Quantitative Reasoning Working Group
February 2015
FAQ

These FAQs accompany the Quantitative Reasoning Working Group’s (QRWG) request for feedback on two proposed models to implement a UH Mānoa quantitative reasoning requirement(s). The QRWG will soon ask the Mānoa Faculty Senate to vote on the proposed models. Both models change the current General Education Program requirements:

- Model 1 and Model 2 replace the Foundations Symbolic Reasoning requirement with a Foundations Quantitative Reasoning requirement; and
- Model 2 replaces a Focus Writing-intensive requirement with a Focus Quantitative Reasoning requirement.

A. Why did UH Mānoa form the QRWG?
Students’ quantitative reasoning (QR) skills have been an ongoing concern of UH Mānoa faculty for several years. We want Mānoa students to not struggle when faced with quantitative reasoning. Furthermore, the need for graduates with adequate QR skills has been confirmed by external organizations such as the Western Association for Schools and Colleges (WASC), which accredits the Mānoa campus. The QRWG is motivated by the desire to create useful QR experiences for Mānoa’s undergraduates, ensuring that they graduate from UH Mānoa with a sufficient level of competence and a relevant set of skills in QR.

B. What has been the QRWG’s process?
For nearly one year, the QRWG has sought feedback from faculty at all UH campuses and consulted expert sources.

Feedback has been received from individual faculty from Hawai‘i CC, Honolulu CC, Kapi‘olani CC, Kaua‘i CC, Leeward CC, UH Mānoa, UH Maui, UH West Oah‘u, Windward CC. Feedback has been received from groups: Council of Chief Academic Officers, Mānoa Arts & Sciences Faculty Senate Executive Committee, Mānoa Deans & Directors, Mānoa Foundations Board, Mānoa General Education Committee, UH System Foundations Board.

The expert sources we consulted include the following:

- Syllabi, assignments, course descriptions, including StatWay, QuantWay, Math 100, Math 132, science courses that require quantitative reasoning and financial literacy initiatives
- Association of American Colleges & Universities’ Quantitative Literacy VALUE rubric
- Common Core Math Standards, grades 9-12 Recommendations from the Mathematical Association of America
- Publications such as Health Literacy and Numeracy and Mathematics and Democracy

C. What if Mānoa does not change its general education requirements to include QR?
Mānoa must demonstrate that it offers students sufficient QR learning opportunities and must demonstrate that students graduate from Mānoa with QR skills. This is an accreditation requirement as of 2013.
The QRWG weighed a requirement option vs. a no requirement option. A QR requirement(s) will require less faculty time. If Mānoa does not build QR into general education requirements, individual faculty must still document that they offered QR experiences to students, document their evaluation of students’ QR skills, and other faculty must still review the documentation on a regular basis, and submit the information as part of the re-accreditation process. The QRWG believes that including QR in the general education requirements is the best route.

D. What will be the impact on students?
Students will be required to complete the same number of credits/courses. The impact will be on what is learned in the first year and in subsequent courses: students will learn about quantitative reasoning as a practical, relevant skill and have opportunities to solve “real-world” and disciplinary problems.

Students will be able to satisfy their QR requirement(s) by taking approved course(s) at Mānoa, at another campus in the UH system, and at a college not in the UH system. Students will also be able to satisfy the requirement through non-course means that will need additional faculty input and expertise to determine: score on an internal or external exam (e.g., Advanced Placement Exam); extraordinary educational experience (see “Exemption from a Focus requirement” in the Catalog, http://www.catalog.hawaii.edu/corerequirements/grad-requirements.htm.

E. What will be the impact on faculty?
A quantitative reasoning requirement(s) offers faculty members opportunities to enhance their courses with quantitative reasoning assignments and activities. Departments that offer FS courses will be asked to review their courses and modify as needed to meet the FQ hallmarks. Faculty across the curriculum will be encouraged to include quantitative reasoning in their courses. If a Focus quantitative reasoning requirement is approved, resources for faculty are needed and willing faculty are needed to offer a sufficient number of Focus QR courses to students. Faculty in non-STEM disciplines will need to offer Focus QR courses. New faculty boards/committees/working groups are needed.

F. Will there be a gradual implementation of a quantitative reasoning requirement(s)?
Yes, of course. We plan to have Mānoa start offering quantitative reasoning courses in 2016-2017 alongside Foundations Symbolic Reasoning (FS) courses. The Foundations Symbolic Reasoning (FS) courses have been approved through summer 2018 and Mānoa departments can continue to offer them as FS until then. In fall 2018, all entering students will be required to fulfill the new general education requirements. Starting in fall 2018, students who entered Mānoa in fall 2015-summer 2018 will have the option of fulfilling the current general education requirements or “move up” to the new general education requirements with the quantitative reasoning requirement. In fall 2018 and beyond, students under the previous general education requirements will satisfy the Foundations requirement with a Foundations quantitative reasoning course.

G. What is the difference between quantitative reasoning and math?
The following chart is taken from “Quantitative Reasoning: The Next ‘Across the Curriculum’ Movement” by Susan Elrod (Figure 2, page 6, Peer Review, Summer 2014), and it summarizes the main differences:
H. What is quantitative reasoning? What are the hallmarks of a QR course?

Quantitative reasoning (QR) is the ability to apply mathematical concepts to the interpretation and analysis of quantifiable information in order to solve a wide range of problems, from those arising in pure and applied research to everyday issues and questions. It includes the ability to do the following: apply math skills; judge reasonableness of results; understand and communicate numerical information via variables and equations, graphs and charts, words/sentences; and recognize the limits of mathematical or statistical methods.

[Note: quantifiable information can be expressed numerically or graphically]

**Foundations Quantitative Reasoning Hallmarks** (updated 01/15/2015)

To satisfy a Quantitative Reasoning Foundations requirement, a course will meet these hallmarks:

1. help students value the relevance and usefulness of quantitative reasoning.
2. include practical quantitative reasoning problems that apply to specific disciplines, daily and civic life, and/or professional settings (i.e., not be purely theoretical).
3. provide opportunities for practice and feedback that are designed to help students evaluate and improve quantitative reasoning skills by including a course component with a 30:1 student to teacher ratio (e.g., a lab/recitation section, Supplemental Instruction sessions, or a class limited to 30 or fewer students).
4. be designed so that students will be able to
   A. identify and convert relevant quantitative information into various forms such as equations, graphs, diagrams, tables, words;
   B. make and evaluate assumptions in estimation, modeling, and data analysis;
   C. calculate (including selection of appropriate formulas and correct manipulation of formulas);
   D. make judgments and draw appropriate conclusions based on the quantitative analysis of data, the assumptions made, the limitations of the analysis, and the reasonableness of results;
   E. create logical arguments supported by quantitative evidence; and
   F. communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).

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1 The statements listed here are adapted from the Association of American Colleges & Universities’ [Quantitative Literacy VALUE rubric](http://www.qlvalue.org).

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Focus Quantitative Reasoning Hallmarks

To satisfy a Quantitative Reasoning Focus requirement, a course will meet these hallmarks:

1. The course will help students value the relevance and usefulness of quantitative reasoning in a specific discipline.
2. The course will include practical quantitative reasoning problems that apply to a specific discipline, daily and civic life, and/or professional settings (i.e., not be purely theoretical).
3. The course will be numbered 200-499.
4. The course will be limited to 30 students or a 30:1 student to instructor ratio.
5. At least 40% of the final grade for a 3-credit course will be based on student’s quantitative reasoning skills (30% for a 4-credit course; 60% for a 2-credit course; 100% for a 1-credit course).
6. be designed so that students will be able to:
   A. identify and convert relevant quantitative information into various forms such as equations, graphs, diagrams, tables, words;
   B. make and evaluate assumptions in estimation, modeling, and data analysis;
   C. calculate (including selection of appropriate formulas and correct manipulation of formulas);
   D. make judgments and draw appropriate conclusions based on the quantitative analysis of data, the assumptions made, the limitations of the analysis, and the reasonableness of results;
   E. create logical arguments supported by quantitative evidence; and
   F. communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).

I. What QR examples and resources already exist?

Columbia University Quantitative Reasoning courses
http://bulletin.columbia.edu/general-studies/undergraduates/degree-fulfillment/core/core/quantitative-reasoning/

Dartmouth College Mathematics Across the Curriculum Evaluation Summary: Mathematics and Humanities Courses (see section III)

Mathematical Association of America: Quantitative Literacy Curriculum and Department Guidelines & Recommendations

Mathematical Association of America: SIGMAA on Quantitative Literacy Resources, information & faculty development
http://sigmaa.maa.org/ql/resources.php

Mathematical Association of America: SIGMAA-QL Newsletter, December, 2014: “A discussion of the past and future of quantitative literacy”; “perspectives on quantitative literacy from across the curriculum”; “reality math”

2 The statements listed here are adapted from the Association of American Colleges & Universities’ Quantitative Literacy VALUE rubric.

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National Numeracy Network: QR Teaching Activities
http://serc.carleton.edu/nnn/teaching/test.html

The New Mathways Project Curricular Materials


Reality Math (examples from energy, environment, finance, sports)
http://www.realitymath.org/

University of Colorado Boulder: Music 4988: The Entrepreneurial Artist
http://www.colorado.edu/catalog/2014-15/courses?subject=MUSC&number=4988

Textbooks/Guides:
Common Sense Mathematics (textbook for teaching quantitative reasoning to college students)
Currently free, online: http://quantitativereasoning.net/

Math in Society (mathematical topics for entry-level quantitative reasoning courses for liberal arts majors)
Free, online: http://www.opentextbookstore.com/mathinsociety/index.html

Models of Conflict and Cooperation (a comprehensive, introductory, game theory text for general undergraduate students)
By Rick Gillman (Valparaiso University) and David Housman (Goshen College)
http://www.ams.org/publications/authors/books/postpub/mbk-65

Quantitative Reasoning: Tools for Today’s Informed Citizen
By Alicia Sevilla and Kay Somers (both, Moravian College)
Originally published by Key Curriculum Press; available now at J Wiley Site

J. Where did the list of student skills in the Hallmarks come from?
The list is based on the dimensions in the Quantitative Literacy VALUE rubric that was developed by teams of faculty experts representing colleges and universities across the United States. The rubric provides performance descriptors for many of the items listed in hallmark #3.

K. Some of the QR examples appear to use only high-school-level mathematics. Will QR courses be at the college level?
Yes. The quantitative reasoning courses will require students to apply mathematical tools to complex professional and daily-life scenarios. An analogy is literature: students read the same novel in high school and college. In college, the novel is re-analyzed using advanced tools of literary criticism and student’s understanding of the work’s themes and context is informed by other college courses and post-secondary life experience.

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L. Does the System Foundations Board need to approve a change in Mānoa’s Foundations requirements?
No. However we acknowledge that a change in Foundations requirements at Mānoa will have an effect on the systemwide committee on Foundations. Thus we will work with faculty on the systemwide committee and at all UH campuses to have simple, efficient student and course transfer procedures.

UH Hilo and Hawai‘i Community College already have a quantitative reasoning requirement. Maui College is working on a quantitative reasoning requirement. Because WASC requirements state that campuses need to demonstrate student competency in QR, we encourage all campuses (both 4-year and 2-year) to examine whether their current core/graduation requirements are adequately preparing all students in this area.

Contact us at qrwg.hawaii@gmail.com.

Thank you.

Visit our website: http://manoa.hawaii.edu/quantitativereasoning