ENGAGING STUDENTS WITH THEIR iPAD AND iPHONE APPLICATIONS

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Introduction

To use calculators, or not to use calculators? The preceding question has been commonly debated in mathematics and education for decades. Today, the question transformed into, "to use, or not to use iPads and iPhones?" With the burst of Apple technology sales, specifically with iPads and iPhones as a multi-billion industry (Michaels, 2013), educators can expect students to be consumers of these popular products. Do educators accept the student owned technology in their classroom, or reject it?

As a collegiate faculty member and former high school teacher who owns multiple mobile technologies (laptops, iPads, iPhones, netbooks, etc.), I not only support Apple technologies but also encourage students to use their mobile devices in and out of my classroom. During the 1990's, technology proficiencies for teachers and students were developed by curriculum specialists, which were a driving force towards the one-to-one laptop initiative in U.S. education (NCTM, 2000; Center for Digital Education, 2004). However, instead of schools and universities seeking large quantities of funding to provide fast-changing technology to every student, educators can utilize students' personal devices in every classroom; shifting startup costs to the parents and students who are the consumers of the most popular iPad and iPhone products. Recent research found that students expect their instructors to engage them in the learning process through the use of technology (Dahlstrom, Dziuban, & Walker, 2012).

For the digital immigrant instructor, those educators who have not been interacting with technology since childhood, can find student use of mobile technologies to be cumbersome and overwhelming in their classrooms. Common questions from the digital immigrant professors tend to be directed towards classroom management and time-on-task, as students can easily be engaging in non-academic related activities with mobile technologies readily accessible at their fingertips. This concern can be reduced when educators are well trained in the functions of technology with academic connections to content, and technological pedagogy, so students may be engaged through delivering content with mobile devices. This paper addresses a few key components for initial classroom set up for projecting iPads and iPhones, as well as popular applications and mathematics based activities.

Replacing Expensive Smart Boards: Displaying the iPad/iPhone

No longer is it necessary to spend hundreds, if not thousands of dollars towards purchasing interactive SmartBoards. Projection capabilitys now exist with second

through fourth generation iPads, and iPhone4 and 5 models. Two main ways to project these devices are by cable connections or wirelessly.

Display Option 1: Cable connections

Tethering a cable to your mobile device might not seem ideal, however, I found it to be a simple and fast approach to display either my iPad or iPhone to a HD television or classroom projector. Two types items are needed: 1) VGA or HDMI cable, and 2) appropriate Apple connector, often called a Dongle.

To display your iPad or iPhone through an HD television, use a HDMI cable and Apple connector. If you choose to display your mobile device through a projector, check to see if the projector has a HDMI or VGA port.

The iPad2, iPad third generation, and iPhone4s require a 30-pin to HDMI or VGA connector cable; whereas the iPad fourth generation and iPhone5 need a Lightening to HDMI or VGA connector cable. Both types of connector cables may be found at the Apple store, BestBuy, or similar establishments for $30 to $50.

Once the iPad or iPhone is connected to the HD television or projector with the cables mentioned above, select the appropriate source (HDMI or VGA) on the display device typically found under the Menu or Settings.

Display Option 2: Wireless connectivity through Apple TV or applications

It is possible to connect an iPad or iPhone wirelessly to a classroom display. Apple TV is known as "the little black box," and can be purchased for $99.99. An HDMI cable connects the Apple TV to any classroom projector; pending the projector has a HDMI port. If not, a VGA to HDMI Adaptor is necessary to join any VGA and HDMI cables. Both the iPad/iPhone and Apple TV will need to be connected to the same wireless network for Airplay mirroring on the devices to occur.

A more cost effective approach is to use Reflector, a program created by Squirrel LLC, which may be downloaded to either a PC or Mac computer. When the computer and iPad/iPhone devices are connected to the same wireless network, a simple touch of the mirroring button will display the mobile device onto the computer through a feature called Airplay. Reflector offers a free 10-minute trial, which can be reused; or a single user license may be purchased for $12.99 or a 5 seat multi-license application for $54.99 is available for download on both Mac and PC.

The key for using either wireless option is the mobile device and the computer need to be connected to the same Wi-Fi network directly functioning through a router. If the Wi-Fi requires a web-based authentication, an Apple TV will cannot be used for mirroring as its menu does not include a web browser which is needed to authenticate the Internet connection. Similarly, the Reflector program also will not work with web-based authentication Wi-Fi. I discovered this issue while presenting at the International Conference on Technology in Collegiate Mathematics in Boston, Massachusetts during

March 2013. The solution required the use of a mobile hot-spot or a router connected to the ballroom Ethernet.

Although the descriptions above may seem overwhelming to the non-tech-savvy pupil, experience and practice makes perfect. There are a number of technology representatives just a phone call away, or demonstration videos on YouTube, which will model the process for displaying your iPad or iPhone device in a meeting or classroom.

iPads as SmartBoards and Annotation Applications

Combining the ability to project an iPad/iPhone with annotative applications, allows teachers and students to create a mobile SmartBoard. Notability and iAnnotate PDF applications share similar annotative functionalities. Both Apps allow the user to import and export PDF documents and photos to DropBox, as well as open or send PDF documents by email. Voice files can be included to any annotation for a more personal form of communication. They also include a number of additional features as described in the App Store.

Notability can be purchased in the App Store for $4.99, and it has been on sale for $1.99 during January through March of 2013; iAnnotate PDF has been listed for $9.99. Since Notability is much cheaper than iAnnotate PDF, my students and I have chosen to use this application.

I have created guided notes for my classes over many years. Saved as PDF's and stored in Dropbox, I am able to import the guided notes and then create a new annotated note through Notability. In class, vocabulary, definitions, and practice examples are explored among students. Figures 1 and 2 shows screen captures of notes annotated in two of my *Mathematics for Teachers II* sections during the Spring 2013 semester. Students used the Geoboard application to create various trapezoids, took a screen capture, inserted their picture into their guided notes, and annotated on top of their Geoboard picture (see figure 1). Later in class, students cut coffee filters and arranged them in a fashion to represent a parallelogram to develop the area formula for any circle. Figure 2 shows photos of their coffee filters taken with the iPad and inserted into their Notability notes. Annotations directly on top of the pictures of the coffee filter allow students to label parts of the circle.

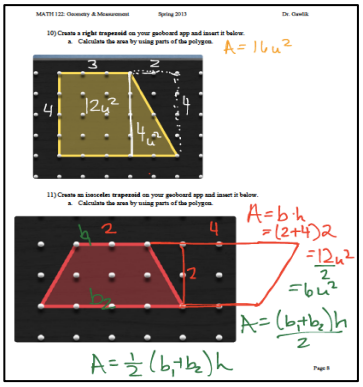

Figure 1: Notability Screen Capture

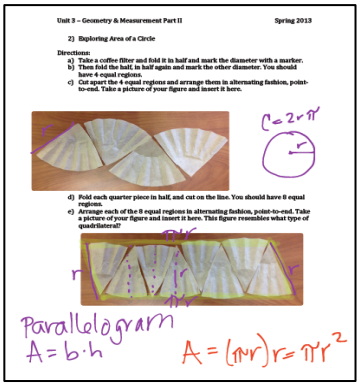

Figure 2: Notability Screen Capture

Students are required to facilitate problems in my classes. Instead of using a SmartBoard or document camera for displaying course materials, students annotate their work on my iPad, which is mirrored through the Apple TV onto the projector, as they explain their problem solving process. To ensure participation from all students, we use a method I call, "the passing of the stylus." With practice examples embedded in the guided course notes running through Notability, a student is called upon to complete the first example problem. After they have discussed and successfully answered the problem, the student passes the stylus onto another classmate who then completes the next problem on the iPad. Each student using the iPad, has the opportunity to choose the color of "pen" to be displayed while solving their problem. This mimics the former choice of selecting the colored Expo marker, one might use on a whiteboard. As simple as a color choice may be, students take pride and ownership in their work, which is saved electronically to our Blackboard or MyMathLab classroom management portal for future viewing and discussion by the entire class.

Random Number Generator Application

A random number generator application, such as Random NumGenerator (see figure 3 for App Store icon), is another great way to select students at random using a class roster of numbered student names. Simply enter the number of students enrolled in your class and then select the generate button (see figure 4). Options allow the user to generate multiple numbers at once, repeat or not repeat numbers, and clear, copy or email a data set.

Figure 3: Random NumGenerator by Bice Applications found in the App Store.

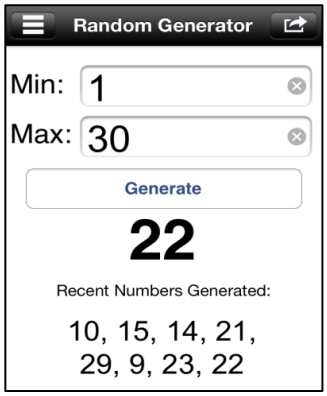

Figure 4: Random NumGenerator screen capture

Mathematics Application Uses

Safari, Maps, and the Calculator are preinstalled applications on all iPad/iPhone devices and have been the three most popular applications I use for teachable-moments.

Safari Application

My teaching philosophy and methods include not directly answering student questions, but guiding them in the right direction through asking questions. These methods benefit from allowing students to conduct Google searches within Safari on the spot. Many of the questions that arise in the mathematics or mathematics education courses I teach, tend to be basic vocabulary questions. Although it may be faster to answer the question directly, students retain information longer and are able to recall it when they do the research to find the answer and engage in discourse about the topic (Windschitl, 2002). Nevertheless, I will provide key words to help students conduct their Internet search. As a class we will share what information were found through our search, discuss any discrepancies, and engage in discussion and come to a consensus towards determining the correct solution.

Calculator Application

The basic calculator application is handy for simple four-function and exponential calculations. Though, the user needs to know to hold either iPad or iPhone device horizontally to turn the calculator into Scientific mode. When I model this feature for the first time in class, I also display the classroom computer and the built-in calculator, which is under the View menu. (Scientific needs to be selected in order to compute exponential or radical calculations.)

Numerous free and paid calculator applications also exist in the in App Store. MyScript Calculator is a hit among my undergraduate students (see figure 5). In a number of mathematics courses I teach, we calculate permutations and combinations both using the formula and the functions in a TI-83/84 calculator. Now, my students are applying the formulas for either concept using MyScript Calculator since it allows the user to handwrite the problem before the app turns it into text. More importantly, MyScript interprets and calculates factorials.

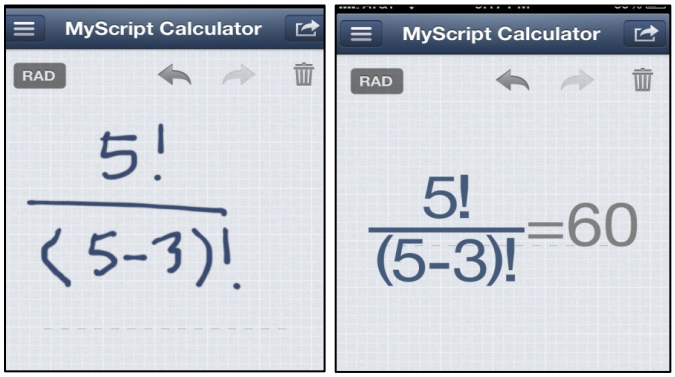

Figure 5: Screen captures of MyScript Calculator

Maps Application

Other teachable-moments benefit from the app, Maps. I have found many mathematics application problems that require background knowledge in geography. A simple example, might include having students express set S using the roster method, where S = {x | x is a U.S. state whose name begins with the letter A}. In order to answer the problem, students must know the states that begin with the letter A. Students can open Maps and use it as an atlas for a quick reference to successfully answer the problem and feel confident with their work.

Consumer mathematics and financial management are topics often covered in Quantitative Literacy, College Algebra, and Mathematics for Liberal Arts courses. There are number of outstanding projects to assign where students experience budgeting issues. One project in particular that I tend to assign in small groups is a vacation planner project. In short, students have to determine what is most cost effective, to fly or drive from Dallas, Texas, to Cancun, Mexico, on a 7-10 day summer vacation. Students are given specific criteria to research along with general parameters to allow creative choice within their project. With these guidelines, students determine an appropriate budget for a full-time college student, and report their findings through a multimedia presentation. To introduce the project, I ask the class to use the Maps application, to identify the two locations and obtain driving route options (see figure 6).

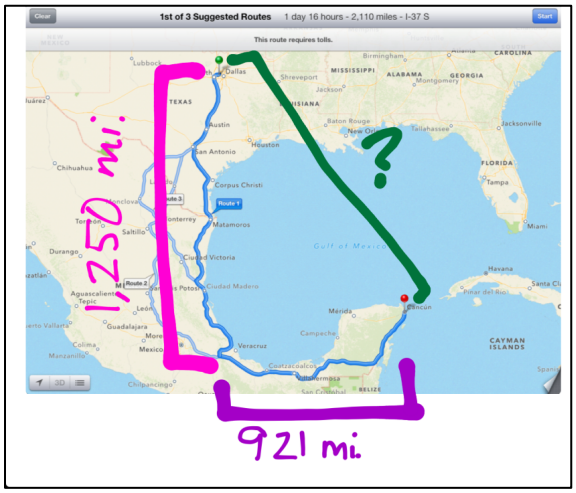

Figure 6: Maps application with annotations using Notability.

Through facilitated questioning, students come to discover that we can use Pythagorean Theorem to estimate the mileage of a direct flight from Dallas, Texas, to Cancun, Mexico. Great discussion includes over and under estimates about the mileage of direct flight, along with using formulas to determine if our triangle is acute, obtuse, or right, and clearly explaining why. Next, students go to American Airlines website (www.aa.com), and search for a direct flight to obtain the actual mileage. As you can see in figure 7, the actual mileage is 1,028 miles, which will be less than what students find using Pythagorean Theorem with the miles used from figure 6 for each leg of the triangle. This information leads to further discussion about classifying our triangle.

Departing

Select	Carrier	Flight #	Departing City	Departing Date & Time	Arriving City	Arriving Date & Time	Aircraft Type	Cabin	Flight Miles	Meals	Travel Time
	AMERICAN AIRLINES	1703	DFW Dallas/ Fort Worth	Mar 15, 2013 01:40 PM	CUN Cancun	Mar 15, 2013 03:15 PM	757	Economy View Seats	1028	Food For Purchase	2 hr 35 min

Figure 7: American Airlines website screen capture.

Finally, students are given the project requirements and in small groups they are given about a week to complete the project and create a multimedia report of their analysis.

Presentation Applications: Engaging Students through Interactive Presentations and Assessments

PowerPoint presentations became popular multimedia tools used among educators since Microsoft launched it in 1990 (Best STL, 2013). But, how engaging is a multimedia presentation? Animation, music, video, and pictures are elements that may visually attract students in a classroom, but nothing about watching and listening to a presentation is physically engaging unless the students are asked to do something with the information presented.

Prezi Application

A cloud based presentation tool, Prezi is available as an application on both the iPad and iPhone, as well as the Internet at www.prezi.com. With a free Prezi account, educators and their students can make 3D animated presentations to be disseminated on any of the aforementioned devices. I found editing features to be more significant through the website, but it was possible to create a basic presentation through the mobile device application. A Prezi presentation does not use slides as found in PowerPoint, instead frames are created and connected with animation features to navigate through the presentation. More impressively, when a Prezi is launched through the mobile application, the zoom in and out features occur by the touch of two fingertips pinching or pushing apart, which are unique features of this web based presentation. Figure 8 is a screen capture of the opening page of the Prezi presentation created for my session at ICTCM 2013. As seen in the picture, a number of red circles seem to disappear among the clouds. However, when the Prezi is in presentation mode, each circle becomes enlarged to display the content to the audience, all with a touch of a screen on the iPad or iPhone, or a press of a button on a computer. The animation features transitioning from each red content circle, allows the audience to appear as they are soaring through the clouds and across the presentation.

Figure 8: Prezi opening screen of presentation.

Nearpod Application

Nearpod is just one solution to enhance multimedia presentations by placing the presentation directly in student's hands, and not on a projected screen. This application allows teachers to share content with students and control the activity through the Nearpod app. Students may be asked to complete a quiz, draw diagrams or write responses, participate in real-time polls and Q&A sessions. Results from student responses can be shared anonymously among the mobile devices, as well as exported as Excel documents via email, for educators to measure student results on an individual and aggregate basis (Nearpod, 2012).

Below includes screen captures of a multiple-choice question from a quiz among slides of a Nearpod presentation. This allows educators to assess students over course content while allowing a self-paced or real-time assessment, based on the settings of the assessment tool. Quizzes, polls, Q&As, and other multimedia interactive capabilities can be imbedded within the presentation, getting away from a traditional approach of lecture then quiz. Figure 9 is an example of one multiple-choice problem with four choices, within a six-question quiz. Figure 10 depicts results as shared from the instructor to the individual student, which they then have the ability to review their answers alongside with the correct results. With immediate feedback provided to each student in class, questions and misconceptions can be addressed without hesitation, while students are engaged through direct participation of the built-in response system.

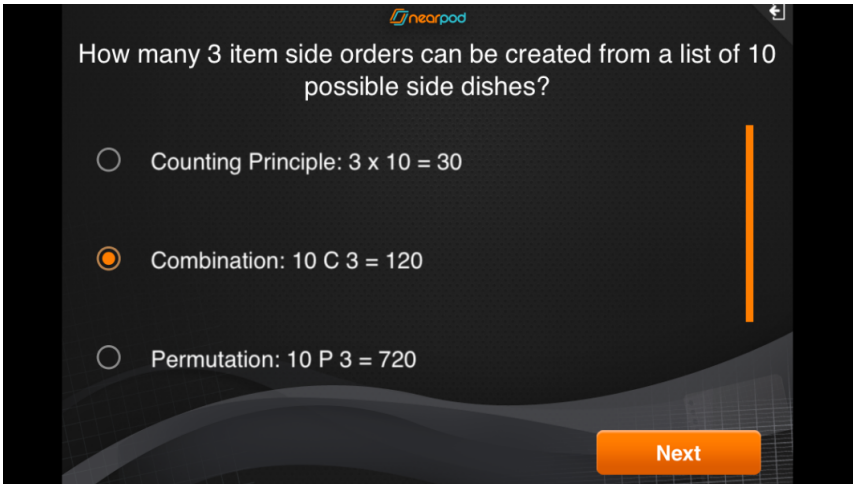

Figure 9: Nearpod Multiple Choice Quiz Example

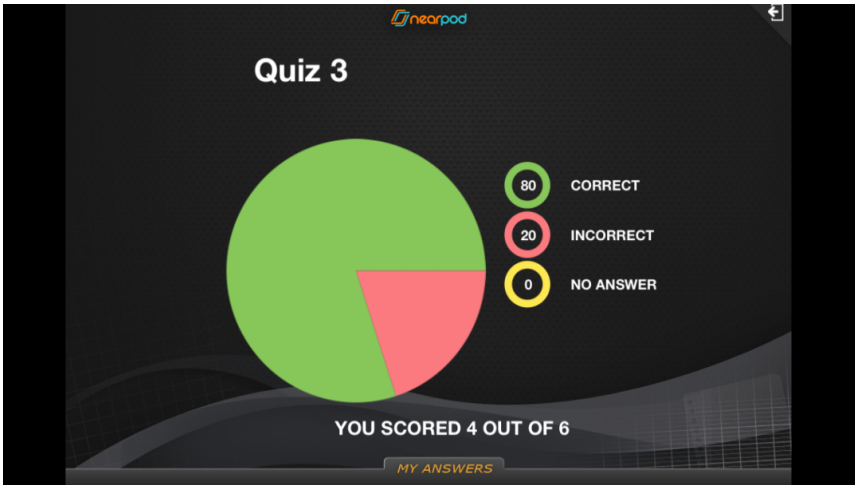

Figure 10: Nearpod Individual Results Shared with Student

Conclusion

The present accessible mobile devices such as iPads and iPhones influence adoption of technologies for teaching and learning. This paper described ways to convert an iPad into a powerful SmartBoard, how to utilize built-in applications for teachable moments, annotation applications for course notes, along with a presentation application that engages students through interactive response features. iPads and other mobile technologies are compelling resources to be embraced by educators and students and enhance learning experiences for all.

References

Best STL. (2013). *The History of Microsoft Office*. Retrieved from http://www.microsofttraining.net/sharing/1-history-of-microsoft-office.html

Center for Digital Education. (2004). *One-to-one laptop initiatives: Providing tools for 21st century learners*. A Center for Digital Education K-12 Strategy Paper. e.Replublic, Inc.: Folsom, CA. Retrieved from http://i.i.com.com/cnwk.1d/html/itp/K12WhitePaperHiResFinal05.pdf

Dahlstrom, E., Dziuban, C., & Walker, J.D. (2012). *ECAR study of undergraduate students and information technology, 2012 (Research Report)*. Louisville, CO: EDUCAUSE Center for Applied Research

Michaels, P. (2013, January 23). iPhone, iPad sales up, macs fall as Apple sees record sales. *Macworld*. Retrieved from http://www.macworld.com/article/2026112/iphone-ipad-sales-up-macs-fall-as-apple-sees-record-sales.html

Nearpod. (2012). *Nearpod: How it works*. Retrieved from www.nearpod.com

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and Standards for Teaching Mathematics*. NCTM: Reston, VA.

Prezi Inc. (2013). Retrieved from www.prezi.com

Windschitl, M. (2002). Framing constructivism in practice as the negotiation of dilemmas: An analysis of the conceptual, pedagogical, cultural, and political challenges facing teachers. *Review of Educational Research*, 72, 2, 131-175.