

Foundations of Computing

Curriculum 2017

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All of these materials are in the Math Department Team folder in DropBox

Abstract

The class is designed as an introduction to not only programming in particular but computing in general. It is based on the new AP Computer Science Principles class (see below for more information). Where possible it seeks to use current events (Russian hacking, bit coin, privacy) as part of the day to day work. The class moves between very specific sequences of hard programming and general knowledge about computing. This back and forth is set by the teacher based on the abilities of the class – which vary every year. Meeting this diversity of ability is well met through sites like Khan Academy. Girls are strongly encouraged to take this class.

Fundamentals

This course will introduce the fundamentals of computing. HTML, JavaScript and the Snap language will be explored. Primarily a hands-on lab based experience, this class will accommodate both beginners and advanced programmers. The class will explore a number of additional topics including the development of computers, the Internet, cryptography and “hacking.” I usually sit in the back of class so I can see what the students are working on. Much of my inspiration comes from a background in media literacy. I feel it is essential for the next generation to understand what they consume and not be passive consumers.

Specifics:

- Understand how computers and networks operate.
- Write and de-bug computer code.
- Understand the importance of computing in culture.
- Learn how to use new software tools.
- Learn techniques of multimedia – including Photoshop, audio editing and interface design.
- Adapt to problems that are not clear or well defined.

Resources

There are many websites they do similar things to the ones I have curated below. Over these past few years I have tried a number of things and failed. These sites have held the test of time.

Khan Academy: This is used *extensively* for both HTML, CSS and JavaScript. You will need to set up a class and enroll your students in this class with a unique code. You can then track the individual progress of all students in a very granular manner. I found this to be extremely helpful. Once set up you can see a dashboard of student progress based on time spent and material covered. I often put this on the projector. They call this the “totem pole.” It does wonders to enhance a work ethic. Khan keeps adding content. One new unit that we did in January was on animation – Pixar has collaborated with Khan to do a series of activities around

how they make their movies. Although somewhat unstructured the students really enjoyed exploring these concepts. Headphones are always required for Khan. It's a wonderful day when you come to class and all your students are logged in with their headphones on working quietly away.

The Beauty and Joy of Computing – University of California Berkeley: This is another incarnation of the AP CSP curriculum using the “Snap” computer language.

Computer Concepts 2016 – Cengage Learning. Text book and online resources for AP CSP. Martha has the text book. This was used to teach Zack Hollander his AP CSP class in 16-17. This text book could be used by itself to teach the class.

Code.org – has many resources although aimed at a younger population.

WWW3Schools – Great site that provides a reference for key HTML terms and JavaScript. Used in conjunction with Khan Academy that does not have a good reference section. In creating tests etc. I often use this site for the parts that need to be memorized. It is also good for those type A students who want a detailed study guide.

Units

This is the sequence of what I taught when. Pedagogically I like to start with physical devices – like their laptops and then move to the more abstract such as the web. The speed at which any given class gets through the material depends on the class the intricacies of the school's calendar. For example, this past year we had only two weeks of class time between Thanksgiving and the Holiday break. For the most part these units don't have to follow in this order except for the first one on HTML. That is the foundation as they consume so much content from the web.

1.0 Hour of Code

First day of class. Without much of an intro, set the students to one of the many Hour of Code sites – usually the Star Wars site is best - <https://code.org/starwars>
The videos here are very motivational.

2.0 What do you have in front of you?

Do you have any idea of how your laptop works?
Break down all the components of a laptop/desktop – hands on activity.
Showcase videos on how microprocessors are made. Many on YouTube.
Discussion of memory- HD/SSD- input output devices. RAM. Operating system and hardware configuration, the yin and yang of computing.
See key terms in computing worksheet.
The students need to memorize the key components of computing!

3.0 HTML. KHAN all the way.

I usually ask someone to open their Facebook page and project it on the screen. Then I open the source code of the page. The students freak out. Good chance to talk about developer tools inside of browsers. You should be able to run this for about two-three weeks.

The material can be spread over the course of two months with no difficulty. It seems they can get bored after about that much work. I spice it up with the occasional current event on hacking or start talking about Edward Snowden – Patriot or Trader and why?

3.5 History of the Internet

You can watch an endless number of videos or present material.

Start with DARPA and get to CERN with the development of HTML

[It is all about the hyper link](#). I mix up historical lessons with programming in Khan.

Towards the end of September, you will get **Grandparents Day** – one of my favorite classes to teach all year. See Appendix for notes. I usually get some great old photos or radios and TVs. The Grandparents get all romantic.

5.0 HTML and CSS – keep on trucking.

After they get through the CSS material you can switch everything up back into a design project. I ask that the students create a website that is all about them. Many of the students will be VI formers and deep into the college application process. How can they stand out of the pack?

6.0 Create Your Own Website

For those who are good programmers, they can do this from scratch. However, some are better designers and this unit is about interface design, marketing and reflection. They can use a site builder like “Wix” for free and share their work with this class. Each student gives a presentation. It will take a couple of classes or one long block to get through all the material. You will always be amazed at what you learn about your class with this project.

7.0 JavaScript Khan

We start this unit on drawing and animation then move to games and finally simulations. This is deep water and requires remarkably little effort in teaching. Sample copies of tests etc. are in the math department team folder.

8.0 Photoshop

Now that we have a site license for Photoshop we can deploy a full version to each student for the course of the year. Photoshop is a skill they will take with them. It is used specifically in the second semester to create “sprites” for the games they will be creating using the programming language Snap. Depending on the schools calendar it fits well into the short time after Thanksgiving and Christmas. I start with teaching them how to do really good “head swaps” For example...



You would not believe the humorous things they can do with Drew's hair! As we progress, we talk about screen resolution, print resolution, pixel dimension, RGB color space and a host of other topics. This leads into designing graphics for apps on the iPhone. The final exam consists of a review of HTML, CSS, JavaScript and a Photoshop test where they are given specific image tasks and email them to me for review. It is a pretty complicated tool.

9.0 "Snap" <http://bjc.edc.org/bjc-r/course/bjc4nyc.html>

This is the real meat and potatoes of the class. This curriculum is being updated by the Educational Development Center, backed by the National Science Foundation, U. Cal Berkeley and the Department of Education NYC.

I pair the students based on my interpretation of their varying ability. In other words, I put the smarter students with those that are differently abled. This has worked out remarkably well. As they take turns in coding, one can teach the other. They can show their work to the class remarkably easy. I try to get them to present to the whole class as much as possible so they can better perform in their CES work. This unit could stretch the entire year. It is also accompanied by a book the class reads called "Blown to Bits." It is a free download and is in the Math Department Folder. This gets to some really interesting questions and *I see a connection with Constitutional Law and Jeff Smith's new class on Intellectual Property -copyright etc.*

10.0 Audio Unit

For the students to create complex games they need to understand how computers process audio. This includes a discussion of MP3 technology, its history and what might be coming next. We also cover how to edit audio using a free program called Audacity. This unit usually takes only a few classes and the students love it. It concludes with a sound creation that is 30 seconds long. I ask them to create a sound that we would hear if we put a microphone inside their head.

11.0 Final Presentations by VI formers (And hopefully Vth as well)

That we have to use paper and pencil for a final exam seems exquisitely antiquated today. It is my desire that all students in this class will be able to give presentations of their final projects. They will work in pairs creating a computational artifact. This involves creating a statement of work, a process journal and reflection on the final outcome. The presentation last about 20 minutes. Many of the students choose to create apps for their iPhones. There are many tools to do this.

Appendix

Grandparents Day Class – This comes at a time when the students have been working in Khan in HTML for some time. I usually do a power point with great images of these media artifacts culminating in social media – Facebook / HTML.

Working on learning HTML – the language of the web

Brief History of Communications Media

Printing Press Gutenberg 1440

Separation of ideas (virtual) from place.

You were where you came from

Photography Joseph Nicéphore Niépce 1827

Separation of image from object – mass market – travel pictures popular

Telegraph Morse Code Samuel F. B. Morse 1836

Revolutionized communications – first stories all first – as with the news today.

Film 1890's "moving pictures"

Radio – 1895 Guglielmo Marconi – while experimenting in his parents attic.

Shaun Fanning and Napster example

Definition of a mass market. First time in human history the same people were listening to the same thing across space and time. This created a new audience and markets. Two world wars later we get the internet.

Television John Loggie Baird 1927

Real time transmission of live images “Tele-Presence” across space and time.

Further creation of a mass market

3 channels – ABC, NBC, CBS. Black and white, then color. Advertising was the sole of this enterprise as with radio. Subscriptions only came with cable. There are only two forms of revenue in media – ads and subscriptions. Now with cable we have 1000’s of channels to look at.

The Computer -1947 the first transistor make an appearance as much as a result from cracking the German enigma. When have entered the Quantum Era – this is where the mass market is at its zenith but also portends its dissolution.

The Internet – somewhere in the early 1950’s but I believe it was in 1972’s Apollo 17 brought back the first pictures of earth as the blue marble. Much of the protocol behind the internet was based on cold war fear and technology to develop nuclear arms.

Email – 1972 instant communications across space and time.

The Web – 1989 Tim Berners Lee – Hyper Media links to share – This is what we are learning!