Creating a Campus-Wide Computation Initiative
Valerie Barr (Union College), Chun Wai Liew (Lafayette College)
http://www.cs.lafayette.edu/~liew/cpath/
http://cs.union.edu/~barrv/Grants/CPATH/

**Vision, Goals and Objectives**

Model a transformation of undergraduate computing education through initiatives that engage in computation:

- Students who are not typically attracted to computer science but who are studying disciplines in which computation can be utilized
- Faculty leaders who are outside the computing community but could also benefit from applications of computing

**Basic Approach**

Create a model for a campus-wide computation initiative:

- Curriculum based in CS dept. that introduces computational methods to students and faculty in other disciplines
- Provide examples of ways to incorporate computation into the curriculum (core and upper-level in non-CS disciplines)
- Raise awareness among students and faculty of the importance of computation
- Promote examples of faculty research projects that involve computation

**Successes, Challenges and Lessons Learned So Far**

**Successes:**
- Increased exposure of students to computation.
- Increase in number of research projects (in other disciplines) that involve computation.
- Increase in number of faculty from other disciplines that use computational tools and approaches in their teaching and/or research.

**Challenges:**
- Difficult to engage non-CS faculty, and difficult to get information out to students.
- Requires constant vigilance and effort on part of CS department.

**Lessons Learned:**
- Administrative support is enormously helpful.
- A change that is seemingly small from the CS perspective may be quite large from the perspective of a faculty member in another discipline.

**Union College Implementation**

**Changes within CS:**
- Six CS1 courses (open to all)
  - Taming Big Data
  - Robots Rule!
  - Game Development
  - Can Computers Think?
  - Creative Computing
  - Programming for Engineers
- Intermediate courses designed for broad appeal
  - Natural Language Processing
  - Web Programming
  - The CS of Computer Games
  - Modeling and Simulation
  - Visualization
  - Bioinformatics
  - Computational Methods Minor

**Changes in other departments:**
- Computation infused into over 25 courses in Astronomy, Biology, Chemistry, Classics, Economics, Electrical Engineering, Film Studies, Mechanical Engineering, Physics, Political Science, Psychology/Neuroscience, Egypt Term Abroad

**K-12 work:**
- 3 infused courses and 1 CS course introduced at high school/early college level

**Results:**
- Approximately 450 students exposed to computation annually, either through a CS1 course or through an infused course in another discipline.
- Surveys show that computational component of infused courses helps students learn disciplinary material!

**Union Future Plans**

**Near Term:**
- Pursue computation based tracks/minors in other disciplines
- Invite outside speakers involved in computational work in non-CS fields
- Disseminate course modules.
- Continue to support computation infusion in Union courses as well as high school/early college courses.
- Promote sustainability by building community among non-CS faculty engaged in infused courses.

**Lafayette College Implementation**

**Changes Within CS:**
- Two CS1 courses for non-majors
  - Computational Science
  - Numerical Computing
- Computational Methods Minor

**Changes In Other Departments:**
- Art:
  - Research collaboration resulting in multiple exhibitions.
- Biology:
  - New introductory modeling based biology course
  - Request for joint position
- Computational biology minor
- Economics:
  - Two new courses that require computational skills (pre-req)
  - Creation of financial certificate with computation
- Collaborative research project (NSF funded) using computation
- Neuroscience:
  - New neural networks course
  - Two collaborative research projects using computation. Funding proposals pending.
- Engineering:
  - Collaborative research project using computation. Funding proposal pending.
  - Many other courses infused with computational content.

**Results:**
- Approximately 400 students exposed to computation annually.

**Lafayette Future Plans**

**Near Term:**
- Develop new courses in other disciplines with computation pre-requisites.
- Develop computation based tracks in other disciplines (biology, neuroscience).
- Develop new computation courses beyond CS1 for non-majors.
- Disseminate course modules/software.
- Disseminate research software.
- Incorporate modules/software into existing high school outreach programs.

Valerie Barr: barrv@union.edu
Chun Wai Liew: liew@cs.lafayette.edu

Work supported by the NSF CPATH program, IIS # 0722203 and IIS # 0722211. Findings, conclusions or recommendations expressed are those of the authors and do not necessarily reflect NSF’s views.