NEON Data in the Classroom: Using the QUBES Platform and Faculty Mentoring Networks to Build, Adapt, and Publish Data-Driven Teaching Resources

Kusum J. Naithani[1], Megan A. Jones[2], and Kristine L. Grayson[3]
[1]University of Arkansas, Fayetteville AR; [2]NEON, Boulder CO; [3]University of Richmond, Richmond VA

ABSTRACT

Background/Question/Methods

The successful integration of data-centric teaching practices plays a major role in efforts to transform undergraduate biology education. Working with authentic data increases student exposure to scientific practices and contributes to the development of quantitative skills. While open access data and resources to incorporate data exploration in the classroom have dramatically increased, the typical barriers (time, training opportunities, and incentives) have imposed limits on broad integration of data-centric teaching approaches. These challenges are particularly acute for the integration of largescale ecological data, where the skills required to manipulate and analyze these data sets can be a large hurdle for both educators and students. We share the outcomes from a partnership between university/college faculty, the National Ecological Observatory Network (NEON) and the Quantitative Undergraduate Biology Education and Synthesis project (QUBES). We have used the online collaborative platform, open educational resources publishing system, and Faculty Mentoring Network (FMN) model of QUBES alongside the full catalogue of NEON data now available to develop and disseminate teaching resources and provide training and community to faculty.

Results/Conclusions

Participants in the NEON Data Education FMN designed and implemented modules across a range of data types and skill levels, from introducing students to large datasets and best practices in managing, summarizing, and conducting basic analyses to advanced code-based explorations to manipulate, analyze, and visualize NEON data. Through the QUBES platform, faculty also adapted versions of published modules to the appropriate software and skill level of students in their courses. These adapted materials were then republished and shared, effectively creating a similar structure as GitHub where teaching resources can be forked and versioned. Building an online community where faculty can share, modify, and republish teaching materials allows for the wider implementation and improvement of data-centric educational resources. The NEON FMN has been offered for three semesters with 37 faculty participating, resulted in a wide variety of new and adapted teaching modules being publicly available (https://qubeshub.org/community/groups/neon/educational_resource). We found the QUBES-FMN model to be successful in providing online professional development and creating communities of educators without geographic barriers. Our work highlights how this model of curriculum development and faculty engagement has been successfully applied to NEON data for the classroom.

FACULTY MENTORING NETWORKS

Goal: High quality teaching materials that teach our students important quantitative skills as well as important subject specific topics.

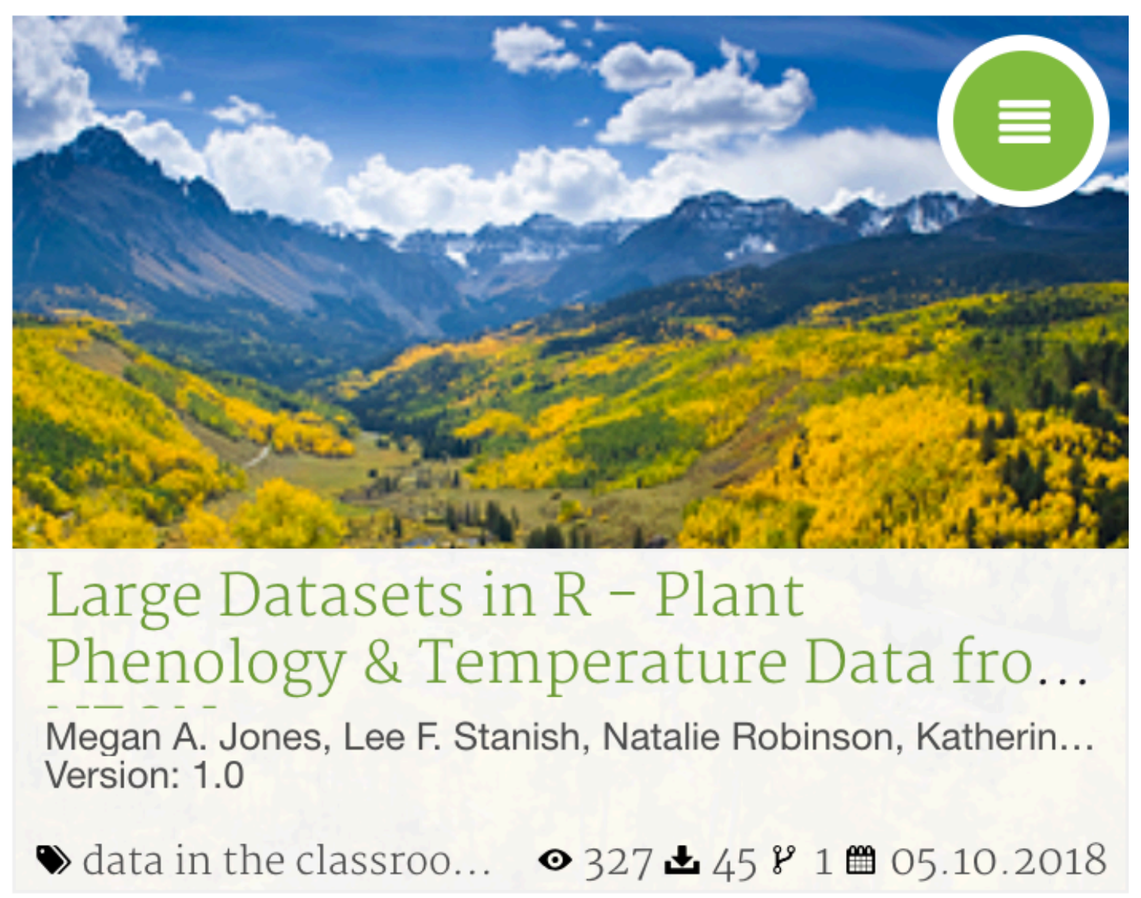
Challenges: Quality materials take a long time to develop. Time is limited for most faculty. Individual faculty may have limited experience teaching quantitative skills. Faculty are unsure of what existing materials may exist that could be used.

Solution: Faculty Mentoring Networks bring together small groups of educators to provide peer-support for creation, modification, and implementation of quantitatively focused teaching materials. The Faculty Mentoring Network model provides a link between pedagogical theory and actionable classroom practice involving a time commitment of 2-4 hours per month.

QUBES: Quantitative Undergraduate Biology Education and Synthesis)

"QUBES is a community of math and biology educators who share resources and methods for students to tackle real, complex biological problems."

Community: The QUBESHub platform allows the creation of community spaces to allow groups to work toward their goals and to allow individuals to find a community of shared interest.



Large Datasets in R – Plant Phenology & Temperature Data fro…
Megan A. Jones, Lee F. Stanish, Natalie Robinson, Katherin…
Version: 1.0
data in the classroo… 327 45 1 05.10.2018

Open Educational Resources (OERs): Support for Faculty Mentoring Networks is one of many services offered by QUBES OERs. By sharing OERs, instructors can use, modify and improve existing materials in their own classrooms while obtaining professional credit for sharing these teaching materials.

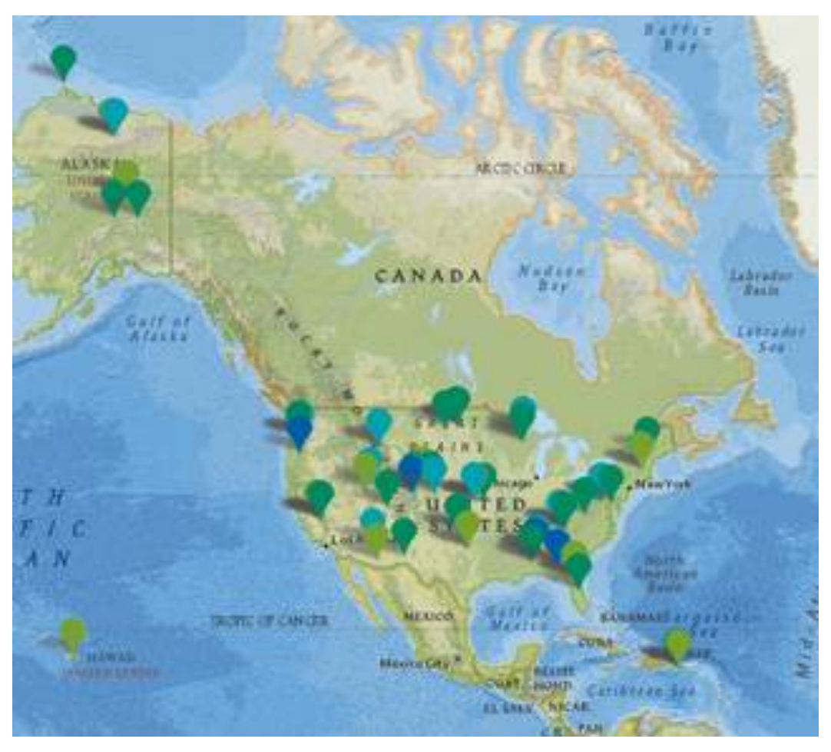
Software: Cloud-based software allows any instructor with internet access to use a variety of software tools with their students, regardless of local resources.

NATIONAL ECOLOGICAL OBSERVATORY NETWORK

The National Ecological Observatory Network is a continental-scale ecological observation facility that collects and provides open data from 81 field sites across the United States that characterize and quantify how our nation's ecosystems are changing.

Open Access Data to Understand our Changing Ecosystems: All NEON data are open and available for you to use in research and education. Access NEON data through the portal: data.neonscience.org.

NEON collects archival specimens and samples, ranging from ground beetles to soils to DNA extracts that are available by request.



NEON Field Site Locations

NEON DATA EDUCATION FACULTY MENTORING NETWORK

FMN is a collaborative effort between scientists from the NEON program and college/university faculty interested in using NEON data with their students. The focus is on undergraduate instruction, however, high school and graduate level materials have also been developed.

Participant benefits:

- Support through peer review to create/modify teaching materials faculty want to develop.
- Bolster teaching profile; OERs shared on QUBESHub have a citable DOI.
- Learn about NEON data and have direct interaction with NEON scientists and educators to help with questions and resources.
- Increase awareness of other resource that can also be used in the future.
- Receive instruction on special topics in education pedegogy.
- Receive recognition as a NEON Data Education Fellow.

NEON benefits:

- Faculty create and share teaching materials using NEON data or protocols.
- Students are introduced to NEON as a source of data for future research.

Participant Responsibilities:

- 1-hr online meetings twice per month for the semester.
- Create/adapt and implement a teaching module with students.
- Participate in review and feedback of FMN colleagues' materials.
- Publicly share a new or modified Open Education Resource through QUBESHub or other platform.

USING QUBES AND NEON RESOURCES TO APPLY THE OER LIFE CYCLE FOR TEACHING MATERIALS

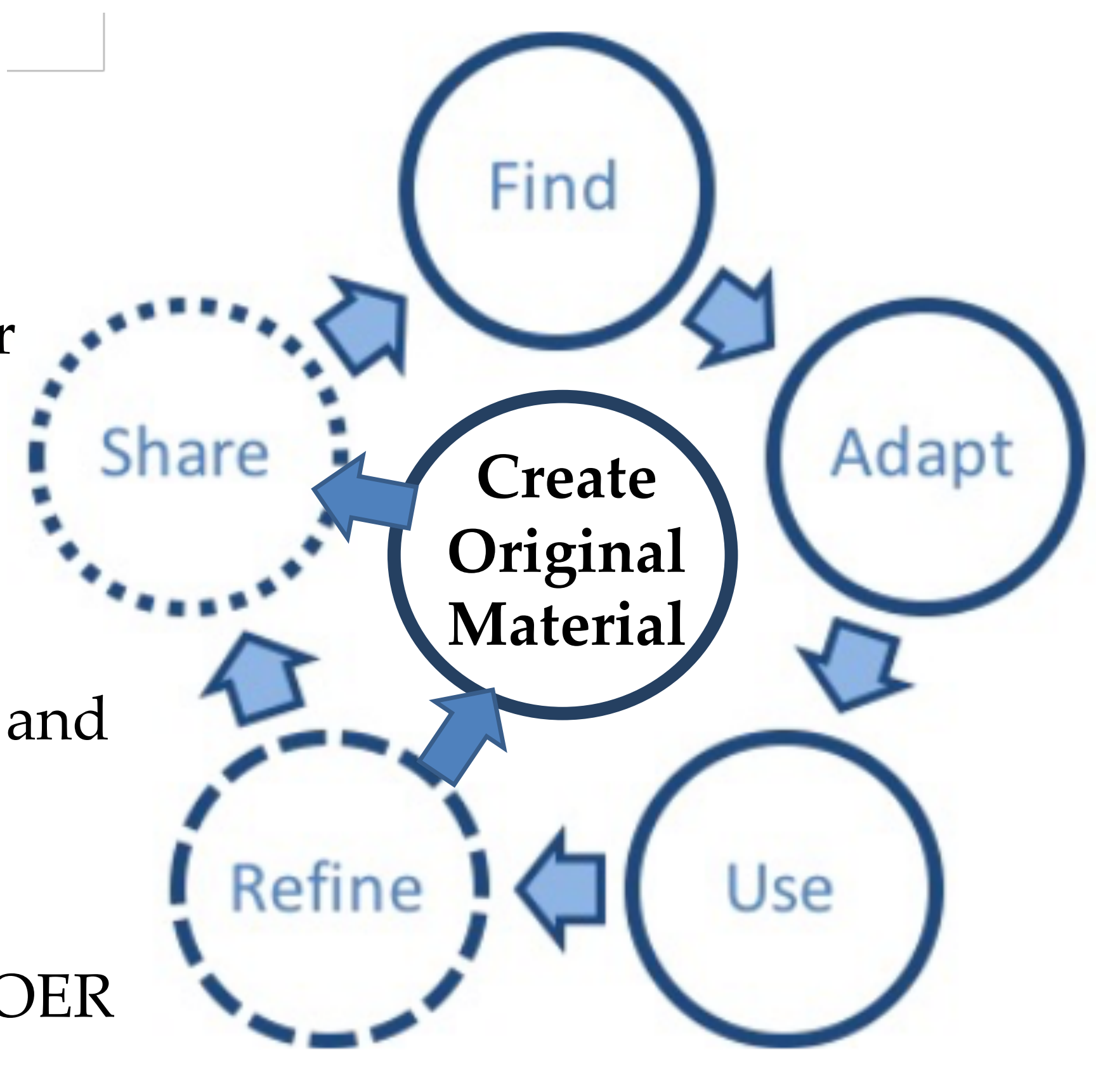
Step 1: *Find* teaching materials for the classroom

Step 2: *Adapt* the resource so that it is relevant for your class and students

Step 3: *Use* your adapted teaching materials and assess student learning

Step 4: *Refine* the materials after implementation and assessment and *create original material* that is not available in the OER database

Step 5: *Share* your refined or new product on an OER platform so that others can find and use



OER life cycle model for education resources
Source: Adapted from Atkins et al. 2007

NEON FMN PRODUCTS

The NEON FMN has been offered for three semesters with 37 faculty participating, resulted in a wide variety of original and adapted teaching modules being publicly available at

(https://qubeshub.org/community/groups/neon/educational_resource).

We found the NEON/QUBES-FMN model to be successful in providing online professional development and creating communities of educators without geographic barriers.

Teaching Materials

Faculty can choose to create new material or implement existing teaching materials and share their original material or adaptation of the original materials through QUBES and NEON platforms.

For questions about Fall 2019 NEON FMN, contact Megan Jones (mjones01@battelleecology.org) or Kusum Naithani (kusum@uark.edu)