October 2, 2023 Education Working Group Call

Join Zoom Meeting
https://notredame.zoom.us/j/92805268479?pwd=YVhBTnYxc21QaUNQaDNhRlFkUjRHUT09
Meeting ID: 928 0526 8479
Passcode: 740261

September 11, 2023 Education Call Notes HERE

Attendees: Jason McLachlan, Cazimir Kowalski, Jody Peters
Regrets: Mary Lofton

Agenda/Notes:

1. EFI 2024 Conference Announcement - any thoughts for proposals for workshops, panels, short courses, socials, etc?
    a. Use this form to submit proposals for workshops, panels, short courses, socials before/after/during this conference.
    b. Deadline for proposals: 01 Nov 2023

2. Papers Discussion:
    a. See a summary of the papers below
    b. "Data Science in Undergraduate Life Science Education: A Need for Instructor Skills Training"
        i. The paper: https://academic.oup.com/bioscience/article/71/12/1274/6403634
        ii. Discuss the barriers to teaching data science
            - What are the barriers to instructors and how to reduce those barriers?
            - Changing culture in science - how to actually do it. It is really hard.
            - How to get people inspired to do analyses in a different way.
            - Ecological forecasting is doing this
        iii. How to make resources easy for people to access education materials?
            - Have Alyssa's list of resources (it hasn't been updated for a long time so there will be other materials)
            - Have NEON Forecasting materials
            - Have Macrosystems EDDIE
            - Have Morgan, Hao, and Ethan's paper
            - Will have materials developed through the Sloan grant
            - Write a grant to support someone to coordinate and collate materials and promote them so people know they are available.
                - Outreach to educators
                - Connect with The Carpentries, QUBES, BEDE

    c. "Ecological Forecasting and Dynamics: A graduate course on the fundamentals of time series and forecasting ecology"
        i. The paper: https://jose.theoj.org/papers/10.21105/jose.00198
        ii. Ethan and/or Morgan will be able to join the group to discuss their class on the Dec 4 call
        iii. Course materials for students to learn independently or for instructors to use are available at: https://github.com/weecology/forecasting-course
        iv. Lessons: https://course.naturecast.org/lessons/
        v. Jason is really interested in this and thinks he could do this, but it would be another 100% revision of the course
            - How to help students who want to go to med school and really want an A? How to get them engaged?

3. Are there Education resources that should be added to the compiled list of resources?
    a. Google doc
    b. QUBES

4. Are there resources that need to be added to the Education Resources/Working Group pages?
    a. Educational Resources page: https://ecoforecast.org/resources/educational-resources/
    b. Working Group page: https://ecoforecast.org/education/
    c. Potential things to add?
        i. Freya's workshop tutorial
        ii. CEFI short course material
        iii. Syllabi
        iv. Do we want to record a short 5 minute video to update the WG page with information about the Education working group and what kind of resources are available?
        v. A how to get started learning about forecasts set of recommendations?
            - Could do this from a student perspective or from an instructor perspective

5. Ethics in Forecasting Project Manuscript - submitted to Teaching Issues and Experiments in Ecology!!

6. Jody is leaving this in from the August call Next steps - not totally clear what the next steps for the group are. Have the list of ideas above. Could try to follow up on those or see if there are others in the bigger EFI community who are interested in working on those projects.
    a. Could collectively read papers this helps people who are worried about jumping in
    b. Small Teaching book - new book suggested to Jason recently

c. Could also invite people to the calls to discuss
    i. 1-day challenge workshop - what does it need
    ii. Invite people who have all taught a class - where are we on that and what do we need
        - Code has developed a lot and class has worked well for different people
        - Mike feels that part of his textbook needs to be updated since the field is developing so quickly
        - Come up with a list of priorities

7. Notes from a long time ago, that may be good as a reference. But doesn't need to be discussed on this call. Open Book Project to keep in mind and mash up of notes from previous calls
    a. There is potential to use the educational materials developed for the Sloan grant or with Olivia's class to start providing content for this that other EFI members could contribute to.
        i. This is a book you would read before you read Mike's Forecasting book
        ii. If we start to develop modular materials they could be included in such a book
        iii. Can start to develop a list of the components that would be useful to include in a book and think about how to make it applicable to a wide range of students from many different backgrounds
        iv. Think about developing slides/materials that provide context
        v. Running list of who has expressed interest at one time or another
            - Jason McLachlan, Shannon LaDeau, Elva Escobar
        vi. Has anyone seen the Open Forecasting Textbook (does exist as a paperback as well)
            - In the Preface this is for a 3rd year undergrad intro master's course
            - Interesting template. Success in part due to free online and R packages are nicely user friendly
            - This is a bookdown format where R code is integrated and is a living document
            - Wouldn't get the credit of something like an AGU Monograph, but would be more broadly available.
            - Could do something that are RMarkdowns that could be combined as a book
            - Loop John Zobitz into this. He is also writing a book for his courses. Mike has used some of his chapters in his 300 level course.
            - Do this in the context of NEON data and walking through all the steps of forecasting. Could get long, but would be a nice resource.

- A self-contained book to walk through. Could reference other books.

vii. This sounds like a strong potential for a proposal for NSF Education Directorates, especially if we could bring in an education evaluator who evaluates the open source, collaborative textbook.
   - If we structured it well it could have a strong educational research component

Emery et al 2021: Data Science in Undergrad Life Science Education

https://academic.oup.com/bioscience/article/71/12/1274/6403634

The authors surveyed biological and environmental science instructors (n=106) about teaching data science, and identifying instructor needs and barriers.
Results:
Instructors use, teach, and view data management, analysis and visualization as important.
Coding, modeling, and reproducibility were less valued (but differed by institution type/career stage)
Greatest barriers: instructor and student background and space in the curriculum
Instructors most interested in training on how to teach code and data analysis

Introduction:

- Data science is needed for careers and society. It is interdisciplinary. There is an unmet need for a workforce capable of handling the vast quantities of data produced.
- 2 strategies: 1) teach biology to computer science majors, 2) Incorporate data science into biology courses
    - The authors acknowledged that there are promising curricular innovations for computer science programs, but then focused on the benefits of incorporating data science into biology classes
- Integration of concepts/skills across several courses helps decrease knowledge compartmentalization
    - From JP: Imagine integration across biology courses could be done, but would it be possible to integrate across disciplines? E.g., student takes a computer science course and a biology course and sees similar concepts? Is this even possible?
        - How often do students have the same instructor for multiple courses or how often do instructors have the same students?
- Known barriers to integrating bioinformatics skills in biology courses: instructor training, curricular space, a perceive lack of student interest or preparation

- Key skills for biology students: data management, analysis, visualization, modeling, workflow reproducibility, and coding, and being able to scale analyses for high-performance computing, write scripts, and use command line interfaces, version control, and high performance computing clusters
- Because technology changes and skills change rapidly, techniques may not have been emphasized when current bio/env sci instructors were receiving their education. Educators may need to upgrade their skills sets to provide up to date instruction. There are networks & consortia who have been established to promote data science education
- BEDE: Biological and Environmental Data Education Network - provides professional development and training specific to undergrad biology educators
    - https://qubeshub.org/community/groups/bede

Survey: sent to department chairs of 536 colleges/universities

Respondents: n=106, 85% from the US, 46% tenured faculty, 25% pretenure tenure-track faculty, 41% taught at doctoral universities. No respondents from associate's colleges. No respondents taught at minority serving institutions BUT 44% indicated they did not know if they taught at a MSI…85% White, 3% Asian, 3% Hispanic or Latino, 2% Black or African American, 1% Native American

Data analysis, data visualization, and data management were frequently taught at baccalaureat and doctoral institutions but more frequently taught at doctoral universities (fig 1)
Code was taught about as frequently as data management at doctoral universities. Modeling reproducibility were taught infrequently.

Many of the instructors reported not teaching or not intending to teach reproducibility to students (48%).

Early career researchers are more likely to teach the skills.

The majority of instructors, regardless of institution type used open sources online material (57%) or their own materials (32%) (fig 8).

3 biggest barriers:

- 1) Lack of instructor and 2) student background in necessary skills and knowledge and 3) space in the curriculum
- Student background is a bigger barrier at baccalaureate and master's colleges compared to doctoral universities
- Other barriers to instructors developing courses shared by respondents: lack of institutional or departmental support, lack of incentives for course innovation, resistance to change, lack of cooperation among departments and with the administration
- Helping students identify the applicability of data science was a challenge
- Students lack of access to equipment and technology was a barrier

Interests:

- Greatest interest in data science skill training for instructors was in data analysis, coding, and data visualization. Interest was lowest for reproducibility
- Preference for mode of training:
    - 45% self-guided tutorial
    - 20% webinar
    - 35% workshop, ideally in person
- Gaps in instructor training
    - Data visualization, data management, and reproducibility

Increased instructor training will require investments from both individuals and institutions to build confidence in the core skill sets, and a framework for implementing them in the classroom

Ernest et al 2023: Ecological Forecasting and Dynamics Grad Course

The authors provide a description of a semester long course, Ecological Forecasting and Dynamics that introduces students to the fundamentals of ecological forecasting & dynamics.

Uses: paper-based discussions to introduce students to concepts and ideas and R-based tutorials for hands on application and training.

Materials include

- Reading list with prompting questions for discussion
- Teachiners notes for guiding discussions
- Lecture notes for live coding demonstrations
- Video presentation of all R tutorials

Materials can be used for self-directed learning or part of a college/university course

R tutorials use publicly available datasets.

Material is based around content themes so instructors can modify and remix materials based on course goals and student levels of background knowledge.

The course combines 2 key components for developing a community of practice around ecological forecasting

1) Learning and engaging with the background and current state of knowledge in the field
2) Developing the quantitative tool set for using time-series data to make and evaluate forecasts

Typical part of discussion involves students reflecting on how the concepts apply to questions or systems they are familiar with.

R tutorials follow the principles of “explicit teaching” and “scaffolding” - this is the same approach used by The Carpentries.

- Demonstrate a new approach using live-coding, then have student complete an exercise applying that approach to a different dataset in class, then discuss this exercise as a group