A Comparison of Tablet Computers for Use as a Class Presentation Platform

Thomas Murphy[1], Christopher Williams[2], Frank Katz[3]

Abstract – The Apple iPad was the first multimedia tablet computer to gain wide market acceptance. Tablet computers have subsequently been released by Acer, ASUS, Hewlett Packard, Lenovo, Motorola, Samsung, Sony, Toshiba, and others. In this paper, we focus on the use of tablet computers as a classroom presentation platform rather than some of the many other uses marketed towards "typical" consumers. The paper provides an overview of currently available Android and iOS tablet computers, their advantages and limitations for use in presenting class material, recommendations for a minimum feature set when choosing a tablet computer for use as a class presentation platform, suggestions for how to use the tablet computer to deliver course material, and guidelines for how to prepare course material for presentation via a tablet computer. Results of faculty and student surveys on how tablets are being used in class, their usefulness and effectiveness, and impressions are also reported.

Keywords: iPad, Android tablet, Apple tablet, Presentation platform

INTRODUCTION

The Apple iPad was released in April 2010 and 14.8 million iPads were sold in 2010. Since the release of the first generation iPad, consumer tablet computers have been released by Acer, ASUS, Hewlett Packard, Lenovo, Motorola, Samsung, Sony, Toshiba, and others, including Apple's iPad2 released in March 2011. More faculty members have access to them and use them in the classroom. In a previous paper [30], the Apple iPad was found to be an effective and viable alternative to a laptop computer for use in presenting class lectures/material. First generation Apple iPads were used during the Fall 2010 and Spring 2011 semesters and the iPad2 during the Summer 2011 semester as class presentation platforms by several faculty members in both technical and non-technical disciplines at Armstrong Atlantic State University (AASU). This paper predominately covers work done in Fall 2011 using iPad2s and a Samsung Galaxy Tab.

The authors found that there are several good Android alternatives to the iPad2 for presenting class material, such as the ACER Iconia A500, ASUS Transformer, Samsung Galaxy Tab 10.1, Toshiba Thrive. Currently available tablets and the two main tablet operating systems, Android and iOS, will be summarized and discussed in the Overview of Current Tablets and Operating Systems section. Also, recommendations on tablet features necessary for using the tablet for presenting class material are provided.

Students in four classes where the instructor is teaching using a tablet were surveyed and found the material presented using the tablet as good as or better than with a laptop. A faculty survey indicated that tablets were being used across campus to present slides, show web pages, draw/sketch, and play audio/video. Based on numbers from the AASU Information Technology Services department, approximately 25 - 30% of faculty at AASU have access to a tablet although almost 50% of our faculty survey respondents indicated they had access to a tablet. Detailed

---

[1] Associate Professor, Engineering Studies, Armstrong Atlantic State University, 11935 Abercorn Street, Savannah, GA 31419, thomas.murphy@armstrong.edu

[2] Instructional Technology Support Specialist, College of Science and Technology, Armstrong Atlantic State University, 11935 Abercorn Street, Savannah, GA 31419, chris.williams@armstrong.edu

[3] Assistant Professor, Information Technology, Armstrong Atlantic State University, 11935 Abercorn Street, Savannah, GA 31419, frank.katz@armstrong.edu

results of the faculty survey on how AASU faculty are using tablets for instruction along with student impressions of their effectiveness for instruction are provided in the Faculty Use and Faculty and Student Perceptions section.

In the Tips for Presenting Material Using a Tablet section, Android and iOS applications (apps) necessary for using the tablet to present class material are provided along with some tips on how to prepare class material for presentation and how to transfer files from a personal computer to the tablet.

OVERVIEW OF CURRENT TABLETS AND MOBILE OPERATING SYSTEMS

In the following two subsections, we provide an overview and comparison of some of the available tablets along with a comparison of the iOS and Android mobile operating systems. Current Windows tablets tend to be more expensive, and are closer in form to laptops, so these tablet computers were not considered for this work.

Tablet Overview

There are many sites that have reviews and rankings of tablets, for example [14][15][16][17][18][23][24][34]. A summary of some of the more commonly available tablets is provided in Table 1. All of the Android tablets use a NVIDIA Tegra2 1GHz dual-core processor and have 1GB RAM. The Apple iPad2 uses an Apple A5 1GHz dual-core processor and has 512Mb RAM. Performance of the Android tablets and the iPad2 is comparable. Storage is typically 16GB or 32GB of flash memory. The Toshiba has an 8GB version and the Apple and Lenovo have 64GB versions. Several other manufacturers indicate that there are 64GB versions of their tablets, but they are not available at this time. All of the tablets have 3.5mm headphone jacks, Bluetooth and Wi-Fi, and most have a gyroscope, accelerometer, compass, GPS, and front and rear facing cameras with the rear camera supporting video. Full specifications of the tablets in Table 1 can be found at [1][3][12][25][28][35][37][41].

Tablet	Release Date	Cost	Dimensions(mm) /Weight (g)	Battery Life	Operating System
Acer Iconia A500	4/24/11	$449 - $549	260 x 177 x 13.3/730	8 hours	Android 3.2
Apple iPad2	3/11/11	$499 - $829	241.2 x 185.7 x 8.8/601	10 hours	iOS
ASUS Eee pad Transformer TF 101	4/26/11	$460 - $649	271 x 171 x 13/680	9.5 hours	Android 3.2
Lenovo Idea Pad k1	8/23/11	$549 - $619	264 x 189 x 13.3/750	10 hours	Android 3.1
Motorola Xoom	2/24/11	$499 - $799	249.1 x 167.8 x 12.9 /708	10 hours	Android 3.2
Samsung Galaxy Tab	6/8/11	$500 - $629	256.7 x 175.3 x 8.6/565	9 hours	Android 3.2
Sony Tablet S	9/16/11	$499 - $599	241.2 x 172.7 x 7.6/595	8 hours	Android 3.2
Toshiba Thrive	7/10/11	$379 - $479	273 x 177 x 16/725	11 hours	Android 3.2

Table 1, Currently Available Tablets

Table 1 notes: when possible cost is list price from the manufacturers website, weight is for the Wi-Fi model (cellular models are typically 10 – 30 grams heavier), battery life is under Wi-Fi and web browsing/video, Android 3.0 to 3.2 is Honeycomb, Google's tablet version of the Android mobile operating system, with the exception of the Apple iPad2 and Samsung Galaxy most of these can be found on sale or discounted.

In addition to the tablets in Table 1, there are other tablets such as the BlackBerry Playbook, HP TouchPad, Acer Iconia A100, Samsung Galaxy Tab 8.9, ViewSonic Viewpad 7, T-Mobile G-Slate, Barnes and Noble Nook, Amazon Kindle Fire, Toshiba AT200, etc, that we did not investigate for one or more of the following reasons: lack of support for Android 3.1 (Honeycomb) or access to Android marketplace, small screen size, lack of output ports for screen display, or too new to evaluate. The ASUS Eee Pad Slider was not considered as it has a non-removable keyboard unlike the other tablets; some people may see this as desirable.

Since storage and performance of most tablets is comparable, what distinguishes one tablet from the next is the cost, user experience, design/build quality, and the connectivity (input and output ports). To assess build quality, besides relying on reviews, a local Best Buy and Staples were visited on several occasions. Each tablet was carefully examined, the interface was explored, and the tablet was held and shifted between hands for a few minutes. In terms of feel and build quality the iPad2 and Samsung Galaxy were the best followed by the Motorola Xoom. The Toshiba

Thrive and Sony Tablet S felt thicker and heavier and more awkward in one's hand. The ACER looked and felt cheaply made although several reviews commented on its good build quality. The ASUS and Lenovo tablets were not available locally.

AASU classrooms that support multimedia support input via VGA and 3.5 audio jacks and some classrooms also have support for component video/composite video. None of AASU's current classrooms with projectors support HDMI in or wireless transfer to the projector. A tablet for presenting class material in most settings must provide a HDMI or VGA output. The ACER Iconia, ASUS Transformer, Lenovo Idea Pad, Motorola Xoom, and Toshiba Thrive all have HDMI out ports. The Samsung Galaxy and iPad2 have dock to HDMI or VGA adapters. The Sony Tablet S does not have a HDMI out port and is thus is not a good choice for presenting class material. The Barnes and Noble Nook Tablet and the Amazon Kindle Fire were not considered as neither of them has a HDMI out port either.

Due to budget limitations, the authors were only able to purchase one Android tablet for physical comparison to the several iPads already in their possession. However, since reviews [15][16][17][18][24][34] indicated the user experience and performance among Android tablets was comparable, this comparison can be generalized to other Android tablets that have the ports or adapters needed for connection to a projection system. The Lenovo Idea Pad and ASUS Transformer were not considered as the authors could not test their user experience and design/build quality before purchasing since they were not available locally. The Sony Tablet S was eliminated due to its lack of an HDMI out port and the Motorola Xoom was eliminated because it does not provide enough power on its HDMI port to power [27] a passive HDMI to VGA adapter such as [20] although it could be used with a VGA projection system using a powered HDMI to VGA adapter [22]. This left the Acer, Toshiba, and Samsung. The Samsung was decided upon for its excellent design/build quality, consistently excellent reviews, and the fact that it could be connected to a projection system via VGA. It is also the closest in look and feel to the iPad2.

The following tablets are recommended for use in presenting class material (along with the necessary accessories for connecting to projection system via VGA):

- Acer Iconia A500 – micro HDMI to HDMI adapter, HDMI to VGA adapter, standard VGA cable
- iPad 2– Apple dock to VGA adapter, standard VGA cable
- ASUS Transformer TF 101 – ASUS mini HDMI to VGA adapter, standard VGA cable
- Lenovo Idea Pad – mini HDMI to HDMI, HDMI to VGA Adapter, standard VGA cable
- Samsung Galaxy Tab 10.1 – Samsung dock to HDMI adapter, HDMI to VGA adapter, standard VGA cable
- Toshiba Thrive – HDMI to VGA adapter, standard VGA cable

We recommend the HP HDMI to VGA adapter [20] as it gets its power from the HDMI +5V power line although a powered adapter can be used. The Samsung dock to HDMI adapter requires the tablet be connected to power via its charging cable which can be somewhat awkward depending on the classroom setup. ASUS Eee Pad Slider, although not considered in this work, can be used with the same accessories as the ASUS Transformer TF 101.

Android and iOS Overview

The current tablet market offers two major groups of devices: Apple's iPad or Android-powered tablets. A number of manufacturers produce consumer-based tablets and smart phones using Google's Android operating system (OS) while all Apple tablets and smart phones use iOS (originally known as iPhone OS), an Apple-developed OS. In general, a mobile OS provides a user interface, utilities and applications, and controls the device while running; the software provides an interaction layer between the device hardware and the user. Both operating systems use touch-based input with multi-touch capabilities and virtual keyboards for text input.

In general, both OSs are upgradable to newer versions with some restrictions. For Apple devices, Apple restricts OS upgrades to devices that can support the new version based on hardware. The downside to this is that Apple decides what is "supportable" which often leads to newer features being arbitrarily restricted to newer devices. Android device users must rely on their hardware manufacturer to provide updates. Because Android is an open-source product, anyone can modify and use the source code before putting it on their device. Most manufacturers modify the OS in some way before placing it on their devices, often leading to delays with providing end-users the latest version of the OS, which may contain new features and security upgrades. Some manufacturers choose not to support their Android tablets after they are released, which gives the user no easy route to upgrade the device.

Starting with iOS5, both iOS and Android provide over-the-air OS updates, which allow the device's OS to be updated without connecting it to a computer. In addition, both provide the ability to access cloud-based storage

accounts so that users can access those stored files when they have internet access through either cellular or Wi-Fi service. One problem with Android devices is the fragmentation occurring with the number of OS versions. Because not all manufacturers will update their devices, some users are stuck on old versions of Android while many others choose not to upgrade their devices even when updates are available. Even worse, it can be difficult to impossible to determine if the device that is being purchased will be supported and, if so, for how long. Of course, as pointed out before, Apple decides which features will be supported on which devices from OS version to OS version.

In summary, both operating systems are more than capable pieces of software. Providing essentially the same functionality, and the ability to expand that functionality through applications, both OSs are very usable and have advantages and disadvantages. Depending on cost, experience, and preference, both are able to provide a robust and satisfying experience when being used in the classroom.

Android Market vs. iTunes App Store

Both Android and iOS devices have online stores where developers can sell or distribute applications to users. A report published in November 2011 by research2guidance [33] showed that there were approximately 365k applications in the Android Market. During the release of the iPhone 4s, in October 2011, Apple representatives stated that there were more than 500k applications in the Apple App Store [5].

Both stores contain paid and free applications, or apps, that users can browse or install on their devices. Both stores contain the ability to search or browse for apps, movies, music, e-books, and keep track of previous purchases. Both are accessible from mobile devices and allow the user to make purchases and download applications directly. Both OSs have applications dedicated to facilitating application purchase and installation for users.

The major difference between the two stores is the process for submitting apps for sale. The Apple App Store has a stringent process where every app is reviewed and must follow strict guidelines about content and actions that are allowed on the device. Apple rejects apps that do not pass this part of the review process and asks the developers to correct any issues and resubmit the app before it allowing the app into the App Store. The Android Market allows anyone with a registered account to upload and publish an application. There is no formal review process although they will remove apps when an app is malicious or otherwise breaking the content policies [19]. Obviously, both of these approaches have advantages and disadvantages. In Apple's case, only vetted apps (by Apple's standards) will make it into the App Store, providing a superficial level of security, but also preventing useful apps that may break Apple's standards from being available for users. On the other hand, the Android Market cannot guarantee that every app is safe to use or non-malicious when it is uploaded. This can lead to security issues, but also make a wider suite of software available to users.

Another key difference between the two stores is in the payment options. Apple's App Store allows, depending on country, credit cards, gift cards, store credit, and PayPal [4]. While this makes payment options robust, apps can only be tied to one specific account, which is also true for the Android devices. However, because those apps are tied to a device, once a user is signed in, they have access to their purchased apps. The Android Market uses Google Checkout to process payments, a service that only takes credit cards. Some phone carriers allow direct billing which charges a user's monthly bill, but this feature is not always available on all plans and to all users. This can make it difficult for a user in an academic setting to purchase software on school accounts since a credit card must be tied to an account to allow purchasing. That means they either need to purchase the software and be reimbursed, or use a university credit card and remove the information from their account when done.

TIPS ON PRESENTING MATERIAL USING A TABLET

After over a year of using tablet computers in the classroom, the major teaching needs identified were presenting or working with Office documents, displaying PDFs and web pages, and drawing or annotating. However, other needs have been identified where the tablet computer proves useful. These include: showing videos, displaying class information, documents, and other web content, including relevant articles. Finally, note-taking apps have proven useful to keep track of the issuance of assignments, discussion questions, and tests, and grading.

Android Apps for Teaching

The Samsung Galaxy Tab, which was used for Android testing, comes with Quickoffice Pro HD [32], a mobile office suite that allows the creation and editing of Microsoft Office files (Excel, Word, and PowerPoint) as well as displaying PDF files on the tablet. Most office suite software enables the user to create or edit Word, Excel, or

PowerPoint files and display PowerPoint presentations. While these suites do not provide some of the advanced features of Microsoft Office, they work well for quick edits, basic content creation, and presentation. Since a large number of users will not do much more than work with Office documents, these suites prove to be a useful tool. Quickoffice can work with local files, or files stored "in the cloud" through Google Docs, Dropbox, iCloud, or other cloud-based services. The purchase of a Bluetooth keyboard is recommended for long periods of typing, as is the case with most tablets. Other alternatives to Quickoffice include Polaris Office, DataViz Documents To Go, OfficeSuite Pro 5, ThinkFree Office Mobile, and Google Docs. See [40] for a comparison of Office suites for Android.

Quickoffice also has the advantage of being able to display PDF files on the device. While being shown, searching, bookmarking, and zooming within the PDF file are possible. Android tablets usually comes with a web browser to display web pages although the user can install third-party browsers if the default one is not sufficient and they also have the ability to show Flash movies, something that iOS devices cannot do.

Users who need the ability to sketch or annotate images can use Sketchbook Pro by Autodesk [13] or similar drawing applications. This software allows free hand sketching using either a finger or a capacitive-touch screen stylus. Sketchbook also has the concept of layers, allowing one to import an image from the tablet and, on another layer, "draw" on the image. This allows the presenter to annotate existing images or diagrams in front of the students.

iOS Apps for Teaching

In a previous paper[30], teaching apps were discussed that were available at the time. The following apps are listed in addition to the original findings. Quickoffice is also available on the iPad and a detailed description can be found above. Keynote [10] is still a good choice for the presentation of PowerPoint slides, but alternatives to Keynote and Quickoffice can be found at [39]. Both Quickoffice and GoodReader [9] display PDF files and Sketchbook Pro, as noted in the original paper, is still the best app identified for sketching and annotation. List management can be done through the Toodledo [11] or Evernote [8] apps. Cloud storage can be accomplished by using Dropbox [7] or Apple's iCloud [6] service.

Transferring Files for Android

The most convenient way to transfer files to and from Android tablets is to use a cloud-based service (Dropbox, box.net, iCloud, etc.) to store the files on a remote server, and then use the built-in abilities of the tablet to access and synchronize those files. Many of the applications that can be purchased or installed on the device can access these cloud-based services as well, providing a central location for files that can be accessed by mobile devices or other computers.

Some manufacturers provide desktop-based syncing software to transfer files between the device and a computer. In particular, Samsung provides KIES [36] to work with the Galaxy Tab. KIES can synchronize files over the same wireless network and deliver firmware/OS updates to the device from a computer. Acer provides similar software for their Iconia tablets called Acer Sync [2]. Asus, which produces the Eee Pad Transformer, has their Asus Sync software, which is included as part of their PC Suite Software [12]. Lenovo offers the aptly titled "Synchronization Software" suite [26] for their IdeaPads. For Motorola products, users can sync with a computer using the appropriate drivers [29], which is also the case for Sony Tablet S users [38].

Transferring Files for iOS

There are several ways of transferring files to the iPad. The easiest is to install the Dropbox app, install the app that will display the file (Keynote, Quickoffice, or GoodReader), and open the file from Dropbox into that app. Once Dropbox and any of those three apps are installed, it's possible to open a file from Dropbox directly in one of those apps. One has to remember that data available in Dropbox does not reside in the iPad's internal storage; it resides on the Dropbox server. If the user's iPad is not 3G enabled (has not purchased a 3G service) and only uses Wi-Fi, then files stored in Dropbox are not accessible to the user unless the iPad is authenticated into a wireless network.

There are two Apple provided alternatives. The first is to load the files directly into iTunes on a PC or Mac and then sync those files directly to the iPad via USB cable. This method is somewhat cumbersome, as the user has to ensure that the files are loaded into the app in iTunes, and iTunes attempts to back up existing files on the iPad from it to

the PC or Mac before performing the sync of new files. The second method is sign up for the iCloud service and to transfer files from the cloud to the device.

Things to Know Before Using a Tablet in the Classroom

Before attempting to use an Android tablet or iPad in the classroom, one should ensure that

- The classroom to be used has either an HDMI or VGA input to projection system
- One has the necessary adapters and power cable to connect the tablet to the projection system
- One can access a wireless network for displaying web pages and showing video from internet
- Any password protected sites/accounts are logged into before turning on the projector
- The sleep mode on the tablet is disabled
- One is familiar with all the apps they will use during class
- One is familiar with the file formats and how to transfer and access files for each app they intend on using

Instructors should also ensure that they are proficient in using their tablet with the proper adapter(s) and projection system. Many of the Android-based tablets do not provide an easy way to display video to a projector-based classroom. The use of a micro or mini HDMI to HDMI adapter is often necessary to connect to an HDTV or projecting system with an HDMI input. For example, the Samsung Galaxy Tab requires a Samsung Dock to HDMI connecter and a standard HDMI cable; the iPad requires an Apple Digital AV adapter (dock to HDMI) and a standard HDMI cable. Connecting to a VGA-based projection system often requires an additional adapter. For example, the Samsung Galaxy Tab requires a Samsung Dock to HDMI connecter, an HDMI to VGA connector, and a standard VGA cable; the iPad requires an Apple VGA adapter (dock to VGA) and a standard VGA cable. Along with the cabling, the Samsung Galaxy Tab also requires that the power adapter cable be plugged in to use the dock to HDMI adapter. This necessitates that a power outlet be near where the tablet will be and may not be practical in certain classrooms settings. Other Android-based tablets, such as the Acer Iconia 500, do not require the power connection to display video.

None of the tablets support wired (Ethernet) network access thus any internet materials must be accessed via a wireless network. All of the recommended tablets for presenting class material except the first generation iPad have screen mirroring. Anything typed on the tablet including account names and passwords (although one letter at time) will be displayed if the tablet is connected to the projection system and the system is on. Thus for security reasons, one should log into the wireless network and to any password protected sites/accounts before connecting the tablet to the projection system.

The tablet's sleep mode should be disabled or set to a long time to prevent the tablet from going to sleep during any lulls in the presentation or use of apps. The tablet output is typically suspended when the tablet goes to sleep and this can cause interruptions as one awakens the tablet and potentially has to restart apps. Some apps will continue to provide output while the tablet is asleep or prevent the tablet from going to sleep.

One must be familiar with the apps to be used, the file formats the apps support, how to transfer files and associate them with apps, and how to access files from apps. Each app is different, and thoroughly understanding how each app works will prevent glitches in the classroom. One of the instructors whose class was surveyed as part of this work did not have time to fully get accustomed to the tablet before the semester started and had some problems in the first few classes. The survey results from that class had the highest percentage of "Worse" answers for students responding to the question "Do you think the class using the tablet computer is better/same/worse as if the instructor used a laptop computer?".

FACULTY USE AND FACULTY AND STUDENT PERCEPTIONS OF TABLETS IN THE CLASSROOM

A survey of laptop and tablet classroom use was sent to all Armstrong faculty members in November 2011 and there were 100 respondents from multiple disciplines. The survey was constructed to progressively eliminate respondents who did not use a tablet computer to present class materials. 47/98 respondents had access to a tablet computer, 56/62 were aware that they could use tablet computers to present in class, and 20/62 used a tablet computer in classes that they taught. A question to determine the frequency of tablet usage (which was only to be answered by the 20 people who used tablets) ended up with 24 respondents. Of those 24, 7 used the tablet in every class, 8 used it once or twice a week, 4 used it a couple of times a month, and 5 used it rarely. Based on frequency ratings, presenting lecture slides was the most frequent activity, followed by displaying video, displaying web content,

drawing/graphing, and video. The authors expected displaying video and displaying web content usage to be the two highest activities, but presenting lecture slides was ranked as the most frequent by 13/25 respondents (we should note the discrepancy with total respondents here as well; we should have only received responses from 20 people (or 24), not 25). Finally, 7/25 people said that preparing class material for use with a tablet was easier than for a laptop, 8/25 said it was the same, 4/25 said it was more difficult, and 14 marked the question as "Not Applicable/No Opinion."

As of November 17, 2011 there are 72 tablets in AASU ITS inventory (all iPads except one Samsung Galaxy Tab). The vast majority of these are in faculty hands and there are surely more as some faculty would have purchased tablets for their own use.

A student survey was conducted in four classes in Fall 2011. Prior to the Fall 2011 semester, the faculty teaching the courses in which students were surveyed used laptop computers to present class material (PowerPoint slides, web pages, audio/video) and generally used them in all their classes on regular basis. From the student survey results, summarized in Table 2, almost all students, 76/77, noticed that the instructor used a tablet instead of a laptop. Students generally thought the presented class material using a tablet was the same or better, 69/76, as using a laptop. The largest percentage that thought the material presented using a tablet was worse was in the BIOL 4100, which is a lab class.

Course	Question 1	Question 2	Question 3	Question 4
BIOL 3100 (39 students)	34 all 5 PS or PS/AV	39 yes 0 No	19 Same 17 Better 3 Worse	30 Yes 9 No
BIOL 4100 (11 students)	8 all 3 PS or PS/WP	10 yes 1 No	6 Same 1 Better 3 Worse 1 No answer	4Yes 6 No 1 No answer
ITEC 3600 (13 students)	1 all 12 PS	13 yes 0 No	12 Same 1 Better 0 Worse	3 Yes 10 No
ITEC 5001 (14 students)	6 all 7 PS or PS/WP 1 No answer	14 yes 0 No	9 Same 4 Better 1 Worse	7 Yes 7 No

Table 2, Summary of Fall 2011 Student Survey Results, Answers to Q1: PS is presenting slides, AV is playing audio/video, and WP is showing web pages

The student survey questions were:
1. What does your instructor primarily use a computer for during class? Presenting slides, Showing web pages, Playing audio/video, He/she uses it for presenting a wide variety of material (all of above)
2. Have you noticed that your instructor uses a tablet computer instead of a laptop computer during class? Yes or No
3. Do you think the class using the tablet computer is better/same/worse as if the instructor used a laptop computer? Better , Same , Worse
4. Do you believe your instructor is more technically savvy because they use a tablet in class? Yes or No

Student responses for content usage confirmed the instructor's responses from the faculty surveys. Student opinion was mixed on whether they viewed an instructor using a tablet as being more tech savvy.

The student survey results match what the authors expected from their previous work [30] and their experience and student comments from Spring 2011 and Summer 2011. Tablets are an effective device for presenting class material and are a cost effective alternative to a laptop or tablet computer.

CONCLUSIONS

Small-form tablet computers are both effective and convenient alternatives to pricier laptops and tablet PCs, especially in increasingly tough budget times. Based on our faculty survey and information from AASU's ITS department, many faculty have access to tablets and are using them in the classroom to present slides, play audio/video, show web pages, and draw/sketch. Tablets are especially effective for this type of material.

Based on reviews [14][21][23][31] and our experience, the iPad2 is the best tablet for presenting class material (and the best overall tablet). Its design/build quality is excellent, the user experience of iOS is excellent, the Apple App Store has a wide selection of apps, and a dock to VGA adapter (dock to HDMI is also available) is available making connecting to a projection system easy. The iPad2 now has screen mirroring and multi tasking so switching between apps is very seamless and one no longer needs to worry about which apps have display out. If one already extensively uses an Android smart phone, it makes sense to consider the Android tablets for classroom use. Faculty impressions of both the Galaxy Tab and the iPad2 once again pointed out the lightness and overall portability of the device, which made presenting material more convenient.

There are several good Android tablet alternatives to the iPad for use in presenting class material: Acer Iconia A500, ASUS Transformer TF 101, Lenovo Idea Pad, Samsung Galaxy Tab 10.1, and Toshiba Thrive. They either have a VGA adapter or a HDMI port that provides enough power for a passive HDMI to VGA adapter. One still needs a standard VGA cable and in some cases a micro or mini HDMI to HDMI adapter. Of these, the Samsung Galaxy Tab 10.1 has the best design/build quality and is closest in experience and look to the iPad. All of these tablets can be used with either a dock and keyboard or wireless keyboard if one wanted to do development of material on the tablet. The authors have done very little development on the tablet and predominantly develop the material on a laptop or PC and transfer it to the tablet for presentation/consumption.

The base software recommendations for iOS and Android tablets are essentially the same. For working with office documents and presenting PDFs, Quickoffice is a good choice. For displaying web content, the built in browsers (Safari on iOS) do a perfectly fine job. Sketching and annotation can be done on both tablets with AutoDesk's Sketchbook Pro software.

For projection systems that have HDMI in ports, there are several other tablet options that could be used to present class material. The only tablets we found that would not work are the Sony Tablet S, the Barnes and Noble Nook, and the Kindle Fire as they do not have an HDMI out port. The most convenient way to send material to a projection system with a tablet is wirelessly (such as with Apple AirPlay). Most modern televisions support this type of transfer but no classroom projection systems at AASU do.

REFERENCES

[1] Acer Inc, http://acer.us/ac/en/US/content/iconia-tab-a500, last visited December 7, 2011 12:24 pm

[2] Acer Inc., "Acer Sync", http://mobile.acer.com/en/acer-sync/, last visited December 2, 2011 4:15pm

[3] Apple Inc, http://www.apple.com/ipad/, last visited December 7, 2011 12:24 pm

[4] Apple Inc., "App Store Frequently Asked Questions (FAQ)", https://support.apple.com/kb/ht2001, last modified June 21, 2010, last visited November 28, 2011 9:45 am

[5] Apple Inc., "Apple Special Event", http://events.apple.com.edgesuite.net/11piuhbvdlbkvoih10/event/index.html, October 4, 2011, last visited November 28, 2011 10:42 am

[6] Apple Inc, "iCloud", http://www.icloud.com, last visited December 2, 2011, 4:11pm

[7] Apple Inc, iTunes Preview, Dropbox, http://itunes.apple.com/us/app/dropbox/id327630330?mt=8, last visited December 7, 2011 11:20 am

[8] Apple Inc, iTunes Preview, Evernote, http://itunes.apple.com/ca/app/evernote/id281796108?mt=8, last visited December 7, 2011 11:19 am

[9] Apple Inc, iTunes Preview, GoodReader for iPad, http://itunes.apple.com/us/app/goodreader-for-ipad/id363448914?mt=8, last visited December 7, 2011 11:22 am

[10] Apple Inc, iTunes Preview, Keynote, http://itunes.apple.com/us/app/keynote/id361285480?mt=8&ls=1, last visited December 7, 2011 11:23 am

[11] Apple Inc, iTunes Preview, Toodledo – To Do List, http://itunes.apple.com/us/app/toodledo-to-do-list/id292755387?mt=8, last visited December 7, 2011 11:20 am

[12] ASUSTeK Computer Inc, "Eee Pad Transformer TF101", http://www.asus.com/Eee/Eee_Pad/Eee_Pad_Transformer_TF101/, last visited December 7, 2011 12:22 pm

[13] Autodesk, Inc., "SketchBook Pro", https://market.android.com/details?id=com.adsk.sketchbookhd&hl=en, last visited November 28, 2011 9:51 am

[14] Bell, Donald, "Best 5 tablets", http://reviews.cnet.com/best-tablets/?tag=reviewCategories;revCatWrap, updated November 22, 2011, CNET, last visited November 30, 2011 2:00 pm

[15] Bell, Donald, "Best Android tablets", http://reviews.cnet.com/best-tablets/best-5-android-tablets, updated November 22, 2011, CNET, last visited November 30, 2011 1:50 pm

[16] Connors, Devin, "Tested: The Five Best Android 3.1 Tablets", http://www.tomsguide.com/us/Honeycomb-Android-Tablets-Tested,review-1691.html, tom's hardware, September 16, 2011, last visited November 30, 2011 2:05 pm

[17] Donnell, Wendy, "The Best Android Tablets", http://www.pcmag.com/slideshow/story/266915/the-best-android-tablets#fbid=q7kjzpZfP9_, PCMAG.COM, July 16, 2011, last visited November 30, 2011 2:00pm

[18] Gabel, Marty, "The best tablet alternatives to the iPad 2", http://www.androidapps.com/tech/articles/10206-the-best-tablet-alternatives-to-the-ipad-2, appolicious, November 21, 2011, last visited November 30, 2011 4:40 pm

[19] Google, "Android Market Developer Program Policies", http://www.android.com/us/developer-content-policy.html, last visited, November 28, 2011, 9:32 am

[20] Hewlett-Packard Development Company, http://www.shopping.hp.com/product/computer/categories/cables/1/accessories/NP031AA%2523ABA, Last visited 11/3/2011 1:30 pm

[21] Hiner, Jason, "The 10 best tablets of 2011 [UPDATED]", http://www.techrepublic.com/blog/hiner/the-10-best-tablets-of-2011-updated/9066?tag=siu-container;photo-frame, November 8, 2011, last visited December 2, 2011 9:25am

[22] iaamart.com, http://www.iaamart.com/pc-dvd-hdmi-to-vga-and-audio-hdtv-video-converter-adapter-1080p-oc-087.html, last visited 11/29/2011 12:45 pm

[23] Ku, Andrew, "Meet iPad2: Thinner And Lighter", http://www.tomshardware.com/reviews/apple-ipad-2,2932-2.html, tom's hardware, June 16, 2011, last visited November 30, 2011 2:10 pm

[24] LaCouvee, Darcy, "The Best Android tablets of 2011 Compared", http://www.androidauthority.com/the-best-android-tablets-of-2011-compared-spreadsheets-11841/, April 5, 2011, last visited November 30, 2011 2:15 pm

[25] Lenovo Inc, http://www.lenovo.com/products/us/tablet/?menu-id=learn&ref-id=learn, last visited December 7, 2011 12:21 pm

[26] Lenovo Inc, "Synchronization Software", http://support.lenovo.com/en_US/downloads/detail.page?DocID=DS019284, last updated November 13, 2011, last visited December 2, 2011 4:15pm

[27] Motorola Inc, "Connecting Mini-HDMI to a VGA Projector", https://supportforums.motorola.com/thread/45677?start=0&tstart=0, original post February 24, 2011, last visited November 29, 2011 12:10 pm

[28] Motorola Mobility Inc, http://www.motorola.com/Consumers/US-EN/Consumer-Product-and-Services/Tablets/ci.MOTOROLA-XOOM-with-WiFi-US-EN.alt#anchor, last visited December 7, 2011 12:20 pm

[29] Motorola Mobility Inc, "How do I transfer files to/from my computer?", https://motorola-global-portal.custhelp.com/app/answers/detail/a_id/61296/, last visited, December 2, 2011 4:28pm

[30] Murphy, Thomas and Williams, Christopher, "The iPad as a Class Presentation Platform", Proceedings of the 2011 ASEE Southeastern Section Conference, ASEE, Charleston, SC, April 2011

[31] Perenson, Melissa, "The Best Tablet for You", http://www.pcworld.com/article/244096/the_best_tablet_for_you.html, November 28, 2011, last visited December 2, 2011 9:25am

[32] Quickoffice, http://www.Quickoffice.com/, last visited November 28, 2011, 9:47 am

[33] research2guidance, "Android Market Insights October 2011", http://www.research2guidance.com/shop/index.php/android-market-insights-october-2011, November 16, 2011, last visited November 28, 2011 9:18 am

[34] Rivington, James, "13 best Android tablets in the world Buying Guide: Our updated list of the best Android tablets in 2011, http://www.techradar.com/news/mobile-computing/tablets/13-best-android-tablets-in-the-world-905504, techradar.com, November 11, 2011, last visited November 30, 2011 1:55 pm

[35] Samsung, http://www.samsung.com/us/mobile/galaxy-tab, last visited December 7, 2011 12:20 pm

[36] Samsung, "Kies 2.0", http://www.samsung.com/us/kies/, last visited, November 28, 2011 11:00am

[37] Sony Electronics Inc, http://store.sony.com/webapp/wcs/stores/servlet/ProductDisplay?catalogId=10551&storeId=10151&langId=-1&productId=8198552921666369301, last visited December 7, 2011 12:18 pm

[38] Sony Electronics Inc., "How to backup or transfer files between the tablet and a computer." http://www.kb.sony.com/selfservice/microsites/search.do?cmd=displayKC&externalId=C1023783&fes=true, last modified November 11, 2011, last visited, December 2, 2011 4:31pm

[39] Strohmeyer, Robert, "Office Suites for iPad: The Roundup", http://www.pcworld.com/businesscenter/article/236371/office_suites_for_ipad_the_roundup.html, PCWorld, July 24, 2011 9:00 pm, Last visited 11/29/2011 12:00 pm

[40] Strohmeyer, Robert, "The Best Office Alternatives for Android Tablets", http://www.pcworld.com/businesscenter/article/235744/the_best_office_alternatives_for_android_tablets.html, PCWorld, July 24, 2011 9:00 pm, Last visited 11/29/2011 12:00 pm

[41] Toshiba America Information Systems, http://us.toshiba.com/tablets/thrive/10-inch/, last visited December 7, 2011 12:16 pm

Thomas Murphy

Thomas Murphy is an Associate Professor of Engineering Studies at Armstrong Atlantic State University. He received his PhD and M.E. in Electrical and Computer Engineering from the University of Florida and his B.S. in Electrical Engineering from the University of Notre Dame. His research interests are primarily in the areas of digital systems, control systems, signal processing, engineering education, and computer applications in these areas. Dr. Murphy is a member of several professional societies including The American Society for Engineering Education (ASEE) and The Institute of Electrical and Electronics Engineers (IEEE).

Christopher Williams

Christopher Williams is an Instructional Technology Support Specialist at Armstrong Atlantic State University in Savannah, GA. He received his B.S. and M.S. in Computer Science from Armstrong Atlantic State University. His research interests are primarily in the areas of mobile computing, usability, and education. Mr. Williams is a member of the Association for Computing Machinery (ACM).

Frank Katz

Frank Katz is an Assistant Professor of Information Technology at Armstrong Atlantic State University. He received his MS in Management from Georgia State University and his BA in Computer and Information Science from the University of Florida. His research interests are primarily in the areas of computer and information security and systems analysis methods. Mr. Katz is a member of the Association for Computing Machinery (ACM).