

Adapting BioQUEST and QUBES Resources to Accelerate STEM Education Reform

Shared 2/11/22 at the SIMIODE EXPO



Dr. Sam Donovan (sam.donovan@bioquest.org)
Director of Outreach and Strategic Engagement



Takeaway Message

The BioQUEST Curriculum Consortium and the QUBES platform integrate social and technical functionalities to support an Educational Gateway Infrastructure that can accelerate undergraduate STEM education reform.

This community is built by faculty for faculty with the goal of fostering continuous professional development that reflects the scholarship of teaching and learning. Our mission involves an emphasis on open practices, using computational and data-centric approaches, bridging research and education, promoting diversity, equity, inclusion, and creating pathways for faculty participation.

This is an open community and we encourage you to join us.

Outline

Statement of the challenges

Orientation to the BioQUEST Curriculum Consortium and QUBES

Overview of our infrastructure (social and technical)

The QUBES OER Library

Collaborative work spaces

Faculty Mentoring Networks

Many of us are hard at work within our carefully delineated “backyard”

But what happens when we look at the bigger picture?





Challenge

The future is here - it is just not
very evenly distributed.

- William Gibson



Challenge

The last mile problem

Systems that work at some scales of distribution do not always connect with the final user.

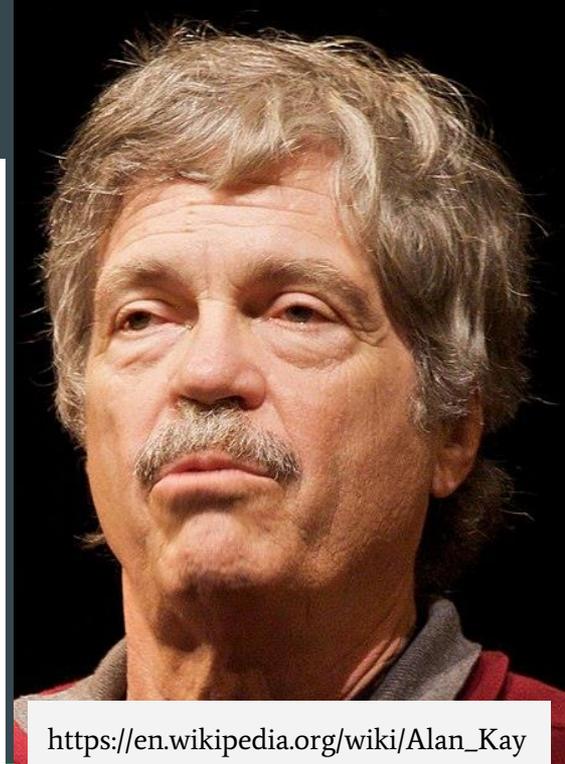
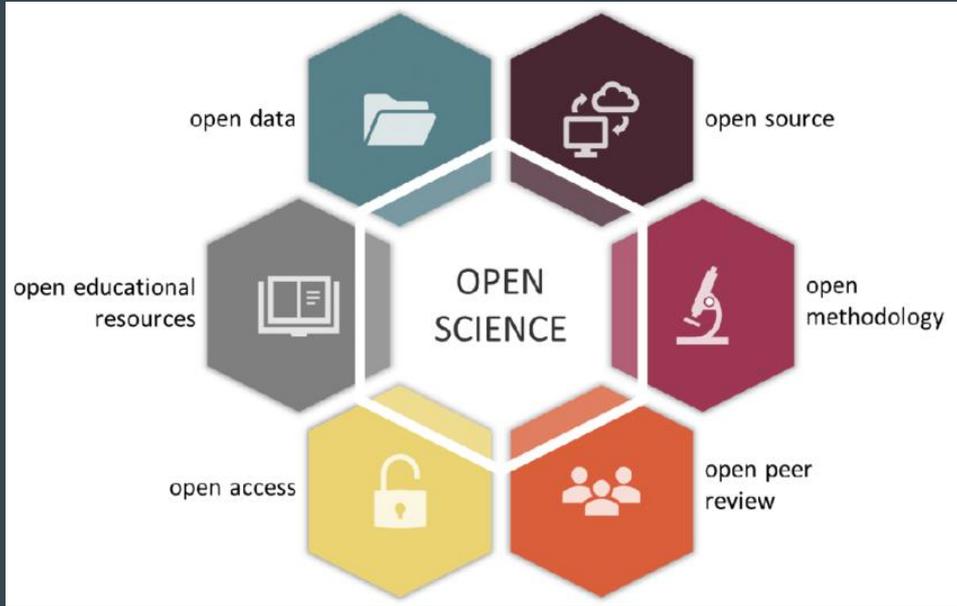
Moving from “accessing resources” to “changes in behavior” can be very challenging.



Opportunity

The best way to predict the future is to invent it.

- Alan Kay



https://en.wikipedia.org/wiki/Alan_Kay

BioQUEST Curriculum Consortium

35 years strong!

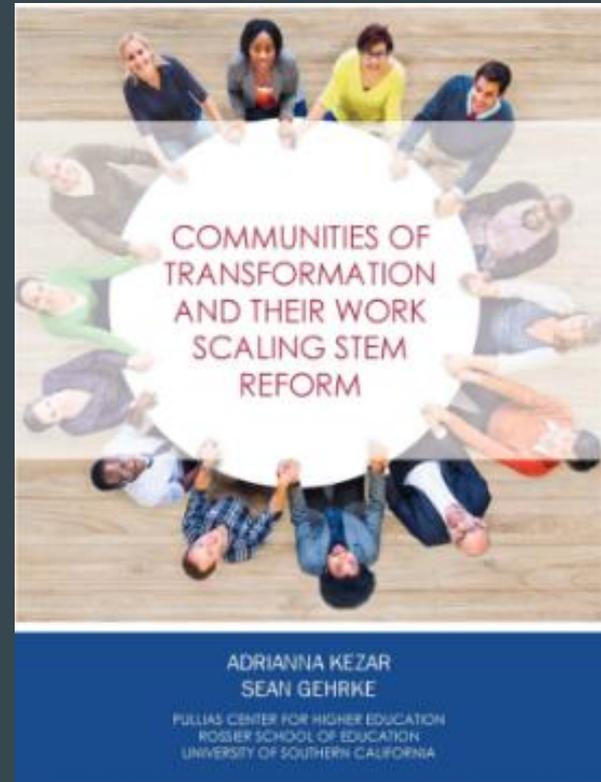
Driven by a shared philosophy.

Community sustaining.

QUBES platform

NSF support to address the interface of mathematics, statistics, computation, and biology.

Infrastructure to promote scholarship around teaching and learning.



Bio*QUEST*



Problem Posing

To understand science as it is practiced, rather than solving already well-formulated problems from a textbook, students must be engaged in problem-posing. To appreciate this, students must learn that they could stand in the field or laboratory forever and no problems would come to them pre-posed.

Problem Solving

After having posed a problem, students need to experience open-ended problem-solving. Real scientific problems do not have answers at the back of the book. The scientist entertains multiple competing hypotheses and makes inferences over a long series of experimental observations.

Peer Persuasion

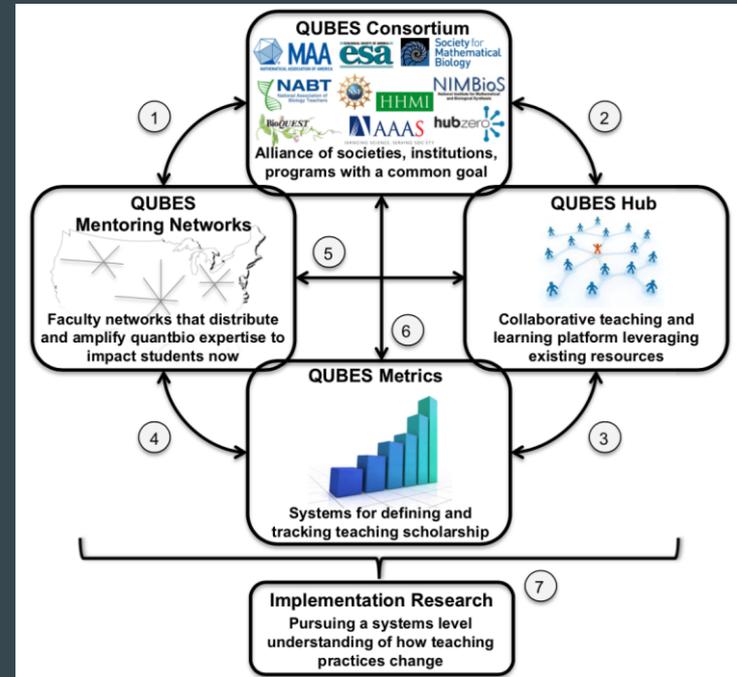
Research is not complete, no matter how many experiments have been conducted, no matter how many puzzles have been solved, until peers outside of a research team are persuaded of the utility of the answers. Persuasion is a social process and an essential one for students to experience in order to understand the nature of scientific theories and paradigm shifts.

A brief overview of how the QUBES platform is organized

QUBES is an educational gateway infrastructure that combines a variety of communications/productivity tools, computational environments, and teaching and learning resources to support STEM education reform.

It is purpose built by college educators for college educators with an emphasis on collaborative workspaces and open education resources publishing.

Resources Community Services



How QUBES is organized - Resources

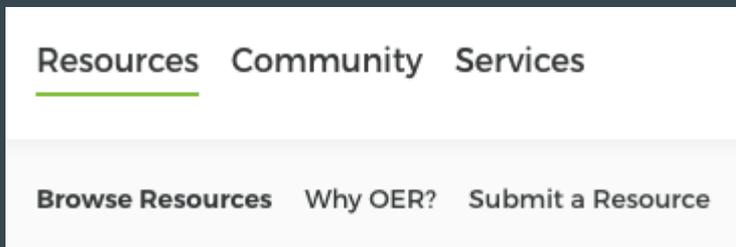
Resources are published into the OER Library.

Full support for the OER lifecycle including versioning and adaptations.

Today (2/11/22) there are 1638 resources available.

Every resource is associated with authors and a group.

Resources draw many visitors to QUBES.



A screenshot of the QUBES website showing the "BioSkills Guide" resource page. The page includes a navigation bar with "Resources Community Services" and "About News & Activities Help". The main content area features the "BioSkills Guide" title, author information (Alexa Clemmons, Jerry Timbrook, Jon Herron, Alison Crowe), a summary, and a list of authors with affiliations. A red arrow points from the author list to a text box. The text box contains the text "Visit group or author to find related resources". Other elements include a "Collect" button, "Watch resource" button, social sharing options, and a "Contents" section.

QUBES A BIOQUEST Project

Resources Community Services

About News & Activities Help

BioSkills Guide

2436 total view(s), 974 download(s)
0 comment(s) (Post a comment)

Download Adapt

Author(s): Alexa Clemmons¹, Jerry Timbrook², Jon Herron¹, Alison Crowe¹

1. University of Washington 2. University of Nebraska-Lincoln

Summary:
The BioSkills Guide comprises program- and course-level learning outcomes for the Vision and Change core competencies that elaborate what general biology majors should be able to do by the time they graduate.

Contents:
BioSkills Guide Broc...
License terms

Share: Facebook Twitter YouTube LinkedIn

Brought to you by
Core Competencies for Undergraduate Biology
BioSkills

Licensed under CC Attribution-NonCommercial-NoDerivatives 4.0 International according to these terms

Version 5.0 - published on 08 Jul 2020 doi:10.25334/156H-T617 - cite this

Tags
Other Reference material Reference sheet Teaching material

from project BioSkills Guide. This is a live resource with the page and content being updated.

Visit group or author to find related resources

Open Publishing Platform

Featured Resource of the Week

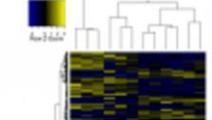


miRNA

Using Undergraduate Molecular Biology Labs to Discover Targets of...

Adam Idica, Jordan Thompson, Irene Munk Pedersen, Pav...
Version: 1.0

▼ molecular biology, bi... 585 138 P 0 0 01.2019



Teaching RNAseq at Undergraduate Institutions: A tutorial and R packag...

Mark Philip Peterson, Jacob T Malloy, Vincent P...
Version: 1.0

▼ statistics, R program... 746 196 P 0 0 01.2019



Infectious Chocolate Joy with a Side of Poissonian Statistics: An activity...

Eric T. Holland, Greg Manley, Tamara Chiba, Rona Ramos...
Version: 1.0

▼ quantitative biology, ... 450 106 P 0 0 01.2019



A grid of ten software logos arranged in two rows and five columns. The logos are: R Studio (R logo), Jupyter (orange circle with 'jupyter' text), Jupyter Lab (black circle with 'lab' text), NetLogo (red arrow pointing right), COPASI (blue and red logo), QtOctave (blue circle with orange squares), ImageJ (gold microscope), Mesquite (green leaf), PPLANE (white funnel), and XPPAUT (blue box with 'XPP-Aut' text and a graph).



Software for Students & Faculty

C1. Role of Bioinformatics C2. Computational Concepts C3. Statistical Concepts C4. Bioinformatics Tools

C5. Data Retrieval C6. Model C7. Scripting C8. Data Types C9. Implications

Supplemental Resources for Instructors

C1. Explain the role of computation and data mining in addressing hypothesis-driven and hypothesis-generating questions within the life sciences

QB@CC Modules

- Sorted by Quality
- Sorted by Most Popular
- Sorted by Bioinformatics
- Sorted by Accessibility
- Published Date

These quality modules are those that come with the most...

List of Quantitative

Some QBCC modules fall into the following categories.

1. Understand the relationship between biology and mathematics
2. Write mathematical models of biological systems
3. Understand rates of change and differential equations
4. Choose appropriate statistical methods
5. Explain descriptive statistics
6. Use statistics when appropriate
7. Make probability calculations
8. Convert units of measurement
9. Estimate accuracy and error
10. Change scales (orders of magnitude)
11. Use elementary functions
12. Create graphs - 8
13. Interpret graphs - 8
14. Interpret tables - 5
15. Manipulate equations

Featured Resource of the Week

RNaseq data analysis using Galaxy

Matthew Escobar, Sam S Donovan, Irina Makarevitch, Bill...
Version: 4.0

Lab, bioinformatics, ... 250 36 P 0 0 07.2021

Featured Resource of the Week

Sequence Similarity: Introducing Biological Databases to Community...

Jennifer Katcher
Version: 1.0 Adapted From: Sequence Similarity: An I...
phylogenetics, bioinform... 201 48 P 0 0 06.2021

Yeti or not: Do they exist?

Keith Johnson, Adam Kleinschmit, Jill Ruffs, William (Bill)...
Version: 3.0
case study, bioinform... 492 448 P 0 0 12.2020

Featured Resource of the Week

A Critical Guide to the PDB

Teresa Attwood, GOBLET Foundation
Version: 1.0
NIBLSE, GOBLET, In... 322 89 P 0 0 12.2020

Featured Resource of the Week

A Critical Guide to BLAST

Teresa Attwood, GOBLET Foundation
Version: 1.0
NIBLSE, BLAST, GO... 298 85 P 0 0 12.2020

Bioinformatics: the Power of Computers in Biology - a Practical...

Daniel Barker, Heleen Plaisier, Stevie Anne Bain, Teresa...
Version: 1.0
NIBLSE, GOBLET, U... 247 75 P 0 0 12.2020

How QUBES is organized - Collaborative work spaces

QUBES is made up of a bunch of Groups.

Each group has a lot of independence with respect to - look and feel, membership management, information sharing, and collaboration tools.

Everyone still publishes into the OER Library

Resources can be displayed in groups - both those published by the group and others.

Resources Community Services

Community Groups Faculty Mentoring Networks Partners



Collaborative work spaces: Using a group to

Host a project



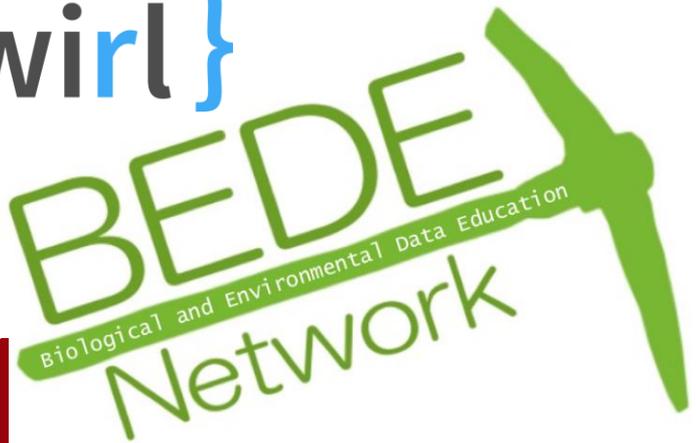
Partners Page

Professional societies, grant funded projects, pet projects, ...

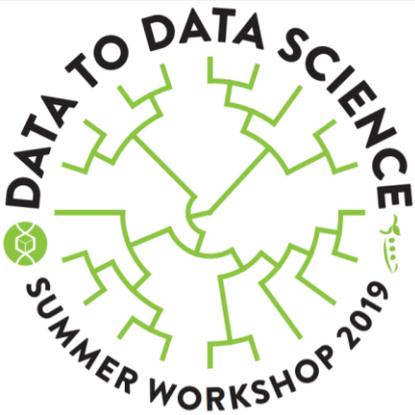


{swirl}

DIG Into Data



Make
TRUBLE



SYSTEMIC
INITIATIVE FOR
MODELING
INVESTIGATIONS &
OPPORTUNITIES
WITH
DIFFERENTIAL
EQUATIONS
SIMIODE

**SIMIODE is an open community
of teachers and learners using
modeling first differential
equations in an original way.**

***SIMIODE is a Community of Practice
focused on a modeling first method of teaching differential equations.***

SIMIODE EXPO 2022, 10-13 February 2022

SIMIODE Textbook Now Available
A FREE Preview of Chapter 1 is available for you to read.

SIMIODE Remote Teaching Modules

SIMIODE Immediate Activities Using Data



EXPO ▾ SCUDEM Textbook ▾

Systemic Initiative for Modeling Investigations & Opportunities with Differential Equations – SIMIODE

Happening Now

- The next [SIMIODE EXPO](#) is scheduled for February 10–13, 2022. *Registration is open now, and abstracts for presentations are being accepted too.* The slides and videos from [EXPO 2021](#) are available if you want to see what last year's conference was all about.
- [SCUDEM](#) judging is completed. We had loads of wonderful video submissions and the [results are now posted](#). Videos from Outstanding Award recipients will be posted on our [YouTube channel](#) soon.

SCUDEM is a 3-student group modeling challenge that runs over multiple days culminating in a 10 minute video which is reviewed by at least 3 judges. Challenge Problems are provided in the areas of:

- physics/engineering,
- chemistry/life sciences,



Peer-reviewed, open-access journal for
active learning open educational
resources in biology and physics



AMERICAN
SOCIETY FOR
MICROBIOLOGY



SOT

Society of
Toxicology

Articles in *CourseSource* are organized by courses

Courses

-  [Anatomy-Physiology](#)
-  [Biochemistry and Molecular Biology](#)
-  [Bioinformatics](#)
-  [Cell Biology](#)
-  [Developmental Biology](#)
-  [Ecology](#)
-  [Evolution](#)
-  [Genetics](#)
-  [Immunology](#)
-  [Introductory Biology](#)
-  [Microbiology](#)
-  [Neurobiology](#)
-  [Plant Biology](#)
-  [Professional Development and Career Planning](#)
-  [Science Process Skills](#)
-  [Toxicology](#)

Powered by QUBES

LOGIN



[Browse](#) [For Authors](#) [For Reviewers](#) [Forum](#) [About](#) [Contact](#)



Welcome to CourseSource, an open-access journal of peer-reviewed teaching resources for undergraduate biology and physics

We publish articles that are organized around courses in both biological and physics disciplines, and aligned with learning goals established by professional societies representing those disciplines. Please let us know what you think as you explore the articles and other information in the journal. [We welcome your comments, questions, and/or suggestions.](#) You can also follow us [@CourseSource](#) on Twitter to receive notifications about newly published articles and announcements!

Courses

- [Anatomy-Physiology](#)
- [Biochemistry and Molecular Biology](#)
- [Bioinformatics](#)
- [Cell Biology](#)
- [Developmental Biology](#)
- [Ecology](#)
- [Evolution](#)
- [Genetics](#)
- [Immunology](#)
- [Introductory Biology](#)
- [Microbiology](#)
- [Neurobiology](#)
- [Plant Biology](#)
- [Professional Development and Career Planning](#)
- [Science Process Skills](#)
- [Toxicology](#)

Latest - [view more](#)



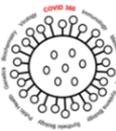
Using Bioinformatics and Molecular Visualization to Develop Student Hypotheses in a Malate Dehydrogenase Oriented CURE
Kevin P Callahan, Tamara Mans, Jing Zhang, Ellis Bell, Jessica Bell*

Version: 1.0
Published on 01.2022

Developing student creativity and ability to develop a testable hypothesis represents a significant challenge in most laboratory courses. This lesson demonstrates how students use facets of molecular evolution and bioinformatics approaches involving

858	61	0
Views	Downloads	Adaptations

▼ bioinformatics, Noncovalent Interactions, Enzyme Catalysis, Protein Structure/function



A 360° View of COVID-19
Nikolaos Tsetakos, Victoria Del Gaizo Moore, Lisa Z. Scheifele, Michael J. Wolyniak, Joseph W. Chihade, Joseph J. Provost, Jennifer A. Roeklein-Canfield*

Version: 1.0
Published on 11.2021

In March 2020, institutions underwent a massive transition to distance learning as a result of the COVID-19 pandemic. With so little time to devise new materials to maximize learning in the new virtual environment, instructors devised a variety of

625	87	0
Views	Downloads	Adaptations

▼ genetics, Immunology, Biochemistry, bioinformatics, molecular evolution, public health, virus, COVID19

[CourseSource Blog - view more](#)



[BioQUEST Webinar: An Introduction to CourseSource](#)

January 25, 2022

BioQUEST Webinar: An Introduction to CourseSource
In this webinar, BioQUEST staff and CourseSource Managing Editor Erin Vinson will give a brief overview of CourseSource, a journal of...

[Two postdoc positions in biology education research](#)

September 1, 2021

We are excited to share the below advertisements for two biology education research postdoc positions. These postdocs will join our research team to explore how Open Educational Resources (OERs) have helped the biology...

Tweets by [@CourseSource](#)

Tweets by [@CourseSource](#)

 CourseSource Retweeted

 [BioQUEST Consortium](#)

[@BioQUESTed](#)
Our first newsletter of 2022 featured resources, publications, [@qubeshub](#) platform tips, and fantastic news

Embed

[View on Twitter](#)

<https://qubeshub.org/community/groups/coursesource>



Cell Biology

The study of the formation, structure, components and function of cells.

Members of the American Society of Cell Biology have worked with *CourseSource* to create a Learning Framework for the Cell Biology Course. The table below lists the learning goals and objectives that the Society agrees any undergraduate biological sciences major should know about Cell Biology by the time they graduate.

The following people worked to develop this society-approved Cell Biology Learning Framework:

Alison Adams (Northern Arizona University), Robert Brooker (University of Minnesota), Jennifer Carney (Finger Lakes Community College), Bradley Hyman (University of California), Michael Klymkowsky (University of Colorado), Kathryn Miller (Washington University), Susan Singer (Carleton College), Kimberly Tanner (San Francisco State University), Michael Wolyniak (Hampden-Sydney College) and Sue Wick (University of Minnesota).

[Download the Cell Biology Learning Framework](#)



the american society for cell biology
American Society of Cell Biology

The American Society of Cell Biology (ASCB), founded in 1960, is an inclusive, international community of biologists studying the cell, the fundamental unit of life. They are dedicated to advancing scientific discovery, advocating sound research policies, improving education, promoting professional development and increasing diversity in the scientific workforce.

Course Editor(s):



Scott Gehler



Valerie Haywood



Stanley M. Lo



Leocadia Paluilis



Samiksha (Sami) Raut

Cell Biology Learning Framework [see all Cell Biology articles](#)

Society Learning Goals

Articles

▼ Membrane Structure and Function

▼ Nuclear Structure and Function

▼ Cytoskeleton Structure and function

▲ Cell cycle and cell division

How do cells conduct, coordinate, and regulate nuclear and cell division?

[Sample Learning Objectives](#)

- [A virtual laboratory on cell division using a publicly-available image database](#)
- [Building a Model of Tumorigenesis: A small group activity for a cancer biology/cell biology course](#)
- [GMC: Genes, Mutations and Cancer - Group Concept Map Development](#)
- [Meiosis: A Play in Three Acts, Starring DNA Sequence](#)
- [Sex-specific differences in Meiosis: Real-world applications](#)
- [Using Immunocytochemistry and Fluorescence Microscopy Imaging to Explore the Mechanism of Action of Anti-Cancer Drugs on the Cell Cycle](#)

Using a group to

Support a meeting



Northwest Biosciences Consortium Winter Workshop

A face to face meeting that was supported using a QUBES group.



Using a group to

Support a meeting



BIOME INSTITUTE 2021



2021 Biology and Mathematics
Educators (BIOME) Institute

An online meeting where lots of participant products were captured and lots of pre- and post- meeting collaboration.

Using a group to

Support a meeting



[Southwestern Community College
Poster Session](#)

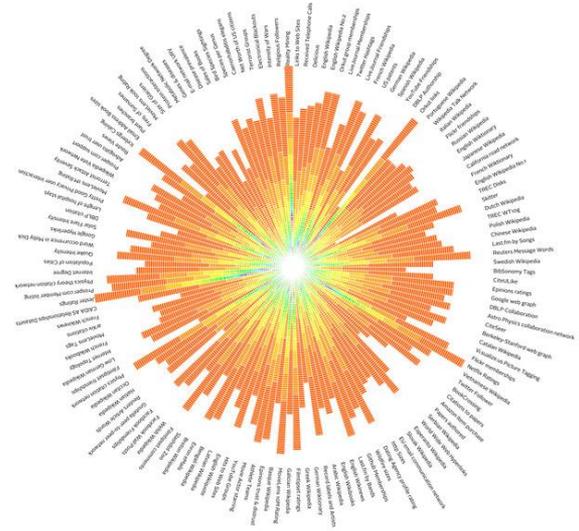
Online space to organize student posters from a CURE - connected to other institutional collaborators.

Using a group to

Create a private
workspace

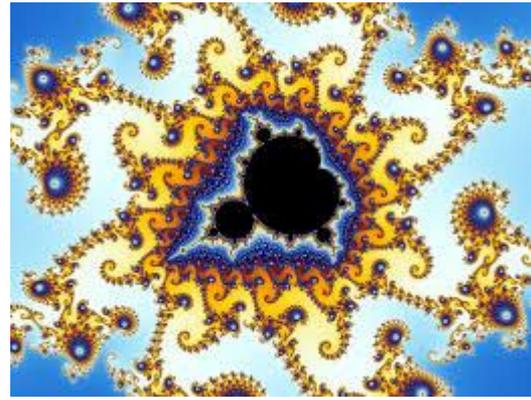
[Introduction to Biostatistics at
William and Mary](#)

A Group designed to support a
course.



Using a group to

Create a private
workspace



[Postdoc and grad student QB Journal Club](#)

Special interest groups, advisory boards, Faculty Mentoring Networks,

...

Faculty Mentoring Networks



Train faculty to use your classroom materials or pedagogical strategies



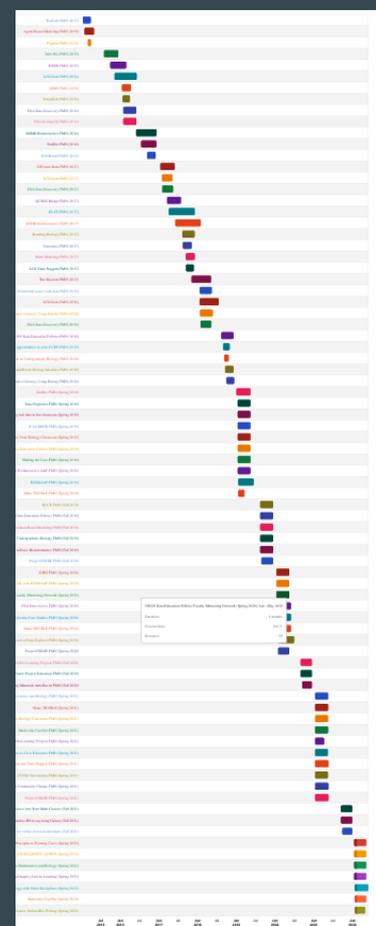
Implement your project ideas and materials in diverse classroom environments



Gather formative or summative assessments of faculty teaching experiences, student perceptions, and/or learning gains, to be used in publications and grant proposals



Engage with a community of faculty that can adapt and share your teaching materials (e.g., adapt a lesson for a different class size or duration), broadening the ultimate classroom adoption



Faculty Mentoring Networks



CourseSource
Online4Bio Writing
(Spring 2022)

CURRENT FMN



ImmunoReach:
Bridging
Immunology with
Other Disciplines
(Spring 2022)

CURRENT FMN



Molecular CaseNet
(Spring 2022)

CURRENT FMN



Applying Universal
Design for Learning
Principles to
Existing Cases
(Spring 2022)

CURRENT FMN



Hosting a Project
with BioQUEST /
QUBES (Spring
2022)

CURRENT FMN



QB@CC:
Conceptualizing
Connections
between
Mathematics and...

CURRENT FMN



Project EDDIE:
Teaching Scientific
Concepts and
Quantitative
Reasoning with...

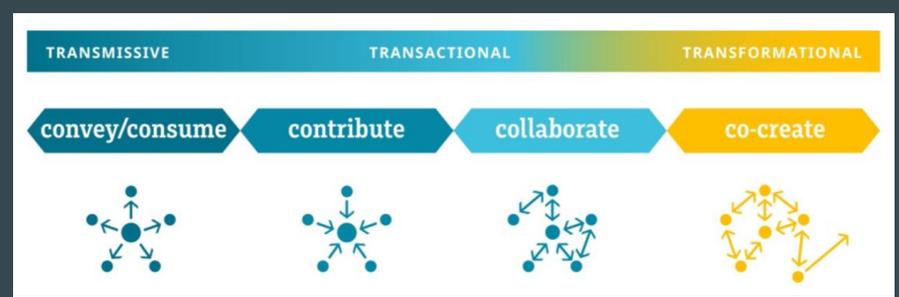
CURRENT FMN

FMN Workflow

Meet every other week for 1-hour synchronous discussion.

Between meeting weeks

1. Reviewing the recommended reading
2. Completing small assignments that give you relevant experience with the topic on QUBES.
3. Work on your project implementation plan for this topic (some groups may choose to meet during off weeks).
4. There will be office hours and help discussions available between synchronous sessions.



Week 7 - Promoting Community

Associated resources and opportunities

1. The CSCCE Community Participation Model – A framework for member engagement and information flow in STEM communities.
2. Contribute to our FMN collections with resources for community
3. Map out opportunities for participation and the broader social context for your project
4. Drop by the office hours for feedback, troubleshooting and discussion.

Project EDDIE Faculty Mentoring Network Spring 2021

Project EDDIE Faculty Mentoring Network

Teaching Quantitative Reasoning and Scientific Concepts with Data Spring 2021

Brought to you by



Visit Partner Group on QUBES

Goals

- Learn how to use Project EDDIE modules in undergraduate courses
- Gain support for further development of pedagogical material focused on teaching quantitative reasoning and scientific concepts with data in the classroom
- Leave this FMN with several data-driven activities that have been tested, adapted, and implemented in multiple classroom settings

Mentors

- **Andrew Haveles**, University of Wisconsin - River Falls

Project EDDIE Faculty Mentoring Network Spring 2021

Final Products



Climate Drivers of Phenology (Project EDDIE)

Beatriz Villar
Version: 1.0 Adapted From: Climate Drivers of Phe...

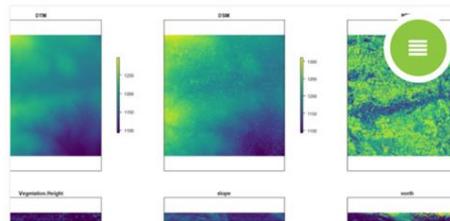
Lab, Online cours... 632 825 0 0 06.2021



Wind and Ocean Ecosystems (Project EDDIE)- adapted to provide greater...

Laura Reynolds
Version: 1.0 Adapted From: Wind and Ocean Ecosy...

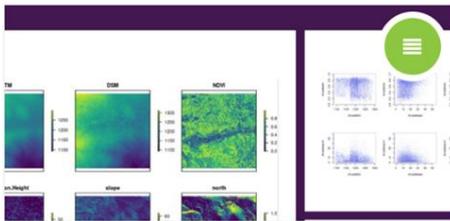
Lab, Online cours... 279 312 0 0 0 06.2021



Remote Sensing of Plants and Topography in R (Project EDDIE) for...

Kristen Brubaker
Version: 1.0 Adapted From: Remote Sensing of Pla...

Undergraduate, A... 211 133 0 0 0 05.2021



Comparative Landscape Ecology Project using RStudio Cloud (Project...

Elizabeth Ferguson
Version: 1.0 Adapted From: Remote Sensing of Pla...

Undergraduate, A... 241 215 0 0 0 05.2021



Sustainability Metrics (Project EDDIE)

Andrew Haveles
Version: 1.0 Adapted From: Sustainability Metrics (...)

Lab, Online cours... 205 63 0 0 0 05.2021



Phenology Trends and Climate Change in Minnesota (Project EDDIE...

Kristine Hopfensperger
Version: 1.0 Adapted From: Phenology Trends and ...

Introductory, Onli... 192 97 0 0 0 05.2021



9200 registered users



1139 resources available through QUBESHub



95 total partners, **69** new groups formed last year



27 proposal efforts last year

Faculty Mentoring Networks (FMNs):

Faculty professional development



57 total FMNS, **14** FMNs sponsored last year.

621 overall FMN faculty participants

154 FMN faculty participants last year



FMN faculty participants will have likely impacted over **100,000 students** through reformed curricula/OER.

Partners feedback of QUBES:

“ QUBES provides a community of individuals dedicated to improving quantitative skills in our undergraduate biology community, an opportunity to connect to other individuals interested in this topic, and a platform in which to interact and build community around these topics.

“ QUBES provides a resource sharing platform, links to a ready-made audience, and profile/recognition that would be hard to replicate independently.

“ Thus far QUBES has been an optimal platform for bringing new faculty into our organization.

Taylor, R. (2021). HF Bates Mid Year Progress Report. Sustainability Challenges for Open Resources to promote an Equitable Undergraduate Biology Education (SCORE-UBE), QUBES Educational Resources. doi:10.25334/7HG6-2A86

Thanks for joining us. Please feel free to share questions and comments.



Sarah Prescott, PhD

Executive Director



Sam S. Donovan, PhD

Director of Outreach and Strategic Engagement



Drew LaMar, PhD

Director of Cyberinfrastructure

Follow us for updates and announcements.

@BioQUESTed
@QUBES

Newsletter



Caitlin Hayes

Communications Manager



Jenny Kwan

Full Stack Developer



Hayley Orndorf

Workshop Coordinator and UDL Program Manager



Deborah Rook, PhD

Deputy Director



Katrina Wells

Project Assistant