iPad Tablet – Love or Leave It
Engineering Students Perspective

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Abstract - Mobile tablet devices (iPads, Androids, Dell, Surface, etc.) are being used by students in universities and colleges around the country, the number is unclear and what they are using them for is also unclear. The purpose of this paper is to present the pros and cons of using mobile tablet devices as experienced by two engineering undergraduate students (one civil and one environmental) and a civil engineering faculty member. Each student is using an iPad 2; Priscilla Tengdin since January 2012 and Kayla Santello since September 2012. Prof. Henry has been using an iPad 1 for about two (2) years and an iPad mini since December 2012. The big questions are: how are mobile tablet devices being used and how useful are they for undergraduate students and the same questions for a faculty member. The hope is to provide engineering students and faculty with some personal reflections on the use of mobile tablet devices that they might use to decide whether a tablet device is right for them.

Keywords: mobile tablet devices, iPads, classroom presentations, tablet apps, tablet styli

Introduction

The iPad was introduced in 2010 and there is no question that it as a consumer device it has been very successful. As of October 23, 2012 over 100 million iPads have been sold.¹ There are over 275,000 iPad apps in the App Store and over 40 billion apps have been downloaded. If one visits the Apple App Store for the iPad one will find that there is a large selection of applications for note taking, engineering, mathematics, science and presentations. Most of the applications are $4.99 or less with the majority being less than $0.99. Many fully functional apps are free.

Even though the iPad was introduced a couple of years ago a big question is what role will the iPad or any mobile tablet device play in the world of higher education? There has been a lot of conversation about using the iPad in the K-12 world, but little in the higher education world. This paper will provide the reader with some information as to the pros and cons associated with using an iPad as experienced by two undergraduate engineering students and a civil engineering faculty member. One must remember that this is a limited sample of users, but hopefully it will provide an individual with some insights based upon hands-on uses.

Project Beginning

In September 2012 Prof. Henry asked two students, Priscilla (a civil engineer) and Kayla (an environmental engineer), if they would participate in writing a report expressing their thoughts about the value of using an iPad 2 (Figure 1)² from the perspective of an undergraduate engineering student. Prof. Henry has been using the original version of the iPad for a variety of activities including making presentations in the classroom and for formal presentations. Since obtaining an iPad in August 2010, Prof. Henry had noticed that more students were bringing an iPad into the classroom.

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While the percentage of students is small (1 to 4 students per class of 30 students), it is growing. Prof. Henry has been involved with computing in the higher education since the early 1980s. As computers became more commonplace and less expensive, there has been an expectation that an entering engineering student would have their own computer. More of these have been Windows based pcs or laptops. In the last couple of years the number of engineering students with Mac Book laptops as increased significantly at UNH. The following sections present the experiences of the two engineering students and the engineering faculty member using the iPad tablet devices.

Priscilla’s Experience

In September 2012, Prof Henry asked me if I would like to participate in a project that would try to identify the benefits and drawbacks of using an iPad 2 for an engineering student. During the spring 2012 semester I took CIE 525 – Statics for Civil Engineering with Prof. Henry. He noticed that I used an iPad in class. We would frequently share information about iPads as Prof. Henry was also using an iPad to present his class notes. Actually I started using my iPad around January 2012.

At the time he invited me to help out with this project, he asked if I knew another engineering student that would like to join the project team. Kayla Santello is a friend of mine and I suggested that she be asked to participate in the project because she did not have an iPad and therefore was unfamiliar with using one.

When I first started to use my iPad a year ago, I felt somewhat self-conscious and I felt like people definitely noticed that I had one. Even thought millions have been sold, not many students use them in the classroom. It was much more common to see students with a laptop, both Windows based and Apple based. Now, I really do not notice any reaction when I pull my iPad out. I don’t know if that is because I have gotten used to their reactions or if it is because people have gotten used to students owning tablets.

I initially got the idea of finding a touch-screen device when I saw two students using touch-screen laptops to take notes. Since I already had a MacBook, I decided to look into using an iPad. At first taking notes on my iPad seemed slower than using paper and pencil. However, I was able to begin taking notes during a January-Term online class, so that by the start of spring semester I was able to take notes much more quickly. I continued using my iPad to take notes in class. During the fall semester I noticed an increase in both tablet use and students’ interest in the thought of tablet use for note taking around campus.

Let me start out by mentioning some of the pros and cons of using the iPad over using pencil and paper. Using paper you can write or draw anything that you see on the board or anything that comes to mind. It is easy to go from writing notes to drawing charts and diagrams and then back to notes. The tools are the same for all activities, a pencil or pen. One does not need to worry about the paper notes getting lost in a hard drive crash nor do I need to worry about running out of battery while in class.

With my iPad I do not need to worry about having enough paper or running out of ink or losing my notebook. I find that once you get use to an iPad application (app) and it features writing notes by hand can actually take longer. I have gotten to the point where I can type more quickly than I can write and the quality is better. Taking notes with my iPad allows me to annotate my notes with different colors, highlights, images, quality graphs, etc. When you use paper notebooks, except for loose-leaf notebooks, which have their own set of problems, all your notes are sequential. When taking notes using the iPad I can store my notes in different folders and change my organization as I work through the semester.

The app I use to take all my notes is called Notability®. As with most iPad writing apps one can change pen colors and size easily, highlight text quickly and add common symbols to your notes. Notability also syncs to Dropbox so I can store files online. When using a stylus it has a magnifying tool so that what I write transfers onto the primary “paper” screen but just smaller. There are several missing features that would be really useful for an engineering student. Notability does not have a lot of science or math symbols that are common to many engineering, science and mathematical equations. A wrist guard feature would be great for the in-app keyboard. If you are not familiar with using a tablet device a wrist guard provides a portion of the iPad screen where you can rest your wrist without the iPad thinking that you are writing in that area. It would be similar to when one does a charcoal drawing and you do not want to smug an area that you have already completed.

Once I have completed taking notes in class I can back them up to the cloud (I usually use Dropbox). This means that I can access these notes from any computer, at any time from any place. If I am studying with a
fellow student I do not have to worry about carrying several notebooks around with me. Everything is stored either on the iPad or in the cloud. At the end of the semester I do not have worry about cleaning up my notebooks or having to decide which ones I keep and which ones I throw away. It is common to throw a lot of notebook paper away.

There are several ways to enter information onto your iPad. One is that you can use your fingers. This is the primary method used to interface with the iPad operating system. You tend to navigate through the different applications by tapping or dragging with your fingertips. Another method is by using your voice and some software will convert your voice into text. As one can imagine this method is not very practical in the classroom.

The iPad does have a built-in keyboard that allows you to type your notes. If you are proficient at typing this produces very clean notes that are easy to read later. Typing does have its drawbacks when one wants to enter charts or graphs or sketches that are often necessary for engineering related courses. Another method is to replicate taking notes with a pencil by using a stylus. Pencils are basically all the same. Not too many surprises when you use a pencil except for running out of lead. On the other hand there is a wide variety of styluses (or styli) on the market. Since these products are only a couple of years old, the technology is young and has a long way to go before it feels like a pen or a pencil, (Figure 2) [3]. The primary feel of a stylus is through its tip. Most tips are soft and wide in order to produce the appropriate conductivity. The advantage to a soft tip stylus is that it always writes on the app but can be less accurate than the hard tip stylus I have. Another drawback to the soft tip is that it wears out in just a couple months. The hard tip stylus is much more accurate, but one needs to keep it angled correctly or it will not write at all. The hard tip has yet to wear out for me.

![Figure 2](image)

I highly recommend using an iPad to take notes. My backpack is lighter, my notes are more organized, and I save hundreds of pages of paper. It would be useful to find an app that had more scientific symbols or was designed to be used by engineering students. There are also Bluetooth keyboards that could make note taking on an iPad quicker and easier.

**Kayla’s Experience**

I am a sophomore environmental engineering major at the University of New Hampshire. In late September 2012, Prof Henry asked me to participate in a project involving the use of an Apple iPad 2. The idea was to identify the pros and cons of using an iPad as an engineering student. One of the reasons Prof. Henry asked me is that I had not used an iPad before and I would be starting from ground zero. A civil engineering student, Priscilla Tendgrin, had agreed to participate in the project and she has been using an iPad 2 for about a year and was quite familiar with using it in class for taking notes.

I would like to relate my experiences with using the iPad from a couple of viewpoints. I am going to start with the social aspects. I have found people’s (meaning fellow students) reactions quite interesting and unexpected. There is some kind of stigma associated with owning an iPad. One might call it the “rich kid" effect. Honestly I am not from a rich family so I really notice the tone or inflection in someone’s voice when they would comment, “Oh you have an iPad”. Since I stood out, this made me feel special and unique. However these comments also made me feel slightly defensive and I felt compelled to explain or justify my jaunty possession.
But more often than not the feelings surrounding the iPad were positive. Many students were envious and wished that they had one. They would ask if they could play with it to see what it was like. Then there were students that would put their fingers on the screen in an attempt to try to mess up my notes. This was annoying, but manageable. The funny part of this is that I did not expect that there would be a social aspect to owning one. Certainly one does not get the same reaction to owning a laptop computer, especially in the engineering college. I expect that one day the iPad will be integrated into the social scene and be as hackneyed as the rest of the technology currently employed.

In the classroom there are many things I like about the iPad. Here is a list of some:

- The ability to bring up a homework sheet during recitation allowed me to be more focused and did not require me to patch my work together later. My notes were clearer and it definitely saved time.
- Makes it easier to multitask in class and be more productive. For example, I could be listening to lecture, taking notes, responding to an e-mail, checking grades online, finishing a PowerPoint, etc. all at the same time. This alleviated the stress I used to feel upon returning to my dorm computer at the end of the day when I would try to recall what I still needed to do. By getting things done in the moment instead of “worrying about them later” I am more efficient and relaxed.
- My notebook never runs out of paper and my “pen” never runs out of ink. My notes are better organized.
- My notes are all in one, easily accessible place. Never again will I be at the library kicking myself for forgetting to pack a notebook or grabbing the wrong notebook. The iPad is exactly what I have always needed, but never knew I wanted.

Outside the classroom I found using the iPad:

- Makes it easier to study for quizzes and exams
  - Ease to store pictures of the homework I handed in so that I can review them for quizzes. Often I will have a quiz before the homework for that topic is handed back.
  - Can download class notes, homework solutions and reference material easily to one location
- I can write in bed without worrying that the pen will stop writing
- The class notes and syllabus is readily available without worrying about Internet or WiFi availability
- I like the option to make text shortcuts. In Settings > General > Keyboard > Shortcuts, one can create text shortcuts. For example, one can program the iPad to change “bc” to “because” while typing – this saves time. It is the equivalent of shorthand for typing, and it also prevents the frequent battles with auto-correct where if I just typed “bc” it would be changed to “be.”
- Can read a variety of book formats compared to some other “readers”
- Can send e-mails on the go – keep me more connected. MUCH EASIER to plan meetings with professors when you don’t have to go back to your dorm to check your e-mail for their response.

Of course the iPad is not a perfect device. I find the following items can be annoying:

- Editing words can be a challenge. It is hard to tap a word to edit it and it really wants one to delete or change the whole word.
- Glare on the screen can be a problem and so it can be difficult to use outside
- Not all apps provide the same level of functionality or options which can be frustrating
- Not all apps have an “undo” button
- The iPad version of some programs can be quite limited in their functionality compared to the full-blown versions on a PC or Mac; example is Keynote
- E-mail can be hard to navigate
- No restart ... one of my apps totally froze and my pen wasn’t clicking where I needed it to...on a normal computer I would restart it, but I guess you just need to turn the iPad off and on
- Requires planning (download documents ahead of time, charge the iPad, etc.)
- When I tried to send a PowerPoint file it is sometimes too large

I found that I was not able to use the iPad in all of my courses. I was not able to find the right app for my math class that would allow me to take notes the way I like. My math notes are kind of crazy and have arrows going everywhere. During class and recitation it is hard to take notes quick enough while keeping them

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I would like to mention some other things I like about having an iPad:

- I like using Dropbox for cloud file sharing
- I like Pages as an alternative to Word, which is not available on the iPad
- Great movie quality
- Save so much paper and ink and money.

It would like to finish my portion of the paper with the following additional comments:

- It would be cool to have Clickers connected to the iPad
- Pens: Priscilla’s pen, which is a Jot (middle image, Figure 2) has a hard tip and a different feel.
  - One needs to press harder, but it is more precise
  - In comparison with the softer tip pen, hers will last longer
  - My pen, with the soft tip, can wear down and drag/stick to screen which is annoying
- A primary reason why I find using the iPad so helpful is because in 3 of my 5 classes this semester, my teachers taught using PowerPoint files.
  - I believe that even when professors don’t use PowerPoint file, the iPad will still very helpful, for example, I took my statics recitation notes on the iPad and it worked out great.
- What if tablets could connect and sync our PowerPoint’s slides – To elaborate, what if another student and I (in the same class) were able to send each other our PowerPoint notes and then they would automatically sync. This would be useful if I missed something while I was still jotting down an idea or perhaps if I was late to a class and missed the first few slides.
- What if we could record what teachers write on their PowerPoint slides in lecture. For example, my statics professor this semester lectured with accompanying PowerPoint slides, which would have examples. Using a tablet of his own, my professor would solve the problem with the class – writing on the PowerPoint slide like it was a whiteboard. I wonder if there is a way to record/copy/download my professor’s solution to the example as it was written on the slide. This may be a tad advanced. Additionally, once this technology exists, what motivation might a student have to get up and go to class?

I would like to conclude that after using the iPad for most of a semester, I don’t know how I will ever go to school without one. It makes my life easier. I never go to a class, or anywhere really, without it. The only time I stress out is if I forgot to charge it, forgot my pen, or forgot to download a professor’s PowerPoint slides ahead of time.

**Prof. Henry’s Experience**

I purchased my iPad (version 1) in August 2010, just prior to the start of the fall academic semester. At the time I was the Associate Dean for Academic Affairs in the College of Engineering and Physical Sciences. A major portion of my week involved attending several meetings. I thought that a tablet device, like the iPad, would be a more efficient way of taking, storing and sharing my meeting notes.

Another part of my position requires that I make a variety of presentation to groups. While a laptop can be quite versatile I find it cumbersome to carry around and setup. The iPad on the other hand is light and very quick to get ready for a presentation. The iPad feels natural to have with me at all time; similar to a cell phone. The size and weight of a laptop make me think twice about taking it with me.

While the iPad is convenient to carry around it does require some changes. The first was that I had to get use to the operating system (OS). Even though I now do most of my work on an iMac, it took me some time to get comfortable with the iPad OS. It functions quite differently then the Mac OS. The applications and characteristics of the two operating systems are merging with the most recent version of the Mac OS, Mountain Lion. One also needs to realize that the iPad complements my other computers and is not really a replacement for them. Let me explain by presenting a couple of examples.
Like most faculty, I spend a lot of time developing presentations for my class and groups. When the presentation involves creating a large number of slides, my first tendency is to use my iMac with its standard size keyboard and a large screen. Until recently PowerPoint was my go-to program, but with my purchase of the iPad I have started using Keynote more. Each program has its pros and cons. I keep going back and forth between which program I like more. It is quite common for me to develop sketches in CAD and grab part of a photograph or image to be used in a presentation. Using a Mac or PC, which has all the programs I need to create the support material for the presentation, just feels more comfortable.

The value of the iPad becomes clear when I am traveling. It is much easier to carry the iPad around, but one must plan ahead when using it for a presentation. If the presentation does not require files from other programs, Keynote on the iPad can creates a strong presentation. One can even create the presentation on a desktop computer and then transfer it to the iPad via the cloud (Dropbox ©, Google Drive ©, or iCloud ©). If the presentation does not involve any multimedia files or animations the best approach is to save the presentation (either a PowerPoint or a Keynote file) as a PDF file. This is the easiest method by which to project ones presentation. The other nice feature of using a PDF files is that there are several programs that will allow you to annotate the PDF during the presentation.

If the presentation does involve multi-media files and/or animations, one must plan ahead. First you transfer your presentation file to Keynote on your iPad. There are a couple of things you need to know. The iPad version of Keynote does not support some of the features of the PC/Mac versions of Keynote or PowerPoint. The most common issues are related to fonts and symbols. Keynote on the iPad will attempt to replace them with something similar. In addition, if you have embedded multi-media files or images in your presentation, they do not transfer with the file. You are required to transfer the multi-media files and images to an area on your iPad for photos and then relink them to your presentation. Once this is complete the presentation looks great unless your animation requires “flash”, which the iPad does not support. There is an Internet program called CloudOn © that allows you to use Microsoft Office applications over the Internet. I have tried this a couple of times. It is extremely slow especially using WiFi, but I cannot recommend it.

The second example focuses on engineering related software. Currently the iPad has a small number of civil engineering related software and many are quite limited in what they can do. I often need to develop CAD drawings or perform an analysis of a structural system for my courses. There are a couple of software packages, but they are quite expensive and lack the versatility these courses require. While there is not much choice for engineering software under the Mac OS one can run a virtual Windows 7 environment using VMWare Fusion © software. This virtual environment enables one to run programs like AutoCAD ©, GT-Strudl ©, SAP 2000 ©, MatLab © and Mathcad ©. At the moment programs of this level are available not on the iPad.

One nice feature of the iPad is that several applications do allow one to view files generated by many of the most common Windows based engineering programs. One can view them and possibly annotate them, but generally one cannot modify them.

I have made the transition from a laptop to my iPad in the classroom. The primary reason is that I now have the ability to easily and comfortably annotate my class notes that are stored in PDF format. The process I use is to typical develop my notes using PowerPoint on my iMac. My decision is based upon the ease of incorporating graphs, imagines and drawings. I then save my notes in PDF format. The advantages of doing this is that I can easily transfer the notes to my iPad via DropBox and post my notes on Blackboard, the course manage system used by UNH. Prior to class I load the file into one of a couple of applications that let me project the PDF file and then annotate it if I wish. These programs work similar to an electronic whiteboard so that I can save the annotated file and share it with the students after class. I have had laptops with a tablet feature in the past and found them awkward to use and quite expensive. It is my opinion that the iPad is a lower cost and effective alternative to a tablet laptop.

Now that I better understand its strengths and its limitations, I find the iPad to be a very useful tool. Of course with each new version of the hardware comes new capabilities and the same can be said for the applications. In my opinion the iPad’s primary strengths are:

- General applications
  - View and respond to e-mails
• View several email accounts without the requirement to login in to each one separately
• View and annotate PDF files while at a meeting
• Read papers and news articles
• Search the web for information
• The GPS and map features
• Using the camera to capture images for presentation
• Light weight and easy to transport
• Long battery life compared to a laptop (10 hrs. vs. 3 hrs.)

• Classroom and course applications
  • Present and annotate PDF files in the classroom
  • Review, markup and grade homework and examination papers that have been submitted electronically
  • Sketch simple drawings for presentations
  • Present multi-media files directly from the web

On the other hand the iPad does have its weaknesses:
  • General applications
    • The resolution and feel of the handwriting is not great but is improving
      • Takes a while to get use to the feel of the stylus
      • Often hard to see what you are drawing or writing, but the stylus tips are large
    • Can be difficult to copy information from one application to another
    • Runs one application at a time
      • Other applications do sit in the background for quick retrieval
    • While there are a large variety of applications most have not been developed to address the needs of an engineering student or a faculty member.
    • Must use the cloud to transfer files to the iPad
    • No flash support, which can limit what web sites one can visit.
      • On Engineering.com there are several games that would are fun to play and provide engineering insight into structural engineering, requires flash
  • Classroom applications
    • Several steps are required to prepare a presentation for the iPad
      • Some people are comfortable using the iPad directly to prepare and thus reduce the steps needed
    • Need a special cable to connect the iPad to most VGA computer projectors – typical Apple product issue,
    • The iPad can not be hardwired to the internet, has only WiFi or cell phone connectivity
      • 3G or 4G connectivity can be expensive, if available
      • Not all locations have WiFi

In general I find that the iPad is a wonderful supplement to my iMac and expands my work environment. One does need to be careful about the cost. While the base price of the iPad is not too bad, the cost can rise substantially depending on what options and accessories one purchases. My iPad (version 1) has 32 gigs and 3G support. In addition I have purchased a couple of styluses, a cover, a VGA adapter and a carrying case. My total expenditures were approximately $880 plus the cost of a service contract. One can easily purchase a Windows based laptop for this price, but would not have tablet functions.

In addition one must consider applications for the iPad. While many are free I believe that I have around 70 applications for a total cost of approximately $100. I know people that have spent a lot more. Many civil engineering programs cost $50 or more and several would be required to meet my classroom needs. I have not seen any of these providers mention an educational price.

Another part of the cost equation is what accessories do you purchase. There is a wide range of accessories for the iPad. An external keyboard would be another $75 to $100 and this could be just the start. There are stands, speakers, camera connectors, 3G or 4G data plan, car chargers, screen shields, Apple TV, etc. It is similar to buying a car. The advertised price is very attractive and then you add desired options and accessories and the price can
change significantly. With approximately 300,000 applications to select from there is no limit to how much one might spend on software.

I really enjoy using my iPad. Would I urge a faculty member to purchase one, that is a tough question? I am fortunate to have an iMac desktop and a MacBook Pro laptop in my office and an iMac in my home. I do not focus my computing on the laptop. With this computing environment the iPad fits quite well and I am able to use the computer that best fits the application and situation. I find that because of its size and its operating environment, I have the iPad with me most of all the time and have expanded how I use it.

Conclusions

The question posed is: “iPad tablet, love it or leave it”. The two engineering students are very happy with using their iPads. Kayla indicated that it would be hard to return to school without one and for Priscilla it has become a natural part of her engineering toolbox. To begin replacing laptops in the classroom for students the tablet applications need to become more sophisticated and more oriented to the educational environment. Right now there are many applications that present educational material in an interactive format. These applications are enhanced textbooks and references. We need applications that recognize how students do their work and make these tasks easier. In addition more educationally focused engineering applications need to be developed. One must remember that the iPad was introduced less than three years ago and the tablet market is still quite young. The sale of all tablets remains quite strong and the market is expanding. The student population is a significant market and developers will recognize this and begin producing more and more engineering student-oriented applications.

From the teacher’s point of view there are several pros and cons. The pros are that the size of the tablet, the battery life, the ease of getting the iPad ready for making presentations, ability to annotate PDF files in the classroom, WiFi connectivity and access to e-mails. The cons are the limited engineering based software, limited ability to present simulations in the classroom, lack of full compatibility with PC and Mac versions of key software packages and the lack of writing resolution with a stylus.

Whether a faculty member or engineering student should purchase an iPad at the moment is a tough decision and an individual one. Both the students and the faculty member have found the iPad to be quite useful, but often wished it could do more. As the technology advances so will the functionality of tablet devices. The conclusion from our collective experiences is that at the end of the day we all love it.

Just a final note. Starting with the Spring 2013 semester, Prof. Henry will have access to a new Dell tablet (Dell Latitude 10) that will run the Windows 8 operating system. Part of the March presentation will include a report on using the Dell tablet and how it compares to using an iPad.

References