This draft guide is to be piloted and revised by module development teams in AY 2020/2021

**Module Development Guide**

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Part 1: Module Development

Faculty working on the Module Development Teams (MDTs) are the heart of the Nexus Institute of Quantitative Biology (NIQB) project. This guide is intended to make the module development and implementation process as straightforward as possible.

**What is an NIQB module?** The NIQB module is envisioned to be a collection of teaching material to support student learning of quantitative reasoning skills as applied to specific biological topics. A typical module will consist of a set of guided active learning activities for students to complete in one laboratory period, as well as supporting materials for instructors including student pre-work activities, guidelines for implementation in the classroom, guidelines for assessment, and student performance data acquisition and reporting.

**The module development process:**

* Identify a topic in your course that lends itself to quantitative applications and reasoning
* Develop learning goals for the module focused on how quantitative approaches would enhance the understanding of the biological topic
* Consult the [Quantitative Competencies](https://drive.google.com/file/d/1E71O8DTFh_DhkXQj3VwZnyxwDax5sKpK/view) and the [Quantitative Competency Curriculum Map](https://niqb.umbc.edu/files/2020/11/QR-Curriculum-Map_IUSE_Fall20.pdf) to identify quantitative competency and goals that are the focus of this project and that have been covered in other modules. You can use this map to identify opportunities to incorporate quantitative competencies into your module that have not been covered or to revisit a competency that you feel could use reinforcement or presented at a [higher level](https://niqb.umbc.edu/files/2020/11/Increasing-difficulty-examples-for-the-Quantitative-Competencies-DRAFT-10_13_2020.docx). We recommend a minimum of two to three quantitative goals and no more than four for each module, depending on the difficulty level of the chosen quantitative goals
* Consult the [Module Template](https://drive.google.com/file/d/1YlPJwYUyvGweyumyHuhhaQ9KDXSf3_ma/view) to identify components of the module that will need to be completed.
* Develop module activities. As you do this make sure that you indicate which components of the module are required ([the intended CORE of the module](https://niqb.umbc.edu/files/2020/11/Elements-of-a-CORE-module.docx)) and which activities/questions the module development team feels is optional. Each module activity should directly relate to the identified learning objectives.
* Identify quantitative / computer skills that students may need to be proficient in before participating in the module. For these skills, students may need to complete pre-work assignments before coming to class. A set of pre-work exercises are available [here](https://umbc.box.com/s/18jkaj8413ldv6d7coy24z46a3kop30n). If you require additional pre-work exercises please [contact](https://niqb.umbc.edu/files/2020/11/Pre-Work-folder-contacts.docx) the member of the math team associated with your course.
* Develop a set of pre-post module assessment questions to be given before and after module implementation. We are asking module developers to prepare 2 assessment questions per quantitative goal to optimize validity. We also recommend that this post assessment be given one week after module implementation to allow students time to assimilate what they learned in the module. To ensure that module activities can be completed during the class time, we recommend that the assessment be offered online.

**Additional Resources for the Module Development Process**

* A summary of the grant, previously developed modules for a previous project, the [HHMI NEXUS Project](https://www.hhmi.org/science-education/programs/nexus-national-experiment-undergraduate-science-education), and other resources can be found by following this [link](https://sites.google.com/umbc.edu/niqb-iuseresources/resources).
* [FAQ](https://niqb.umbc.edu/niqb-community/quantitative-reasoning-modules/quantitative-reasoning-module-development-faq/) sheet for module developers

Part 2: Module Review

* Once a module is completed and before it is implemented in class, it must be submitted to the Curriculum Alignment Committee (CAC) for review. To do this the MDT will need to fill out the [**Module Review Form**](https://docs.google.com/forms/d/e/1FAIpQLSdQ-8Xvs5CFhYspSxhAD7x87cKGamIY38sQgxlwpWGh1Eqv5w/viewform). This form should be submitted to the PI of the [CAC team](https://niqb.umbc.edu/curricular-awareness/) associated with your course at least two weeks prior to it being presented to the CAC for review.

Part 3: Module Implementation

The first week of class students should fill out the [Math Biology Values Instrument and Demographic Survey](https://umbc.co1.qualtrics.com/jfe/form/SV_9otT7O3EuTD3Npb) which includes a student consent form. If not taken during the first week of class make sure that it is filled out **before any modules are implemented so that we can use the student data in this study.**  To minimize the potential influence of stereotype threat, the survey should be given at least one week prior to first module pre-assessment.

**Module implementation Activities**:

 1) Have students take the pre-module assessment (ideally at least one week before the class and BEFORE any module pre-work has been assigned)

2) Implement the modules activities in class

3) After the module has been completed please have students complete the post-assessment questions. We recommend that the post-assessment be given online within a week of module implementation.

Part 4: General Data Collection

**After a module** is implemented

* Complete and submit the [**Module Post-Implementation Form**](https://umbc.co1.qualtrics.com/jfe/form/SV_bBdEBx05GY4mfPL). Ideally these should be submitted within a week of module implementation or at least by the end of the semester.
* **Data Collection:**

Contact your institutional PI about how to submit student data.