

### QBMR CALL for Collaboration

The Quantitative Undergraduate Biology Education and Synthesis (QUBES) project met at NIMBIOS on March 24-26 to determine areas of focus for our work. There are a multitude of topic areas within quantitative reasoning, including quantification of a context (quantitative act), quantitative skill development (quantitative literacy), interpreting biological models (quantitative interpretation), and creating models (quantitative modeling). QUBES determined that modeling would be the focus for the project. In addition to commissioning papers laying a framework for quantitative modeling in biology, QUBES assigned a subgroup to work on researching the current state of modeling in undergraduate biology courses that have implemented a quantitative approach. The Quantitative Biology Modeling Research (QBMR) team invites you to collaborate in the research project.

#### Research Questions:

- What is the impact of incorporating quantitative modeling into undergraduate biology courses on student understanding of modeling?
- What is the impact of incorporating quantitative modeling into undergraduate biology courses on student understanding of biology?
- What is the impact of incorporating quantitative modeling into undergraduate biology courses on student belief and attitude towards modeling in biology?
- What types of models and modeling methods are commonly used in quantitative biology courses?

Method: QBMR has piloted a short closed item survey of modeling for quantitative biology courses. The survey focus is on interpreting quantitative biology models (QI) to determine student ability to use the model to determine trends, make predictions, translate between representations, and revise models. QI is the gateway to quantitative modeling (QM) and the research team is working on developing QI revision of model questions that bridge to QM, while retaining closed-form items. The QBMR assessment is not focused on quantitative literacy (QL); it is not a test of applying arithmetic and algebraic skills in modeling. While QL is a critical underlying aspect of QM, the research team does not want to get lost in the QL void. We are considering other QL assessments which could be given as pre-assessments and provide formative assessment to indicate QL areas in need of supplemental instruction or just-in-time instruction. The QBMR assessment will include quantification act (QA), the ability of the student to quantify a biology context so they understand the variable quantities which are the building blocks of the model. QA includes naming the object, understanding the measure, and identifying attributes of the object that are basis of setting up relationships between variables.

The pilot QBMR assessment includes multiple choice questions on QA, QI, and the bridge to QM. The biology context for the QBMR assessment was not one that was directly studied in the pilot study classes. The QUBES team expressed an interest in having the QBMR assessment allow the use of biology contexts that were studied in a participating class. We are considering development of a more open-ended version of the assessment to allow for this, providing an

opportunity to incorporate the QBMR as a formative assessment, while still providing data for the study.

The QBMR will be implemented in undergraduate quantitative biology courses in Fall 2016 and Spring 2017. The survey will be short, taking no more than 20 minutes. It will be provided in both a paper and online survey form (Qualtrics Survey). Data from the survey will be shared with the research team without student identifiers. We are exploring inclusion of demographic data (gender, race/ethnicity, major, etc.) which would be collected as part of the survey.

Participation: There are multiple levels at which faculty teaching undergraduate quantitative biology courses can participate.

- Modeling Exemplars: share examples of models you have your students interpret or develop, providing a collection of contexts for item development
- Item Review: review items developed to provide input on improving item, ensuring it is biological correct and elicits desired modeling concept
- Implementation Site: implement the QBMR assessment in your class
- Research Analysis: join the research team in analyzing data and discussing outcomes

How do I get involved? The project is being supported by QUBES, so information, blogs and updates for the QBMR project can be accessed at the QUBES Hub - <https://qubeshub.org/> . The research leads are Robert Mayes [rmayes@georgiasouthern.edu](mailto:rmayes@georgiasouthern.edu) and Joseph Dauer [joseph.dauer@unl.edu](mailto:joseph.dauer@unl.edu) . Feel free to contact us to discuss engaging in the project. The QUBES working group consists of: Kristen Jenkins, Sam Donovan, Drew LaMar, Carrie Diaz Eaton, Melissa Aikens, Hannah Callender, Kam Dahlquist, Joe Dauer, Joe Redish, Robert Mayes, Gerg Goins, and John Jungck. By all means if there is someone in this group you are familiar with fill free to ask them about the project.