Engaging Programming Assignments to Recruit/Retain CS0 Students

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CS0 Overview

The Rise of CS0
Because only 25% of high schools offer CS courses [1], often college students enroll in CS courses with little or no programming experience. Consequently, the need for a CS0 course taught at a slower pace using a more beginner-friendly programming language is growing. Studies have found higher retention and success rates for CS1 students when they take CS0.

Who Enrolls in CS0?
Students in CS0 vary significantly in terms of their:
• Programming experience levels
• Majors
• Math experience levels

CS0 (CptS 111) at WSU
CptS 111 is the CS0 course at Washington State University (WSU). To more successfully recruit students to CS0 and retain students to CS1, we aim to:
• Engage students in the course materials early and frequently
• Focus on programming assignments that incorporate engagement practices put forth by the National Center for Women in Information Technology (NCWIT)
• Cover foundational topics such as functions, literals, operators, arithmetic, lists, loops, conditionals, and graphics.

Programming Tools Used
The CptS 111 course uses:
• Python programming language
• APIs such as Google Maps [2]
• Hardware from AdaFruit Industries [3].

Example CS0 Assignments

Lightboard Lab (Lists, Loops)
• Hands on with Adafruit hardware
  - Fadecandy microcontroller (~$25 each)
  - 8x8 RGB LED matrix (~$35 each)
• Design “frames”, 1D (or 2D) lists of RGB tuples
• Insert time delays between frames
• Animate frames/delays with iteration

Best Road Trip Ever! (File I/O, Strings)
• Create a file that stores a road trip
• Use Google Maps Distance Matrix API to compute the distance/time between stops on the road trip

NCWIT EngageCSEdu

NCWIT sponsors a program called EngageCSEdu [4], a collection of peer-reviewed introductory CS materials that are contributed by faculty. All materials in the collection have demonstrated evidence of NCWIT’s research-based engagement practices:
• Make it matter
• Build student confidence and professional identity
• Grow inclusive student community

Publicity and Outreach Efforts

Advisors
Advisors encouraged to inform students about CptS 111 provide handouts to give to students during advising sessions.

Website
http://school.eecs.wsu.edu/cpts111/
Describes the course, emphasizes no prior programming experience is necessary, showcases course projects, includes student testimonials.

Posters Displayed On Campus
16 students (18.39%) saw a poster prior to enrolling; 3 said the poster influenced their decision to enroll in CptS 111:
• “The ‘All Majors Welcome’ was very encouraging.”
• “Made it seem interesting”
• “I thought about it and decided that I wanted to gain a stronger understanding about computers”

Impact
NCWIT has published research concluding that students are more motivated, perform better, and are more likely to persist when a CS lesson connects to their life, interests, goals, and values. These outcomes are of increasing importance as demands for CS-related jobs continue to rise and as universities endeavor to produce innovative graduates to enter diverse and interdisciplinary fields.

Future Work
Future work includes collecting more quantitative and qualitative feedback from students about the assignments, as well as:
• Tracking CSE student success in CS1 and CS2
• Designing more assignments
  - Utilize Python turtle graphics
  - Attract more diverse majors, minors, and certificate programs into CSE

Summary

CarBot (Input/Output, Arithmetic)
• Example program output
Cyberdyne Systems: Hello, what is your name? >> Joe
Cyberdyne Systems: Nice to meet you Joe. I am Skynet, a neural net-based AI designed to assist mankind... In order to add you to the database, I will need some basic information from you.

References