

Quantitative Reasoning Curriculum Considerations

“In teaching quantitative literacy, content is inseparable from pedagogy and context inseparable from content. Fortunately, because numeracy is ubiquitous, opportunities abound to teach it throughout the curriculum. Only by encountering the elements and expressions of numeracy in real contexts that are meaningful to them will students develop the habits of mind of a numerate citizen.”

—“The Case for Quantitative Literacy”, Lynn Arthur Steen

Question: Do our Quantitative Reasoning Skills and Goals fully reflect this integrated approach?

A sampling of how other colleges define a QR curriculum:

“QR courses are by their nature centered on making sense of and communication about quantitative ideas, which means that students need opportunities for first-hand experience with data. Courses qualifying as QR are expected to include appropriate practice...in finding and using quantitative information in context. Quantitative data and conclusions should be communicated mathematically, visually, orally, and in writing, and students should be able to translate from one form to another. Students are expected to use basic computational skills, but the focus of a QR course is on thinking about using quantitative information in context rather than on the computation itself.

“You will improve your quantitative reasoning skills when your course asks you to do the following:

- Apply empirical data to a special problem or issue.
- Draw conclusions based on quantitative information.
- Analyze graphical information and use it to solve problems.

For faculty members, the course must address 3 of the following 5 elements of quantitative reasoning, which must comprise 30% or more of the course:

- *Confidence with Mathematics*: Being comfortable with quantitative ideas and at ease in applying quantitative methods. Individuals who are quantitatively confident routinely use mental estimate to quantify, interpret, and check other information. Confidence is the opposite of “math anxiety”; it makes numeracy as natural as ordinary language.
- *Interpreting Data*: Reasoning with data, reading graphs or maps, drawing inferences, and recognizing sources of error. This perspective differs from traditional mathematics in that data (rather than formulas or relationships) are at the center.

- *Making Decisions*: Using mathematics to make decisions and solve problems in everyday life. For individuals who have acquired this habit, mathematics is not something done only in math class but a powerful tool for living, as useful and ingrained as reading and speaking.
- *Mathematics in Academic and Practical Contexts*: Using mathematic or numerical tools in specific setting where the context provides meaning. Notation, problem-solving strategies, and performance standards all depend on the specific context. Knowing how to solve quantitative problems that a person is likely to encounter in a civic, professional, or personal environment.
- *Number Sense*: Having accurate intuition about the meaning of numbers, confidence in estimation, and common sense in employing numbers as a measure of things.

-University of North Dakota, Summary of Task Force findings on QR

“Quantitative reasoning is correctly using numbers and symbols, studying measurement, properties, and the relationships of quantities, or formally reasoning within abstract systems of thought to make decisions, judgments, and predictions...

...The University expects graduating students to effectively use quantitative reasoning to evaluate information and argument, solve problems, and make decision to these ends.

“A graduating fourth-year undergraduate at the University of Virginia will be able to:

1. Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
2. Communicate mathematical information symbolically, visually, numerically, and verbally.
3. Use arithmetical, algebraic, geometric, and analytical methods to solve problems.
4. Estimate and check answers to mathematical problems in order to determine reasonableness.
5. Solve word problems using quantitative techniques and interpret the results.
6. Apply mathematical/statistical techniques and logical reasoning to produce predictions, identify optima, and make inferences based on a given set of data or quantitative information.
7. Judge the soundness and accuracy of conclusions derived from quantitative information, recognizing that mathematical and statistical methods have limits and discriminating between association and causation.
8. Solve multi-step problems.
9. Apply statistics to evaluate claims and current literature.

10. Demonstrate an understanding of the fundamental issues of statistical inference, including measurement and sampling.”

-University of Virginia Quantitative Reasoning Competency Assessment Plan

“Quantitative Reasoning is defined by the following five skills and abilities that will be assessed across the three primary courses designed to meet the Gen Ed requirements.

1. *Logical Reasoning*: Students will be able to interpret sentences that contain the logical connective “and”, “or”, “some”, “all”, and “none”. They will be able to use deductive reasoning to draw conclusions from a series of statements and to identify appropriate generalizations or trends.
2. *Computational Skills*: Students will develop facility in the language and symbols of mathematics and will be able to perform basic calculations and operations related to the application of mathematics or statistics.
3. *Data interpretation*: Students will be able to read and interpret visual displays of quantitative information such as bar graphs, line graphs, pie charts, pictographs, and tables.
4. *Problem Solving*: Students will be able to read a word problem, set up the necessary equations that describe the problem, solve these equations using basic quantitative techniques, and interpret or draw a conclusion from the solution.
5. *Quantitative Modeling*: Students will be able to model physical and natural phenomena and assess validity of a model, make prediction from the model, and draw conclusions based on the model.”

–Old Dominion University General Education Program

“For students in non-quantitative majors, the appropriate demand is that QR instruction act as a basic element of the ‘liberal arts’ curriculum; that it prepare graduate to function well as citizens in modern society. Many students do not learn sophisticated math skills, but all should be able to use simple math tools to reason – to understand, interpret, critique, debunk, challenge, explicate, and draw conclusions. In short, college graduate should be able to evaluate the crush of quantitative data modern life throws at all literate citizens.”

-Western Washington University

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