Developing educational resources to support iPad use in speech-language pathology

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Educational iPad resources

ABSTRACT

The iPad is a relatively new technological device with many features that make it a useful tool for speech and language assessment and intervention. As iPads are becoming more prevalent in settings where speech and language services occur, and little evidence exists to guide their effective use, creation of educational resources to support effective iPad use is important. In order to provide a broad audience with accessible educational resources, an online repository of application descriptions, individual application ratings, and instructional videos was developed. This project, a collaboration between the University of Alberta and Alberta Health Services, was a continuation of research previously undertaken by students and an instructor in the Department of Speech Pathology and Audiology, and served as the resource development component of a larger project carried out by the same instructor and current students of the program. Forty-nine applications were reviewed with a list of Best Practice Principles resulting from previous research; these principles served as guidelines for the development of a new application rating scale that was completed for each application. Brief application descriptions were written, and included each application's intended audience, strengths and weaknesses, and potential uses in intervention. Of the 49 reviewed, 20 of the highest scoring applications were featured in short videos. These videos illustrate how each application works, and highlight how applications can be individualized in order to meet each client's unique needs. These descriptions, ratings, and videos were posted on the University of Alberta's Department of Speech Pathology and Audiology website, iPad Research and Resources page, which can be accessed at: http://rehabilitation.ualberta.ca/departments/ communication-sciences-and-disorders/ ipad-resources

LITERATURE REVIEW

New technology: iPad

Technology plays a pivotal role in modern society. People are becoming increasingly reliant on technology to assist them in their daily lives. Indeed, it is difficult to imagine what life would be like without cell phones, tablets, and personal computers. Of the many recent technological advances, the iPad stands out for use in educational contexts: iPads are a readily available platform on which numerous educational and speech and language therapy applications have been made accessible to users.

In 2010, Apple introduced the iPad: a computer tablet that allows the user to download, store, and utilize applications (apps) that are manipulated with the fingers via a touch screen. Many people immediately recognized the potential for this device to replace a laptop computer (Apple Inc., 2011); in the first 80 days on the market, Apple sold 3 million iPads. The iPad has also been well-received by critics: Time Magazine named the iPad one of the 50 Best Inventions of the Year in 2010, and Popular Science proclaimed it the Top Tablet in its Best of What's New 2010 feature (McCracken, 2010; "Best of What's New 2010", n.d.).

The iPad offers many of the same capabilities as a laptop (or desktop computer); however, the iPad may appeal to users as a more convenient option. Some benefits of using an iPad rather than a computer are as follows: it costs a fraction of the price (they start at $399); at less than half an inch thick and weighing in at under two pounds, it is very portable; it has a very user-friendly design (the iPad is compact but has a large screen, which means people, regardless of age, can operate it fairly effortlessly); and it is simplistic, intuitive, and easy to use. In addition, according to Consumer Reports, the iPad offers consumers increasing choices: app

developers create more apps, often exclusively, for the Apple App Store than for other tablet platforms (“Tablet Buying Guide”, 2013). Further, due to the larger user base, any technological problems with an app are more likely to be repaired if using an Apple device.

Although many features of the iPad make it appealing for use in speech and language therapy, other aspects of this technology may be cause for concern. For instance, many clinicians may wish to transfer data to and/or from the iPad using a USB port, but iPads do not come equipped with this function. However, clinicians do have the ability to transfer some data via email (Apple Inc., 2014). While iPads are small and portable,a seemingly positive feature, they are more readily lost or stolen than larger computer systems. There are, however, apps such as “Find my iPhone” that may be used to locate the device (Apple Inc., 2014). iPads may be susceptible to damage when working with young children who handle them carelessly, though protective cases that may help to improve durability are available for purchase (Martin, 2013). Despite the fact that many accessories are available to help mitigate the potential difficulties of using iPads in speech and language therapy, these accessories do not address every problem, and they may prove costly.

Technology and education

Watt (2010) notes that children’s increasing use of technology has implications for education; how technology factors into children’s lives needs to be considered. A survey conducted by the United Kingdom Government Department for Children, Schools, and Families found that 4 out of 5 children between the ages of 5 and 15 have access to technology such as a home computer (as cited in Watt, 2010, p. 142). Children today frequently come into contact with various technological devices.

Despite the fact that technology is ubiquitous in today's world, concerns about widespread use of technology adversely affecting children's language development remain; some people have reservations about implementation of technology in classroom settings. For instance, some have argued that using technology reduces social interaction, thereby having a detrimental effect on children's social, emotional, and language development (Watt, 2010). However, Watt (2010) notes that appropriate use of technology in a classroom setting is advantageous. For example, McCarrick and Xiaoming (2007) found that classrooms that used technology provided an equally rich environment for language development as those that did not; while computers were not shown to enhance language, computers were shown to promote an environment that encouraged children to use language with their peers and teachers. Furthermore, various technologies, including the iPad, can be an innovative and beneficial way to administer speech and language therapy. A study by Klerfelt (2007) found that targeting non-verbal interactions, such as gestures, with the assistance of a computer in an adult-child interaction generalized to positive effects in learning literacy. Further, Sweeny notes that using technology in the field of speech-language pathology helps clinicians "implement context-driven therapy sessions that engage students and move them toward their academic goals" (as cited in Fernandes, 2011, p. 35).

While those findings encourage the use of technology when educating children, Watt (2010) cautions that implementing technology requires both adult supervision and interaction. Espinosa et al. stress that "having access to technology can contribute significantly to learning of young children, but mere access is unlikely to be sufficient to bringing the full potential of

technology in the home to bear on helping children achieve. Adults will need to mediate the use of these potential learning tools for children" (2006, p. 439). Clearly, it is important for speech-language pathologists (SLPs) to be educated in appropriate uses of technology before using these devices with their clients. The literature documents the potential benefits of using technology in educational settings, but also cautions about technology use without appropriate adult mediation.

Technology in intervention

A survey conducted by Fernandes (2011) found that a significant portion of SLPs own an iPad or similar device. In the survey of 302 SLPs working in a school-based environment, 72.9% owned an iDevice (iPad, iPod touch, or iPhone), and among those who used the iDevice in therapy, 55.9% chose to use the iPad (Fernandes, 2011). Given the popularity and capabilities of the iPad, it is understandable that SLPs would want to use the device in intervention. In fact, the iPad may be considered an ideal tool for clinical use for many reasons: it is easy and fun to use, it is portable and secure, and may be familiar to clients.

Since the iPad condenses many of the functions of a computer into a user-friendly and convenient device, it is especially useful in clinical settings. Research has shown the practicality of this platform: even six year olds can understand and use them with little difficulty (McKnight & Fitton, 2010). The iPad's portability enables it to function in a variety of settings where traditional computers, or even laptops, could be impractical. Furthermore, the iPad has many security features which make it a secure device that is easy to monitor for mass dissemination (Apple Inc., 2012).

The use of the iPad as a tool in speech and language therapy shares its beginnings with

the advent of the iPad itself. Games and technologies not designed specifically for speech and language therapy are consistently adapted by SLPs to make them suitable for application in treatment. The iPad is no different, since many of its applications – productive, educational, and gaming – can be used in intervention. There are several ways in which SLPs can utilize the iPad: many apps are designed specifically for SLPs (they target articulation, phonological awareness, building appropriate syntactic structures, etc.); games can be repurposed to work on a client's goals; and some work productivity apps can assist SLPs with devising ways to work on their treatment targets. iPads can also be easily incorporated into the classroom via a Smartboard connection, thus exposing speech and language strategies to a broader range of students (Scapin, 2012).

Experts in the field have recognized the value of this device and have compiled lists of apps for the purpose of speech and language therapy and special education (Alberta Health Services, 2010a, 2010b; Cormier, 2010; Sailers, 2010b; Welsford & Kingdon, 2010; Caroll & Morey, 2011). The American Speech-Language-Hearing Association (ASHA) has dedicated part of its website (http://asha.org) to the iPad's speech and language apps, providing interested parties with information on funding, use, links to blogs, guidelines for selecting apps, and lists of apps for specific populations (ASHA, "Applications (Apps) for Speech-Language Pathology"). The market seems to have preceded the research with a proliferation of speech and language apps being promoted for the iPad. Research examining iPad use as a tool in speech-language therapy, special education, and education in general is beginning to emerge, and the findings are encouraging. A non-exhaustive list of the educational benefits of the iPad includes: reduced teacher workload, increased student motivation, improved collaboration, growth in quality of

student work, mutual feelings of boosted productivity (Heinrich, 2011), portability, ease of use, engaging format, suitability for children with learning difficulties (Learning Exchange, 2011), promotion of active and experiential learning, accessibility to course material, and applicable for learning outside the classroom (Wagoner, Schwalbe, & Hoover, 2012).

While iPad apps have many useful features, they are not flawless. Fernandes (2011) pointed out that most of the educational iPad apps are designed to entertain and engage clients while teaching a concept. However, the author notes that, "most speech therapy apps were not designed as a tool to be used by the student independently, but to serve as a means to reach an end: language development" (2011, p. 38). Furthermore, not all apps are created equal. Fernandes asserts that with "more than 400, 000 apps, it is essential that SLPs evaluate the potential usefulness of apps they consider for use in therapy" (2011, p. 38). Conley, Fournier, Hanson, O'Brien and McFarlane (2012) asked a focus group of SLPs to evaluate iPad apps that were targeted specifically to SLPs. The SLPs reported concerns about the inflexible nature of these apps (they often cannot be individualized for each client), which is unfavorable when planning effective and efficient treatment. Other concerns were the lack of a trial period (i.e., the SLPs were unable to try apps before committing to a purchase); limited effectiveness (i.e., the children were not learning as much from the apps as the SLPs had hoped); feedback provision (i.e., children were receiving feedback too quickly); capacity to engage young clients (i.e., after the initial use, the appeal of apps quickly faded); difficulty incorporating or following best practice principles; and difficulty including cues.

Previous research on iPad use in intervention conducted by the Department of Speech Language Pathology at the University of Alberta has emphasized the importance of providing

education for the use of iPads in clinical settings. For instance, a focus group of SLPs believed that an iPad would be a useful home programming tool, but only under the condition that families be educated on appropriate use of the iPad prior to home study (Conley et al., 2012). Another study conducted by Gibson, Humphreys, Palmer, Miller, McFarlane, and Decker (2012) noted that, for agencies striving to adopt the use of technology in their practice, providing employees with proper education and IT support is very important. Thus, it is necessary to educate SLPs not only so that they can effectively use the iPad in treatment, but also so that they are able to determine which apps will be appropriate for use with clients. SLPs can then use this information to provide the appropriate education to their clients and their client's families.

Speech-language pathologists who are unfamiliar with the iPad, or similar technologies, may benefit from education beyond debating specific merits of individual apps. Some crucial foundational knowledge may be needed prior to mastering the use of apps in clinical practice; these precursors may include understanding basic iPad functionality, knowing how to install and manage apps, and understanding the basics of security and connectivity. Speech-language pathologists familiar with the iPad can approach learning about apps differently than those who are unfamiliar with the device. Indeed, Gibson, Humphreys, Palmer, Miller, McFarlane, and Decker (2012) found group differences in themes of discussion between inexperienced and experienced iPad users. Despite the potential need for education on the iPad in a broader sense, this paper is limited to the evaluation of apps and education for their use in speech and language therapy. Orienting new users to the iPad was considered too general for this project and the scope of this paper, and it was felt that the effort had already been undertaken by

documents such as the user's manual. Furthermore, general instruction on the basic functions of an iPad need not be specific to speech-language pathology, whereas analysis of specific apps was considered more utilitarian. New users may benefit from learning the fundamentals of the iPad prior to examining particular apps; however, this paper will focus specifically on clinician training regarding the use of apps.

Selecting and evaluating applications

At the current time, there is limited systematic research in the area of iPad use in speech-language pathology. Best Practice Principles (BPPs) can be used as a component of Evidence Based Practice (EBP) to provide criteria for selecting and evaluating apps. Although there is no agreed upon set of BPPs for SLPs, a study by Conley et al. (2012) identified a number of guidelines in the literature and validated that list through clinician focus groups. Seven key principles of intervention for children emerged: "'Best Practice' intervention for children will be individualized, focused, engaging, provided in a facilitative context, functional, naturalistic and including meaningful communication partners" (Conley et al., 2012). In order to provide quality services to clients, clinicians should consider these principles when selecting apps for intervention, and when using the iPad with clients. Each of these principles is explored below.

Individualized. Each child is an individual, and every child has unique needs when it comes to learning language. As such, a specific child's level of knowledge and learning style will help to determine suitable language intervention for that child (Johnston, 2007). By individualizing instructional programs, the speed of learning can be maximized (Johnston, 2007). Many apps can be individualized through user options and settings; however there are some apps that cannot be personalized for the specific needs of a client. In the latter case, a clinician can

creatively modify the way the app is used in order to maximally benefit the client.

Focused. According to Koutsoftas, Harmon, and Gray (2009), focusing treatment by increasing its frequency and intensity helps the client learn the concept being taught. By manipulating factors such as salience, frequency, and context, the SLP can focus the child's attention on important information (Johnston, 2007). Conley et al. note that "by ensuring the learning targets are the focus of intervention, the SLP will reduce the demands on the child's attention and memory and will therefore increase the likelihood that the target skill will be learned" (2012, p. 7). Clinicians can use apps for quick, focused, and engaging practice of a target skill. As clients will benefit most from frequent practice, a familiar app can be used regularly in order to provide efficient and effective therapy.

Engaging. The more engaging an activity, the more likely a child will be motivated to take part. A study by Culatta, Setzer, and Hornet (2005) found that a child's motivation and attention span were both increased when therapeutic activities were designed to be more engaging. The iPad is inherently engaging, especially for clients who are interested in technology. The majority of apps provide some degree of interaction, thereby piquing the interest, and increasing the participation, of users.

Facilitative Context. By providing a facilitative context, clinicians increase the likelihood of a child learning the targeted skill. A study by Timler, Vogler-Elia, and McGill (2007) found that when modeling, mass practice with peers, and feedback from the clinician were included in treatment, the child's learning was facilitated. Apps often facilitate client learning through modeling a target skill and then providing repeated practice of the skill with some means of timely feedback, such as sound effects for correct and/or incorrect answers. For apps that lack

these elements, clinicians can enhance the experience by providing the client with a model and verbal feedback.

Functional. Functional language tools are those that serve people in their everyday language interactions. According to Johnston, "children will learn language more readily when they see it function in the moment, when specific utterances spring directly from specific communicative intents, and when these intents are drawn from the world of the child" (2007, p. 161). In order for learning to be most effective, and generalize to real life situations, the therapeutic practice situation should be modeled after the real life performance situation (Creaghead, 1989). The majority of apps do not simulate real world communicative experiences; however, clinicians can modify the manner in which some apps are used with clients in order to make them more functional (e.g., by involving a meaningful communication partner).

Naturalistic. Paul states, "all things being equal, a natural activity is better than an unnatural one" (2012, p. 77). The more natural the intervention, the more likely the skills learned will generalize to everyday language contexts. It is possible for intervention to seem quite natural to the child even though it has been carefully planned by the clinician (Paul, 2012). Since the nature of communication is one person conveying a message to another, the clinician can make the use of apps more naturalistic by creating opportunities for the client to share or exchange ideas with a communication partner. For example, when using Articulation Station flashcards, the client could be asked to share something they know about each picture.

Meaningful Communicative Partners. Meaningful communication partners, such as parents, peers, and teachers, should be part of intervention. These types of partners create a social foundation for therapy, and provide a reason for the child to use language (Owen, 2014).

According to Johnston (2007), it is parents, peers, and other social partners that teach children to speak through shared interactions. Parent education programs can enable parents to take part in the language intervention of their child (Johnston, 2007). Many apps are not designed to be used with a communication partner. Therefore, clinicians should consider ways of modifying the use of an app in order to include meaningful interactions with a communication partner. For example, the clinician could watch a short YouTube video together with a client, and then have the client describe what was seen to a peer or parent.

There are many potential benefits for utilizing technology, like the iPad, in speech and language intervention. These benefits include, but are not limited to, increasing client motivation and engagement, and reducing clinician workload. Although employing technological devices in speech therapy shows promise, it is clear that more research is needed to help determine the best and most efficient ways for speech-language pathologists to incorporate technology into their clinical practice. Future research and development of educational materials will help to provide clinicians with guidelines for appropriately and effectively implementing technology in therapeutic intervention. Following these steps will help to ensure that clinicians continue to adhere to Best Practice Principles, especially as technology continues to advance.

A study by Gibson, Humphreys, Miller and Palmer (2012) used the International Classification of Functioning, Disability and Health (ICF) model, developed by the World Health Organization, as a means of categorization in considering iPad use with clients. The ICF model, the commonly accepted framework for intervention in speech-language pathology, is divided into three areas: body function and structure, activities, and participation (World Health

Organization, 2001). Body function and structure relates to the anatomical parts of the body and how their functions are affected by the disability. Activities addresses the tasks and actions carried out by an individual. Participation recognizes an individual's involvement in a life situation (World Health Organization, 2001). Gibson et al. (2012) noted that participating clinicians found it difficult to "process information and express their perspective in the language of the ICF model" (p. 23) and that they were "unable to classify apps in terms of their focus on impairment, activity or participation" (p. 23). Participants discovered that the majority of apps target impairment only, and that clinicians themselves must modify the way the apps are used with clients in order to address activity and participation (p. 23).

PURPOSE

This project aimed to produce instructional materials for speech-language pathologists interested in using the iPad as a tool for assessment and intervention. These materials were created so that SLPs would have access to a resource that will enable them to select, evaluate, and learn how to use specific apps as a tool in speech and language intervention.

PAST AND CONCURRENT RESEARCH

This project is one component of a pilot study to document the implementation of iPads into clinical assessment and treatment in Alberta Health Services, a large speech-language pathology service organization covering a wide geographic area. Alberta Health Services (AHS) is responsible for delivering health services to the 3.9 million people living in Alberta. Approximately 550 speech language pathologists work in inter-professional teams to provide

services to all age groups and service sectors including community, acute care, rehabilitation hospitals, and continuing care. SLPs work across sites and settings to deliver care to clients in their homes and communities. In rural and remote locations, one SLP may be responsible to travel up to 100 kilometers to reach clients and provide services across the continuum, from health promotion to intervention and prevention to end of life care. For more information about provision of speech-language pathology services, access the AHS website: http://www.albertahealthservices.ca/

There were three parts to this study: 1) a provincial survey of perspectives about iPad use in speech-language pathology; 2) data collection after deployment of 15 iPads to clinicians within the province; and 3) development of educational resources to support deployment. The educational resources began with development of app reviews based on Best Practice Principles (Conley et al., 2011) and instructional videos of specific apps. Although developed with the research participants in mind, the resources are available to other interested members of the public and are promoted across AHS. This project only involved the creation of these resources; the evaluation of this educational material is a component of a larger project.

Research participants have identified a range of educational needs to support their use of iPads in clinical settings, with accessing and learning about apps being the most commonly referenced (Borys, Desjarlais, Sample, Wilson & McFarlane, 2013). This need is often considered the most pressing for clinicians new to the technology. The educational resources developed for this project focused on supporting app selection and evaluation.

COMPONENTS OF EDUCATIONAL RESOURCES

Numerous iPad apps were reviewed, and forty-nine apps were selected to be featured on the website of the Department of Speech Pathology and Audiology at the University of Alberta (Appendix A1). These reviews can be accessed at: http://rehabilitation.ualberta.ca/departments/communication-sciences-and-disorders/ipad-resources

The apps chosen for this project were previously selected in the research of Conley et al. (2012), which were picked based on reviews that were completed by various agencies and individuals. According to Conley et al., apps were selected if they appeared on multiple reviewed app lists, or if they were the only app representing a specific intervention area. See Conley et al. (2012) for more specific app selection criteria.

Each of the forty-nine selected apps was reviewed based on the Best Practice Principles emerging from the research of Conley et al. (2012). Each BPP was ranked numerically, from one through five, with an individual description of each numerical marker to facilitate consistent rankings. A copy of the BPP rating scale is found in Appendix A2. A blank modifiable rating scale, in the form of a Microsoft Word document, was also posted to the website to be publicly accessed and downloaded from the website by SLPs interested in reviewing apps for themselves. SLPs participating in the pilot study were asked to rate preselected apps based on BPP ratings.

In addition to the BPP ratings, the information for each app also included a paragraph description and a link to download the app from iTunes. The paragraph descriptions highlighted how the app could be used in speech-language therapy assessment or intervention, and drew attention to its particular strengths and weaknesses.

Of the forty-nine apps posted to the website, twenty of them were selected to be featured with video tutorials (Appendix A3). These apps were selected to demonstrate a variety of app types, and how different types can be used for intervention and assessment. Those selected include apps specifically designed for speech-language therapy, apps that can be adapted to this purpose but are designed to be otherwise educational, and those that are designed primarily for entertainment. These apps were chosen because they were deemed to represent a good archetype of their particular kind of app, and they scored comparatively well on the BPPs when compared to apps designed for a similar purpose. In addition, each member of the project selected two apps as "favorites" to highlight apps that were considered to be especially effective, engaging, and appropriate for use in intervention.

To ensure clear picture quality during video preparation, an iPad (3rd Generation, Model number A1416, Apple Inc.) was mirrored on a MacBook Pro using the program *AirServer* (AirServer, 2013), and the screencast was captured and edited using the program *Camtasia 2* (TechSmith Corporation, 2013). In order to ensure a high fidelity voice recording, an external USB microphone was used (Snowball, Model number 78908Q , Blue Microphones, Inc). The videos, similar to the paragraph description, illustrated the strengths and weakness of each app as they relate to speech-language therapy, but did so in a more detailed fashion. These videos were designed to be a quick introduction to the app and its use, as it was believed that busy SLPs would be more likely to watch a video that was brief. A runtime of approximately five minutes was targeted. To this end, the videos range in length from 2:09 to 7:42 with one exception: Kristen Hedley, R.SLP (C), who has had personal experience using the app *Keynote* (Apple Software, 2009) in speech-language intervention, assisted with this project in the

creation of a video for *Keynote*. This particular video lasts 44:17, as this app was believed to require a comparatively greater amount of instruction for an unfamiliar user to understand how the program works, and, more specifically, how it can be effectively used in speech-language therapy.

Supplementary Materials

The educational resources detailed above have been uploaded to the iPad: Research and Resources page of the University of Alberta's Department of Speech Pathology and Audiology website. This webpage also highlights results of previous iPad research studies completed at the University of Alberta, educational presentations on iPad use, rating scales for evaluating apps, and links to helpful iPad resources that can be found on other websites.

SUMMARY

While the resources created do not encompass a comprehensive review of all apps that are available to speech-language pathologists, or all educational needs related to the iPad, the materials developed serve as a starting point for future research and educational projects. Future development of these educational resources will be driven by the feedback and needs of the research participants and others using the website. Evaluation of the current resources is important and will be part of future research. Further development is anticipated to include additional app reviews, as well as information about other aspects of iPad use. General orientation to the basics of iPad use, security and connectivity issues, and installation and maintenance of apps may benefit unfamiliar users. Previous research by Gibson, Humphreys, Miller and Palmer (2012) identified three levels of iPad users: non-users, emergent users, and

integrated users. Non-users had not yet used an iPad in therapy, emergent users were using the iPad with some clients in therapy, and integrated users had begun "to integrate the tool into their clinical practice for a broad range of purposes with a variety of client populations" (Gibson et al., 2012). Thus, as the needs of iPad users change over time, there may be a need to develop additional, and more advanced, supports as more sophisticated iPad users begin to emerge. Creating a platform for integrated users to share their experiences with others will also be a goal for future development. Remaining cognizant of educational resources being generated elsewhere is also important; in order to be maximally efficient, users of the webpage should be directed to pre-existing resources, such as materials designed for general iPad users as well as ones that have been created specifically for use by SLPs.

The tendency and ability of speech-language pathologists to adapt an array of materials to target speech and language goals, paired with the proliferation of speech, language, education, assistive, and entertainment apps indicates an auspicious future for the use of the iPad in assessment and intervention. Due to the iPad's portability and relatively low cost, it has the potential to continue to revolutionize service delivery in various contexts. However, the variability in suitability of apps for clinical use underscores not only the importance of careful review of each app, but also beckons speech-language pathologists to become actively involved in the consultation and creation of apps. Future research should focus not only on app reviews, but also on examination of how to incorporate iPads into group intervention, everyday contexts, and other components of speech and language therapy. We have only begun to see the innovative ways in which new technologies can, when building on established practices and research, propel our discipline ever forward. As long as best practice principles are utilized and

research continues to explore the benefits and limitations of this technology, the future of the iPad in speech-language intervention is boundless.

REFERENCES

AirServer (2013). AirServer (Version 4.7.1) [Software]. Available from: <http://www.airserver.com/>

Apple Inc., (2014). Find My iPhone, iPad and Mac. Retrieved from: <http://www.apple.com/ca/icloud/find-my-iphone.html>

Apple Inc., (2014). iPad with Retina Display. Retrieved from: <https://www.apple.com/ca/ipad-with-retina-display/specs/>

Apple Inc., (2014). iOS: How to transfer or sync content to your computer. Retrieved from: <http://support.apple.com/kb/HT1296?viewlocale=en_US&locale=en_US>

Apple Inc., (2011). Samsung Complaint. Retrieved from: <http://www.apple.com/pr/pdf/110415samsungcomplaint.pdf>

Apple Software. Keynote (2009) [Mobile application Software]. Retrieved from: <http://www.apple.com/ca/iwork/keynote/?cid=jm>

ASHA (n.d.). Applications (Apps) for Speech-Language Pathology practice. Retrieved from: <http://www.asha.org/SLP/schools/Applications-for-Speech-Language-Pathology-Practice>

Best of What's New 2010. (n.d.). Popular Science. Retrieved from: <http://www.popsci.com/bown/2010/product/appleipad?dom=PSC&loc=poprail&lnk=9&con=apple-ipad>

Cirrin, F. M., & Gillam, R.B. (2008). Language intervention practices for school age children with spoken language disorders: A systematic review. American Speech-Language-Hearing Association, 39, S110-S137.

Conley, R., Fournier, A., Hanson, K., O'Brien, C. & McFarlane, L. (2012, May). There's an app for that; clinical perspectives on the iPad as an intervention tool for children. Paper presented at Annual Conference of Canadian Association of Speech-Language Pathologists & Audiologists, St. John's, NFLD.

Creaghead, N.A., Neuman, P. W., & Secord, W. (1989) *Assessment and remediation of articulatory and phonological disorders*. Columbus, OH: C.E. Merrill Publishing Co.

Culatta, B., Setzer, L., & Horn, D. (2005). Meaning-based intervention for a child with speech and language disorders. *Topics on Language Disorders, 25(4),* 388-401.

Espinosa, L. M., Laffey, J. M., Whittaker, T., & Sheng, Y. (2006). Technology in the home and the achievement of young children: Findings from the Early Childhood Longitudinal Study. *Early Education & Development,* 17(*3*), 421–441.

Fernandes, B. (2011). iTherapy: The revolution of mobile devices within the field of speech therapy. *Perspectives on School Based Issues, 12(2),* 35-40.

Gibson, M., Humphreys, E., Palmer, J., Miller, P., McFarlane, L., & Decker, S. (2012). *A hotspot for contemporary SLP practice: Using the iPad in therapy with adults.*

Johnston, J. (2007). *Thinking about child Language: Research to practice.* Greenville, SC: Thinking Publications University.

Klerfelt, A., (2007). Gestures in conversation- The significance of gestures and utterances when children and preschool teachers create stories using the computer. *Computers & Education, 48*, 335-361.

Koutsoftas, A.D., Harmon, M.T., & Gray, S. (2009). The effect of tier 2 intervention for phonemic

awareness in a response-to-intervention model in low-income preschool classrooms. *American Speech-Language-Hearing Association, 40,* 116-130.

Learning Exchange. (2011). iPads in Schools: Use Testing. Catholic Education. Diocese of Parramata, Australia.

Martin, J. (2013). Best cases and covers for the new iPad: protect your tablet in style. *PC Advisor.* Retrieved from: <http://www.pcadvisor.co.uk/features/apple/3345046/best-cases-covers-for-new-ipad/>

McCarrick, K., & Xiaomung, L. (2007). Buried treasure: The impact of computer use on young children's social, cognitive, language development and motivation. *Journal of the Association for the Advancement of Computing in Education, 15 (1)*, 73-95.

McCracken, H. (2010). The 50 Best Inventions of 2010. *Time.* Retrieved from: <http://content.time.com/time/specials/packages/article/0,28804,2029497_2030652,00.html>

Owens, R.E. Jr.(2014). *Language Disorders:A Functional Approach to Assessment and Intervention (6th ed.*). Upper Saddle River, NJ:Pearson Education, Inc.

Paul, R. (2012).*Language Disorders from Infancy through Adolescence: Listening, Speaking, Writing, and Communicating (4th ed.).* St. Louis, MO: Elsevier Inc.

Sackett,D., Rosenberg, W., Grey, J., Haynes,R. & Richardson, W. (1996). Evidence-based medicine: What is it and what it isn't. *British Medical Journal*, 312, 71-72.

Scapin, R. (2012). iPad and Smartboard: A Great Duo to Boost your Classes. Retrieved from: <http://www.slideshare.net/rscapin/ipad-and-smartboard-a-great-duo-to-boost-your-class>

Tablet Buying Guide. (2013). *Consumer Reports*. Tablet Buying Guide. Jan. 2013. Web. 12 Sept. 2013. Retrieved from: <http://www.consumerreports.org/cro/tablets/buying-

guide.htm>

TechSmith Corporation (2013). Camtasia 2 (version 2.51) [Mobile application Software]. Retrieved from: http://itunes.apple.com

Timler, G.R., Vogler-Elias, D., & McGill, K.F. (2007). Strategies for promoting generalization of social communication skills in preschoolers and school-aged children. *Topics in Language Disorders, 27(2),* 167-181.

Watt, H. (2010). How does the use of modern communication technology influence language and literacy development? A review. *Contemporary issues in communication sciences and disorders, 37,* 141-148.

World Health Organization (2001). *International Classification of Functioning, Disability, and Health: ICF*. Geneva, Switzerland: WHO.

APPENDIX

A1. Applications reviewed and featured on the website of the Department of Speech Pathology and Audiology at the University of Alberta

Alphatots	Artic Pix	Articulation Station
Assistive Chat	Audio Memos Pro	Bob's Book Magic
Bus HD	Cookie Doodle	Custom Boards
Decibel Ultra Pro	Disfluency Index Counter	Doodle Buddy
Elmo Loves ABCs	Fluency Tracker	iPractice Verbs
Keynote	Language Builder	LetterSchool
Linguisystems Phonology Cards	Match2Say	Model Me Going Places
My Memoir	My Playhome	Naming TherAppy

Noodle Words	Notability	Pictello
Picture Scheduler	Proloquo2Go	Scene Speak
Small Talk Apps	Social Skills	Speak It
Speech Sounds on Cue	Spell Board	Story Patch
Sunny Articulation Phonology Test	SurprisePro (You're the Story Teller: The Surprise)	TapSpeak Sequence
TherAppy Comprehension	TherAppy Reading	TherAppy Spaced Retrieval
TherAppy Writing	Toca Tea Party	Typ-O HD
Visual Planner	WH Questions at Home Fun Deck	YouTube

A2. App rating scale based on previous research and Best Practice Princi

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Application Summary					
Engaging: How engaging is this application for the target population?					
Not Applicable	Very difficult to engage client with this app.	With considerable effort, could be modified to be engaging.	With some effort, could be adapted to be engaging.	With minimal effort, could be adapted to be engaging.	This app is inherently engaging.
Facilitative Context: Does this application provide a context that facilitates acquisition of the target skills or allows the clinician to incorporate facilitative cues?					
Not Applicable	Very difficult to include facilitative context.	With considerable effort, could be modified include a facilitative context.	With some effort, could be adapted to include a facilitative context.	With minimal effort could be adapted to include a facilitative context.	This app is designed to include a facilitative context.
Naturalistic: Can the application expose the client to the target skills in a naturalistic communicative or social interaction?					
Not Applicable	Very difficult to incorporate naturalistic communication.	With considerable effort, could be adapted to be naturalistic.	With some effort, could be adapted to be naturalistic.	With minimal effort, could be adapted to be naturalistic.	This app encourages practice in a meaningful /naturalistic context.
Communication partner: Can the application incorporate interaction with a meaningful communication partner?					
Not Applicable	Very difficult to incorporate a communication partner.	With considerable effort, could be modified offer a communication partner.	With some effort, could be adapted to be communication partner.	With minimal effort, could be adapted offer a communication partner.	This app is designed for use with a communication partner.

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Individualized: Can the application be modified or adapted to meet the needs of individual clients?					
Not Applicable	App cannot be modified within the program or through clinician strategies.	With considerable effort, could be adapted to be individualized.	With some effort, could be adapted to be individualized.	With minimal effort, clinician could adapted use to be individualized.	This app is easily modified by use of setting or features within the app.
Focused: Can this application focus on a specific skill, or skills, and allow for concentrated practice with that skill?					
Not Applicable	App cannot be used in a focused way.	With considerable effort, could be modified to be focused.	With some effort, could be adapted to be focused.	With minimal effort, could be adapted to be focused.	This app is focused on the target skill.
Evidence/theory/developmentally based: Is this application based on evidence or generally accepted theoretical or developmental principles?					
Not Applicable	This app contradicts evidence/theory.	Substantial difficulties with established.	This app is not inconsistent with evidence/theory.	Mostly consistent with treatment/developmental principles.	This app shows clear evidence of alignment with established treatment or developmental principles.
Accountability: Does this application facilitate the collection of outcome measures of client progress?					
Not Applicable	This app is inconsistent with monitoring progress.	With considerable effort, client progress could be monitored.	With some effort, client progress could be monitored.	The clinician could easily track client progress while using this app.	This app is designed to collect data or record responses.
Efficient/practical: is this application set up for efficient and easy application to the target group?					
Not Applicable	Preparation and use of app is very complex for clinician and client.	Substantial clinician set up and client instruction is required.	Substantial clinician set up is required but client instruction is minimal.	With minimal clinician effort, app can be used easily by client.	This app can be used effectively with little set up or instruction for client.

A3. Applications featured with video tutorials

Alphatots	Articulation Station
Bus HD	Cookie Doodle
Doodle Buddy	Elmo Loves ABCs
Keynote	LetterSchool
Linguisystems Phonology Cards	My Playhome
Noodle Words	Pictello
Story Patch	SurprisePro (You're the Story Teller: The Surprise)
TherAppy Comprehension	TherAppy Reading
TherAppy Spaced Retrieval	TherAppy Writing
(You're the Story Teller: The Surprise)	YouTube