

Assessing Quantitative Reasoning



Corri Taylor, Director

Wellesley College's Quantitative Reasoning Program

QR is defined as....

- the ability to understand and use quantitative measures and inferences that allow one to function as a responsible citizen, productive worker, and discerning consumer.
(Bernie Madison)
- the ability to identify, understand and use quantitative arguments in everyday contexts. Quantitative literacy describes a *habit of mind* rather than a set of topics or a list of skills.
(Deborah Hughes Hallett)

How does "QR" differ from "Math"?

(Bernie Madison's "two mathematics")

Math

- Math track moves vertically to higher levels of abstraction....beauty and elegance
- Focus on content and components: algebra, geometry, statistics, calculus

QR

- QR reaches out horizontally, applying processes of reasoning, deduction, and analysis to a wide array of applications in many practical fields
- Focus on the hands-on use of logic, statistics, and math to solve problems in context-rich settings

QR Competencies

(MAA's Standards for College Students)

- Reading and understanding quantitative info in graphs, tables, etc.
- Interpreting quantitative info and drawing appropriate inferences
- Solving problems using logic, math, statistics
- Estimating answers and checking for reasonableness
- Communicating quantitative info – verbally, graphically, numerically
- Recognizing the limitations of mathematical or statistical models

QR at Wellesley College



Two-Part QR Requirement

1. Basic skills requirement –
Pass QR Assessment (18 open-ended questions) *or* pass Basic Skills Course in first year. Prereq for quant courses.
2. QR overlay requirement –
Take course that emphasizes analysis of data. Note: Wellesley also has a mathematical modeling requirement.

QR Overlay Courses in....

Astronomy	Economics
Biology	Education
Chemistry	Philosophy
Computer Sciences	Political Science
Geology	Psychology
Mathematics	and
Physics	Sociology

Various Assessment Efforts



Assessment of QR at Wellesley and Beyond

Folks at Wellesley, Dartmouth, Carleton, James Madison, etc. have been assessing....

1. Incoming students' skills for placement and the placement tests themselves
2. Students' attitudes and behaviors
3. Students' outcomes and program effectiveness

Assessing Incoming Students' Skills for Placement

- Wellesley uses an 18 item, open-ended assessment during Orientation.
- For prior versions of our placement test:

http://serc.carleton.edu/files/nnn/teaching/wellesley_qr_booklet.pdf

- Good article on assessing such tests for validity and reliability by Wallace et al. at:

<http://services.bepress.com/numeracy/vol2/iss2/art3/>

Assessing Students' Attitudes and Behaviors

- Dartmouth Student Attitude Assessment – J. Korey's pre- and post- test on 4 scales: ability, utility, personal growth, & interest

<http://www.math.dartmouth.edu/~matc/Evaluation/humeval.pdf>

- Analyses and surveys on students' course-taking behavior, etc. by OIR
- Continuous feedback from faculty teaching quantitative courses

Assessing Student Outcomes (Beyond Class-Related Tests and Projects)

1. JMU: measures two specific objectives
2. Carleton: QR in rhetoric – sophomore writing portfolios
3. AAC&U: QR in electronic portfolios
4. Wellesley: outcomes for students on either side of the placement margin

JMU's QR Assessment

Computerized, 26 item multiple-choice test to measure:

- * How well students use graphical, symbolic, and numerical methods to analyze, organize, and interpret natural phenomena.
- * How well students discriminate between association and causation, and identify the types of evidence used to establish causation.

http://www.jmu.edu/assessment/resources/prodserv/instruments_qr.htm

Carleton College's Study of QR in Rhetoric

Rubric for assessing QR in students' sophomore writing portfolios.

Examines whether quantitative evidence is presented when it is peripherally or centrally relevant and, if so, how well the evidence is presented.

http://serc.carleton.edu/files/quirk/quirk_rubric.v5.doc

The AAC&U's QR Rubric for Students' Electronic Portfolios

Four performance levels for progressively more sophisticated understanding.

Six performance categories: interpretation, representation, calculation, application and analysis, assumptions, and communication.

<http://www.aacu.org/value/rubrics/pdf/QuantitativeLiteracy.pdf>

Wellesley's Regression-Discontinuity Study

Examines the outcomes of students at the margin on the placement assessment: those who took the basic skills test and those who did not.

No major differences in GPA, course-taking, etc. but differences do appear in peer groups.

<http://www.wellesley.edu/Economics/mcewan/PDF/quantitative.pdf>

NNN's journal *Numeracy*

- For more info on assessing QR, see the June 2009 edition and....
- the upcoming January 2010 edition for more on the JMU assessment, in particular.

<http://services.bepress.com/numeracy/>

