DESIGN, IMPLEMENTATION, AND REFLECTIONS ON THE TEACHING OF COMPUTER PROGRAMMING MODULES TO UNDERREPRESENTED STUDENTS

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THE PROBLEM

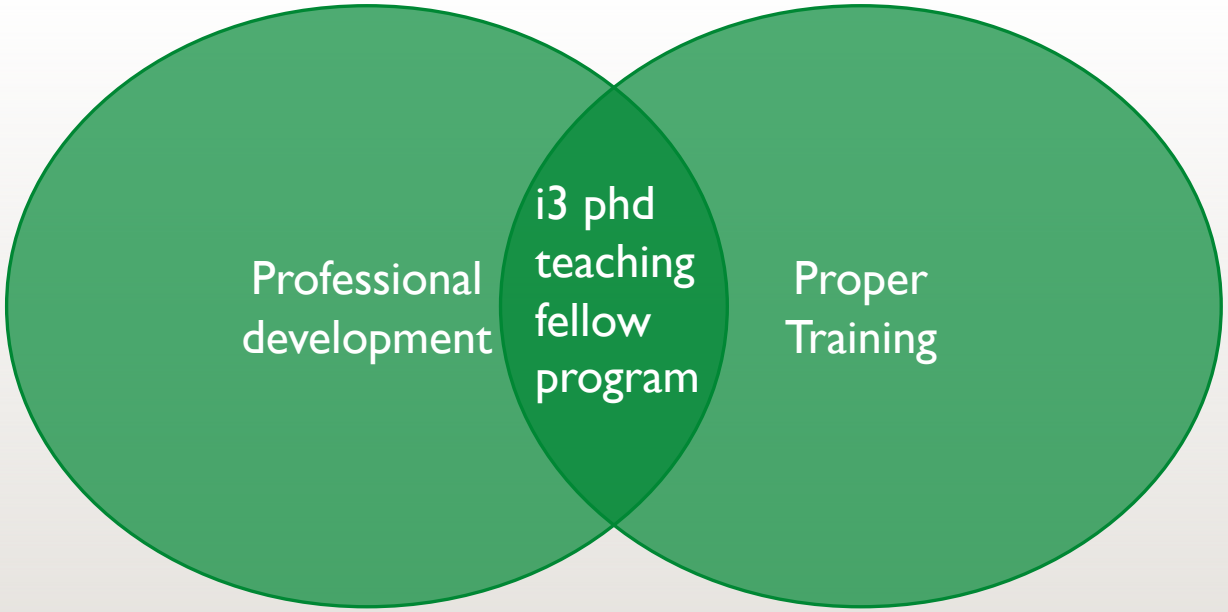
- Misalignment between doctoral student training and career aspirations
- Most academic positions are non-tenure in nature
- Doctoral programs typically focus heavily on research

Teaching ≠ Research

A BARRIER

- Doctoral programs lack proper training in teaching activities (*assessment, inclusive teaching approaches, mentoring strategies*)
- Underrepresented groups' experience are impacted negatively by this exact lack of training
- We must better prepare graduate students to teach

A NOVEL INITIATIVE



Doctoral students partake in these activities:

- Curriculum design
- Mentoring
- Classroom management
- Syllabus development
- Instructional design
- Informal assessment
- Experience co-teaching

THE I3 INCLUSION INSTITUTE

The iSchool Inclusion Institute (i3) is an undergraduate **research and leadership** development program that prepares students from **underrepresented populations** for graduate study and careers in **information and computing.**

Living Learning Residency Model

http://www.i3-inclusion.org/ @i3program

PROGRAM STRUCTURE (20 MONTHS)

Introductory Institute

Summer 1: 4 weeks

Fellows are situated here

iConference 1

Fall 1: Submit preliminary work to iConference

Spring 1: Attend iConference

Concluding Institute

Summer 2: 2 weeks

iConference 2

Fall 2: Submit final work to iConference

Spring 2: Attend iConference

PROGRAM FELLOWSHIP EVALUATION

- Summer 2019 Programming for Research module
  - Students learn how to use python libraries to extract data on twitter
  - Learn tools to aid in visualization and organization of large information
  - Students learn how to use this data to answer important real-world research problems
- Goals
  - Measurement of fellow-identified outcomes (survey data)
  - Reflections of what this process looks like (open-ended comments)

Design Feature	Description and Goals
Creating Safe Space and a Welcoming Atmosphere	We wanted to ensure that learners felt comfortable asking questions of the instructors and found solace in a group of learners similar to themselves. We intended to strike a balance between using a structured curriculum with an informal tone.
Learning Environment	The environment was designed to use active learning strategies wherein learners have opportunities to work in small groups, engage in community discussions, and develop a mini-project.
Mentoring	We offered a structure where learners can contact the teaching team and summer program directors for module support, office hours, and other concerns. We use Slack, a chat and threaded discussion tool, to provide real-time support.
Open Tools	The module used free, open source tools so that students would not need to purchase software. We used the following software in the modules; Twitter API with a developer account, Python and Tweepy, Visual Studio Code Online, Tableau Public, Github, Excel, and Google Drive.

MODULE EVALUATION

- Teaching Fellows identified their own goals for the 2-week teaching module
- Self-Efficacy
  - CPSES Scale (programming-specific)
  - MSLQ Scale (general)

Construct	Pre-Module	Post-Module
CPSES	3.67 (1.44)	4.52 (0.974)
MSLQ	5.43 (0.891)	5.92 (0.901)

CPSES ($t(24) = 4.69$, $p < .001$)
MSLQ ($t(24) = 2.75$, $p = .011$)

FELLOWSHIP EVALUATION

- Teaching Fellows reflected on the process from design to implementation
- Being able to evaluate the module from a high level is an important skill going into academia as an educator

“A huge barrier - especially with underrepresented students - in STEM courses and new topics is feeling uncomfortable and defensive in learning environments. This leads to not being able to voice opinions and ask questions which directly impacts attitude and learning. And so being personable in this manner was a prime example of promoting this mindset.”

“Other times, they did require our help, and this was done 1:1 or with students hovering around a laptop whilst we explained specific problems and their solutions. These impromptu and informal sessions felt like valuable gatherings where, in parallel, friendships and mentoring relationships became stronger. And those bonds of trust allowed students to become less guarded to reveal their passions and overcome their underestimation of ability when it came to programming.”

DISCUSSION AND CONCLUSION

- Teaching Fellows' module was only 2 weeks – successes were seen at the module level and fellowship program level
- Brief exposure was enough to significantly increase learners' self-efficacy and their attitude towards computational and programmatic learning when part of the i3 structure
- From start to finish: from designing to teaching to evaluation, provides a professional development effort that centers inclusion unlike common design of TA-ships

Thank you!

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