Jupyter For Every High Schooler!*

Using Jupyter Notebook in the classroom

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*By every “high schooler,” I mean last year’s 127 freshman enrolled at a small, exclusive independent school. So a considerably smaller number than every high schooler in America.

Computer Science notes

- 40% of schools offer CS with programming
  - 2016 Gallup study, *Trends in the State of CS in US K-12 Schools*

- 4 states require all public high schools offer at least one CS course
  - Texas, West Virginia, Arkansas, Virginia (2017)
  - BNY Mellon *State-Level Policies Supporting Equitable K-12 CS Education* - 2017

CS notes continued

- Twenty-three states and the District of Columbia require that CS be allowed to fulfill a core graduation credit.
- Four States leave it up to the individual districts
  - BNY Mellon *State-Level Policies Supporting Equitable K-12 CS Education* - 2017

- 50% of Americans rank CS as one of the most important subjects to study
  - Horizon Media Study - 2015
    - 75% said more important than a foreign language

Gender Inequity in CS

- 22% of the Advanced Placement CS-A test takers in 2015 were female.

- Women who try AP Computer Science in high school are ten times more likely to major in it in college
  - 2007 College Board Study

- Young women are not getting enough practical, hands-on experience with STEM subjects.
  - 2017 Microsoft Survey (Europe)

Combat Self-Selectedness

My goal to integrate more computer science principles into the existing math curriculum to broaden exposure to computer science principles as well as create more meaningful interactions in STEM.

Is there room?

Yes, integrate it with Inquiry-Based Learning!

4 Steps of Inquiry-Based Learning

1. Motivate students to ask questions
2. Research the topic
3. Present their findings
4. Reflect

Inquiry-Based Learning and CS

Teaching CS principles and ideas is highly integrable with Inquiry-Based Learning!

Make use of all the incredible resources online.

How are we doing it?

Python on a chromebook (roughly $130) using web-based Jupyter notebooks

jupyter.org/try

Advantages of Python:

- Easy Syntax
- Clean
- Versatile
- Industry used

Current Math Curriculum

9th Grade: Integrated Algebra and Geometry

10th Grade: More Integrated Algebra and Geometry

11th Grade: Analysis of functions, introduction to infinity

12th Grade: Calculus, Stats, Advanced Topics

9th Grade

Project 1: Variables, mathematical operations, **if, elif, else** logic with triangles, **print**()

Project 2: Functions

Project 3: Loops, **range**(a,b)

How did it go?

Some bumps, but quite well!

Student reflection: “I did programming at a summer camp and it seemed really hard but this was pretty easy and kind of fun.”

Current Developments:

Create a 4 year computer science strand in the mathematics program.

10th Grade

Project 1: Introduction to Numpy (and more broadly introduction to packages) and matrices.

Project 2: Transformations with matrices

11th Grade

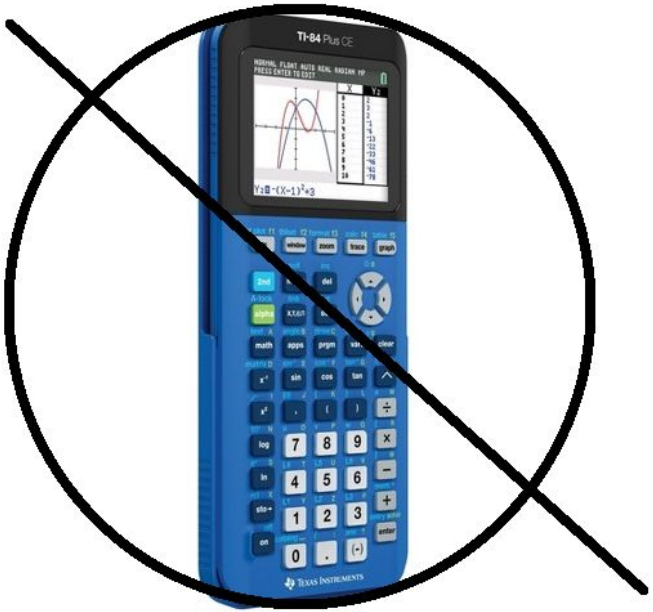
Project 1: Introduction to graphing, matplotlib

Project 2: Recursion! Loops again.

12th Grade - Statistics

Statistics in 2018!

Pandas, Scipy, Scikit-learn



12th Grade - Calculus

Calculus is a tool for approximation!

Experience:

1. **If**, **elif**, **else**, functions, **print()**, **for**, **while**
2. Numpy, matrices
3. Matplotlib
4. Algorithms
5. Pandas, data analysis

Future Projects!

Train more teachers!

Future Projects cont.

2. Using programming to motivate math

Ex: Project Euler #278, https://projecteuler.net/problem=278

Given the values of integers $1 < a_1 < a_2 < \ldots < a_n$, consider the linear combination $q_1a_1 + q_2a_2 + \ldots + q_na_n = b$, using only integer values $q_k \geq 0$.

Note that for a given set of a_k, it may be that not all values of b are possible.
For instance, if $a_1 = 5$ and $a_2 = 7$, there are no $q_1 \geq 0$ and $q_2 \geq 0$ such that b could be 1, 2, 3, 4, 6, 8, 9, 11, 13, 16, 18 or 23.
In fact, 23 is the largest impossible value of b for $a_1 = 5$ and $a_2 = 7$.
We therefore call $f(5, 7) = 23$.
Similarly, it can be shown that $f(6, 10, 15)=29$ and $f(14, 22, 77) = 195$.

Find $\Sigma f(p*q,p*r,q*r)$, where p, q and r are prime numbers and $p < q < r < 5000$.

Future Projects Cont.

3. Raspberry Pi with GPIO

4. Gazebo, ROS, and Jupyter

Thank you!

Questions?

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