MOBILE LEARNING TRENDS

ACCESSIBILITY, ECOSYSTEMS, CONTENT CREATION
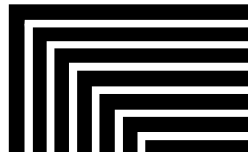
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Library Technology

R E P O R T S

Expert Guides to Library Systems and Services

Mobile Learning Trends:
Accessibility, Ecosystems, Content Creation

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About the Author

Nicole Hennig is an independent user experience professional, helping librarians and educators effectively use mobile technologies. She is the author of several books and technical reports, including Apps for Librarians: Using the Best Mobile Technology to Educate, Create, and Engage and Best Apps for Academics (http://nicole hennig.com/books).

Her online courses—Apps for Librarians and Educators, Organize Your Life with Mobile Apps, and The Book as iPad App (http://nicolehennig.com/courses)—have enabled librarians from all types of institutions to effectively implement mobile technologies in their programs and services. Her e-mail newsletter, Mobile Apps News (http://nicolehennig.com/mobile-apps-news), helps librarians stay current with mobile technologies.

Nicole worked for the MIT Libraries for fourteen years as head of user experience and web manager. She is the winner of several awards, including the MIT Excellence Award for Innovative Solutions. For more information, see her website: nicolehennig.com.

Abstract

The widespread adoption of mobile computing is a good thing for librarians who care about access for all. Mobile devices make use of "natural user interfaces," and those interfaces are making computing easier for people of all ages and abilities. Mobile learning is headed in a direction that is empowering for learners of all abilities. *Library Technology Reports* (vol. 52, no. 3), "Mobile Learning Trends: Accessibility, Ecosystems, Content Creation," focuses on three trends:

- natural user interfaces and accessibility
- multi-device ecosystems
- content creation with mobile devices

It includes ideas for how libraries can use this information to empower their users and resources for learning more about these topics.

Acknowledgments

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Natural User Interfaces and Accessibility

The widespread adoption of mobile computing is a good thing for librarians who care about access for all. That's because mobile devices make use of natural user interfaces, and those interfaces are making computing easier for people of all ages and abilities, as you'll see in this report.

This trend, combined with the move toward multi-device ecosystems and the emphasis on students as creators with mobile apps, means that mobile learning is headed in a direction that is empowering for learners of all abilities.

There are other trends in mobile learning, but this report focuses on these three:

- natural user interfaces and accessibility
- multi-device ecosystems
- content creation with mobile devices

That's because there are synergies between these trends that offer opportunities for those who care about access for all. We'll also discuss opportunities for libraries and librarians and suggest resources for continuing your learning.

Many notes and links are included throughout the report, so it's recommended that you sit down with your computer or mobile device and prepare to follow links to view interesting photos and videos related to the topics within.

I enjoyed gathering the research for this report, and I think you will find it inspiring to read about how mobile computing is making life easier for so many people of all ages and abilities.

Natural User Interfaces Are Making Computing Easier for All Ages and Abilities

NUI stands for *natural user interface*. Natural user interfaces are those where humans interact with computers using actions related to everyday behavior, such as touch, gestures, speech, and conversation.[1] The goal is to make it easy for humans to understand and use computers without having to learn complicated or abstract ways of doing things. Designers of these interfaces aim to create experiences that feel just as natural to a novice as to an expert user—and for expert users it can feel like an extension of their body.

Putting the Human before the Computer: The Move from GUI to NUI

NUIs are a new branch in the evolution of human-computer interaction, after GUIs (graphic user interfaces). GUIs were designed to make computing easier to learn than command-line interfaces, where you had to remember specific commands and type them. By using the metaphor of a desktop, with a trash can, menus, and so on, users no longer needed to memorize commands. You could just look under each menu to find the command you needed. Now with NUIs, it's possible to move away from abstract metaphors and toward interactions that feel more natural.

Some examples of natural user interfaces are touchscreens, speech recognition, and voice commands. There is also camera input, which allows the device to recognize objects in the real world, and augmented reality, using the camera in a way that shows additional information superimposed on your view of the real world.

Experts agree that NUIs won't entirely replace GUIs. Instead, they are opening up a new niche of computing that is accessible to a wider audience. GUIs will continue to exist for those applications and devices where they work best.[2]

Mobile devices are using many kinds of natural user interfaces, and that's good news for learners. In

this section, we'll look at several examples of how these interfaces work and how they make computing easier for all ages and abilities. And in the final chapter of this report we'll discuss some opportunities for librarians to help their communities by serving as expert advisors about these mobile technologies.

Types of NUIs

The NUIs we'll discuss can be grouped into the following categories:

Touch, including the following:
- Touchscreens and multi-touch gestures, such as those used on smartphones and tablets.
- Haptic interfaces, such as the Apple Watch's ability to tap your wrist as a way to notify you.
- Force Touch and 3D Touch. These are Apple's technologies used in the Apple Watch, the trackpad on newer models of Apple's MacBook, and the latest models of iPhones (6s and 6s Plus). With Force Touch you can push down on the screen to activate certain functions. With 3D Touch, there are more sensitive levels of touch based on a lighter or firmer push.

Sound, including the following:
- Speech recognition, such as that used by Siri and other digital assistants.
- Conversational interfaces, where you can talk to your device and it can react, such as that used by the Amazon Echo, a device that listens for your commands for answering questions, playing music, and controlling other smart devices.
- "Hearables"—new kinds of devices that merge the health-tracking features of smart watches and fitness bands with high-quality audio like that found in premium earbuds. An example is "The Dash"—wireless, bio-sensing headphones.

Sight, including the following:
- Camera as seeing eye, such as that used by Google Translate, which allows you to point your camera at text in one language and see it translated to another language on the fly.
- Camera as scanner, such as with document-scanning or barcode-scanning apps, especially apps that use OCR (optical character recognition) to translate what the camera sees to written text. Scanbot for iOS and Android is a good example.
- Augmented reality, such as the ability to show a virtual overlay on top of what you are seeing, like that offered by the app Layar.

In this report we'll look at examples of how each of these types of interfaces can enable better access to learning, for people with various types of disabilities, and for everyone.

3D Touch
www.apple.com/iphone-6s/3d-touch

Amazon Echo
www.amazon.com/Amazon-SK705DI-Echo/dp/B00X4WHP5E

The Dash smart earphones
https://store.bragi.com

Scanbot
https://scanbot.io/en

Layar
https://www.layar.com/mobile-download

Why Everyone Should Pay Attention to Matters of Disability

All of us, over time, move between times of independence and dependence on others. If you've ever had a broken bone or similar injury, you've experienced the need for assistance.

Do you wear glasses? Contact lenses? Perhaps you have braces on your teeth? Maybe you know someone who has a pacemaker. Whether your need for these technologies is temporary or permanent, you are using "assistive technologies." In fact, one could say that all technology is assistive technology. Even your smartphone or headphones serve to augment your abilities in some way. Separating technologies into assistive technology versus "regular" technology no longer makes sense in a world where we all benefit from technologies that increase our abilities.

It's important for all of us to think about how technology can help improve lives, whether you work with those who have recognized disabilities or not. The idea of "normalcy," based on a bell curve of statistics about how your body or mind should perform, is a recent one (since the nineteenth century).[3] This goes along with the idea that disabilities are medical conditions in need of cures and the idea that disabled bodies are somehow deficient.

These days there is talk of turning people into cyborgs, with both utopian and dystopian visions of how that might play out.[4] Exoskeletons designed to make soldiers run faster and carry heavy loads have been developed from military research and are now being used to help people who are paralyzed stand and walk.[5] This is proving to be wonderful for some people and has also sparked debate. There are those to want to "fix" people with disabilities, while doing nothing to adjust infrastructure, laws, and social norms to make our society more accessible for all.[6]

This is a significant concern particularly in the autism community and the deaf community. They are not people in need of fixing. If you haven't had the opportunity to think much about this issue, these two articles will help:

- Judy Endow, "Is Autism a Disability or a Difference?"
- Allegra Ringo, "Understanding Deafness: Not Everyone Wants to Be 'Fixed'"

For more in-depth thinking about these issues, see Carrie Wade's "Pity Is Not Progress: Why Disabled People Don't Need to Be 'Fixed.'"

Is Autism a Disability or a Difference?
http://ollibean.com/2014/06/20/autism-disability-difference

Understanding Deafness: Not Everyone Wants to Be "Fixed"
www.theatlantic.com/health/archive/2013/08/understanding-deafness-not-everyone-wants-to-be-fixed/278527

Pity Is Not Progress: Why Disabled People Don't Need to Be "Fixed"
https://medium.com/@wadeacar/pity-is-not-progress-f416f0491f9e

Improving our physical and virtual worlds for people with disabilities makes things better for everyone. For example, adding curb cuts in sidewalks for wheelchair access makes it easier for those pushing strollers or pulling a rolling suitcase. Making text resizable on websites also helps people without any vision problems, for example, in situations where you are doing a presentation and need to show people in the back row something specific.

With this idea in mind, let's now look at some categories of disabilities and how mobile devices with their natural user interfaces are helping to make access to computing easier for all of us.

Types of Disabilities

Apple's iOS and Google's Android have many features built in for improving accessibility. Apple has taken the lead in this area, and it has some useful groupings of features on its website. We'll use those categories as a starting point.

For an overview, here are Apple's accessibility categories for iOS, with the names of each feature.

- **Vision.** VoiceOver, Siri, Speak Screen, Dictation, Zoom, Font Adjustments, Invert Colors and Grayscale, and Braille Displays for iOS.

- **Hearing.** FaceTime, Closed Captions, Messages with iMessage, Mono Audio, Visible and Vibrating Alerts, and Made for iPhone Hearing Aids.
- **Physical and Motor Skills.** AssistiveTouch, Siri, Switch Control, Touch Accommodations, Dictation, Predictive Text, Keyboard Shortcuts, Support for Third Party Keyboards, and Hardware Keyboard Support.
- **Learning and Literacy.** Guided Access, Speak Screen, Dictionary, Safari Reader, and Speech Apps.

Braille Displays for iOS
https://www.apple.com/accessibility/ios/braille-display.html

Made for iPhone Hearing Aids
https://www.apple.com/accessibility/ios/hearing-aids

iOS Speech Apps
https://www.apple.com/accessibility/third-party/#speech

To learn more, see Apple's iOS Accessibility site. For Android, which has similar features, see Google's site. Android users need to keep in mind that not every device has the same set of features. Some features are specific to certain models of smartphones and tablets, so it's best to look at your manufacturer's website for specifics.

iOS Accessibility
https://www.apple.com/accessibility/ios

Android Accessibility Help
https://support.google.com/accessibility/android

Rather than go through each feature and explain it, let's look at a few stories of particular people and how mobile devices are improving their lives. These examples are from the website Bridging Apps.[7]

Bridging Apps
http://bridgingapps.org

Stories of People Whose Lives Are Improved by the Use of Mobile Technologies

THE PROLOQUO2GO APP IS HELPING THOSE WITH AUTISM SPECTRUM DISORDER BECOME MORE VERBAL

Susan is a speech-language pathologist at an outpatient rehabilitation clinic for children up to age

twenty-one. Many of the children she works with have an autism diagnosis. One of the apps she finds most useful is called Proloquo2Go. The app makes it easy to add pictures with vocabulary words of objects that are meaningful to the child. The child can touch specific items on the screen as a way to start communicating. She tells the story of a student who at first could communicate only with sounds, squeals, and temper tantrums. Using this app, he was able not only to request things that he wanted, but also to greet people, ask questions, and begin speaking verbally in short phrases.

Proloquo2Go
www.assistiveware.com/product/proloquo2go

She discusses this and other apps for people with autism, and she emphasizes that while they can't replace an actual therapist, these technologies are extremely beneficial. Many children are interested, engaged, and motivated when using this type of technology.

Read Susan's full story on the Bridging Apps website.[8]

APPS ARE HELPING THOSE WITH AUTISM SPECTRUM DISORDER DEVELOP FINE MOTOR SKILLS, AND THEY SERVE AS A BRIDGE TO BECOMING MORE SOCIAL

Michael is the father of Colin, a young boy with autism spectrum disorder. He tells the story of how his son likes to use an app called Write My Name. With it, he writes his name and his brother's name and spells out words, tracing every letter of the alphabet with his finger on the screen. It helps him develop the fine motor skills that many kids with ASD struggle with. Michael also talks about how much Colin loves the calendar and calculator, since he's precocious in math and with dates.

Michael makes the point that while some experts are critical of the use of apps with ASD kids because it's taking them away from interactions with people, many of these apps help form a bridge that leads Colin to communicate more in a way that's less threatening to him. So Michael is very grateful for how these devices and apps are improving life for his son.

Read Colin's full story on the Bridging Apps website.[9]

Write My Name
www.iactionbook.com/?slide=write-my-name&lang=en

Todd is a successful businessman, mentor, and public speaker. An accident at age eight caused a spinal cord injury that left him as a C4 quadriplegic. He uses a device called a Tecla Shield that enables him to use his iPhone, iPad, or laptop without touching the screen.[10] Control is done entirely with his chin and mouth since he has no movement below the shoulders.

I recommend taking a few minutes to watch his video, "iLove Stories of Independence," where he tells the story of gaining more independence with these technologies and what that means to him. Voice recognition has come a long way since he was young, but you always had to press a button to start the process—something he could not do without help from others. With the advent of Apple's Siri, he was able to communicate on his own for the first time using his iPhone, without the help of others. You'll hear from a friend of his, who is also quadriplegic, in the video, and the two of them tell the amazing story of how they can get out into nature with their wheelchairs and iPhones, easily staying in touch with others, not needing to have other people do everything for them.

iLove Stories of Independence video
https://youtu.be/w9LGAJVLBEg

Read Todd's full story on Bridging Apps, and watch his video on YouTube.[11]

A SEVENTH GRADER WITH CEREBRAL PALSY USES THE BOOKSHARE SERVICE WITH AN APP CALLED READ2GO TO ENJOY BOOKS WITHOUT THE HELP OF OTHERS

Connor is a seventh grader with cerebral palsy who used to depend on his mom to read to him. Now he uses a service called Bookshare that offers a free online library for students with print disabilities who qualify. He uses an app called Read2Go on his iPad to read the books on his own. With it, he can follow words that are highlighted on the screen and listen to the text being read aloud.

This type of reading experience is useful for a wide range of students, including those who have trouble focusing or concentrating on the screen. Read Connor's full story on Bridging Apps.[12]

The people in these examples have what we would traditionally call a disability. As you read these and other examples in this report, think about how these technologies can be useful to a wide range of people

of all ages and abilities, not only those we would call disabled.

Bookshare: An Accessible Online Library
https://www.bookshare.org

Read2Go
http://read2go.org

Examples of NUIs

Now let's look at specific apps and devices that are making learning easier because of their natural user interfaces. These examples include apps designed specifically for people with disabilities and apps designed for everyone. All of these technologies can improve learning for a wide range of ages and abilities.

Touch

TOUCHSCREENS AND MULTI-TOUCH GESTURES

Human anatomy apps for medical students are booming. They make use of touchscreens in innovative ways to help students understand and visualize the human body and its processes. An excellent example is 3D Brain by Cold Spring Harbor Laboratory. It's free and available for both Android and iOS.

You can use the touchscreen to rotate and zoom around interactive structures to learn about how each region of the brain functions. Watch Cold Spring Harbor's demo video to see how the app works.

3D Brain for iOS
https://itunes.apple.com/en/app/3d-brain/
id331399332?mt=8

3D Brain for Android
https://play.google.com/store/apps/details?id=org.dnalc
.threedbrain&hl=en

3D Brain demo video
https://youtu.be/1Hmi2bVVzLQ

Another developer that makes excellent anatomy apps is 3D4Medical. Its Complete Anatomy Lab app for iOS is one of the apps rated the highest by medical students. 3D4Medical has several different apps for various systems of the human body. There is a demo video on YouTube for the app Brain & Nervous System

Pro III, which I made for one of my online courses. Not only can you slice and rotate the brain to learn about it, but you can also add your own notes, drop pins to mark specific regions (like you would in Google Maps), and quiz yourself.

Complete Anatomy Lab
http://completeanatomy.3d4medical.com

Brain and Nervous System Pro III
https://itunes.apple.com/en/app/brain-nervous
-system-pro-iii/id451427448?mt=8

Brain and Nervous System Pro demo video
https://youtu.be/akWspUriVqU

For learning about anatomy, being able to touch and manipulate the images with your finger is so much more intuitive than using a mouse and menus. Read the user comments on these apps to see how much students appreciate them.[13]

HAPTIC INTERFACES

Haptic interfaces are those involving touch. They can include the act of touching a device and also the device communicating back to you by touch or vibration. An example is the Apple Watch, which uses a technology that Apple calls its "taptic engine." When you receive a notification, the watch lightly taps you on the wrist. You can also choose to receive subtle audio cues along with the taps.

Apple Watch
www.apple.com/watch/watch-reimagined

One way that the "taptic engine" is used is with the Apple Maps walking directions on the watch. Once you've entered where you want to go and started the directions, the watch will tap you in different ways to indicate whether to turn right or left. A steady series of twelve taps means to turn right at the intersection you're approaching, and three pairs of two taps means to turn left. You also feel a vibration when you're on the last leg of the trip and when you arrive.

This is especially useful for blind users, as you can imagine. For an interesting demonstration, you can listen to an eleven-minute podcast by David Woodbridge, an assistive technology consultant for Vision Australia, who is blind himself.[14] The podcast is an audio recording of his walk in a residential

neighborhood with his seeing eye dog and the Apple Watch on his way to pick up his boys from school. You can hear the sounds of traffic on his street, you can hear the voice on his watch instructing him ("take a left on Gilda street in 20 meters"), and you can hear the audio dings that go along with the vibrations. He talks about how it's working for every step, making you feel you are with him during his walk.

Woodbridge is not the only blind user to be enthusiastic about the Apple Watch. Molly Watt writes about her experience in her blog post "My Ears, My Eyes, My Apple Watch." She is an advocate for those living with Usher Syndrome, which for her means she is deaf and mostly blind. Here's what she has to say:

> So far for me the most useful App on the Apple Watch is Maps—on my iPhone I can plan my journey from one destination to another, for me it will be on foot with Unis my guide dog. This is where Haptics really come into its own—I can be directed without hearing or sight, but by a series of taps via the watch onto my wrist—12 taps means turn right at the junction or 3 pairs of 2 taps means turn left, I'm still experimenting with this but so far very impressed—Usher Syndrome accessible![15]

It's interesting to think about the bigger picture of how haptic interfaces might be helpful for different situations and for people of all ages and abilities.

3D TOUCH AND FORCE TOUCH

Force Touch was first introduced by Apple in the Apple Watch.[16] With Force Touch the device can recognize that you are pushing down in order to activate various features, such as switching faces on your watch. 3D Touch is a newer feature, first announced for the iPhone 6s and 6s Plus, that is more sensitive and quicker to react and can offer different levels of action based on how firmly you press.[17]

With 3D Touch, you can use something called "peek" and "pop." The peek opens a preview of what you're looking at, such as an e-mail message in a list, and pop lets you go immediately to that content, such as the full e-mail message. The device gives you haptic feedback so that when you peek, your finger gets a response buzz of ten milliseconds. A longer look gets you a buzz of fifteen milliseconds. It's built in to the apps from Apple, such as Mail and Maps, and third-party developers can add it to their apps as well.

Though right now this feature is available only for Apple devices, it's likely that Android smartphones will add a similar feature.[18]

Here are a few examples of what app developers are doing with 3D Touch.

Evernote (iOS and Android)
Evernote is making it easier to move between your notes. Peek into links and press deeper to pop into the full website for that link. Use peek also to preview your notes from Evernote's homescreen.

Evernote
https://evernote.com

Dropbox (iOS and Android)
Dropbox offers 3D Touch on the homescreen icon to activate new Quick Action shortcuts, such as viewing files you've recently added. Use 3D Touch inside Dropbox to peek into files and folders.

Dropbox
https://www.dropbox.com

Genius Scan (iOS and Android)
Genius Scan is a very useful document scanner app. Use 3D Touch Quick Actions to scan from the cloud or from one of your photos.

Genius Scan
http://thegrizzlylabs.com

Sky Guide (iOS)
Sky Guide is one of many excellent astronomy apps for finding constellations, planets, and satellites in the night sky. Peek and pop give quick access to your favorites, search, and satellites from the homescreen icon.

Sky Guide
www.fifthstarlabs.com/#sky-guide

Magic Piano (iOS)
Magic Piano, the fun music-playing game and virtual piano, uses 3D Touch presses as a way to control the volume—the harder you press down on a piano key, the louder it will be.

Magic Piano
www.smule.com/apps

Endless Alphabet (iOS)
Endless Alphabet is an app for kids to help them learn their ABCs and build vocabulary with fun puzzle games. 3D Touch enables you to press firmly on a letter to make it louder and more animated. This developer also makes another popular and useful app

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called Endless Reader (iOS). It introduces sight words to learn for reading fluency.

One of the best things about 3D Touch is that it means less visual scanning and less need for fine motor skills. It's a time and energy saver. See Steven Aquino's "What 3D Touch Could Mean for Accessibility" for more thoughts on how 3D Touch makes computing easier for those with disabilities.

Sound

SPEECH RECOGNITION IN A DICTIONARY

Speech recognition has improved quite a lot since the early days when Siri was first introduced on the iPhone. Many apps take advantage of this fact, and one simple example is the *Merriam-Webster Dictionary* app. With this app, you can speak a word, and the app will hear and recognize it and show you the dictionary definition. Of course, you can also look up words by typing them. Another useful feature is that when you tap on a small speaker icon, it will pronounce the word for you. To see and hear this app in action, watch the short video demo that I made for my Apps for Librarians and Educators online course.

READING ALOUD FOR CHILDREN

Many children's books for the iPad are being designed to take advantage of several features, such as audio and sound recording. An excellent example is the children's storybook app The Pedlar Lady of Gushing Cross.

In this app, you can have the story read aloud to you while you follow the text, or you can turn off the read-aloud function and read it yourself or to your child. The read-aloud narration is available in English, Spanish, or French. The app also includes a very nice feature where you can record your own voice reading the book and save it in the app.

To see this app in action, watch a short demo video I made for my online course Book as iPad App.

You can probably imagine how these features open up the reading experience for different ages and abilities. The multiple language options are also useful to learners of those languages.

READING ALOUD FOR ALL AGES

Capti Narrator is a useful app for having text read aloud to you. With it you can save text from many different sources, such as websites, e-books from Project Gutenberg or Bookshare, and documents in your Dropbox, Google Drive, OneDrive, Instapaper, or Pocket accounts. You can make playlists of items you want to hear and then listen to them whenever you like. You may also follow along, reading the text and seeing each word highlighted as it's read. The app is available for iPhone, iPad, and iPod Touch and also for Firefox on the Mac and any browser on Windows XP or greater.

In the settings, there are several different narrator voices and several different languages to choose from. If you want to hear some articles written in English and some written in Spanish, you can select which English voice and which Spanish voice to use. I like "Tessa" from South Africa, and "Paulina" from Mexico. You can set the speed to a rate that's most comfortable to listen to.

You can listen to formats such as Word documents, PDFs, HTML pages, DRM-free EPUB e-books, and more. It's a free app for the basic features, and with the premium app you can get more voices. There is also an educational version that institutions can purchase and make available to their users.

This type of app is useful for many different audiences, such as anyone who listens while working out or driving, people who learn better through listening, people with print reading disabilities, people learning foreign languages (including ESL students), and more.

The voices do quite a good job of sounding natural, with the exception of running the title of the article into the first sentence. The app is also customized to work together with screen readers, such as VoiceOver for iOS or JAWS for Windows.

Learn more and see video demos on the developer's website.

Capti Narrator
https://www.captivoice.com/capti-site

Bookshare
https://www.bookshare.org

Capti for Education
https://www.captivoice.com/capti-site/public/entry/education

Capti website
https://www.captivoice.com/capti-site

AUDIO WAYFINDING FOR THE BLIND

BlindSquare is an iOS app for blind people to help them navigate the world. It uses GPS and the compass to locate you; then it gathers information from Foursquare and Open Street Map to tell you what's nearby, such as coffee shops or transit stops. It uses high-quality voices to tell you about interesting places and street crossings nearby. It's available in several different languages and works in many locations worldwide. You can use it together with navigation apps to hear what's nearby as you are navigating. Learn how it works by listening to the podcast demo on the Apple Vis website. Android users may want to look at a similar app, Sendero GPS LookAround.

BlindSquare
http://blindsquare.com

Introduction and Overview of BlindSquare podcast
www.applevis.com/podcast/episodes/introduction-and-overview-blindsquare-updated

Sendero GPS LookAround
https://www.senderogroup.com/products/shopandroid.htm

CONVERSATIONAL INTERFACES: TALK WITH YOUR DEVICE

Google Now, Microsoft's Cortana, and Apple's Siri are the leading smart digital assistants. You can talk to them and quickly find information.

Google Now
https://www.google.com/landing/now

Microsoft Cortana
www.windowsphone.com/en-us/how-to/wp8/cortana/meet-cortana

Apple's Siri
www.apple.com/ios/siri

Now there is a new device from Amazon, the Amazon Echo, which is similar, but not a mobile device. It's a Bluetooth speaker that serves as a conversational smart assistant. It takes the form of a nine-inch-tall, black cylinder that you plug in to power and connect to your Wi-Fi network.

Amazon Echo
www.amazon.com/Amazon-SK705DI-Echo/dp/B00X4WHP5E

You can activate listening mode by saying "Alexa." Then ask your question. You can speak in a normal voice from anywhere in the room, and she answers in a natural way, using a woman's voice. She can understand you even when there is background noise, like music playing in the room, and she can recognize anyone without being previously trained. Of course if you ask something beyond what she can do, Alexa will say that she can't find the answer, and sometimes she does mishear you. However, she works very well for the things she's programmed to do, which are many.

You can ask her to play music from Amazon Prime streaming music or from other services like Pandora or iHeartRadio. You can ask her to play any radio station from around the world, streaming from TuneIn.com. You can ask for news headlines (NPR, BBC, and others), traffic, and weather; ask her to read audiobooks you've purchased from Audible; set timers and alarms, ask factual questions; ask for sports scores; ask her to add things to your shopping list, to spell a word, to tell you when the next appointment is in your calendar, to tell you jokes, and more. She also has quite a few witty responses from pop culture references.

The Echo is getting very positive reviews, and Amazon is planning to add more features and capabilities,

especially since it is offering ways for developers to create apps for the Echo.[19]

To see her in action, start by watching Amazon's video demo. If you want to enjoy the fun side of her with pop culture references, watch the video by Jerry David, "The Truth behind Amazon Echo."

Echo video demo
https://youtu.be/KkOCeAtKHIc

The Truth behind Amazon Echo
https://youtu.be/EaynIXcWvyM

As you think about what devices like this can mean for people with disabilities, most likely blind users will come to mind first. See the report from Kathryn Wyeth at the Michigan Assistive Technology Program, who finds the Echo useful, "Getting to Know Alexa: Amazon Echo."

Getting to Know Alexa: Amazon Echo
www.miassisttech.org/mdrcat/index.php/getting-to -know-alexa-amazon-echo

SMART HEARING AIDS, CONTROLLED WITH APPLE WATCH

Hearing aids are improving, and now there are apps that help you control them. What's even more convenient is the ability to control a hearing aid from your Apple Watch while your iPhone is tucked away in your bag or pocket.

Twenty-year-old Molly Watt, who was mentioned earlier in the section on haptic interfaces, is deaf and partially blind due to Usher Syndrome. Her website is devoted to raising awareness about it and helping others understand the challenges.

Molly Watt's website
www.mollywatt.com

In June 2015, she wrote a post called, "My Ears, My Eyes, My Apple Watch."[20] She had previously written about how the small screen of the Apple Watch works well for her since she has a small window of vision in one eye. As with many blind or deaf people, her sense of touch is very acute, so the haptic touches of the watch work very well for her.

In this post she tells the experience of getting a new hearing aid, the ReSound Linx[2] smart hearing aid. It works together with the ReSound Smart app (Android and iOS) to allow discreet control of volume, switching

between smart programs (with settings optimized for different environments), finding your mislaid hearing aids, and more. This is one of many models of hearing aids that connect to your smartphone via Bluetooth.

ReSound LiNX² smart hearing aid
www.resound.com/en-US/hearing-aids/resound -linx2#.VjmtYWC5Ml0

ReSound Smart app
www.resound.com/en-US/hearing-aids/apps/smart-app

She tells the story of how for the first time she was able to tell which direction various sounds were coming from, a huge advancement for safety.

She also discusses making a phone call to her father from the watch and hearing his real voice for the first time.

> On leaving the ReSound Offices and within 15 minutes I had my Apple Watch set up and it was a real "WOW" moment when I made my first call to my Dad, via my Apple Watch, his voice came straight into my ears, he sounded different, so much clearer than before, it dawned on me, I'd never heard my Dad's real voice before, my Mum, ever faithful support and chauffeur sat beside me sounded totally different, even I sounded different to myself, it was strange, very strange, hard to process but it made me feel so emotional that day, day one, I was experiencing so much, new things for the first time ever! I spoke into my Apple Watch talking to my Dad, it was quite amazing, my iPhone was safely tucked away in my bag.[21]

She sums up how the Apple Watch works so well for her, especially for safety and communication.

> I guess to sum up to date, since 24 April when I received my Apple Watch I have found a completely new way of dealing with my everyday challenges. The watch allows me to get from A to B safely with Guidedog Unis using maps and taptics. My friends who have Apple Watch can get my attention using taptics even if I cannot see them, which is more often than not but by using taptics it alerts me, is comforting and keeps me safe and confident in situations where previously I may have felt vulnerable. More and more of my friends now have Apple Watch and we have developed some basic codes to communicate by messaging on the small screen and of course I'm alerted by the vibrating which is brilliant.[22]

Remember that people with hearing impairments are often portrayed as broken in some way and that even with advances like this, it's still important to accommodate everyone's needs with closed captioning,

ASL interpreters, and the like. Don't expect everyone to want to be "fixed" by new technologies.[23]

SMART HEARING AND AUGMENTED HEARING—SMART LISTENING FEATURES FOR HEADPHONES

In addition to "smart" hearing aids, there are also "smart listening systems," such as the Soundhawk Scoop, designed for anyone who wants to boost their hearing in noisy environments.[24] It's a wireless earpiece, wireless microphone, and charging case, together with a mobile app. It streams music or phone calls from your phone, and you can customize what you hear in the environment around you. This means it can also be used to tune into conversations in a noisy place. It also comes with a wireless microphone that you can place near what you want to hear. Move far away and it will stream what it hears to you. Keep an ear on your baby, perhaps? To learn more, see the Soundhawk website.

Soundhawk
www.soundhawk.com

Another new item, called The Dash, mentioned earlier, is three kinds of devices in one. It's (1) a set of Bluetooth earbuds for streaming music from a smartphone, (2) a music storage device so you can listen to music without your smartphone, and (3) a fitness tracking system, measuring heart rate, running pace, distance, and more.

The Dash
https://store.bragi.com

It turns out that the ear is a good place to measure vital signs. The ear doesn't move around much (like your wrist) and can be used to measure heart rate, blood pressure, temperature, and pulse oximetry.[25] New kinds of devices are being developed to combine fitness tracking with high-end audio.

The Here Active Listening System from Doppler Labs is a set of earbuds designed to customize real-time live sounds in your environment. Instead of streaming music from your smartphone, it's meant to be used at live music concerts and other situations where you want to customize what you are hearing in real time. See the video on the Kickstarter page to learn more.

Here Active Listening System Kickstarter page
https://www.kickstarter.com/projects/dopplerlabs/here
-active-listening-change-the-way-you-hear-the/description

Analysts are predicting that the market for hearables will be large since this type of technology is advancing quickly and the prices are coming down. In the words of commentator Mike Elgan:

> These devices will give us super hearing like a comic-book mutant superhero.
> The ability to customize which sounds we hear from our environment and which we tune out will become far more powerful. We'll be able to carry on clear conversations at loud concerts, or do the opposite—tune out nearby conversations and hear only the music.
> We'll be able to set a range for the sound we hear—only sounds generated within 10 feet of us, with everything else blocked out, for example. Or, when we choose, we'll be able to block out all sound.
> When somebody says something that we don't catch, a quick gesture will give us "instant replay" on what was said. And we'll be able to retroactively capture audio for posterity.[26]

This may bring to mind some dystopian science fiction scenarios. Have you seen the movie *Her*, where Joaquin Phoenix's character walks around with a smart earpiece that serves as his interface to an AI-based personal assistant?[27] Or maybe you've seen the episode of TV series *Black Mirror* called "The Entire History of You," where everything is recorded all of the time and can be played back instantly.[28]

Like every new technology, the use of hearables has potential for both utopian and dystopian futures. On the positive side, one of the main reasons that people use any type of wearable device is to reduce the need to access their smartphones for every basic task. With wearables, it's possible to blend technology more easily in your life without breaking the flow.

And for people who are just beginning to experience some hearing loss but don't use hearing aids, these advances will be very helpful. Some estimates say that 16 percent of the world population will suffer from hearing loss this year. For those over forty-five, there is a one in five chance that they have some hearing loss.[29]

Some people don't want the stigma of being seen as "disabled" by wearing highly visible assistive devices like traditional hearing aids. Many of these new products are stylish, modern, and used by all kinds of people, something that helps them gain acceptance. For earbuds as fashion, see the Kickstarter campaign "OwnPhones—The World's First 3D Printed Wireless Earbuds." They even include a "jewelry collection" with earbuds made of silver, brass, or bronze or with or gold plating. Three-D printing makes these buds custom fitted to the shape of your ear.

Sight

CAMERA AS SEEING EYE FOR LANGUAGE TRANSLATION

Smartphone cameras are being used in interesting ways beyond just taking photos. Having a camera in a mobile device means it can be used as a "seeing eye" of sorts, bringing visual information into an app for use. Here are some examples.

Google Translate (iOS and Android) uses the camera to take a photo of text in a language you don't understand and gives you instant translation. For example, I lived in Budapest for a few months in the summer of 2015, and I don't speak Hungarian. While shopping in a grocery store, I wanted to read the label on a package of frozen cherries—I wasn't sure if they were pitted or not. Using Google Translate, I pointed my iPhone camera at the label, and immediately it showed the words *pitted cherries* superimposed over the Hungarian words on the label. That was extremely useful. It can translate without your needing to capture the photo—just by pointing your camera at the text. Google uses a technology for this called "deep neural nets," which you can learn more about on the Google Research Blog.

For more detailed translations, such as a long list of ingredients in tiny print, you can also capture the photo within the app, run your finger over the part where the words are, and save the translated text. It's not 100 percent foolproof, but it's close enough in many situations to be very useful.

The app currently recognizes twenty-seven languages: English, French, German, Italian, Portuguese, Russian, Spanish, Bulgarian, Catalan, Croatian, Czech, Danish, Dutch, Filipino, Finnish, Hungarian, Indonesian, Lithuanian, Norwegian, Polish, Romanian, Slovak, Swedish, Turkish, and Ukrainian.

CAMERA AS SEEING EYE FOR TREE IDENTIFICATION

Leafsnap (iOS) is a tree identification app that recognizes tree species from photos of their leaves. It was developed by Columbia University, the University of Maryland, and the Smithsonian.

When you see a tree that you wish to identify, put a leaf against a white background (carry a piece of paper on your hike), and snap a photo with the app. It matches the shape of the leaf with its database to recognize the tree and bring you to the entry. Like any good nature guide, it's full of descriptive information about trees, include the seeds, flowers, buds, leaves, and more.

It currently includes trees found in the Northeastern United States and Canada. There is a separate version for trees in the United Kingdom. To see it in action, watch Leafsnap's demo video.

CAMERA AS SEEING EYE WITH CURRENCY RECOGNITION FOR THE BLIND

LookTel Money Reader (iOS) instantly recognizes currency and speaks the denomination. This makes it easy for blind or visually impaired users to recognize and count bills. Point the camera at the bill, and it speaks the amount in real time. It also displays the denomination on the screen in high-contrast large numerals for those who have partial vision.

It recognizes 21 currencies: the US dollar, Australian dollar, Bahraini dinar, Brazilian real, Belarusian ruble, British pound, Canadian dollar, Euro, Hungarian forint, Israeli shekel, Indian rupee, Japanese yen, Kuwaiti dinar, Mexican peso, New Zealand dollar, Polish zloty, Russian ruble, Saudi Arabian riyal, Singapore dollar, and United Arab Emirates dirham.

To see it in action, watch the demo video.

LookTel also makes an app called LookTel Recognizer for recognizing everyday objects, such as those in your pantry or at the grocery store.

Another similar app that can scan text on any item and read it aloud is KNFB Reader for Android and iOS. It's getting very positive reviews by blind users—just scan the item using VoiceOver commands, and it can recognize the text and read it to you. The app can also be used with a connected Braille display, handy

for situations where you don't want the text read out loud. See the KNFB Reader video demo.

CAMERA AS SCANNER

Scanbot is a document and QR code scanner (iOS and Android). Just open the app and use the camera to snap a photo of your document. It automatically recognizes the edges and offers tips to guide you in moving your phone to the best view of the document before it snaps. In addition to documents, you can scan barcodes and QR codes. It saves your documents as either PDFs or JPGs, and you can also save to various cloud services, like Dropbox, Evernote, or Google Drive. If you upgrade to Pro via an in-app purchase, you also get OCR (optical character recognition), password protection, ability to add pages to existing scans, full text search within your scans, and more.

It's very handy to have a scanner in your pocket at all times. Students often use this app to scan printed worksheets and other files in order to be able to access them from anywhere.

See a video demo on Scanbot's home page.

AUGMENTED REALITY FOR UNDERSTANDING CHEMISTRY OR HUMAN ANATOMY

Elements 4D (Android and iOS) is an app that works together with a set of wooden blocks or paper cubes you can make yourself (with a downloadable PDF template) to show visually what happens when you combine two elements from the periodic table.

Open the app and point your device toward an element on the block, add a second element, and move them together until they touch (in your augmented view). Then see what is created from your combination in the augmented view on your device. For example, hydrogen combined with oxygen results in water. Look at the Elements 4D website to see how it works.

You can download lesson plans from the developer's website—with options for elementary school, middle school, or high school.

This developer also makes an app for learning human anatomy using augmented reality: Anatomy 4D (Android and iOS).

These apps that use the camera in interesting ways are enhancing learning for students of all ages.

Summary

As you've seen in these examples, NUIs are using unique features of mobile devices to make interacting easier. This can open up computing to new audiences, such as the very young, the very old, or people with disabilities.

NUIs won't completely replace GUIs, just like personal computers didn't replace mainframes. Mainframes are still used widely in large organizations for banking, finance, health care, insurance, government, and more. Even though transactions are going mobile, they are often powered by mainframes on the back end.[30] In the same way, GUIs will continue to be used for popular desktop applications, in office settings, and more.

But the use of NUIs on mobile devices is one of the main reasons that education and access to information is getting easier for all ages and abilities. It's not only the mobility of devices, but the human-centered interfaces.

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Multi-Device Ecosystems

The next trend we'll look at is that of multi-device ecosystems and how they are making learning more convenient.

What do we mean by *ecosystem* when it comes to computing? Sometimes the word is used to describe how devices and apps on a particular platform are designed to work together, such as when talking about Apple's ecosystem or Google's ecosystem.

In this chapter we will go beyond that definition—the word *ecosystem* can apply to a system where mobile and desktop devices work together to do useful work, no matter what the platform. Working with multiple devices is made possible by apps that connect via cloud services to keep information in sync across devices. Multi-device work can happen not only with mobile and desktop devices, but also with other kinds of devices such as "wearables," smart TV, smart home devices, and more.

Cloud Services and the Internet of Things

Services via the Cloud

Here's an example of a multi-device ecosystem. Evernote is a useful app for keeping track of all kinds of information. One of Evernote's slogans is "available on everything you use every day." Your Evernote account is available on the Web as well as on multiple desktop and mobile platforms, and your information syncs between all of them.

> *Evernote*
> https://evernote.com

That makes it very easy to save information from your desktop and access it later on your smartphone or tablet and vice versa.

Quite a few apps work this way, and that's good news for the user. Some apps use their own servers to synchronize information. Wunderlist, a to-do list app, is a good example of that approach. Others offer a choice of cloud providers for their synchronization. 1Password, for example, has options for syncing via Dropbox, iCloud, or Wi-Fi direct syncing.

> *Wunderlist*
> https://www.wunderlist.com
>
> *1Password*
> https://agilebits.com/onepassword

For a list of fifty apps that work across platforms, most with some type of synchronization, see my blog post "Why You Don't Need to Stick with One Mobile Platform: 50 Best Apps for Multi-platform Productivity."

> *Why You Don't Need to Stick with One Mobile Platform: 50 Best Apps for Multi-platform Productivity*
> http://nicolehennig.com/dont-need-stick-one-mobile-platform-50-best-apps-multi-platform-productivity

Many people these days use devices effectively from more than one platform, such as an Android smartphone and an iPad. We are moving away from the days when people defined themselves as Mac users or Windows users. We live in a multi-platform

world, and the services we use live everywhere. For more thoughts on this, see Matt Weinberger's "The Whole 'Mac vs. PC' Thing Is So Over, and 'Android vs. iPhone' Is Close Behind."

MORE KINDS OF DEVICES, WORKING TOGETHER: THE INTERNET OF THINGS

With the advent of wearable computing, such as fitness bands, smart watches, and the like, we are branching out into an even larger ecosystem. Our technical ecosystems can also include smart TV systems like Apple TV, gaming consoles, virtual reality headsets, and "smart home" devices, like the Nest thermostat.

There is much written about the Internet of Things these days. The *Oxford English Dictionary* defines it as "development of the Internet in which many everyday objects are embedded with microchips giving them network connectivity, allowing them to send and receive data."[1]

In May 2014, Pew Research did an interesting study, canvassing experts and asking them, "Will the Internet of Things have widespread and beneficial effects on the everyday lives of the public by 2025?" Eighty-three percent answered yes, and 17 percent no.[2] To read their responses, see the full report. An example of a positive impact is "Sensored roadways, buildings, bridges, dams and other parts of infrastructure that give regular readings on their state of wear and tear and provide alerts when repairs or upgrades are needed."[3] And according to the report, "The realities of this data-drenched world raise substantial concerns about privacy and people's abilities to control their own lives."[4]

It's worth reading the whole study in order to think about the many positive and negative outcomes possible with these advances. For our purposes here, it's useful to look at the ways that different kinds of devices can be used together, in order to begin to understand potential positive uses for education.

Three Ways That Devices Can Work Together

In her book *Designing Multi-Device Experiences*, Michal Levin, senior user experience designer at Google, uses three categories to frame our thinking about how devices work together.[5] These are *consistent*, *continuous*, and *complementary* design.

Consistent Design

In *consistent* design, you have the same basic experience and features no matter which device you are using. Some adjustments are made because of screen size, but overall the experience is meant to be the same. For example, music apps like Spotify and Pandora offer basically the same experience, no matter which device you are using—smartphone, tablet, smart TV, or in-car system.

Continuous Design

Continuous design is when your experience is passed from one device to another, either continuing the same activity or progressing through a series of steps toward reaching a goal. An example of this would be apps for cooking (e.g., How to Cook Everything or BigOven). The activity involves several steps, such as searching for recipes, deciding which ones to use, buying the groceries, and cooking. Each task might be done in a different location with a different device, all leading to the same end goal. You might begin by searching for recipes in the web version of an app on your computer, save recipes into a wish list, and then view the wish list in your smartphone app at the grocery store. You go shopping with your smartphone and access the list there, checking off items as you go. When you are back in your kitchen, you have your iPad on a stand with the recipe in large print and a series of timers in the app to assist you.

Other apps that involve many steps would be travel rentals (such as Airbnb), where you search for places to stay, bookmark them, contact hosts, pay, find directions to the place, and leave reviews after you check out.

Continuous design involves multiple steps and shifting contexts, where particular devices make best sense for each part of your task.

Complementary Design

Complementary design offers an experience where devices complement each other and involves using at least two devices simultaneously. The devices might collaborate, such as in the Scrabble app where a tablet is used as the game board and smartphones control the tiles for each player.

Alternatively, one device might control another, as when using your smartphone as a remote control for your smart TV. The advantage of using your smartphone in this way is that it can remember your preferences and offer a more customized experience than using a dedicated device like a game controller. For the Scrabble game, you have instant access to the dictionary from the app on your phone, and the phone keeps statistics on the gameplay of you and your friends.

Another example of complementary design is the use of "second screen" apps for television viewing.[6] These are apps that let you participate in discussions, interactive polls and check-ins and find content related to what you are watching.

It's useful to keep these three types of design in mind when thinking about educational apps and services—because they may use more than one device in one of these three ways.

Examples

Consistent Design

Remember that with consistent design, you have the same basic experience and features, no matter which device you are using.

Pocket Casts is an excellent app for subscribing and listening to podcasts. It's a good example of consistent, multi-device design because it looks and acts basically the same no matter which screen you are using, and it's easy to switch between devices.

It's available for multiple platforms: iPhone, iPad, Android, Windows Phone, and web player. You can sync your favorites, subscriptions, and your progress in listening to a particular episode, so you can always pick up where you left off. You can set the app to auto-download episodes while you are on Wi-Fi, then listen at your convenience. You can set up lists for continuous playback, great for listening on long car trips. The variable speed feature is nice for those who prefer to listen more slowly—as when learning a new language—or more quickly—some people like to listen quickly, similar to speed-reading.

Podcasts are being used as learning tools in the classroom in interesting ways. For example, Michael Godsey, an English teacher at Morro Bay High School in California, used the well-known murder-mystery podcast *Serial* in his classroom. Improving students' listening skills is part of the Common Core standards, and using the podcast proved to be very effective and motivating for the students. To learn more about how podcasts are being used as effective learning tools, read "What Teens are Learning from 'Serial' and Other Podcasts."[7]

A good resource for finding educational podcasts is Listen Current, a curated directory of public radio podcasts, with nonfiction stories tied to current events. There are both free and premium versions, with lesson plans available.

Continuous Design

Remember that with continuous design your experience is passed from one device to another.

With the Collins Bird Guide app, you can use your iPhone while out on a hike to identify birds that you see and hear. You can create lists of birds and save them in the app. Then when you are back home, use the larger screen of the iPad to read and learn more about each bird in your list, with zoomable illustrations, in-depth information, and audio/video clips.

The app is based on the book *Collins Bird Guide*,[8] which is considered the standard field guide to birds in Europe. This digital version is getting positive reviews, especially because of its searching and comparison features. The video on the app's webpage will give you an idea of how it works.

Collins Bird Guide
http://collinsbirdguideapp.com

This is a good example of an educational app that makes use of multiple devices in succession. There are several other bird identification apps, such as Peterson Birds and Audubon Bird Guide. Collins comes out on top for excellent user interface design and is handy if you are identifying birds in Europe.

Peterson Birds
http://petersonguides.com/Birds.php

Audubon Bird Guide
https://www.audubon.org/apps

Apple Watch and iPhone Together

For more examples of using devices in succession with continuous design, let's look at some apps for Apple Watch.

The excellent note-taking app Drafts makes it easy to record a quick note on your watch by voice dictation, then later open and edit it on the iPhone or iPad, where you can send it off to where you want to use it, such as for a social media post. Drafts can send messages, create reminders and events, and append to notes in Dropbox, Evernote, and Google Drive. It's for iOS.

Drafts
http://agiletortoise.com/drafts

Just Press Record is a professional audio recorder that syncs across all of your Apple devices (iOS, Apple Watch, and Mac OS). You can use the app on your watch even if you don't have your iPhone with you. It will save the recordings, and next time you're near your iPhone, it will transfer the recordings to your phone and sync via iCloud.

Just Press Record
www.openplanetsoftware.com/just-press-record

Sky Guide is an astronomy app for iOS. On the watch, you can see a calendar of upcoming astronomical events, like full moons, eclipses, and meteor showers. When you are ready to do some viewing, use the full app on your iPhone or iPad. You hold your device overhead, and it automatically adjusts your direction,

making it easy to identify stars, planets, constellations, satellites, and more. With the watch app, you can be notified when the International Space Station is overhead, see a list of astronauts on board, and even Tweet to them. You can view and read all of the extensive reference information even when the app is offline. It's a great reference tool for astronomy.

Sky Guide
www.fifthstarlabs.com/#sky-guide

With these examples, you can see how multiple mobile devices can work together for a rich learning experience.

Complementary Design

Remember that complementary design offers an experience where devices complement each other and involves using at least two devices simultaneously. For these examples we'll look at some apps that use smartphones or tablets together with a smart TV. We'll also look at apps that use the iPhone together with Apple Watch in complementary ways.

APPLE TV IN THE CLASSROOM

If you're not familiar with Apple TV, you should know that it has no display of its own. It's a small device that connects to your TV or projector with an HDMI cable. In addition to built-in apps for Netflix, YouTube, and other services, it allows you to easily stream or mirror content from your computer or iPhone, iPad, and iPod Touch. It uses Apple's AirPlay technology to stream wirelessly, so an instructor could walk around the class with an iPhone or iPad in hand while showing the content on a big display. It's easy to switch to a particular student's device when you want to show student work.

Apple TV has security features so that the instructor is the only one who can control the screen. This is why many prefer it to Chromecast, Google's similar device, because with Chromecast anyone in the class could push their content, hijacking the teacher's screen.[9]

Some ways that Apple TV is being used in classrooms are:

- as a document camera
- for live annotation of documents on screen
- for showing student work
- for demonstrating apps
- as an interactive whiteboard

Let's look at a few specific examples.

Math Problems—Showing Student Work

Kyle Pearce is a secondary math department head, teacher, and intermediate-level math coach from Belle River, Ontario, Canada. He receive grant funds to develop a project he calls Tap into Teen Minds with iPad.[10] In his classroom, where all students have iPads, he uses a method called a "modified digital bansho," where each student shows and tells how they solved a particular math problem by showing the work on their iPad on the big screen via Apple TV.

Here is a description:

> The bansho process uses a visual display of all student solutions, organized from least to most mathematically rich. This is a process of assessment for learning and lets students and teachers see the full range of mathematical thinking used to solve the problem. Students have the opportunity to see and hear many approaches, and they are able to consider strategies that connect with the next step in their conceptual understanding of the mathematics.[11]

It's been very successful. In his own words:

> Since I've had iPads in the classroom, student engagement has increased dramatically and I didn't think it could get any better. When I brought Apple TV into my classroom, I instantly witnessed students anxiously awaiting their turn to mirror the screen of their iPads and to explain their understanding. . . .
> Students are constantly sharing their answers while classmates offer constructive criticism to help them bump their answers up to the next level. With students continually sharing answers, we save time "taking up" questions, and have more time to allow multiple students share different approaches to solving the problem.[12]

He found increased student engagement and success in math after only one semester of this program. Creating a paperless digital environment was more cost-effective than purchasing the tools that are found in many interactive whiteboard classrooms.

You can watch a video of the process on his website to see how it works.

> *Kyle Pearce's video of using modified bansho process*
> https://tapintoteenminds.com/apple-tv-in-the-classroom

Interactive Whiteboard Apps—Doceri

One of the best of many interactive whiteboard apps is Doceri. It's a great way to show both instructor and student work via the Apple TV. It combines interactive remote control with screencast recording, which is a nice way to capture live drawing and annotations for later viewing. You can also annotate and record over PowerPoint or Keynote presentations. To get an overview of how it works, watch the video "What Can You Do with Doceri?"

The app's YouTube channel has many examples of specific lessons being taught with the app, including math, history, science, language arts, and more.

> *Doceri*
> http://doceri.com
>
> *What Can You Do with Doceri?*
> https://www.youtube.com/watch?v=ROYg9tOc_oo
>
> *Doceri YouTube channel*
> https://www.youtube.com/channel/UCKv1GPeJ7t43jsteNGMIdlw

Vocabulary Games with Sketch Party TV

Teachers are also making good use of games for learning with iPad and Apple TV. A good example is the game Sketch Party TV. It's a Pictionary-style drawing and guessing game. Teachers can input their own list of vocabulary words and use the game as a fun way to review.

The promotional video for the app gives you an idea how it works.

> *Sketch Party TV*
> http://sketchparty.tv
>
> *Sketch Party TV promotional video*
> https://youtu.be/3EVX56atjHI

Art Classrooms Using iPads with Apple TV

As you can imagine, art classrooms are finding this technology very useful—not only for digital-only art, but also for art made with physical media combined with digital media.

A great place to read about how this is working is on iPads in Art, the website of two elementary art teachers: Tricia Fuglestad of Arlington Heights, Illinois, and Suzanne Tiedemann of South Brunswick, New Jersey.

> *iPads in Art*
> http://ipadsinart.weebly.com

According to Tiedemann:
> The iPad is at the forefront of becoming the most innovative and dynamic tool in art education.

Students can explore drawing and painting, digital photography, critique, digital storytelling, animation, graphic design, website building, movie-making, songwriting, and more through the various apps that are offered in the iTunes store. Many of these apps allow for students to transfer traditional skills and knowledge, while learning new digital concepts at the same time. They can also learn the basics of how to save, upload and email the work they create.

It is important for students to learn how to create digitally using 21st century technology in order to succeed in the future.[13]

There are many video examples on their site. To see an example of using physical media together with the iPad, watch "2nd Gr Used the Brushes App to Alter Their Paintings." (The Brushes app in no longer available, but there are many similar painting apps.) The students took photos of their paintings and imported them into the Brushes app for adding color, textures, line, and more.

There are many more video examples on the iPads in Art site. "Apple TV in the B.A. Art Room" shows several different ways that these teachers are using the TV connection to display student art and to collaborate and instruct.

Video: 2nd Gr Used the Brushes App to Alter Their Paintings
https://vimeo.com/90335390

Video: Apple TV in the B.A. Art Room
https://vimeo.com/31126077

In another classroom, with only six iPads, Theresa Gillespie of the Moline School District in Illinois describes an art project where students took turns working in groups with the iPads and teaching each other what they learned. She demonstrated the project using her iPad hooked up to Apple TV, and the students took turns working with the iPads.[14]

This project also began with physical media and then was transformed using digital tools. They began with Grant Wood-inspired landscape collages that the students had created and used the app WordFoto to add words to their art. This app fills the entire canvas with colorful words inside the existing shapes. See photos on her website for examples. In the project, each student showed another student how to do the project after they had learned it, reinforcing their learning.

WordFoto
www.wordfoto.com

Theresa Gillespie, iPad Art—Words and Landscapes—Manipulating Traditional Art with an iPad
http://splatsscrapsandglueblobs.blogspot.com/2013/01/ipad-art-words-and-landscapes.html

For many specific ideas about using iPads in art classrooms, see the Pinterest board iPad Lesson Ideas by Denise Jackson. Since many teachers share ideas on Pinterest, you can find similar boards by searching Pinterest for iPad art lessons.

iPad Lesson Ideas
https://www.pinterest.com/denise7jackson/ipad-lesson-ideas

USING THE APPLE WATCH AS A REMOTE CONTROL

Another example of complementary design, using two devices simultaneously, is the use of the Apple Watch as a remote control. It works very well for this use, with several different apps. Here are some examples.

Remote Control for the iPhone's Camera
You can prop up your iPhone, point it at what you want to photograph or make a video of, and then move away and use your Apple Watch to press the shutter. Through the watch face you can see what the camera sees and take as many photos as you like. There is a button for snapping instantly and also a three-second delay button. This process works well with the Camera app that comes with iPhones and also third-party apps with more features, like Camera+ and others.[15]

Remote Control of Music and Other Audio on Your iPhone
Not only can the Apple Watch remotely control the Music app on your iPhone, but it can also control apps like TuneIn Radio, Pandora, and apps for Spotify (like Decibell or Joy). Play, pause, skip, and do just about anything you need. The audio is still coming from your iPhone or iPad, which may be hooked up to external speakers if you like.

TuneIn Radio
http://tunein.com

Pandora
www.pandora.com

Spotify
https://www.spotify.com

Decibell for Spotify
https://itunes.apple.com/us/app/decibell-for-spotify
-music/id985819942?mt=8

Joy for Spotify
www.joy-app.com

Remote Control of Apple TV and iTunes

Use your Apple Watch to control any of the functions of your Apple TV, such as mirroring student iPads, viewing slide shows, showing demos of apps, or watching Netflix or YouTube. It can also control iTunes playing on a Mac.

Remote Control of Devices in Your Home

HomeKit is Apple's tool for developers that allows connection to lightbulbs, smoke alarms, thermostats, garage door openers, and other home automation items. See "Growing List of Devices Compatible with Apple's HomeKit" for a list of devices that are available.

This is an area that is sure to grow, as the Internet of Things becomes more common with connected devices everywhere.[16]

Growing List of Devices Compatible with Apple's HomeKit
www.digitaltrends.com/home/a-list-of-apple-homekit
-compatible-devices

Summary

As you think about what you can offer with mobile devices these days, think about multiple devices being used together in the three ways discussed here: consistent, continuous, and complementary. It's no longer only a world of stand-alone devices, but an ecosystem of devices using services in the cloud.

Earlier in this chapter, I mentioned the Pew Research study *The Internet of Things Will Thrive by 2025*.[17] It's worth reading that study in order to understand both the positive and negative possible outcomes with these technologies. As librarians, we've long been privacy advocates, and it's important to think about what these developments will mean and what we can advocate for, as with any new technology. We'll talk a bit more about privacy and security in chapter 4 of this report.

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Content Creation with Mobile Devices

The third trend we'll look at is that of content creation with mobile devices and how that is creating excellent learning experiences.

Libraries Facilitating Creation

On the website for *The Atlas of New Librarianship*, R. David Lankes offers this mission statement: "The mission of librarians is to improve society through facilitating knowledge creation in their communities."[1]

"Facilitating knowledge creation" works well because it is broad enough to cover what libraries have always done, such as build collections of books and other materials, and also cover some of the newer services libraries are offering, such as publishing help, digital media labs, and makerspaces. This emphasis on creation gets at the underlying reasons for why we do what we do—so that people can create with the knowledge and information offered by library use.

Active Creation as the Best Way to Learn

The educator John Holt once said, "Learning is not the product of teaching. Learning is the product of the activity of learners."[2] This emphasis on actively creating as the best way to learn is also found in the work of Seymour Papert, who writes about "constructionism" as a learning theory:

> From constructivist theories of psychology we take a view of learning as a reconstruction rather than as a transmission of knowledge. Then we extend the idea of manipulative materials to the idea that learning is most effective when part of an activity

the learner experiences as constructing a meaningful product.[3]

One of the most helpful books for applying these ideas is called *Invent to Learn: Making, Tinkering, and Engineering in the Classroom.*[4] Based on the ideas of Papert's constructionism, it is full of practical advice for setting up environments where people can learn by creating. This is helpful information for librarians who are planning services that facilitate content creation.

Mobile Devices for Content Creation

When the iPad first came out, there was much discussion and some criticism saying that it was only for passive consumption, like watching movies. While that is one thing it's good at, the iPad and other mobile devices have turned out to be very useful tools for content creation. There are excellent apps for creating and editing photos, videos, music, documents, spreadsheets, presentations, narrated slideshows, and more.

As you've seen in chapter 1, about natural user interfaces, human-centered ways of interacting with mobile devices are making content creation easier and more accessible. These days, you might find it easier to crop and edit a photo on your smartphone than in Photoshop on your desktop computer. Gestures for zooming in on the screen are often much easier than using a mouse.

If you are thinking about how much easier it is to edit a giant spreadsheet on your desktop computer with a large monitor, that is also true. When new tools are invented, the old ones don't go away. Instead, we have more options for different uses and devices can

be complementary to each other. Desktop computers still have their place.

When the iPad first came out there were many articles posing the question "Can the iPad be a laptop replacement?" At the time, I experimented for a few weeks by trying to use my iPad for all my work. While it was good for many things, like e-mail, Web searching, and viewing photos, it soon became frustrating when I needed to edit a wiki page that we used at work. Wikis have an editing interface involving editable regions inside the browser window that are nearly impossible to use without a mouse. However, I also realized that there were things I could do with the iPhone and iPad that I couldn't do at all with my desktop computer, like having a document scanner with me in my pocket.[5] That led me to recommend the iPad as a complementary device.

Since libraries are offering more services to facilitate creation, and creation is such a great way to learn, *and* there are so many useful and accessible creation apps, we have an opportunity to recommend some of these apps to our users.

Types of Content Creation

So what can you easily create using mobile devices? Here are some types of content that can be created with excellent, accessible content creation apps:

- photo art and photo collages
- art images and multimedia collages
- videos
- interactive e-books
- slide presentations
- music
- designs for 3-D printing

In the previous chapter we looked at *consistent*, *continuous,* and *complementary* design, and those types of multi-device uses apply here as well.

Many times it makes sense to start a project on one device, then bring it to another to finish (continuous design). Other times you might use more than one device at the same time (complementary). And of course, there are many examples of apps that work well no matter which mobile device you use (consistent).

App Smashing—Using Multiple Apps in Succession

A term that has become popular in the educational technology world, is *app smashing*. It's the use of multiple apps in succession to complete a project, often with a final product published to the Web. For example, create a comic with the ComicStrip app, bring it into Explain Everything (narrated slideshows) to add your narration, export that as a video to publish on YouTube, then use ThingLink to create an interactive poster with hotspots that will launch the video.[6]

Often the choice of which apps to use is left to the students, selecting from a list of good possibilities provided by the teacher. Smashing apps together is a great way for students to express their creativity. To see many examples of student projects, search Twitter for the hashtag #AppSmash.

In today's mobile world, you can think of apps as a tool kit for content creation—often using more than one app and sometimes more than one device in succession.

Examples of Creating with Mobile Apps

There are many excellent apps for different types of content creation. In this section we'll look at a few examples in order to show how natural user interfaces make it easy to create content.

Most of these examples could be used by students of any age, from elementary school children to adult learners. The ease of use benefits everyone. Sometimes a nine-year-old can pick up and use mobile apps more quickly than an adult who is used to desktop computers—mainly because they will try everything and have no fear of "breaking" the device.

At the same time, beware of stereotypes that depict older adults as afraid of technology and young people as early adopters. There are college students who are luddites and baby boomers who embrace and use all the new mobile devices and apps. So it's good to keep an open mind.

By the way, I have not included examples for preschool and early age elementary children because that could be the topic of a whole separate report—it's a huge area and not the focus of this report. These examples are mostly useful for ages eight and up.

If you work with university students and professors, mobile apps like these can be used in university settings as part of advanced learning projects, even if the example discussed here is with elementary school children. It's also good for all of us to be aware of the experiences younger students are having with apps before they enter universities so you can understand their background and expectations.

We'll look at examples for creating the following types of content:

- visual arts
- text and multimedia
- music and sound
- designs for 3-D printing

Visual Arts

CREATIVE CODING WITH PHOTOGRAPHY FOR ART

iPad ArtRoom is one of the best websites available for learning about creative uses of iPads in art classrooms. Created by Cathy Hunt, a visual art teacher at St. Hilda's school on the Gold Coast in Australia, this site is "about mixing paint with pixels, and traditional with technology for art making." Here's an example from the "Art Apps & Ideas" section of her site.

iPad ArtRoom
www.ipadartroom.com

In a project called "Creative Coding: Painting with Light," Cathy Hunt and another teacher partnered to create cross-curricular lessons for science, math, technology, and the arts, where students created "light paintings."[7] They did this by programming a Sphero robotic ball to move with the colored light turned on and recording the trail with the Slow Shutter Cam app.

Working in teams, the students learned to create code that designates shapes for the Sphero ball to roll in, such as squares, triangles, or zig zags. They also coded the balls to change colors. Once they had their code working, they used the "light trail" mode of Slow Shutter Cam to create light paintings of the trail left by their balls.

Sphero robotic ball
www.sphero.com/sphero

Slow Shutter Cam
https://itunes.apple.com/en/app/slow-shutter-cam/id357404131?mt=8

Here's what Hunt said about learning outcomes:

> One of the great things about this kind of task is hearing the student conversations as their teams engage with experimental ways of working, estimating and making predictions, jumping between the Sphero ball, their code and photographic equipment. Hypotheses are developed and tested, with many decisions emerging through trial and error. Problems are solved on the go and success develops through an iterative process and effective collaboration. And best of all, the "fails" happen over and over again, leading to some really fulfilling moments when the desired outcome is achieved.[8]

Learn about the details, see photos of the artwork, and hear from the students in a video included with her post "Creative Coding: Light Painting with Sphero." This is a good example of a multi-device ecosystem using natural user interfaces to enable better learning.

Video about light painting project
https://youtu.be/1NbLRiL1Mbw

Cathy Hunt is also the author of two excellent, free multi-touch iBooks, full of art projects with the iPad. Download them from the iBooks store and read them on a Mac or iOS device.[9]

AUDIO AND VIDEO CONTENT CREATION FOR THE VISUALLY IMPAIRED

You may think it's not possible for blind or visually impaired people to create videos, but think again. It's quite possible, due to the accessibility features of Apple's iMovie. Blind students are working both on their own and in collaboration with others to create video content.

To learn just how this process works, get the free e-book *Creating in All Senses: Expression for the Visually Impaired*, by Daniela Rubio, a digital media accessibility consultant and an Apple Distinguished Educator.[10] You can download it from the iBooks store and read it on a Mac or iOS device.

In this concise book with embedded video demos, Rubio shows educators how the basics of VoiceOver work to enable the use of iMovie and GarageBand. One recommended app for learning the basics is LookTel VoiceOver Tutorial. It's a fun game-based way to learn the basics of VoiceOver for iOS.

LookTel VoiceOver Tutorial
www.looktel.com/vo-tutorial

This technology gives visually impaired people the ability to collaborate with each other and with sighted people to create videos, presentations, music, and podcasts. Rubio highlights effective ways that teachers can communicate with blind students by learning the basics of important features in VoiceOver, both for iOS devices and the Mac.

Text and Multimedia

CREATING INTERACTIVE E-BOOKS

A very popular app that makes it easy to create interactive e-books is Book Creator, available for both Android and iPad. You can create a book that includes text, drawings, photos, narration, music, and video.

Export your book as EPUB or as PDF. You can submit your book to Apple's iBooks store or the Google Play store. To see examples of books created with this app, visit the Pinterest board of the developer.

Educators are using this app in many different ways.[11] For example:

- to create a digital journal or lab book
- to build literacy and creative skills
- to write fan fiction
- to create collaborative books
- in app smashing

For some very interesting ideas for using this app, see "4 (More) Compelling Reasons to Use Book Creator in the Classroom." You'll see examples of students collaborating with others around the world, good ways to document and record learning progress, app-smashing projects, and using Book Creator with special needs students.

MULTIMEDIA STORYTELLING

Explain Everything is a widely used multimedia storytelling tool in classrooms at all levels. It's available for both Android and iOS and is easy to use. It's an interactive whiteboard with screencasting built in. It's often used by students to demonstrate and apply their knowledge across a wide range of subjects.

In the free e-book *Explain Everything Lesson Ideas*, there are six lesson plans for using this app in the classroom, two for ages five to eleven, two for ages twelve to fourteen, and two for ages fourteen to eighteen.[12] For example, in a math lesson for eight- to nine-year-olds,

students develop examples, sketch visual models, write a script for narration, and add captions to show their understanding of equivalent fractions. They screencast and present their solutions using the app.[13]

It's worth reading through these and other examples to learn more about creative uses of Explain Everything and similar apps.

Music and Sound

An excellent example of content creation in the area of music and sound is described by Darryl Bedford in *Can You See Sound? Adventures in Film and Animation,* available for free from Apple's iBookstore.[14] He is an Apple Distinguished Educator and an art teacher at Oak Lodge School for the Deaf in London. He also works with neighboring mainstream schools and develops approaches that work with all ages (five through nineteen).

In this short e-book, he describes lessons that allow deaf students to create visualizations for music and sound. Students learn to create visualizations from the vibrations they feel and from their own voices and also study the science of sound with visual waveforms. For example, the iPhone app Soundbeam can visualize a student's voice. They also work with apps like Waves and Soundscape 2 to create beautiful visual patterns from sounds and music. For another project, the students create animations and flip books and create their own homemade musical instruments, then make videos of them with various apps. These lessons are appropriate not only for deaf students, but for anyone.

Here is what Bedford says about the results:

My story will hopefully inspire you to try some of the suggested activities, adapting them to your own curriculum. Almost any theme or concept can be animated. Your students can demonstrate their understanding of subject matter by transforming concepts into new forms. This process highlights Bloom's higher-order thinking skills, with creation being the highest order, involving a transformation of knowledge in order to communicate understanding through a new medium.[15]

The iBook *Can You See Sound?* includes several embedded videos. If you don't have access to the book

(it's free and can be viewed on a Mac or an iPad), try watching his introductory video on YouTube.

3-D Printing

3-D printing is another area with some excellent, fun creation apps. Autodesk offers several apps for different aspects of creating 3-D objects. One app that's useful for beginners is 123D Sculpt+, available for Android and iOS. The app makes it easy to design a 3-D animal or creature that can be brought to life with a 3-D printer. You can start with designs that are included in the app for modification or start from scratch. You draw stick figure skeletons and use the touchscreen to sculpt the body on top of it. You can then add photos, colors, or patterns as paint to your object.

For a sample lesson plan designed for a first-grade class that can be modified for any age, see Caitlin Boyce-Brejcha's "3D Digifab Lesson Plan: Sculpting Adjectives." The lesson has students create a 3-D animal with the app, describe it using five adjectives, and view the creations of their peers with a QR code reader. This lesson assumes you don't have access to print the design, so instead students share screenshots of their work.

If you don't have access to a 3-D printer, services such as Shapeways and Sculpteo let you upload your design and get your object printed and shipped.

For more ideas and plans for 3-D printing, see the YouTube channel Maker's Muse. This is a great source of project ideas, many of them appropriate for teenagers or university students, such as "Turn Your Head into a Zombie Candy Bowl."

If you want to learn more about 3-D printing, you might turn to your local makerspace (in a library or other location) because many of them offer workshops. For example, see Open Source Classroom's Makerspace in Bloomington, Illinois. It offers 3-D design workshops and 3-D literacy for educators. If you're in the Boston area, take a look at Artisan's Asylum in Somerville, Massachusetts, for a large number of interesting classes.

Summary

I hope that after learning about these examples, you can see how content creation is getting easier with mobile devices. Natural user interfaces like touchscreens and VoiceOver are making it easier for people of all ages and abilities to use these devices.

Using multiple devices and multiple apps together, as we saw with app smashing, is becoming quite common.[16] Multi-device experiences with information that syncs between devices via the cloud is becoming the norm. We are less stuck within the ecosystem of one platform since many of the best apps are cross-platform and sync between devices.

Learning by creating is on the rise, and mobile devices can be a big part of this trend. In summary:

- People learn very well by creating.
- Libraries are facilitating content creation.
- Mobile interfaces are making it easier to create content.
- Children are learning to create with the latest mobile apps.

There are some good opportunities for libraries to facilitate learning by content creation in our communities—by using and recommending mobile technologies and by becoming experts for our communities.

We'll look at those ideas in the next chapter, along with lists of resources for learning more.

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15. Ibid., 6.
16. "Why App Smash?"

Opportunities for Libraries and Further Resources

S ince librarians care about providing access for everyone of all ages and all abilities, it's important to have an understanding of how the move toward mobile computing with natural user interfaces can help our users. Understanding accessibility as part of a larger system that helps everyone will help keep it from being sidelined as an add-on for when we have extra time or extra money—and how often does that happen?

This report is meant to be a starting point to help you get a sense of where mobile learning is going. With this knowledge, you can begin to offer services that help your users leverage these technologies. Here are a few ideas to get you started with implementing this knowledge.

Create Guides, Online and in Print, That Recommend the Best Mobile Technologies

You could make guides to apps and devices using the Apple's accessibility categories, mentioned in chapter 1:

- vision
- hearing
- physical and motor skills
- learning and literacy

Alternatively, you could offer guides to particular apps and devices grouped by the categories of NUIs used in chapter 1:

- touch
- sound
- sight

An example might be a guide to apps that help you focus and concentrate—good for those with learning disabilities or Autism Spectrum Disorder, but also useful for everyone. See "The Best ADHD iPhone and Android Apps of the Year" for some ideas.

Another idea might be creating a guide to the best touchscreen apps for studying human anatomy. There are many useful anatomy apps beyond the ones mentioned in chapter 1. See "The Best iPad Apps for Anatomy." Adapt these ideas to topics relevant to your communities.

> *The Best ADHD iPhone and Android Apps of the Year*
> www.healthline.com/health/adhd/top-iphone-android-apps
>
> *The Best iPad Apps for Anatomy*
> www.apppicker.com/applists/23751/the-best-ipad-apps-for-anatomy

Offer Workshops on How to Use These Technologies

Your library could also offer workshops, by your own staff or by invited experts. You could partner

with your institution's office of accessibility or other experts in your community.

If you think of accessibility as for everyone, and not just for people with particular disabilities, it helps set the context for a more accessible world for all. Your workshops could be for a wider audience than just people with specific disabilities. Here are some workshop ideas:

- Talk to Your Devices: The Best Apps and Tools for Talking to and with Your Mobile Devices
- Listen to Your Readings: The Best Audio Narration Tools and Apps for Listening on the Go
- Supplement Your Language Learning with Google Translate: Useful Features for Communicating with Everyone
- iPhone and Android Accessibility Features for All: Learn How to Use Accessibility Features of Your Smartphone Whether or Not You Have a Recognized Disability

Provide Devices That People Can Use Together with Their Own Smartphones or Tablets, Such as Large Screens, Smart TV Systems, or Amazon Echo

Since there are so many useful applications for multiple devices, it makes sense for libraries to provide options for using those larger, more expensive devices that people may not have at home. You may outfit a special room with smart TV systems, for example, that can be reserved for use by groups with their smartphones and tablets.

Support Training for Your Staff in These New Technologies

When your staff has a basic familiarity with some of the options available, they can better assist users and point them to accessible solutions for their learning and knowledge creation. See the final section of this chapter for some recommended online courses.

Keeping in Touch

I hope you will implement some of the ideas for how librarians can empower their communities with this knowledge. I would love to hear from you with feedback on this report and also to hear about how your library is offering innovative services with mobile technologies.

Questions to Consider

As you've read through these examples, you may have some doubts or questions coming to mind. Questions such as these:

- How can we bring these technologies to those who can't afford them?
- What are the ramifications for privacy and security?
- How can we keep up with understanding these new technologies?

Of course, these are the same questions that come up for all new technologies. We live in a world of unequal access where more than ever we hear about privacy and security breaches. And the pace of change keeps getting faster. There is some good news, however.

How Can We Bring These Technologies to Those Who Can't Afford Them?

The digital divide is an ongoing problem and not easily solved, but there is some good news when it comes to mobile devices. They are coming down in price, and more people around the world are able to afford them.[1] As of mid-2014, the number of unique mobile phone users around the world has passed 50 percent of the world's total population and is still growing rapidly.[2] Even in developing countries, such as in parts of Africa where electricity is not everywhere, the problem is being solved by the use of low-cost solar panels from China.[3]

Often, a smartphone or tablet with an excellent app is much, much cheaper than previous generation stand-alone devices for specific technology problems. For example, you might think that the price of an iPad with a $250 touch-to-speak app like Proloquo2Go is expensive, but it can replace previous technology for disabled users that cost around $8,000.[4]

Proloquo2Go
www.assistiveware.com/product/proloquo2go

Some libraries are helping bridge the divide by loaning out Wi-Fi hotspots, laptops, and iPads to their communities.[5] As always, we can continue to work toward access for all in ways like these.

What Are the Ramifications for Privacy and Security?

Rather than being paralyzed by media stories about security breaches, you can learn best practices for mobile security and cloud computing. A good starting point is Surveillance Self-Defense from the Electronic Frontier Foundation. Start by reading EFF's short document "An Introduction to Threat Modeling," which can help you think through what levels of security you might need for different types of information. Security best practices for mobile computing is a topic also covered in my online self-paced course, Organize Your Life with Mobile Apps.

As for privacy, I would suggest using the principles and guidelines that have been in place for a while, such as ALA's guidelines on privacy in the Library Bill of Rights.[6] Librarians have long been advocates for privacy and we will continue to serve in that way.

When thinking about privacy and security implications of new and near future technologies, some of the best sources to read are research reports from the Pew Research Center: Internet, Science, & Tech. Sign up for new report alerts on the website.

Surveillance Self-Defense, Electronic Frontier Foundation
https://ssd.eff.org

An Introduction to Threat Modeling, EFF
https://ssd.eff.org/en/module/introduction-threat
-modeling

Nicole Hennig, Organize Your Life with Mobile Apps
http://nicolehennig.com/courses/organize-life-mobile
-apps

Privacy: An Interpretation of the Library Bill of Rights
www.ala.org/advocacy/intfreedom/librarybill/
interpretations/privacy

Pew Research Center: Internet, Science & Tech
www.pewinternet.org

How Can We Keep Up with Understanding These New Technologies?

It's easy to get overwhelmed at the pace of change, and keeping up has long been a challenge for all of us. However, there are some excellent resources in different formats that are useful for keeping up with the world of mobile technologies. See the next section for recommended newsletters, reports, books, and online courses.

Continue Your Learning

If you would like to continue learning about the topics in this report, take a look at the following recommended books, articles, websites, and online courses. These are some of the best available for keeping up with the topics covered in this report.

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Online Courses and Newsletters

23 MOBILE THINGS

23 Mobile Things: Exploring the Potential of Mobile Tools for Delivering Library Services. http://23mobilethings.net/wpress/about.

23 Things is a wonderful model for self-paced technology training for library staff. Over a period of several weeks, people learn by following a blog that each week introduces one or two "mobile things" and sets a task for participants. Participants blog their progress on each "thing" and share information. It's self-paced during a period of several months and gives learners a chance to learn and explore new technologies over time, with community discussion. To learn more about the origins of this framework, see Helene Blowers's blog post "6 Years of 23 Things."

Many libraries have adopted this approach for their local or regional training; see the post "Remix" on the *23 Mobile Things* blog. In early 2015 I had the pleasure of presenting several of the included webinars for a 23 Mobile Things program offered by NEFLIN, (Northeast Florida Library Information Network). See NEFLIN's 23Things website.

This method of learning has proven itself very effective. Learn more about the outcomes in this research report in Michael Stephens's research report, "23 Mobile Things: Self-Directed and Effective Professional Learning."

6 Years of 23 Things
www.heleneblowers.info/2012/08/6-years-of-23
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Remix
http://23mobilethings.net/wpress/remix-2

NEFLIN: 23 Things
http://23things.neflin.org

23 Mobile Things: Self-Directed and Effective Professional Learning
http://tametheweb.com/2014/09/23/new-article-23
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APPS FOR LIBRARIANS

Apps for Librarians: Empower Your Users with Mobile App Literacy. http://nicolehennig.com/librarian-app-experts.

Since 2012 I've been offering this course to librarians and educators, updating it each year. It's a five-week online course designed to help you become an app expert for your community. It covers a wide variety of mobile apps in the areas of e-reading, productivity and writing, reference, multimedia, accessibility, and more. It includes video screencasts of apps, interesting readings, group discussion forums, and optional weekly live chat sessions. Assignments include weekly app reviews that you share with classmates for discussion. Many librarians and educators have gone on to offer their own workshops and guides for their communities after taking this course. See the testimonials online to hear from previous students. I offer this course a few times per year via American Library Association eLearning.

Testimonials for courses by Nicole Hennig
http://nicolehennig.com/courses/testimonials

If you prefer to work at your own pace with no deadlines, I also offer a self-study version of the course, available to begin at any time (with content updated yearly for no extra charge).

Visit my website to learn about my other online courses on mobile technologies.

Apps for Librarians self-study version
https://www.udemy.com/apps4librarians/learn/?couponCode=HENNIG1

Nicole Hennig, online courses on mobile technologies
http://nicolehennig.com/courses

SELF-STUDY COURSES FOR LEARNING ACCESSIBILITY FEATURE OF IOS AND ANDROID

Accessibility Features of iOS for the iPad and iPhone. Online course. Udemy. https://www.udemy.com/accessibility-features-of-ios-for-the-ipad-and-iphone.

Accessibility Features on Android. Online course. Udemy. https://www.udemy.com/accessibility-features-on-android.

These two self-paced courses are recommended if you would like to learn the specific accessibility features of iOS or Android. They were created by Sami Rahman, the CEO of SmartEdTech, a company that develops software for children with disabilities. Mr. Rahman has certification in an Assistive Technology Applications Program offered by California State University.

If you enjoy learning by watching video demos, these courses are recommended.

NEWSLETTERS

To stay current with the best apps for educational use, sign up for my free newsletter, *Mobile Apps News*. I cover the best new apps for use in educational settings and offer links to real-world examples of creative use and to thought-provoking articles about emerging technologies. From time to time I offer discounts on my books and courses. When you sign up, you'll get a free PDF copy of my guide, "10 Tips for Finding the Best Apps."

Mobile Apps News by Nicole Hennig
http://nicolehennig.com/mobile-apps-news

Notes

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Notes

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