Chapter 2

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."

The Whole "Mac vs. PC" Thing Is So Over, and "Android vs. iPhone" Is Close Behind
www.businessinsider.com/apple-mac-vs-microsoft-windows-pc-is-over-2015-10

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.

Nest thermostat
https://nest.com/thermostat/meet-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.

Pew Internet Report: Internet of All Things
www.pewinternet.org/2014/05/14/internet-of-things

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.

How to Cook Everything
http://markbittman.com/app/how-to-cook-everything-app-for-iphone-ipad-windows

BigOven
www.bigoven.com/mobile

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.

Airbnb
https://www.airbnb.com/mobile

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.

Scrabble
www.ea.com/scrabble

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.

Pocket Casts
www.shiftyjelly.com/pocketcasts

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 autodownload 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.

Listen Current
https://listencurrent.com

What Teens Are Learning from "Serial" and Other Podcasts
http://ww2.kqed.org/mindshift/2015/03/11/what-teens-are-learning-from-serial-and-other-podcasts

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, moviemaking, 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.

Notes

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