

Report on Sabbatical Leave – Fall 2016

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Introduction

Since being hired at El Camino College, I have learned to incorporate technology in my own classroom to a much larger degree than I used at other institutions. We have more technological tools available both in the classroom and in the students' backpacks. Students come equipped to learn through the technology medium and many find the classroom much more dynamic when technology is incorporated.

Traditionally, technological advancements in the classroom have been restricted to computational aids like the graphing calculator or computer algebra systems. Tablets provide a unique outlet in terms of integrating the entire student experience in the classroom: computing, text referencing, note taking and the ease of sharing information and communicating between classmates and the instructor. In this paper, I seek to share my research on teaching a college mathematics course using a tablet.

Initially, my plan was to develop a series of instructions on how to effectively use tablets, such as the iPad, together with various available apps in the classroom for a variety of concepts in the mathematics curriculum at El Camino College. However, once I began my investigation, my plan morphed. In this report, I will discuss the results of the survey I conducted, I will provide a table regarding the applications I researched, and I will tell you how this sabbatical will affect the way I plan on teaching in the future.

Investigation of applications

Initially, I had planned on looking at applications for tablets and determining which ones could be used as demos or group work in the classroom. I limited my search of applications to ones that were recommended by instructors or in educational websites.

Here are my initial findings:

Algebra Apps:

Application	Cost	Comments
Algebra Champ	Free	Although this is recommended to be used in the classroom, its use is very limited. It can be used as a quick practice for solving linear equations only. Students can compete in groups of 4 or less. I am unlikely to use this application.
Easel Algebra I Lite	Free	This program has nice explanations for the following topics: <ul style="list-style-type: none">• Numbers and properties• Expressions• More expressions• Slopes and lines• More lines• Foil and factoring If the program did not have so many glitches it would be good to use as a mini lecture for a flipped classroom or for reinforcement. However, it freezes up constantly and needs to be updated before it can be valuable.
Special Binomial Products	Free	This is very complete for this minor topic. I might use it as a supplemental since I do not teach this topic.
Exponents:	Free	This program has some nice explanations and graphics. It

<p>HUP {∞} Exponents</p>		<p>also has links to simple youtube videos for each topic. It has very nice examples and could be used in explanations regarding the following topics:</p> <ul style="list-style-type: none"> • Vocabulary associated with exponents • Forms: Exponential, expanded and standard form • Base 10 and base 2 • Power of 1 • Power of 0 <p>It covers the basics for the following topics</p> <ul style="list-style-type: none"> • Negative powers • Adding and subtracting powers such as $3^4 + 2^4$ versus $(3 + 2)^4$ • Multiplying powers (the product rule) • Dividing powers • Powers raised to powers • Power of a product or quotient <p>This application could be used in conjunction with a worksheet to introduce power rules. It is limited to exponents in arithmetic and has no variables. It does provide the rules with a limited example of why the rules work. It also provides examples to each topic but has a couple errors which would need to be fixed before I would consider using it.</p>
<p>HMH FUSE:</p>	<p>\$19.99</p>	<p>This program is very complete. It could be used in place of a</p>

Algebra 1	<p>textbook. It includes video, assessment, interactive math tools, and resources. The program includes the following topics:</p> <ul style="list-style-type: none">• Foundations of Algebra• Equations• Inequalities• Functions• Linear functions• Systems of equations and inequalities• Exponents and polynomials• Quadratic functions and equations• Data analysis and probability• Exponential and Radical Functions• Rational functions and equations• Power functions• Piecewise and step functions• Solving nonlinear equations by graphing• Patterns and recursion• Linear and nonlinear rates of change• Reasoning and counterexamples <p>Although I expect to use some of the videos in my Elementary Algebra class, I am more likely to make use of it if I were to use it as the textbook in the class.</p>
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Trigonometry Apps:

Application	Cost	Comments
Clinometer Bubble Level – Angle Measuring Tool	Free	This is a simple level which will also measure angles. It can be used in the activity included in this packet. I had originally anticipated that I would have a collection of demos for classroom use as well as activities for group work. This is the type of activity I expected to have a whole collection of when I first requested this sabbatical. However, it is the only activity which I completed as my research led me in a different direction.
Easy Measure	Free	With this app, students can estimate the distance to any object using the camera lens of their tablet. The most interesting part of this app is in understanding how the app uses the trigonometry of right angles to find the distance. If I were to use this app, I would have students measure the distance to objects in the classroom, discuss the mathematics behind the app, and then determine the error and discuss what is responsible for the error. I will consider using this app next time I teach trig. If I do choose to use it, I will write an activity to go with it.
Easy Measure Upgrade	\$3.99	With this app, not only is the distance to the object calculated, but the height and width of the object is also calculated. If I were to use this app, I would first use the Easy Measure app described above and then we would discuss how the device calculated the height and the width and determine some real life applications for these measures.

General apps:

NearPod	Free	Nearpod helps to engage students with interactive lessons by
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		<p>combining slides, multimedia content (like virtual field trips), and assessment tools. Teachers can collect and share answers submitted by students. With a nearpod live lesson, the teacher can see when the students sign in. The students tablet shows the same screen as the teachers. The teacher controls the pace. This is particularly adaptable for an instructor whose strength lies in lecturing. Students can take multiple choice quizzes and the instructor can instantly share the results with each individual student. I can see giving students gateways on using this platform. I would have the opportunity to grade these quizzes as they were completed and I could give the students the opportunity to make corrections almost immediately. There is also a DRAW IT slide. Using this is like placing an interactive whiteboard in your students' hands. Nearpod combines presentation, collaboration, and real-time assessment tools into one integrated solution. The instructor can take attendance and monitor students' active participation. I am impressed with this program and anticipate that I will use it in the near future. It is exceptional that this program is free as, if one took the time, some excellent lessons could be written using this program for a truly impressive delivery. However, they would take a lot of time. The way this company is able to offer their program for free is that they have educators write lessons for them and then they sell the lessons, so there could be some cost involved depending on how many lessons and instructor chose to buy.</p>
AirSketch	Free, \$9.99, \$19.99	AirSketch allows PDF documents or images to be annotated live and projected to the entire class. It can be used as an interactive whiteboard. Images can be projected to the computer and, thus,

		the overhead. Spending extra allows color coding, adjustable pen widths, virtual laser pointer and more. I will definitely be using this Spring 2017.
Blackboard	Free	Blackboard allows the instructor to upload documents in any format, post announcements, upload media, course roster, and possibly students' grades. The students can save these files on their iPads, and view them even if there is no internet. There are a variety of blackboard apps. I discovered six all of which are free.
QuickOffice or QuickOffice Pro	Free to \$14.99	QuickOffice allows the students to edit any word file, excel sheet, or power point presentations. These files can be provided remotely by the instructor through Blackboard.
Dropbox	Free	Dropbox allows the student to put all their files, documents, photos in multiple remote computers simultaneously after class hours for home editing. Students could use QuickOffice to complete worksheets and then upload them to dropbox to turn them in.
iMovie for Apple	Free	Though there are similar apps to iMovie for other tablets, iMovie was the only app I investigated. This application allows the user to easily create movies. It is fast and I think it would be fun for the students. It is easy to save and to share the videos.

Probable implementation of sabbatical findings

I anticipate that I will implement iPad applications to allow the student to:

1. Use the course text as an electronic reference via publisher sites such as MyMathLab.
2. Take course notes via Airsketch.
3. Exchange information in and out of the classroom via Dropbox.
4. Organize their learning.

Next time I teach Math 170 (trigonometry) or 190 (calculus I), I hope to give students an end of the semester project that prompts them to teach a calculus lesson. The students can film their video using their iPads and edit them through iMovie. I have had my Math 170 and 190 students

give live presentations in the past. I like this idea because I think the students will have more fun with the project and there will be a record of their presentation. An instructor in Massachusetts did this with her class and one of the videos that was done can be found at <http://youtu.be/mGd0bp7vOII>. The first time I implement this concept, I intend to give the students a choice between a live presentation and a video.

In the Spring of 2017, I intend to use the iPads in a minimal way just to make sure the technology that supports them is in place. The math department purchased iPads a few years ago which have been very underused. One reason for this is the fact that the manner in which we were using the iPads required wireless internet access and we discovered early on that the available technology for internet access was limited so only a limited number of students seemed to be able to get onto the wireless at a time. In preparation for this, I spent a couple days resetting and updating the iPads. At this point in the semester, I have taken the iPads into the classroom twice. Both times, the experiment was successful. The first time, the students (34) were all able to sign into the iPads and onto the internet. They were able to access the publisher's online program, get registered and complete the first assignment. The second time, the students were able to access an activity through their own laptops or tablets or through the school owned iPads. In one of the groups, the students tried implementing annotation software successfully and completed part of the activity on their iPad. In the future, I expect to transfer this to the class computer and project it for the class. One group was not as successful in trying to implement the annotation software. I am not sure why this is but hope to experiment more during the second half of the semester to determine what the issues are so that I can provide better support in the future. The rest of the groups chose to use paper and pencil or the whiteboards to complete the activity.

One of the most impressive presentations I saw during my research was by Gwyn Whieldon from Hood College. The presentation can be found at https://prezi.com/w_6wndmucg-2/teaching-calculus-with-a-tablet/. I was in contact with Professor Whieldon and plan on adopting several of her ideas after I have experimented with classroom iPad use a little more and feel confident that I can solve issues that might arise in the classroom. In Professor Whieldon's presentation, she talks about considerations when constructing your course integrating tablets of some sort into the math classroom, along with suggested ideas for how/what to do, recommended apps for various tasks, etc. A lot of that information exists in a fairly easily searchable form on her website under the "Technology" page:

<http://cs.hood.edu/~whieldon/pages/technology.html>.