What's BEFORE the iPad®? Teaching Basic Prerequisite Skills for iPad® Use

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Assistive technology, such as that available in an iPad®, have increasingly been used to support learning for all students and particularly for those with special education needs. The purpose of this article is to consider the prerequisite skills required for effective iPad® use. The effective integration of assistive technologies, from technology, pedagogy, and content knowledge perspectives is an important theoretical framework. From a Universal Design for Learning perspective, we consider how new skills can be taught and how task analysis is a critical part of the process. A review of suggested apps for prerequisite skills, such as cause and effect, tap, drag, and swipe, is included as are considerations for Individual Education Plans. An authentic case anecdote is provided to illustrate the ways in which prerequisite skills can be addressed. The conclusion integrates the scholarly literature on teaching and assistive technology.

The integration of multiple technologies into twenty-first century teaching is an essential feature in today's diverse, complex, and inclusive classrooms (Draper Rodriguez, Strnadova, & Cumming, 2014). Teachers are expected to contend with technological advancements and incorporate technology into their daily teaching practises as students have been transformed into digital learners (Draper Rodriguez et al., 2014; Fleury et al., 2014). The theoretical framework that appears to have the significant relevance in the integration of technology and teaching is known as TPACK (technology, pedagogy, and content knowledge) (Koehler & Mishra, 2009). Technology, pedagogy, and content knowledge cannot be seen as separate entities in today's classroom; rather technology, pedagogy, and content knowledge need to be integrated for effective teaching and learning. To successfully integrate these three foundations, teachers must be willing to engage in a process of learning how to most effectively do so (Candace, Kamini, & Mueller, 2011).

There is a significant body of scholarly literature that considers how technology is used in schools. This literature includes examinations of teacher attitudes (Aldunate & Nussbaum, 2013; Kopcha, 2012), types of technology being utilized (Al Musawi, 2011; Clarke & Zagarell, 2012), how students use technology (Gasparini & Culen, 2012; Geist, 2011), and the impact of various technology tools and environments on student achievement and attitudes (e.g., Shapley, 201; Wood et al., 2012). Of most relevance to the focus of this article is literature that considers how technology can support students with exceptionalities and other special education needs.

Students with cognitive, communication and/or motor exceptionalities can benefit significantly from the implementation of technology (Fleury et al., 2014; Powell, 2014). There are numerous ways in which technology supports students with diverse needs. For example, students with exceptionalities are often able to have increased engagement with learning tasks because of technology integration (Israel, Maynard, & Williamson, 2013). As well, students who use assistive technologies often feel more empowered in accessing and accomplishing learning tasks (McNaughton & Light, 2013). One of the most significant benefits of technology is the opportunity it provides for supporting differentiation for diverse student needs (Fernández-López, Rodríguez-Fórtiz, Rodríguez-Almendros, & Martínez-Segura, 2013). For example, the algorithms in computer applications can recognize progress and gaps in specific learning areas thus facilitating student focus in areas of need. Although technology can support the specific needs of students with exceptionalities, the general principles of Universal Design for Learning suggest that accessing technology can be beneficial for all students (Sider & Maich, 2014).

Tablets, such as iPads®, are an example of a technological tool that is becoming increasingly popular in the classroom due to the flexible ways in which they can be used, ease of use, and low cost (Aronin & Floyd, 2013). However, despite their rapidly increasing integration, there are many challenges to successfully incorporating the iPad® into the classroom including educator training and student readiness to begin using the technology (Mautone, 2013; Powell, 2014). Ultimately, much iPad® use is preceding related research and many students are not successfully prepared to use this technology in educational settings (Mango, 2015). Ibharim, Borhan, and Yatim (2013) therefore raise the argument that not all students possess the same baseline knowledge and skills regarding touch technology. Clearly, there is a gap in the literature that examines the types of prerequisite skills that children require to engage with technology. This article addresses the gap by considering the prerequisite skills required to successfully operate an iPad®.

Universal Design

Before we teach new skills to any child, student, adult learner, or learner with or without a disability, ensuring that the environment is set up for success is a key factor in making that environment accessible for the needs of that individual learner. In the case of the iPad®, making it an accessible microcosm of teaching and learning translates to learning, managing, and tweaking its built-in accessibility features to meet the needs of its user. The iPad® has many examples of features that help to individualize it as an effective, efficient accessible assistive technology tool, including a screen reader (voiceover) feature, the ability to set large text and icons, speech-to-text options (Siri®), text-to-speech options, predictive text, guided access, assistive touch, switch control, braille compatibility, hearing aid compatibility, and AssistiveTouch®—supporting diversity in gesture use and individual abilities (Apple Inc., 2017). These are some examples of settings that can be accessed and manipulated to meet the needs of learners with visual, hearing, fine motor, and communication needs. Despite the appeal of iPad® integration in education, various barriers can exist to the success of student iPad® use. Ibharim et al. (2013), for example, discovered in their research that students often adapt their own strategies for use (i.e., one hand vs. two hand use). Furthermore, physical restrictions such as fine motor difficulties may prevent students from accessing the technology adequately as well as lack of prior experience using iPads® even with its built-in features. An assessment of prerequisite skills, therefore, can aid educators in developing an appropriate plan to teach students necessary iPad® skills.

McDowell (2013) shared a proposed inventory of prerequisite skills which was used when working with students who had vision difficulties focusing on skills in a variety of areas such as gestures, features, and iPad® care. This specific type of inventory allows educators to clearly track the necessary prerequisite skills for using the iPad® successfully, which includes basic skills such as swiping or tapping motions as well as more advanced skills such as operating the camera successfully (McDowell, 2013). However, this inventory is not yet comprehensive.

Teaching New Skills

Even prior to examining a student's readiness for using the iPad®, it may be beneficial—or necessary—to examine that student's individual needs in the area of assistive technology itself. Consider comprehensively assessing that student's needs in assistive technology as the first step to accessing prerequisite skills instruction. The Wisconsin Assistive Technology Initiative (2009) developed a comprehensive, cost-free, open access tool entitled: *Assessing Students' Needs for Assistive Technology Manual* which is now in its fifth edition. Users can access and complete the full assessment or choose specific assessment topics to complete (e.g., communication, computer access, and organization) for completion.

If you are moving forward with the iPad®, teaching skills with or within the iPad®—as with using any structured teaching models—developing clear learning goals and targets is essential (Konrad, Ressa, Alexeef, Chan, & Peters, 2014). Goals should be specific, measureable, attainable, relevant, and timely or SMART (Jung, 2007) in order to effectively assessment growth and change. Instruction and assessment should be collaborative, using Applied Behavior Analysis-based instructional strategies such as task analysis, modelling, direct trial training, and positive reinforcement (Gongola & Sweeney, 2012; Lovitt, 2012).

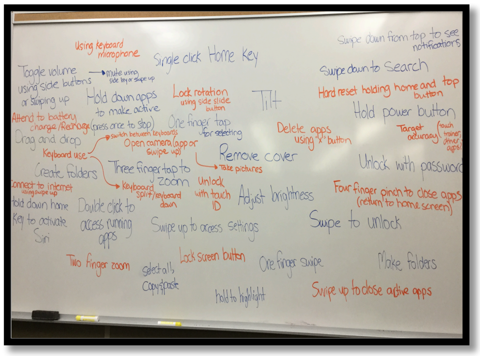
Task Analysis

A task analysis is an effective teaching strategy that involves the process of breaking skills down into their component parts to teach students who struggle to learn all the steps at once (Szidon & Franzone, 2009). The three ways to create an effective task analysis, foundational to teaching skills in a step by step manner, are by watching an expert, reading about it, or doing it yourself (Cooper, Heron, & Heward, 2007). Figure 1 was created with the observation of expert users—college-age native users of technology, developing task analyses of exemplar of basic, intermediate, and advanced skills for iPad® use. Table 1 is a fairly comprehensive list of single skills and task analyses of the current beginner, intermediate, and advanced set of prerequisite skills needed to successfully access an iPad® with independence. These are skills that will assist with individuals navigating the basic environment to then use additional programs for augmentative communication, educational software, or entertainment. Please keep in mind the omnipresent caveat the field of technology is rapidly changing; thus, this table, while currently quite comprehensive, should always be considered a foundation to be individualized and personalized according to context (version) and time frame (e.g., iOS).

Suggested Apps for Prerequisite Skills

The below suggested apps for the development of prerequisite skills are free or low-cost, simple suggestions to match the

Figure 1. Prerequisite skills and task analyses brainstorming.



iPad® learner's needs with various areas of basic prerequisite skill development. They are listed by the skill of best fit, though other skills may apply. Some of the below are designed specifically for AT purposes and others can be simply *utilized* for developing AT-related skills. Please note that viewing the demonstration videos using a Google Video or You Tube search before trying the apps out yourself may be beneficial.

Cause and effect. Pocket Pond (Trigger Wave, 2012) is one option to support the development of cause-and-effect understanding. Its developers advertise it as "Create relaxing ripples while you enjoy the sounds of nature. Interact with the fish - scare them, feed them, and watch their schooling behavior. It's your own personal pond to cleanse your worries and free your mind." Aside from these potential benefits, the use of your finger on the interactive iPad® screen creates movement (e.g., ripples, fish) and sound (e.g., ripples) providing not only cause-and-effect teaching and learning but with the immediate feedback and potential positive reinforcements of the movement and sound accompanying touch.

Tap and more. Tiny Piano (SquarePoet, Inc., 2016) provides tap practice, immediate audio feedback, and the potential joy of tapping any key to play the next note in a song. Our iPad® learners with any skill level with iPads®—or piano—can play complex songs using even random tap skills (or with closed eyes or vision-related disabilities). Peekaboo Barn Lite (Night & Day Studios, Inc., 2014) with its preschool-like visuals, provides a range of reinforcers for tapping in the right spot—the barn doors. Its developers note that "Inside a little bouncing barn, friendly farm animals are waiting to pop out and surprise your little one. Try and guess who they are; tap the doors to find out!" Its animation rewards play with audio, visual, and even the names of animals. Touch Trainer (Touch Autism, 2014) is an app designed for "single finger fine motor skills" instruction, allowing the adult to adapt the preciseness of the finger tap and the size of tap targets over time as skills develop, rewarding its user with swirling shapes and sounds. It allows the adult to customize the criteria for mastery where the target becomes smaller or the length of the reinforcer that plays with a successful finger touch.

Drag and more. Sea Creatures (Atech, Inc., 2016) (a free app) lists easy to follow directions: "Drag the screen to move. Tap the empty area on the screen to feed the fish. The fish run away when you touch them." This app adds an extra skill to basic requisite skills—dragging. When users drag the screen, more seascape appears providing

Table 1. *Beginner, Intermediate, & Advanced Skills*

Beginner	• Allows basic operation • Requires cause-and-effect knowledge	• Remove cover • Tilt • Tap targets • Swipe (to change screens or unlock device) • Double tap • Pinching (to zoom) • Drag and drop • Flick (scrolling)
Intermediate	• May use combinations of beginner skills • Requires procedural knowledge	• Turn the device off / on (using the top button) • Keyboard use (switch; split; minimize the keyboard) • Camera use (switch between front and back camera; use top button and home key to take screen shots) • Double click home key to access running apps • Swipe up (close apps; access settings) • Swipe down (access notifications) • Four finger pinch to close apps (return to home screen) • Select all, copy, paste • Hold to highlight • Lock screen button • Unlock device (using password or touch ID) • Hold power button (restart) •
Advanced	• May use complex combinations of skills • Adjustments for personal preferences	• Changing brightness level (using the swipe up function) • Changing the volume • (using swipe up function **or** side buttons) • Mute using side button • Connect to internet • (using the swipe up function) • Organizing apps • (Create folders, hold down apps to activate, press home key to stop activation of apps, delete apps) • Lock rotation (using side button or swipe up) • Use keyboard microphone • Attend to battery charge • Charging battery • Hold down home key (to activate Siri®)

more opportunities to interact with colourful fish. Endless Alphabet (Originator Inc., 2016) ($11.99) is a reading app but its users can also practice dragging letters into place to form words, and are rewarded with colour, sound, and talking animated animal creatures who walk across the screen when they successfully drag and match the correct letter.

Swipe. Fruit Ninja, a popular mainstream free game (Halfbrick Studios, 2012) marketed as entertainment (“take a break and experience a new way to slice your favourite fruit”) focuses on swipe skills (from simple to complex) to slice fruit—the main task for game success! Finger Paint with Sounds (Inclusive Technology Ltd., 2013)—another free app—is focused on exploring touch for students with disabilities to “practice their first interactions with a touch screen,” and includes music and color as potential reinforcers when the individual drags their finger across the screen.

Varied touch. Heat pad will work with any type of touch, and has strong potential to use for new learners with little to no touch skills, or to teach complex touch such as the three-fingered swipe, pinch, or more. Padadaz SARL (2016), its developers, explain that "This app simulates various heat-sensitive surfaces reacting to the heat of your fingertips. Simple, yet surprisingly relaxing and entertaining!” In contrast, apps like Bubble Popper (Mob Touch, Inc., 2014) demand a precise or distinct touch to pop one bubble at a time, along with a “realistic bubble appearance and popping sounds.”

Individual Education Plan Integration

Individual Education Plans (IEPs) are detailed documentations that provide strategic ideas and procedures for teachers and other educators to support specific students (e.g., Ontario Ministry of Education, 2004). Depending on the educational jurisdiction, IEPs might be referred to as Special Education Plans or Individual Learning Plans (or similar). Developing prerequisite skills for iPad® usage should be incorporated into IEPs since this provides a coherent and coordinated plan to support students in this process—and to document successes. IEPs should serve as a guide to daily instructional and assessment practices for students with special education needs and are reviewed on a regular basis by educators and parents, guardians, or caregivers. As a result, IEPs serve as an excellent way to document and communicate a child’s progress.

There is no common template for IEPs; however, IEPs typically include environmental, assessment, and instructional strategies. The instructional strategies and tools that have been identified in the previous sections should be noted in the instructional strategy section of the IEP. As well, educators can identify assessment strategies in the IEP to document a child’s progress with prerequisite skills. The various types of assistive technologies, including iPads® should also be noted on the IEP as well as any specific human resources that are required to ensure the effective integration of the technology. Noting that the IEP is a “living document,” it is important for educators to continually refer to the IEP, and make changes to it, as prerequisite skills are addressed.

As referenced earlier, The Wisconsin Assistive Technology Initiative (WATI) provides a free tool to determine a student’s need for assistive technology (2009; http://www.wati.org/?pageLoad=content/supports/free/index.php). The WATI also provides an excellent section (chapter 15) giving detailed instruction on how to use the tool to assess the current level of academic achievement and functional performance as well as to identify goals and specific strategies to address these targeted areas. The development of annual goals, strategies, and reporting mechanisms for IEPs differs from context to context; however, the WATI provides a practical, helpful guide to the process.

Teaching Touch for Future Communication: An Anecdote

For one high school student with global developmental delay, the introduction of an iPad® provided motivation to communicate and engagement to interact with reinforcers in an age-appropriate manner in an inclusive classroom. This student (using a pseudonym of "Ella") demonstrated little motivation with low-technology communication strategies in the past. The potential of tablet technology was anticipated immediately by the involved educators; however, upon receiving an iPad®, this student had little history with touch technology and could not navigate the device, but was still attracted to her favourite online videos. The prerequisite skills, then, to use her communication software, open the app, and access her reinforcers, were itemized in both individual teaching programs and task analyses. *Guided access®* was used to prevent her leaving any target app. First, Ella was taught how to use distinct touches with *Touch Trainer*, gradually increasing the settings toward the goal of distinct taps on small targets. Then, the *YouTube app* was placed alone on a single screen, and Ella undertook the processes of learning to open this app to her pre-loaded favourite video—an immediate reinforcer. A task analysis was developed requiring Ella to open the app, choose a video from a selection, and then touch it to begin play. She was taught to swipe using the app *Finger Paint with Sounds*, where music would play only her correct swipes. Next, her YouTube app was then moved a single page with empty pages in-between, motivating her to swipe between pages to access her reinforcer. Placing Ella's favourite videos lower on the YouTube homepage, next, taught her to scroll. Eventually, numerous apps were added to her home page to encourage discriminate between apps. With these prerequisite skills firmly in place, teaching Ella to utilize a communication app was finally possible. This instruction then began with only two visuals per screen and gradually increased to a range of items to allow Ella to address her wants and need, with the later additional of distracters and eventual requests, greetings, and labels. With her now-expert skills of distinct taps, swiping, and scrolling to navigate the iPad® as prerequisite skills to success, Ella was able to focus on using these skills to access her communication software. See Figure 2 to see Ella one year after beginning to learn her prerequesite skills for the iPad®, now ordering her meal at independently at a community restaurant.

Figure 2. One year after teaching prerequisite skills to the iPad®.

iPad Teaching Decision Tree and Teaching Plans

In developing a teaching program to teach students with exceptionalities how to complete prerequisite skills, it is important to first determine *how* you will teach these skills. If a student requires more repetition and can get confused easily with a sequence of steps, for example, it is often more productive (with a lower likelihood of practicing errors rather than skills) when skills are taught discretely or one at a time. In contrast, other learners can learn better through practicing the sequence that leads to their end goal through chaining and a task analysis. The benefit of using a task analysis is there is less generalization to teach. Use Figure 3—a decision-making tree—to determine the most effective manner to teach an individual student, learner, or adult.

Once an approach is chosen, developing of a specific teaching plan is helpful. For teaching a discrete skill, the target skill is broken down from easier to more difficult components in teaching steps and a prompting hierarchy is followed. Figure 4 provides an example of a teaching program for "Quincey" (a pseudonym) with teaching steps that get incrementally more difficult with a most-to-least prompt hierarchy. Alternatively, Figure 5 is the task analysis of the skills that were taught to Ella (above) when she was learning to open her communication app. The sample program teaches her the sequence of skills in a backward chaining method, allowing her to access the end of the sequence quickly in order to meet with reinforcers.

Summary

Ibharim et al. (2013) discovered children used a variation of movements when interacting with an iPad® including using one or two hands. They also found that some children had difficulty accurately touching target locations depending on the size of the target area. Likewise, Benton (2012) identified benefits of introducing iPads® with children who have autism spectrum disorder. Benton suggests that the use of picture exchange communication system promotes successful iPad® integration as children are familiar with exchanging pictures for responses or reactions. Benton further suggests that children may need

Figure 3. Decision making tree for choosing approaching to teaching iPad prerequisite skills.

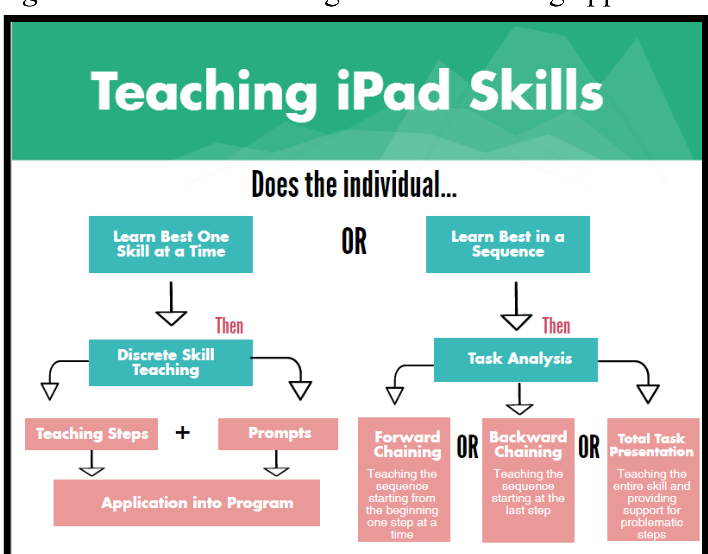


Figure 4. *Quincey's swipe program.*

Error Correction: Single-Response: 1. Allow the student to err 2. Present the instruction again 3. Immediately add higher level of prompt 4. Provide neutral reinforcement 5. Repeat trial at original level *Discontinue after 3 consecutive errors
Data Collection: • Trial-by-trial *Indicate a + for correct action & - for incorrect action (at teaching step and prompt level)* • Calculate Percent *Divide number correct by total opportunities that day*
Generalization: **P- people –** new school staff, various family members **L- location –** different rooms, away from table, on floor **O- object –** with novel apps (drag & drop), with new screens, etc. **P – placement of object –** have apps in different locations **S – S^d –** "Go to," "Place here"
Maintenance: **Once mastery is attained at independence for each teaching step, check:** • Weekly to ensure maintenance • Bi-Weekly to ensure maintenance • Monthly to ensure maintenance

the pictures on the tablets represent objects (i.e., applications). Ultimately, she cautions that training is required to ensure appropriate behavior and successful usage of the technology. Further, McNaughton and Light (2013) contend that it is important to keep the focus not on the technology but on the skills that any given child needs to develop.

As illustrated in the work of Ibharim et al. (2013), Benton (2012), and McNaughton and Light (2013) clearly there are benefits to the use of tablets such as iPad® in settings involving young children and those with exceptionalities. One of the key ways in which tablets can support students with exceptionalities is the ability to differentiate the types of tasks that a student completes based on their specific needs (Fernández-López et al., 2013). However, for teachers to successfully integrate tablets into the classroom context, they must help children develop prerequisite skills. This supports the work of Koehler and Mishra (2009) who contend that technology must be integrated with pedagogy and content knowledge to be effective. As has been highlighted in this article, these include motor skills, processing skills, and developing understanding such as cause and effect. As well, teachers must have a learning stance themselves and be willing to integrate technology with their teaching practices for the benefit of their students (Mueller & Wood, 2012). The provided resources will facilitate the effectiveness of teacher and student interactions involving tablets such as iPads®.

Figure 5. Ella's task analysis for opening a communication app.

<table>
<tr><td colspan="2">Task Analysis for Opening a Communication App
Upon presentation of the iPad Ella will turn it on, open the app, and choose her communication request with 100% accuracy over 2 consecutive days.</td></tr>
<tr><td colspan="2">Opportunities: 5 times per day</td></tr>
<tr><td colspan="2">Chaining Method: Backward Chaining
Begin by teaching the last step in the task analysis first (#6). Complete all steps for Ella and have her complete step 6 until mastery. Then teach steps 5 & 6 until mastery, and so on, until she can complete the entire task analysis.</td></tr>
<tr><td>Task Analysis
1. Push "home" button on iPad to turn on
2. Swipe right to left to scroll pages
3. Swipe right to left to scroll another page
4. Tap on app to open
5. Tap on one of 2 folders
6. Tap on the requested picture/button, to engage the voice output for that item
NOTE: Provide requested item after request

Prompting Hierarchy:
Least-to-Most
1. Independent
2. Gesture prompt
3. Partial prompt
4. Full prompt</td><td>Error Correction:
Chained behavior:
Incorrect start to chain
1. Allow error to occur; mark as incorrect (-)
2. Readminister trial with increased prompt level; provide differential reinforcement
3. Intersperse a distractor trial
4. Readminister initial trial
Error within chain
1. Allow error to occur; mark as incorrect (-)
2. Readminister trial from step at which error occurred to end with increased prompt level; provide differential reinforcement
3. Intersperse a distractor trial
4. Readminister initial trial at start of chain</td></tr>
<tr><td>Mastery Criteria:
90% across 2 consecutive sessions</td><td>Revision Criteria:
3 consecutive data points below 30%</td></tr>
<tr><td colspan="2">Data Collection Procedure:
• Total Task Presentation: complete each step of the chain in order and record a (+) for steps completed independently and a (-) for steps requiring a prompt.
• Calculate percentage by the number of independent accurate responses divided by the total number of steps in the task analysis</td></tr>
<tr><td colspan="2">Generalization:
P (people) – other school employees, family members, friends, support workers
L (location) – different rooms, in the community, etc.
O (object) – various targets requiring different objects
P (placement of object) – various placements depending on chained behavior
S (S^d)– vary depending on chained behavior</td></tr>
<tr><td colspan="2">Maintenance:
Once mastery is attained at independence for each teaching step, check:
• Weekly to ensure maintenance
• Biweekly to ensure maintenance
• Monthly to ensure maintenance</td></tr>
</table>

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