Quantitative Reasoning Summary for Department Heads

Definition:

Quantitative Reasoning: Students will demonstrate the ability to understand and communicate mathematical principles and to follow an extended line of formal reasoning. A student who is competent in Quantitative Reasoning is able to:

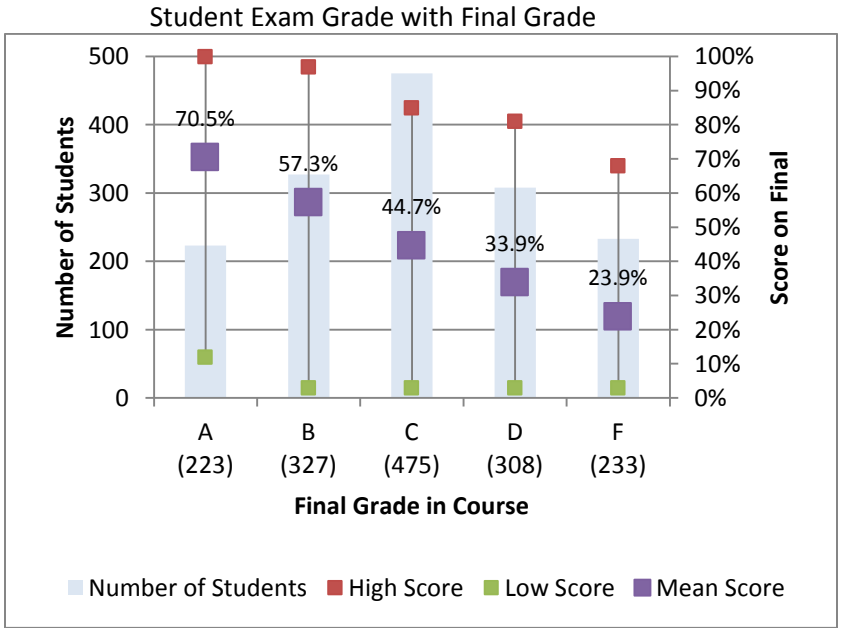
1. Read and identify mathematical information that is relevant in a problem.
2. Interpret and analyze mathematical information presented.
3. Select appropriate methods and apply them to solving problems.
4. Estimate and evaluate the validity and reasonableness of results. (Check and validate)
5. Effectively communicate quantitative concepts using standard written English and correct mathematical syntax.

Proposed Benchmark: 70% of Students will receive a C or better on math department's common final for MATH 118.[1]

Assessment History:

In Fall 2011 the common mathematics department final exam was given to students taking MATH 118: Intermediate Algebra. Seventy-five sections of MATH 118 used the common final (yielding 2,093 student completions). The common final comes from Pearson Publishing and was created by the math department in the MyMathLab module of MyLabsPlus. It has been used at CCP since Spring 2010.

In the classes examined, 51% of students passed the common exam with a score of 45 (out of 100); and 65% of students passed the class overall. There were some notable challenges with both the process and the data, however.



In Fall 2012, a second trial was attempted, using the placement exam with students that had successfully completed Math 118. Too few students completed this follow-up assessment to make a determination of success.

In Fall 2013, we are attempting a third time to assess quantitative reasoning with the rubric developed by faculty (see attached) with students that are taking "math intensive" courses. Results will be reported in early Spring '14.

[1] http://www.ccp.edu/site/about/assessment_evaluation/pdfs/Core-Competency-AssessmentPlan0927111rev.pdf

Additional Indirect Evidence:

- Students have been much less successful in courses that fulfill requirements in the Mathematics learning area than in other general education areas (IR#195).[2]
- CCP students lag behind their peers in believing the College helped develop the ability to solve numerical problems (IR#191).[3]
- Solving numerical problems had the lowest (self rated) benefit score from entrance to graduation (IR#204). [4]

Outstanding Questions

1. When should we be testing students?
With many other Gen Ed measures, we look at students at the beginning and end of their academic careers. Is this appropriate for Quantitative Reasoning?

2. What other programs/classes should we be considering?
Although Math 118 is the default for many students, should that be the only focus for assessment? How do we incorporate students' other courses?

3. How do we consider students' understanding of their Quantitative ability?
Are student's lack of belief in their mathematical improvement a measure of ability or something else (appreciation, applicability, etc)?

[2] http://www.ccp.edu/VPFIN-PL/ir/ir_reports/ir_report_195.pdf
[3] http://www.ccp.edu/VPFIN-PL/ir/ir_reports/ir_report_191.pdf
[4] http://www.ccp.edu/VPFIN-PL/ir/ir_reports/ir_report_204.pdf

Quantitative Reasoning Rubric

Quantitative Reasoning Skills	Beginning	Developing	Competent	Accomplished
	Below basic understanding Beginning = greater than 30% errors in process	**Basic understanding** Developing = 20-30% errors in process	**Good understanding** Competent = 10-20% errors in process	**Accurate and complete understanding** Accomplished = less than 10% errors in process
Read and Identify mathematical information that is relevant in a problem.	The student **cannot**	The student can, **with significant errors:**	The student can, **with minimal errors:**	**The student can, without significant error:**
	Demonstrate understanding of what is being asked and required	Demonstrate understanding of what is being asked and required	Demonstrate understanding of what is being asked and required	Demonstrate understanding of what is being asked and required
	Extract relevant information needed to solve a problem	Extract relevant information needed to solve a problem	Extract relevant information needed to solve a problem	Extract relevant information needed to solve a problem; **explain if /why other information is irrelevant**
	Recognize and interpret mathematical symbols	Recognize and interpret mathematical symbols	Recognize and interpret mathematical symbols	Recognize and interpret mathematical symbols
Interpret and analyze mathematical information presented.	The student **cannot:**	The student can, **with significant errors:**	The student can, **with minimal errors:**	The student can, **without significant error:**
	Identify key topics and types of problems	Identify key topics and types of problems	Identify key topics and types of problems	Identify and describe key topics and types of problems
	Interpret relevant information from symbols, definitions, theorems and laws	Interpret relevant information from symbols, definitions, theorems and laws	Interpret relevant information from symbols, definitions, theorems and laws	Interpret relevant information from symbols, definitions, theorems and laws
	Demonstrate understanding of mathematical vocabulary	Demonstrate understanding of mathematical vocabulary	Demonstrate understanding of mathematical vocabulary	Demonstrate understanding of mathematical vocabulary
	Follow directions to construct graphs, charts and tables to represent relevant mathematical information	**Construct** graphs, charts and tables to represent relevant mathematical information	**Independently** construct graphs, charts and tables to represent relevant mathematical information	Independently construct and **interpret** graphs, charts and tables to represent relevant mathematical information and derive the optimal solution

Problem Solving Select appropriate methods and apply them to solve problems.	The student **cannot**	The student can, **with significant errors:**	The student can, **with minimal errors:**	The student can, **without significant error:**
	Go beyond the first step of a multistep problem	Follow **an extended line** of formal reasoning	Follow **an extended line** of formal reasoning	Follow **and articulate** an extended line of formal reasoning
	Apply definitions, theorems, laws and formulas appropriately	Apply definitions, theorems, laws and formulas appropriately	Apply definitions, theorems, laws and formulas appropriately	Apply definitions, theorems, laws and formulas appropriately
	Employ technology to complement "by hand" calculations	Employ technology to complement "by hand" calculations	Employ technology to complement "by hand" calculations	Employ **and explain the use of** technology to complement "by hand" calculations
	Present an answer in an understandable form	Present a final answer in a correct	Present a final answer in a correct	Present **and explain** a final answer in correct form
Check and validate Estimate and evaluate the validity and reasonableness of results.	The student **cannot:**	The student can, **with significant errors:**	The student can, **with minimal or no errors:**	The student can **accurately and completely:**
	Check and verify that the final answer makes mathematical sense	Check and verify that the final answer makes mathematical sense	Check and verify that the final answer makes mathematical sense	Check and verify that the final answer makes mathematical sense
	Check and verify that the final answer makes common sense	Check and verify that the final answer makes common sense	Check and verify that the final answer makes common sense	Check and verify that the final answer makes common sense
	Employ technology to validate answers, as appropriate	Employ technology to validate answers, as appropriate	Employ technology to validate answers, as appropriate	Employ technology to validate answers, as appropriate
Communicate: Effectively communicate quantitative concepts using standard written English and correct mathematical syntax	The student **cannot:**	The student can, **with significant errors:**	The student can, **with minimal or no errors:**	The student can:
	Present and articulate basic concepts and results in a logical and comprehensible manner	Present and articulate basic concepts and results in a logical and comprehensible manner	Present and articulate **a variety of** complex concepts and results in a logical and comprehensible manner	Present and articulate **a variety** of complex concepts and results **thoroughly and accurately** in a logical and comprehensible manner
	Apply mathematical principles to "real-life" situations	Apply mathematical principles to "real-life" situations	Apply mathematical principles to "real-life" situations	Apply mathematical principles **with facility** in "real life" situations