days per week for a minimum of 2 weeks. ICAPS are now offered in many locations across North America in response to their growing popularity. All programs provide individual and group-oriented speech-language services that are individually tailored to the participant. Some ICAPs also include recreational therapies (InteRACT, 2013; PIRATE, 2013; RIC, 2013; UMAP, 2011). We will begin with a brief review of the structure of the ICAP at Boston University (BU).

OVERVIEW

Since June of 2011, three cohorts, a total of 20 participants, have enrolled in an interdisciplinary BU ICAP. Participants received 6 hours of treatment 5 days per week over 4 consecutive weeks. Speech-language pathology, occupational therapy, physical therapy, and nutrition faculty planned, coordinated, and conducted treatment along with supervised graduate student clinicians. As part of the ICAP, each participant received an iPad, which was customized for his or her usage. On completion of the program, participants kept the iPads and received an individualized home program that included ongoing suggestions of ways to use the iPad to support their rehabilitation goals.

METHODS

ICAP Design

Figure 1 depicts the allocation of treatment hours for 1 week of the BU ICAP across rehabilitation disciplines: speech-language therapy (16 hours), occupational therapy (4.5 hours), physical therapy (4.5 hours) and nutrition treatment (5 hours).

In addition to the interdisciplinary and intensive aspects of the program, integral to the BU ICAP is the treatment philosophy of the Life Participation Approach to Aphasia (LPAA).[6] Treatment is client centered, focusing on the participants' individual goals and supporting their daily participation in meaningful activities of their choosing. Another critical component of this program is the training of individual language goals across diverse linguistic contexts. Therefore, the 16 hours of speech-language treatment is provided in individual, dyadic, and group treatment formats. Community outings further the training of goals outside of the treatment room milieu.

Participants

Table 1 includes information about each of the three cohorts of ICAP participants. A range of aphasia types and severity levels is represented among the 20 participants. These participants were recruited from the Aphasia Community Group at BU and through referrals from area stroke rehabilitation units. Participants were not engaged in any other treatments during the program (Table 1).

Assessment

Outcome measures were selected based on the aphasia profiles and personal goals identified by each participant during initial intake interviews. In addition to word retrieval, speech-language goals included the increased usage of verbs, pronouns, prepositions, and morphological markers as well as increased sentence complexity, discourse level comprehension, reading, and spelling. The measures detailed in Table 2 were administered to all participants immediately pre- and posttreatment. Discrete language measures were chosen for their sensitivity in measuring various aspects of verbal communication.

The American Speech-Language-Hearing Association Functional Assessment of Communication Skills for Adults (ASHA FACS)[13] and the Stroke Impact Scale (SIS)[14] were also completed by each participant or significant other to understand the impact of the program on quality of life and functional communication skills. The communicative independence score from the ASHA FACS was completed immediately before and after the program by an individual who knew

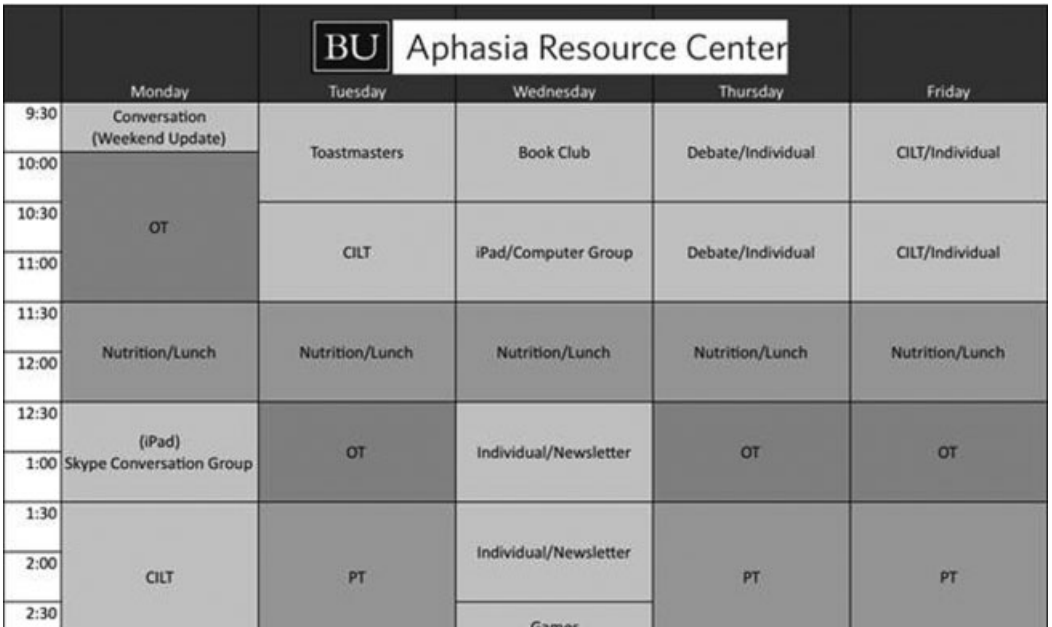

Figure 1 BU intensive, comprehensive aphasia program treatment schedule. Abbreviations: BU, Boston University; CILT, Constraint Induced Language Treatment; OT, occupational therapy; PT, physical therapy.

the participant well. This score is derived from 43 questions organized into the following domains: social communication; communication of basic needs; reading, writing, and number concepts; and daily planning. Responders were asked to rate the participant along a 7-point scale with 7 indicating "does" and 0 indicating "does not at all." For the majority of the participants, the rater was a spouse or partner. For two participants, however, the questionnaire was completed by a speech-language pathologist who knew the participant well from their previous therapies.

The SIS was completed by the ICAP participant. This score is derived from 60 questions organized into the following domains: physical problems, cognition, mood/emotions, communication, activities of daily living at home and in the community, challenge areas, and levels of participation in the community. Participants are required to answer questions using a 5-point scale, in which 5 indicates "not difficult at all" and 0 indicates "could not do at all."

Given the variability in treatment goals for each participant, "targeted" outcome measures were also identified. Targeted measures were those from Table 2 on which a change was expected based on the individualized goals. For example, if a participant worked on naming nouns and verbs using a semantically based naming treatment, we might expect to see an improvement on his or her performance of the

Table 1 Intensive, Comprehensive Aphasia Program Treatment Participant Demographic Information

Cohort	*n*	Severity Levels	Age (y), Mean (range)	Education (y), Mean (range)	Time Postonset (y), Mean (range)
1	6	Mild to moderate	55 (46–61)	16.0 (12–20)	3.7 years (1.5–10)
2	8	Mild to moderate–severe	61 (48–72)	16.3 (12–20)	5.8 years (1.5–9.75)
3	6	Moderate–severe	55 (43–65)	15.7 (12–20)	5.5 years (0.5–12.33)

Table 2 Outcome Measures

	Measure	Reference
1	Verbal Narrative Production: picture description task	Nicholas and Brookshire (1993)[7]
2–5	Psycholinguistic Assessment of Language a. Oral repetition b. Production of affixed words c. Picture homophone matching d. Sentence production	Caplan and Bub (1990)[8]
6	Philadelphia Naming Test	Roach et al (1996)[9]
7	Northwestern Verb Production Battery: Northwestern Verb Naming Test	Thompson (The Northwestern Verb Production Battery, unpublished; 2002)
8	F-A-S Word Fluency Test	Strauss et al (2006)[10]
9	Discourse Comprehension Test	Brookshire and Nicholas (1997)[11]
10a	Assessment for Living with Aphasia (Cohort 1)	Kagan et al (2010)[12]
10b	American Speech-Language-Hearing Association Functional Assessment of Communication Skills for Adults (Cohorts 2 and 3)	Frattali et al (1995)[13]
11	Stroke Impact Scale	Duncan et al (1999)[14]

Philadelphia Naming Test (PNT) and (Northwestern) Verb Naming Test (VNT). Similarly, if this same patient worked on auditory comprehension of paragraph material, we might expect to see an improvement on the Discourse Comprehension Test—Revised. Table 3 illustrates goal areas, individual treatment programs, and the hypothesized "targeted outcomes" for two participants. Performance on these targeted measures was converted to a percent correct score. Pre- and posttreatment scores were subsequently analyzed using the Wilcoxon signed rank test to determine if a significant improvement in performance was seen following treatment for the group.

Integrating the iPad into Treatment

The BU ICAP incorporated the iPad into all treatment formats across disciplines. The following sections outline how the iPads were used as part of the speech-language treatment program. In addition, examples of the participants' ongoing use of the iPad upon completion of the ICAP are also included in the Outcomes section.

iPad in Individual Treatment

Each participant received 3 hours (3 × 60 minutes) of individual speech-language treatment each week. The participants' personal goals together with performance on assessment measures informed the development of individualized treatment plans. Treatment approaches were theoretically driven and aimed to address goal areas identified by participants during pretreatment assessments. Table 3 illustrates an example of a treatment plan for two participants in which goal areas, treatment approaches, and "targeted outcome measures" are identified.

INDIVIDUALIZED APPS

Participants whose treatment plans included augmentative and alternative communication (AAC) used apps such as Proloquo2Go (AssistiveWare B.V., Amsterdam, the Netherlands) to communicate words of personal significance, phrases, greetings, and so forth. The Pictello (AssistiveWare B.V., Amsterdam, the Netherlands) app was also used to store Conversational Scripts developed during individual treatment sessions allowing for easy home practice as well as the projection of scripts in other settings (e.g., the toastmasters group).[17]

STIMULUS STORAGE

iPads also served to support individualized treatments for clients using theoretically driven, traditional approaches. We created customized picture vocabulary banks (from Google image searches) as stimuli for naming, spelling, sentence

Table 3 Individualized Speech-Language Pathology Treatment and Targeted Outcome Measures

Participant	Speech-Language Concerns	Goal Areas	Treatment Approach	Targeted Outcomes
A	Severe anomia (deficit at the level of semantic system); auditory comprehension; global dysgraphia	Word finding; auditory comprehension; written language: single word key vocabulary; functional communication	AAC (Beukelman et al, 2007)[15]; AAC (matching icons with verbally presented scenarios); copy anagram recall treatment (Beeson 2002)[16]; see AAC and conversational scripting (Holland et al 2010)[17]	PNT, VNT, PAL: oral repetition, discourse comprehension test-revised, picture description task
B	Anomia (deficit at the level of phonological output buffer); alphabetical word fluency; sentence complexity; usage of nonspecific language/unclear referents	Word finding; sentence/discourse production	Phonological components analysis (Leonard et al 2008)[18]; sentence/discourse production targeting clauses and cleft sentences via TUF (Thompson and Shapiro 2005)[19]; PACE/design generation tasks (Davis and Wilcox 1981)[20]	PNT, PAL: production of affixed words, sentence production, picture description task, alphabetical word fluency

Abbreviations: AAC, augmentative and alternative communication; PACE, Promoting Aphasic Communicative Effectiveness; PAL, psycholinguistic assessment of language; PNT, Philadelphia Naming Test; TUF, treatment of underlying forms; VNT, (Northwestern) Verb Naming Test.

production, and script/narrative treatments and stored these images in the Keynote (Apple, Inc.) app. For example, the Keynote app was used with the following treatments: Copy and Recall Treatment,[16] Phonological Components Analysis (PCA),[18] Semantic Feature Analysis (SFA),[21] Verb Network Strengthening Treatment,[22]and so on. Creating digital picture banks was not only cost- and time-effective from a printing perspective, but it also allowed for the use of realistic, relevant, and meaningful practice in sessions and homework. Examples sheets of how Keynote was used for practice SFA and PCA worksheets can be found under clinician resources at www.bu.edu/aphasiacenter/.

iPad in Dyadic Treatment

Dyadic speech-language treatment involved two main tasks: (1) an SFA[21]/Promoting Aphasic Communicative Effectiveness (PACE)[20] exchange and (2) a modified Constraint Induced Language Treatment (CILT).[25] The SFA/PACE treatments provided an opportunity for participant pairs to practice naming, circumlocution, and auditory comprehension skills for semantic feature discrimination skills. The CILT task expanded upon the earlier task by practicing key words in simple (interrogative) sentences. For both tasks, thematic and customized stimuli were used as participants took turns alternately describing and naming pictured items to each other from behind a barrier. In week 1, participants described and requested pictures of other program participants and members of the treatment team. This practice allowed participants to get to know each other. Support sheets were created, which detailed both physical and personal descriptors to aid with descriptions. In week 2, dyads described and requested favorite food items that were generated by the group. In this case, the nutrition faculty consulted to ensure that food items important to their group instruction were represented among the stimuli. Other themes included occupations represented by the participants along with other high-frequency and salient jobs and geographic locations of personal significance (e.g., hometowns, frequently traveled places, countries of ethnic origin, locales related to current events, etc.). Here again, the iPad can easily be used as either the storage bank for pictures in the Keynote app or as the visual support reference in the Pages (Apple, Inc.) app.

iPad in Group Treatment

Speech-language group treatment was divided among the following groups: computer (iPad/Skype [Skype Communications SARL, Clausen, Luxembourg]): 2 h/wk; toastmasters: 1 h/wk; book club: 1 h/wk; newsletter: 1 h/wk; games: 30 min/wk; debate/news: 1 h/wk; conversation/current issues/wrap-up: 3.0 h/wk. The groups chosen were based on existing aphasia groups that are offered through BU's Aphasia Resource Center.[24] Consistent with the LPAA philosophy, groups were selected according to the interests of the participants and tailored to their communication goals. In addition, particular attention was paid to selecting groups that would allow for the training and carryover of linguistic goals. A brief description of selected treatment groups and examples of how the iPad was used during sessions follows.

Computer: iPad/Skype Group

This treatment group focused on orienting participants to general usage of the iPad and providing specific instruction on apps that were introduced to all participants. An initial survey to determine the participants' comfort level with technology and to gain information about apps of interest was administered at the start of the program. In addition to group instruction, participants received step-by-step handouts including screenshots of how to operate each app (examples can be found at www.bu.edu/aphasiacenter/). Below is a description of iPad features and apps that were introduced during the course of this group:

1. Accessibility features such as "Speak Selection" and "Reader"
   a. "Speak Selection" is a text-to-speech accessibility feature that is activated through the iPad's settings. It allows the user to highlight text on Web sites and select "Speak" to have the text read aloud. Each word is highlighted as it is being spoken aloud.

   b. "Reader" is a feature that isolates desired text from a Web site, allowing for manipulation of font size and limiting the potential for unintentional activation of banners/ads.
2. Built-in apps and other free/low-cost apps that provided immediate functional utility were also reviewed and practiced during computer group sessions. Many of these apps are widely used by the general population to manage their schedules, keep in touch with family and friends, and access information of interest. In addition to the initial survey, regular check-ins with participants assessed their level of interest in apps, the need for additional practice, and the pace of introducing new apps.
   a. Calendar (Apple, Inc.): for managing appointments, setting reminders, and so on
   b. Notes (Apple, Inc.): for recording daily homework assignments, making lists, and so on
   c. Mail (Apple, Inc.): for communicating with friends, family, other ICAP participants, faculty, students, and so on via e-mail
   d. Maps (Apple, Inc.): for acting as a visual aid when communicating about local events, world news, past travel, future travel, and so on
   e. Safari (Apple, Inc.): for accessing favorite news Web sites and for serving as an electronic reference/library
   f. FaceTime (Apple, Inc.)/Skype: for making video calls with other aphasia centers, mystery guests, family, friends, and so on
   g. The Weather Channel (The Weather Channel Interactive, Atlanta, GA): for accessing current and future weather forecasts
   h. Camera (Apple, Inc.)/Photos (Apple, Inc.)/Camera Awesome* (SmugMug, Mountain View, CA): for taking photos, recording videos and storing photos
   i. Dragon Dictation (Nuance Communications, Burlington, MA): for converting speech to text to support e-mail usage, note-taking, and so on

   Fig. 2 illustrates an example of a handout used for the Camera Awesome apps.
3. Apps specific to the rehabilitation and remediation of speech-language function were also introduced during the iPad/Skype group. The following is a selected list of those apps:
   a. Language Builder (Mobile Education Store, LLC, Salem, OR): an app that provides for sentence production practice using photographic stimulus
   b. SmallTalk (Lingraphicare, Inc., Princeton, NJ): a series of free apps that includes functional phrases that can be activated for communication and/or used for speech practice
   c. VASTtx—Key Words (Speak in Motion, LLC, Vienna, VA): an app that provides visual models for the production of phonemes, keywords, and customizable playlists
   d. Language TherAppy (Tactus Therapy Solutions, Ltd, Vancouver, BC, Canada): a suite of apps that allows for the home practice of naming, spelling, auditory comprehension, and reading
   e. iTherapy/Constant Therapy (Constant Therapy, LLC, Lexington, MA): an app that allows a clinician to assign various cognitive and language tasks relevant to specific goal areas and to monitor performance and update task assignments remotely

Toastmasters Group

The purpose of the toastmasters group is to improve narrative verbal expression in a stressful speaking context and was inspired by the group offered at the Pat Arato Aphasia Institute in Toronto. Each session, participants gave two- to three-minute speeches that they had prepared. The speeches began with self-identified goals and culminated with a self-critique and group feedback. Implicit in this group is the carryover and practice of individual verbal expression goals into a group format.

* *The built in Camera app requires the user to press in a specified location on the screen to take a picture, which was not accessible to all of our participants due to dexterity issues. The Camera Awesome app, however, allows the user to touch anywhere on the screen to take a photo.*

Figure 2 Section of a handout introducing the Camera Awesome app (SmugMug, Mountain View, CA). Abbreviation: BU, Boston University.

In the first session, all participants began with an autobiographical speech. Some participants chose to repeat the same speech in subsequent toastmasters meetings, expanding and/or revising certain sections, and others chose to move on to new speech topics of personal interest. Participants with milder profiles eventually moved from personal topics to speeches that were more expository in nature.

In the toastmasters group, participants used an array of apps to support their speechmaking. Props and visual aids (e.g., pictures, maps, etc.) were strongly encouraged. Personal photos or maps were scanned before the session and loaded into the Keynote app so that they could be projected for the whole group. Participants who were working in individual treatment sessions to develop Conversational Scripts to support their toastmasters speech used the Pictello app to provide both visual support for speeches and to cue their speech output as needed. The Pictello app allowed one participant in cohort 2 to move from requiring maximum support for sharing basic biographical information to independence during his speeches, using his own pre-recorded voice as a self-cue. Other apps such as Notes, Dragon, Photos, and the Video Recorder (Apple, Inc.) were also used as part of the toastmasters group to support both the preparation and delivery of speeches. Participants had the option of receiving one-on-one support during individual treatment to assist with this preparation or developed their speeches independently at home.

Book Club

The book club closely follows the structure described by Elman and Bernstein-Ellis.[25] Participants read sections of an assigned text in preparation for each meeting. Participants received written chapter summaries to support their reading/auditory comprehension of the selected text. The selected text was purchased and downloaded into iBooks (Apple, Inc.) or Kindle (AMZN Mobile LLC, Seattle, WA) app, and the audiobook was made available via the Music app. Participants also received step-by-step instructions on features such as text enlargement, highlighting, dictionary, and copy and paste to support reading and recall. Fig. 3 details the instructions provided for the use of the Kindle app.

Figure 3 Introducing tips for using the Kindle app (AMZN Mobile LLC, Seattle, WA) on the iPad (Apple, Cupertino, CA). Abbreviation: BU, Boston University.

iPad in Debate/News Group

The debate/news group served to provide opportunities for conversation about current events. Each session, a choice of adapted articles was presented, read as a group, and discussed. Summaries were rewritten in simpler language and paired with a relevant image and a keyword bank. Discussion questions were provided to spark debate. The articles were projected onto a larger screen using the iPad. The iPad also served as an electronic reference or librarian (e.g., the Maps app was launched to support the discussion of relevant geography, the Safari app was used for keyword searches), and related images and video clips were projected from the iPad to support and expand on the discussion of news items.

iPad for Homework

A sample homework handout in Fig. 4 illustrates how participants used the iPad to support homework assignments. The example includes reminders to practice toastmasters speeches supported by the Pictello app, continue with home practice of individualized tasks assigned in the Constant Therapy app, and read assigned text and listen to the audio support using the iBooks/Music apps for the Book Club group.

iPad in Home Program

Each participant received an individualized home program at the end of the ICAP. The home program included recommendations for continued home practice toward goal areas as well as recommendations for ongoing therapy. The iPad was integral to the home program for continued practice with apps and customized vocabulary/stimulus items. Native apps such as Calendar/Notes are also useful for scheduling ongoing practice times.

OUTCOMES

Analysis of Targeted Measures

Targeted measures were defined as those measures on which a change was expected to occur based on the participants' individual goals and deficits. All pre- and posttreatment results were converted to percent correct scores and subsequently analyzed using the Wilcoxon signed

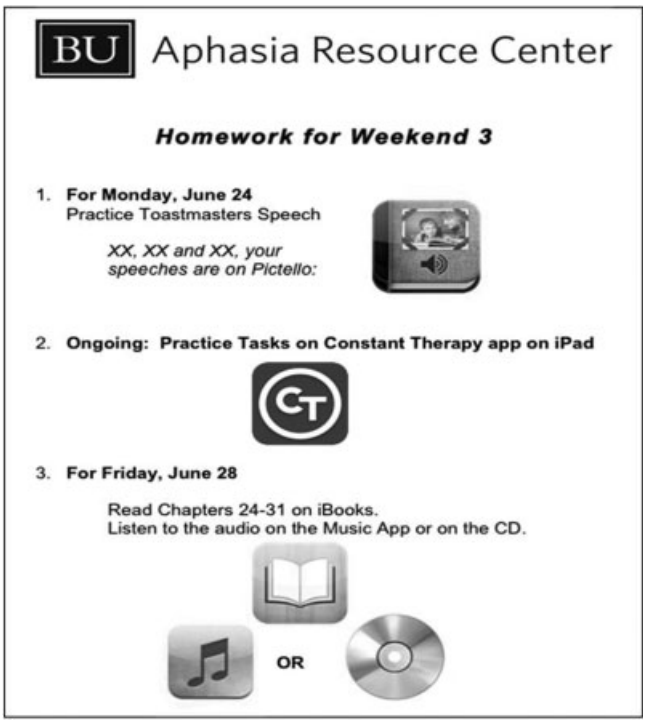

Figure 4 Sample homework detailing usage of iPad (Apple, Cupertino, CA) to support home practice. Abbreviation: BU, Boston University.

rank nonparametic test statistic (paired comparison of samples). Pre-/postperformance on "targeted measures" for the group revealed significant improvements from pre- to posttreatment ($Z = -6.146$, $p < 0.001$).

Analysis of Functional and Quality-of-Life Measures

The SIS was completed by each participant immediately pre- and posttreatment. Pre and post (paired) overall raw scores were compared using the Wilcoxon signed rank test. Performance on the SIS revealed significant improvements from pre- to posttreatment ($Z = -2.172$, $p = 0.03$).

The Assessment for Living with Aphasia (ALA) (first cohort only) or ASHA FACS was completed where possible by the significant other of each participant immediately pre- and posttreatment. Participant paired scores from the ASHA FACS were once again analyzed for the group using the Wilcoxon signed rank test and also revealed statistically significant improvements ($Z = -2.215$, $p < 0.027$).

Anecdotal Report

Upon completion of the ICAP, all but one participant (who traveled from out of state to participate in the program) continued or began group treatment at the BU Aphasia Resource Center. Each of these 19 ICAP alums brings his or her iPad to group sessions and uses it both in trained and novel ways. Specific examples of continued iPad usage include e-mailing, texting, reading and listening to audiobooks, preparing scripts via Pictello, using Skype/FaceTime as an alternative to the telephone, sharing video clips, managing appointments and reminders using the Calendar app, and the ongoing home practice of individualized speech-language therapy tasks through the Constant Therapy app. The ongoing use of the iPad among all of the participants illustrates how use of the device has generalized to their day-to-day life.

DISCUSSION

The preliminary data above reflect significant improvements on discrete language areas targeted in treatment. The results also demonstrate

statistically significant improvements on functional and quality-of-life measures.

The communicative independence score from the ASHA FACS was completed immediately before and after the program by an individual who knew the participant well. This measure was used with the second and third cohorts of participants rather than the ALA to try to capture the communicative and functional changes observed by significant others as a result of the treatment. The group demonstrated a significant change from pre- to posttreatment on the communicative independence scores, suggesting that other individuals noticed a change in the participants' functional communication. Anecdotally, family members and raters reported that the ICAP participants seemed more confident in social situations and were less dependent in novel environments. Furthermore, they reported that the participants were using more language spontaneously at home and with improved communicative effectiveness as a result. Scores on the SIS reflect feelings of increased competence in various aspects of life and a reduced impact of the stroke on their overall quality of life on the part of the participant with aphasia.

The iPad was central to many aspects of the program and was incorporated for all participants in individual, dyadic, and group treatments. An emphasis was placed on independent use of the iPad for management of participant schedules, e-mail correspondence, and reference strategies. The step-by-step handouts upon the introduction of each new app and multiple opportunities for practice were important to the levels of independence with the iPad that we observed. In addition, homework assignments that incorporated the usage of various iPad apps (e.g., to access book club readings and audio support, to practice toastmasters speeches, to take pictures of their home environment, etc.) ensured further independent practice and use. Approximately one-quarter of the participants had some experience with the iPad prior to beginning the program. Others voiced varying levels of enthusiasm for using the iPad in treatment. Universally, participants left the program acknowledging that the iPad had made a big difference in their feelings of self-confidence and levels of participation in new aspects of life.

Although it is not possible to isolate the impact of the iPad on the participants' performance on the outcome measures administered, participant testimonials suggest a positive impact on the participants and the overall success of the program.

CONCLUSIONS

The descriptions included in this article highlight the flexibility of tablet technology in many aspects of treatment. New and sophisticated aphasia apps show great promise for increased recovery and ongoing practice of language and cognitive functions. However, tablets can also be a tool both for remediation of customized language activities and reengagement in other aspects of life. We hope that this article may inspire an ongoing discussion of creative use of technology for our clients.

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