

# I'm Not Teaching You To Program!

Extra credit: If you type the following into your calculator, what do you get?

“1<enter>2 + 5<enter>2 –x”

**Todd Zimmerman**  
**University of Wisconsin – Stout**  
**Menomonie, Wisconsin**

**AAPT Summer Meeting**

**July 22, 2019**

# PICUP

- Lowering the barriers for the integration of computation into your curriculum



PARTNERSHIP FOR INTEGRATION OF COMPUTATION INTO UNDERGRADUATE PHYSICS

# Outline

- Faculty Hurdles Encountered
- Student Hurdles Encountered
- How to Fail at Integrating Computation

# Departmental Norms

- Some faculty opposed to computational modeling in introductory courses
  - *“Not your job”*

# Not My Job

- It's not my job to teach students how to....
  - *switch a calculator to radians*
  - *access material in the LMS*
  - *solve a quadratic equation*
  - *integrate a polynomial*
  - *write a paper*
  - *modify a computer program*

# Implementation

- I was expecting them to program
- Activities not well implemented

# Myth of the Lone Professor

- “I’ve got a PhD...”
- “I’ve been teaching physics for a number of years...”
- “I’ve read the literature...”
- “I know how to program...”
- I was just as much of a hurdle

# It's All About the Community

- Why should we include computational modeling
  - *Reasons to take to colleagues*
- How can we make modeling meaningful to students
- How to go about incorporating computation into classes



Link to reports on PICUP website



# I'm Not Teaching You to Program

- Students see programming as part of CS
- Students don't see how it is relevant
- Students don't see how it helps them to understand physics
- Students see it as extra work

# “Why are we learning programming?”

- Students haven't seen this in other physics classes
- Don't call it programming
  - *Computational modeling*
- Don't say “we are programming” or “we are coding”
  - “*We are modifying code*”

- What is “1<enter>2 + 5<enter>2 – x” equal to?



- $(1 + 2) \times (5 - 2) = 9$

# That's not programming!

- This isn't programming...

```
1  from vpython import *
2
3  sphere()
4
5  print("Hello Sphere")
```

- THIS is programming...

```
6502 MICROPROCESSOR
10011000 98 A    PC 0000    STACK SP 017F
11011100 DC X    STATUS 00000000
11011000 D8 Y    NV BDIZC

0000-    4C 3C D4    JMP $D43C
00000000 00 00 00 00 00 00 00 00
00000001 00 00 00 00 00 00 00 00
00000002 00 00 00 00 00 00 00 00
00000003 00 00 00 00 00 00 00 00
00000004 00 00 00 00 00 00 00 00
00000005 00 00 00 00 00 00 00 00
00000006 00 00 00 00 00 00 00 00
00000007 00 00 00 00 00 00 00 00
00000008 00 00 00 00 00 00 00 00
00000009 00 00 00 00 00 00 00 00
0000000A 00 00 00 00 00 00 00 00
0000000B 00 00 00 00 00 00 00 00
0000000C 00 00 00 00 00 00 00 00
0000000D 00 00 00 00 00 00 00 00
0000000E 00 00 00 00 00 00 00 00
0000000F 00 00 00 00 00 00 00 00
00000010 00 00 00 00 00 00 00 00
00000011 00 00 00 00 00 00 00 00
00000012 00 00 00 00 00 00 00 00
00000013 00 00 00 00 00 00 00 00
00000014 00 00 00 00 00 00 00 00
00000015 00 00 00 00 00 00 00 00
00000016 00 00 00 00 00 00 00 00
00000017 00 00 00 00 00 00 00 00
00000018 00 00 00 00 00 00 00 00
00000019 00 00 00 00 00 00 00 00
0000001A 00 00 00 00 00 00 00 00
0000001B 00 00 00 00 00 00 00 00
0000001C 00 00 00 00 00 00 00 00
0000001D 00 00 00 00 00 00 00 00
0000001E 00 00 00 00 00 00 00 00
0000001F 00 00 00 00 00 00 00 00
```

# “This is a physics course”

- Show how learning objectives tie to computational modeling
- Make it relevant
  - *Long term projects*
  - *Include exam questions*
- Talk about computational thinking



# "I should be learning physics"

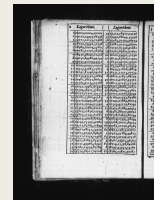
- Solve problems that aren't possible otherwise
  - *Electric field of a rod of charge not on axis or perpendicular to axis*
- Show things that aren't intuitive
  - *Field between two charged plates*

# A Short History of Computational Modeling

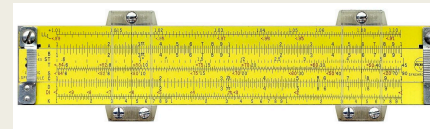
- Hand-written math: ~ 3000 BCE - ...



- Logarithm Tables: 1614 to ?



- Slide Rules: 1620 to 1975



- Handheld Calculator: 1972 - ...



- Personal Computer: 1977 - ...



- Python: 1989 - ...



# “Just one more thing to learn”

- Start small
  - *Modify working code or minimally working code*
- Provide resources
  - *Video tutorials*
  - *Online courses in Python*
- Provide timely feedback
  - *Don't be afraid to “give them the answer”*





# What if I fail?



- Too much content to cover
- Colleagues don't know Python
- Departmental norms

# Content Coverage

- 3-credit Statics course
  - *No lab or discussion*
- Talk to "downstream" instructors and departments
- Does "coverage" equal "understanding"?

# Lack of knowledge

- Colleagues don't use Python
  - *Send them to FDW*
- Co-teach a course
- Give them your intro material

# Departmental Norms

- Serendipity
  - *Keep trying when circumstances change*
- Mentor new faculty
  - *Set the new norms*
- “Change happens one retirement at a time”

# Join PICUP

- Lowering the barriers for the integration of computation into your curriculum



PARTNERSHIP FOR INTEGRATION OF COMPUTATION INTO UNDERGRADUATE PHYSICS

- Join the conversation and ask your questions on Slack:



# Thank You

- Thanks to the UW-Stout Office of Research and Sponsored Programs and to the Department of Chemistry and Physics for financial support

