

**Curricular Affairs Committee  
of the Faculty Senate**

**MEMO**

**To:** The UVM Faculty Senate  
**From:** Curricular Affairs Committee of the Faculty Senate, Laura Almstead, Chair  
**Date:** March 3, 2017  
**Re:** Approval of a proposal for a University-wide General Education requirement in Quantitative Reasoning

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At its meeting on March 2, 2017, the Curricular Affairs Committee unanimously approved the action recommended in the following memo and attached proposal.

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The Curricular Affairs Committee unanimously approved a proposal for a University-wide General Education requirement in Quantitative Reasoning. The proposal, which was developed by a committee of dedicated faculty, puts forth the resolution below. The full proposal is attached to this memo, and describes the development process and specific courses identified as fulfilling the proposed requirement. If approved by the Faculty Senate and Board of Trustees, the requirement will be implemented starting Fall 2017.

Resolution

Be it resolved, that beginning with entering fall 2017 undergraduates, the Quantitative Reasoning proficiencies be made a General Education requirement.

Be it also resolved, that the following language be used in the course catalog:

"Quantitative Reasoning (QR) requirement: Beginning with the entering first-year class in fall 2017, all undergraduates must meet the Quantitative Reasoning General Education requirement for the University of Vermont. To meet this requirement, students must complete a course, curriculum, or co-curriculum prior to graduation that has been approved by the Faculty Senate's Quantitative Reasoning Curriculum Review Committee.

**Topic:** Quantitative Reasoning General Education Requirement

**Date:** February 18, 2017

**Committee Membership:**

Joan Rosebush, Mathematics, Committee Chair

Judith Christensen, Psychological Science

Lia Cravedi, Secondary Education

Stephanie Phelps, Microbiology and Molecular Genetics

Larry Rudiger, Psychological Science

Joan Rosebush, Chair and named above, brought the committee together in July 2016.

**Charge:**

We were tasked with the following:

- 1) Developing learning proficiencies in the area of quantitative reasoning,
- 2) Developing a method for assessing whether a course contributes to the quantitative reasoning requirement, and
- 3) Developing an assessment plan that would be implemented in the future.

**Steps Taken by Our Committee:**

To meet our charge, we have engaged in the following activities, beginning with our first meeting in July 2016 and culminating in this proposal.

**1. We reviewed the General Education goals and definition of Quantitative Reasoning President Sullivan outlined in the October 22, 2014 Issue of Vermont Quarterly.**

“At the University of Vermont, our faculty over a course of years has developed six learning outcomes within its general education criteria. These learning outcomes are 1) communication, writing, and information literacy; 2) quantitative reasoning; 3) science, systems, and sustainability; 4) cultures, diversity, and global perspectives; 5) integrating and the application of knowledge; and 6) art, aesthetic and design. These carefully considered learning outcomes, I believe, address almost all of the issues contained in the debate about the purpose of an education and the responsibility of our universities.”

**What is Quantitative Reasoning?**

(President Sullivan uses “quantitative reasoning,” while The Mathematical Association of America, (MAA), refers to it as “quantitative literacy.”)

According to The Mathematical Association of America (MAA),

“A quantitatively literate college graduate should be able to:

- Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
- Represent mathematical information symbolically, visually, numerically, and verbally.

- Use arithmetical, algebraic, geometric and statistical methods to solve problems.
- Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
- Recognize that mathematical and statistical methods have limits.”

The MAA guidelines further explain quantitative literacy expectations of college students: “The level of sophistication and maturity of thinking expected of a college student should extend to a capability for quantitative reasoning which is commensurate with the college experience. College students should be expected to go beyond routine problem solving to handle problem situations of greater complexity and diversity, and to connect ideas and procedures more readily with other topics both within and outside mathematics.”

## **2. We generated a rationale for the Quantitative Reasoning requirement.**

The Quantitative Reasoning General Education requirement is intended to assure that graduates of the University of Vermont possess the ability to think critically, evaluate information, and reason quantitatively in order to excel in their chosen field and to perform as successful citizens in the world.

## **3. We identified expected proficiencies embedded in the identified quantitative reasoning courses.**

Each student will be a productively numerate citizen who will be proficient in:

- Interpreting data represented in a variety of ways, such as graphs, tables, and charts;
- Solving problems, through the use of patterns, numbers, and symbols;
- Evaluating the value and validity of provided information;
- Determining if the solution to a quantitative problem makes logical sense in the real world;
- Formulating alternative solutions; and
- Communicating effectively the thought process used to interpret and solve the problem.

*Note: We understand that each of the six (6) proficiencies will not be emphasized equally in each course that will fulfill this requirement. We believe that our students will be proficient in at least four of the six areas with any of the courses fulfilling the Quantitative Reasoning requirement.*

## **4. Rebecca Clark in the Registrar’s Office gave us the list of University’s majors and the minimum MATH requirement of each major. (This “MATH” requirement also included courses in CS, PHIL, and STAT.)**

The courses in which these proficiencies are evaluated include, but are not limited to:

- MATH numbered 009 or higher,

- STAT numbered 051 or higher,
- CS numbered 008 or higher, or
- PHIL 013\*.

*\*Note: The committee thought that Phil 013 was an appropriate course to include in the above list however; we felt it was important to support this assertion with evidence. Chair Rosebush attended the course and noted the following: “the symbolic representation is similar to that in mathematics. “Math with words” is how many students express PHIL 013. The logical thought required and the symbolic notation used, make it akin to a mathematics course. Also, a student in that class with whom Chair Rosebush spoke told her that with his mathematics learning disability, a MATH course would be “extremely difficult, if not impossible” for him. PHIL 013 makes sense to him since words, instead of numbers, are around the operation symbols.*

**5. We addressed the fact that there were three (3) majors that either had no quantitative reasoning requirement or did not include one of our specific quantitative reasoning courses. The majors were Human Development and Family Studies, Art Education, and Music Education. (See Appendix A: Minimum Quantitative Reasoning Requirement by Major.)**

Prior to bringing this proposal forward for consideration, committee members contacted Larry Shelton from Human Development and Family Studies, Erika White from Art Education, and Patricia Riley from Music Education. All of the three (3) programs are willing to revise their program sequence and advisement processes to ensure each student will have one or more of the above courses on their transcripts at graduation.

**6. We contacted a representative group of Quantitative Reasoning instructors and asked them to identify which proficiencies are addressed in their courses.**

A survey was sent to the fall 2016 instructors of CS 008, MATH 009, PHIL 013, and STAT 051. The survey included a list of the six (6) proficiencies introduced previously in this proposal (see #3). Instructors, without having seen the proficiencies prior, responded to the question “Which of these proficiencies do you address in your course?” Results were sent to Chair Rosebush, who summarized them. Seven (7) of the eight (8) course instructors surveyed indicated that they address a minimum of four (4) of the six (6) proficiencies. One course instructor reported she addresses three (3) of the six (6) proficiencies.

This proved to be a valuable step in the process, as it provided baseline data about what is already occurring in the target courses. It affirmed that these are appropriate courses in which to assess the Quantitative Reasoning proficiencies.

It is of note that the instructor of MATH 009A, the course in which only three (3) of the six (6) proficiencies were addressed in the fall of 2016, found the proficiencies illuminating. She affirmed that she definitely would include all of the proficiencies in the course the next time she teaches it. (She communicated this in a personal communication with Chair Rosebush.)

**7. We wrote a brief description for each of the identified quantitative reasoning courses. (Note that courses with CS, MATH, and STAT prefixes numbered higher than the course indicated below also fulfill the requirement.)**

**CS 008: Introduction to Web Site Development**

This course provides a strong foundation in working with images, beginning web programming, and web design so that students can create a functional web site.

**MATH 009: College Algebra**

This course covers sets, relations, functions with particular attention to properties of algebraic, exponential, logarithmic functions, their graphs and applications.

**PHIL 013: Introduction to Logic**

This course covers the basic principles of deductive inference. When does one statement follow from another? When is one statement a logical consequence of another? This course helps students cultivate skills they can put to use to decide whether arguments they encounter in their daily lives really demonstrate the truth of their conclusions. The course will introduce students to the concepts and techniques used in first order logic. The material covered is technical in nature. The aim is to first formalize and then analyze natural English statements using the symbolic language and methods of this first order logic.

**STAT 051: Probability With Statistics**

This course is an introduction to probabilistic and statistical reasoning, including probability distribution models and applications to current scientific/social issues. The roles of probability, study design, and exploratory/confirmatory data analysis are covered. It covers the basic reasoning used in probability models of the real world, with statistical applications.

**8. We checked the historical enrollments in our identified quantitative reasoning courses.**

An analysis of historical enrollments for CS 008, MATH 009, PHIL 013, and STAT 051 indicated that there is sufficient room in these courses to accommodate students in the three majors that do not currently include a course meeting the proposed Quantitative Reasoning requirement.

**Assessment:**

We are able to assert that students have the opportunity to achieve competence in four (4) of the six (6) proficiencies by taking one of the courses listed above. We created a form for tracking student competence in four (4) of the six (6) proficiencies.

**Staffing Plan, Resource Requirements, and Budget:**

Given that the Quantitative Reasoning requirement draws on existing courses, no additional staff, resources, or budget will be required.

**Proposed Motions:**

Be it resolved, that beginning with entering fall 2017 undergraduates, the Quantitative Reasoning proficiencies be made a General Education requirement.

Be it also resolved, that the following language be used in the course catalog:

"Quantitative Reasoning (QR) requirement: Beginning with the entering first-year class in fall 2017, all undergraduates must meet the Quantitative Reasoning General Education requirement for the University of Vermont. To meet this requirement, students must complete a course, curriculum, or co-curriculum prior to graduation that has been approved by the Faculty Senate's Quantitative Reasoning Curriculum Review Committee.