LLU INSTITUTIONAL LEARNING OUTCOME: QUANTITATIVE REASONING DUAL RUBRIC

DEVELOPED FOR ACADEMIC AND PROFESSIONAL USE

Based on the AAC&U Quantitative Literacy VALUE Rubric, value@aacu.org, assessment@llu.edu, or see sites below[1].

The VALUE rubrics were developed by teams of faculty experts representing colleges and universities across the United States through a process that examined many existing campus rubrics and related documents for each learning outcome and incorporated additional feedback from faculty. The rubrics articulate fundamental criteria for each learning outcome, with performance descriptors demonstrating progressively more sophisticated levels of attainment. The rubrics are intended for institutional-level use in evaluating and discussing student learning, **not for grading**. The core expectations articulated in all 15 of the VALUE rubrics can and should be translated into the language of individual campuses, disciplines, and even courses. The utility of the VALUE rubrics is to position learning at all levels within a basic framework of expectations such that evidence of learning can by shared nationally through a common dialog and understanding of student success.

Definition

Quantitative Reasoning (QR) – also known as Numeracy or Quantitative Literacy (QL) – is a "habit of mind," competency, and comfort in working with numerical data. Individuals with strong QR skills possess the ability to reason and solve quantitative problems from a wide array of authentic contexts and everyday life situations. They understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).

Quantitative Reasoning Across the Disciplines

Current trends in general education reform demonstrate that faculty are recognizing the steadily growing importance of Quantitative Reasoning (QR) in an increasingly quantitative and data-dense world. AAC&U's recent survey showed that concerns about QR skills are shared by employers, who recognize that many of today's students will need a wide range of high level quantitative skills to complete their work responsibilities. Virtually all of today's students, regardless of career choice, will need basic QR skills such as the ability to draw information from charts, graphs, and geometric figures, and the ability to accurately complete straightforward estimations and calculations.

Given widespread agreement about the importance of QR, it becomes incumbent on faculty to develop new kinds of assignments which give students substantive, contextualized experience in using such skills as analyzing quantitative information, representing quantitative information in appropriate forms, completing calculations to answer meaningful questions, making judgments based on quantitative data and communicating the results of that work for various purposes and audiences. As students gain experience with those skills, faculty must develop assignments that require students to create work products which reveal their thought processes and demonstrate the range of their QR skills. For more information regarding quantitative literacy best practice and assignments, refer to the following websites:

- https://serc.carleton.edu/NICHE/best_practices.html
- https://www.utdanacenter.org/our-work/higher-education/higher-education-curricular-resources/quantitative-reasoning
- https://www.uwb.edu/qsc/faculty-staff-support/integrating

New Framing Language

This rubric has been designed for the evaluation of work that addresses quantitative reasoning (QR) in a substantive way.

- QR is a way of thinking about the world that relies on data and on the mathematical analysis of data to make connections and draw conclusions.
- QR skills can be applied to a wide array of problems of varying difficulty.
- To accurately assess a students' QR achievement it may be necessary to measure QR achievement within the context of problem complexity that would mean giving one score for the complexity of the problem and another score for the QR achievement in solving the problem.

[1] AAC&U - http://www.aacu.org/value/metarubrics.cfm; LLU Office of Educational Effectiveness - http://www.llu.edu/central/assessment/index.page

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Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	4	3	2	1
Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. *An example would be to accurately explain the trend data shown in a graph and make reasonable predictions regarding what the data suggest about future events.*	Provides accurate explanations of information presented in mathematical forms. *An example would be to accurately explain the trend data shown in a graph.*	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. *An example would be to accurately explain trend data shown in a graph, but may miscalculate the slope of the trend line.*	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. *An example would be to attempt to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.*
Representation *Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.
Calculation	All calculations are accurate using the appropriate formula to solve the problem. Calculations are presented elegantly, clearly, concisely.	Most calculations are accurate and sufficiently comprehensive to solve the problem.	Some calculations are either inaccurate or represent only a portion of the calculations required to comprehensively solve the problem.	Most calculations are inaccurate; or when attempted, they are not successful or comprehensive.
Application / Analysis *Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis*	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for judgments, lacking inspiration or nuance leading to marginal conclusions drawn from the work.	Uses the quantitative analysis of data as the basis for tentative judgments, and is hesitant or uncertain about drawing conclusions from this work.
Assumptions *Ability to make and evaluate important assumptions in estimation, modeling, and data analysis*	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides rationale for why assumptions are appropriate. Shows awareness that final conclusions are limited by the accuracy of the assumptions.	Partially describes assumptions with incomplete rationale.	Attempts to describe assumptions without rationale.
Communication *Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)*	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explains it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work. The data is presented in an effective format.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

[2] AAC&U - http://www.aacu.org/value/metarubrics.cfm; LLU Office of Educational Effectiveness - http://www.llu.edu/central/assessment/index.page