Faculty Mentoring Networks: A model for professional development in undergraduate quantitative biology education

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Faculty development is critical for change in undergraduate education

“Professional development... can help all biology faculty become more effective teachers and ensure that all students... develop the ability to think critically, to evaluate evidence, and to graduate, at a minimum, with a basic understanding of core biological principles.” – Vision and Change
One area where faculty development is especially important: Quantitative Biology

• Faculty barriers
  – Feel unprepared to teach quantitative reasoning
  – Overwhelmed by initial effort to learn new quantitative skills

• Student barriers
  – Math anxiety
QUBES supports faculty development in Quantitative Biology

Quantitative Undergraduate Biology Education and Synthesis

qubeshub.org
QUBES model for faculty development

Traditional Teaching → Scholarly Teaching

- Pedagogical knowledge
- Experience
- Peer support
- Products
QUBES model for faculty development

Engage with a rich collection of pedagogical tools

Traditional Teaching \rightarrow Scholarly Teaching

Pedagogical knowledge, Experience, Peer support, Products
QUBES model for faculty development

Traditional Teaching → Scholarly Teaching

- Pedagogical knowledge
- Experience
- Peer support
- Products

Adapt and implement new pedagogical techniques
QUBES model for faculty development

Traditional Teaching → Scholarly Teaching

1. Pedagogical knowledge
2. Experience
3. **Peer support**
4. Products

Peer support builds faculty confidence to change
QUBES model for faculty development

Traditional Teaching → Scholarly Teaching

- Pedagogical knowledge
- Experience
- Peer support
- Products

Public recognition of teaching scholarship
QUBES model for faculty development

Traditional Teaching → Scholarly Teaching

Self-Efficacy
- Experience
- Peer support

Pedagogical knowledge

Products

Professional Identity
## Existing models of faculty development

<table>
<thead>
<tr>
<th>Model</th>
<th>Pedagogical Knowledge</th>
<th>Experience</th>
<th>Peer support</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Society workshop</td>
<td>New tools and techniques</td>
<td>1-2 days</td>
<td>Limited timeframe for connecting w/ others</td>
<td>Certificate</td>
</tr>
<tr>
<td>NAS Summer Institute</td>
<td>New tools and techniques</td>
<td>1 week</td>
<td>Limited timeframe for connecting w/ others</td>
<td>Certificate</td>
</tr>
<tr>
<td>Local Learning Community</td>
<td>New tools and techniques</td>
<td>Through adaptation and implementation</td>
<td>Establish relationships with others</td>
<td>Local peer recognition</td>
</tr>
</tbody>
</table>
Faculty Mentoring Networks (FMNs): Exploring faculty development

• Challenges across all of these models:
  – Teachers are in diverse settings
  – Limited professional development time
  – Connecting people at a distance
Case study #1: ESA Faculty Mentoring Networks

Global temperature change
(Taub & Graham 2011)

Lake ice and global change
(Bohanan et al. 2005)

Avian local species richness
(Langen 2012)

Climate change effects on phenology
(Calinger 2014)

Population dynamics of bald eagles
(Beckstead et al. 2011)

Cemetery demography
(Lanza 2012)

PVA of a local plant population
(Charney & Record 2013)

Global scale data

Population scale data

Modules available at: http://tiee.esa.org
Case study #2: DryadLab Faculty Mentoring Networks

An Introduction to Extinction and Extinction Bias


Two more DryadLab modules available at: [https://qubeshub.org/groups/dryadlab/resources](https://qubeshub.org/groups/dryadlab/resources)
FMNs work from a rich collection of resources

DryadLab FMN example
“Introduction to Extinction and Extinction Bias”

Includes:
- Hypothesis-driven, group activity for students
- Student learning outcomes
- Notes to faculty

Pedagogical knowledge

![Box plot showing Log Weaning age for Not Threatened and Threatened groups. The box plot displays the distribution of log weaning age, with the median, interquartile range, and outliers highlighted. The x-axis represents categories 'Not Threatened' and 'Threatened', and the y-axis shows the log weaning age with a range from 1.5 to 2.5.]
FMNs encourage faculty to adapt the resources

“Because my class time is short, I had to post a pre-recorded lecture for my students to watch to get the background they need to be successful during the module.”

Kaitlin Bonner
St. John Fisher College

“For the Extinction module, we will be modifying the instructions for implementation in JMP…”

Kristine Grayson
University of Richmond

Challenge: Diverse teaching contexts
FMNs support faculty through implementation

DryadLab (I)  ESA DataDiscovery  ESA Scaling Up  DryadLab (II)

Challenge: Limited time
FMNs connect a diverse community of faculty

Challenge: Connecting at a distance
FMNs live online

"Scaling Up" Faculty Mentoring Network: Bringing Research Data into Undergraduate Classrooms

WORKING_GROUPS

- data in the classroom
- ecology
- Evolution
- faculty mentoring networks

Working Groups

This Faculty Mentoring Network is organized into 3 working groups. The working group is the fundamental collaborative unit - a small community of faculty who will meet regularly with mentors to support each other in the customization and use of the curriculum materials. Each working group has a section of this page where they can share some information about who they are and what they are doing. We hope that this will serve two related purposes: 1) make it easy for you to organize and access the information you need about your working group, and; 2) to promote interactions and information sharing across working groups. Please let us know what we can do to make this a useful resource page.

Jump To a Working Group

- El Verde Group
- EcoChronos Group
- Kristen's Group
- Peer Mentor Group

https://qubeshub.org/groups/scalingup
“I was able to bounce ideas off the other members, and we shared ways in which we addressed certain issues or concerns with the modules and with our student bodies. This gave me more confidence in implementing the module.”

– ESA FMN participant
When possible, FMNs also meet in person

This was a great experience! Please try to keep the in-person meeting if you do this again!
Attending the LDC was also very useful!
– ESA FMN participant
FMNs help faculty generate products

ESA FMN Product

James Vance created this post
11:14 am 09 May 2016

Quadratic Regression

This is a PowerPoint presentation that I put together to get our freshman Biological Diversity Lab (4 hours) students up to speed for the bald eagle lab. It covers how to determine which models and variables are statistically significant as well as quadratic regression. This is a 30 minute presentation to be used in the 1 hour of lecture and 3 hours of lab (4 hours total) course that a biologist and I (mathematician) co-taught. We have about 15 students in each of two lab sections. Feel free to modify in any way to suit your needs.

https://qubeshub.org/collections/posts/1454
FMN benefits: Faculty Perspective

ESA FMN example:

1. What aspects of this faculty mentoring network experience were most beneficial?
   – Access to new materials
   – Networking with peers with similar interests

2. Would you participate in another?
   – 10/11 Yes

3. Would you recommend to colleague?
   – 11/11 (100%) Yes

*11 out of 13 participants took post-survey
Outcomes of a FMN experience

- Pedagogical knowledge
- Experience
- Peer support
- Products

Self-efficacy

Identity

Traditional Teaching → Scholarly Teaching
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  – Hayley Orndorf

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  – Ecological Society of America
  – DryadLab

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For information on current and upcoming faculty mentoring networks...

- Fall 2016 networks:
  - SimBio
  - HHMI BioInteractive
  - Math Attitudes and Anxiety

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