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.
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.
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.

Visit group or author to find related resources.
Open Publishing Platform

Software for Students & Faculty
C1. Explain the role of computation and data mining in addressing hypothesis-driven and hypothesis-generating questions within the life sciences.
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.
Collaborative work spaces: Using a group to Host a project

Partners Page

Professional societies, grant funded projects, pet projects, ...
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
Systemic Initiative for Modeling Investigations & Opportunities with Differential Equations – SIMIOIDE

Happening Now

- The next SIMIOIDE 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
Articles in *CourseSource* are organized by courses

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 03.22.2022

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:

- bioinformatics
- Noncovalent Interactions
- Enzyme Catalysis
- Protein Structure/Function

A 360° View of COVID-19

Version 1.0  Published on 11.21.2021

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

- genetics
- immunology
- Biochemistry
- Bioinformatics
- Molecular evolution
- Public health, virus, COVID-19

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:

Allan Adams (Northern Arizona University), Robert Brasker (University of Minnesota), Jennifer Canney (Winger Lakes Community College), Bradley Hyman (University of California), Michael Klumovskiy (University of Colorado), Kathryn Miller (Washington University), Susan Singer (Carleton College), Kimberly Tanner (San Francisco State University), Michael Wzymezak (Hampden-Sydney College) and Sue Witz (University of Minnesota).

Download the Cell Biology Learning Framework

Cell Biology Learning Framework  see all Cell Biology articles

Society Learning Goals

- 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?

- 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
- Metosis: A Play in Three Acts, Starring DNA Sequence
- Sex-specific differences in Metosis: Real-world applications
- Using Immunocytchemistry and Fluorescence Microscopy Imaging to Explore the Mechanism of Action of Anti-Cancer Drugs on the Cell Cycle

https://qubeshub.org/community/groups/coursesource/courses/cell-biology
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

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, ...

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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

A transformative, collaborative community empowering innovation in STEM education.
Faculty Mentoring Networks

- CourseSource Online4Bio Writing (Spring 2022)
- Applying Universal Design for Learning Principles to Existing Cases (Spring 2022)
- Project EDDIE: Teaching Scientific Concepts and Quantitative Reasoning with...
- ImmunoReach: Bridging Immunology with Other Disciplines (Spring 2022)
- Hosting a Project with BioQUEST / QUBES (Spring 2022)
- Molecular CaseNet (Spring 2022)
- QB@CC: Conceptualizing Connections between Mathematics and...
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

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 Havelas, University of Wisconsin - River Falls

Visit Partner Group on QUBES
Final Products

**Climate Drivers of Phenology (Project EDDIE)**
Beatriz Villar  
Version: 1.0  
Lab, Online course...  
632  825  0  0  06.2021

**Wind and Ocean Ecosystems (Project EDDIE)**- adapted to provide greater...
Laura Reynolds  
Version: 1.0  
Lab, Online course...  
279  312  0  0  06.2021

**Remote Sensing of Plants and Topography in R (Project EDDIE)** for...
Kristen Brubaker  
Version: 1.0  
Undergraduate, A...  
211  133  0  0  05.2021

**Comparative Landscape Ecology Project using RStudio Cloud (Project...**
Elizabeth Ferguson  
Version: 1.0  
Undergraduate, A...  
241  215  0  0  05.2021

**Sustainability Metrics (Project EDDIE)**
Andrew Havelas  
Version: 1.0  
Lab, Online course...  
205  63  0  0  05.2021

**Phenology Trends and Climate Change in Minnesota (Project EDDIE...**
Kristine Hopfensperger  
Version: 1.0  
Introductory, Onli...  
192  97  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."
Thanks for joining us. Please feel free to share questions and comments.

Follow us for updates and announcements.

@BioQUESTed
@QUBES

Newsletter

A transformative, collaborative community empowering innovation in STEM education.