

Q-core Rationale and Assessment Plan

Updated May 11, 2017

Rationale

The ability to reason quantitatively is essential for citizenship in the 21st Century world. An understanding of data and quantity, and how they are presented and interpreted by the press and on the Internet, is invaluable. Mathematics, Statistics, and logic are used throughout the world as essential tools in many fields, including natural science, engineering, medicine, and the social sciences. In the words of John Allen Paulos,

“... There are three reasons or, more accurately, three broad classes of reasons to study mathematics. Only the first and most basic class is practical. It pertains to job skills and the needs of science and technology. The second concerns the understandings that are essential to an informed and effective citizenry. The last class or reasons involves considerations of curiosity, beauty, playfulness, and perhaps even transcendence and wisdom.”

Learning Outcomes

Students completing a Core 2.0 Quantitative Reasoning (Q) course should demonstrate the ability to

1. interpret and draw inferences from mathematical or statistical models represented as formulas, graphs, or tables,
2. represent mathematical or statistical information numerically and visually, and
3. employ quantitative methods such as arithmetic, algebra, geometry, or statistical inference to solve problems.

Rubrics

Learning Outcome 1: Interpret and draw inferences from mathematical or statistical models represented as formulas, graphs, or tables.

Acceptable:

- The student demonstrates the ability to interpret the variables, parameters, and/or other specific information given in the model or statistical output. The interpretation may contain minor flaws.
- The student uses the model to draw inferences about the situation being modeled in a manner that may contain some minor flaw(s).
- The interpretation(s) and/or inference(s) may be incomplete or inaccurate due to a minor flaw, such as a computational or copying error or mislabeling.

Not acceptable:

- The student makes no appropriate attempt to interpret the variables, parameters, estimates, and/or other specific information given in the model due to major conceptual misunderstandings.
- The student either attempts to use the model to make the required inference(s) and/or interpretation(s) but lacks a clear understanding of how to do so, or the student cannot use the model to make the required interpretation(s) or inference(s).

Learning Outcome 2: represent mathematical or statistical information numerically and visually.

Acceptable:

- The student understands most of the important aspects of the mathematical or statistical information and employs the appropriate representation(s) to display the information with possible minor flaws.
- The student correctly and accurately employs most of the appropriate and required aspects of the representation to display the information. The representation may be lacking in a minor way.
- There may be misrepresentations of the information due to a minor computational/copying error. The student uses mostly correct format, mathematical or statistical terminology, and/or language.

Not Acceptable:

- The student does not fully understand the important aspects of the mathematical or statistical information and employs the appropriate representation(s) to display the mathematical information with major conceptual flaws.

- The student may show some knowledge of how to employ most of the appropriate and required aspects of the representation to display the information, but the representation or interpretation is lacking in a major way.
- The representations may show some reasonable relation to the information but contain major flaws. The student may use some correct format, mathematical terminology, and/or language, but the representation is incomplete in some major conceptual way.

Learning Outcome 3: *Employ quantitative methods such as arithmetic, algebra, geometry, or statistical inference to solve problems.*

Acceptable:

- The student demonstrates some understanding of the problem and/or can identify specific arithmetic, algebraic, geometric or statistical method(s) needed to solve the problem.
- The student uses the method(s) to solve the problem. The plan for the solution is clear, logical, and evident but may be lacking in a minor way such as misreading the problem, or a copying error.
- The solution or interpretation is generally correct or well justified, but may contain minor flaws.

Not Acceptable:

- The student demonstrates at best a slight understanding of the problem. The student has difficulty identifying the specific arithmetic, algebraic, geometric or statistical method(s) needed to solve the problem.
- The student may attempt to use a method(s) that will solve the problem, but the method itself or the implementation of it is generally incorrect. The plan is not evident nor logical.
- The solution or interpretation may contain some correct aspects though there exist major conceptual or logical flaws.

Threshold

For each learning outcome, at least 2/3 of the assignments from selected students should be at an "Acceptable" level as defined above.

Process for Assessing:

- 1) For each Q-course and each of the learning outcomes, special problem(s) or question(s) on the final exam, or other signature assignment, will be created, appropriate for evaluation using the above rubric.
- 2) Several sections of each multi-section course will be randomly selected, and then students may be randomly selected from those sections. Special assignments from selected students will be evaluated by two faculty members. At least six students should be evaluated for each course.
- 3) All assessed assignments should be saved electronically and provided with the assessment reports.
- 4) The two faculty members will review the special problems and, using the rubrics, determine whether each student's assignment demonstrates each learning outcome at an acceptable or unacceptable level.
- 5) The percentage of students demonstrating each learning outcome at an acceptable level, as well as the total number assessed, will be provided in a report to the Q-representative of the Core 2.0 Committee and to the Department Head. The report should be well organized following the organization of the Learning Outcomes in this document.
- 6) If the threshold is not met for a particular Q-course, the supervisor and instructors for the course will meet to determine how the course should be improved to better meet the learning outcomes in the future.

Course Review Schedule

All learning outcomes for seven or eight Q-core courses will be assessed during one semester according to the following schedule (assuming the course is offered that year). Starting in 2018-2019 we will start this same schedule over again, assuming no changes have been made.

2017 – 2018

M 133Q, *Geometry and Measurement for K-8 Teachers*

M 147Q, *Language of Mathematics*

2018 – 2019

M 149Q, *Secrets of the Infinite*

M 151Q, *Precalculus*

STAT 217Q, *Intermediate Statistical Concepts*

PHL 236Q, *Logic*

2019 – 2020

M 161Q, *Survey of Calculus*
M 165Q, *Calculus for Technology I*
M 171Q, *Calculus I*
M 181Q, *Honors Calculus I*

2020 – 2021

M 121Q, *College Algebra*
STAT 216Q, *Introduction to Statistics*
STAT 226Q, *Honors Introduction to Statistics*

2021– 2022

M 166Q, *Calculus for Technology II*
M 172Q, *Calculus II*
M 182Q, *Honors Calculus II*

2022 – 2023

M 145Q, *Math for the Liberal Arts*
M 273Q, *Multivariable Calculus*
M 283Q, *Honors Multivariable Calculus*
STAT 201Q, *Statistics in the World*