GES3: Solving problems using Quantitative Reasoning

Math 1054 –Precalculus

Semester: FALL 2013

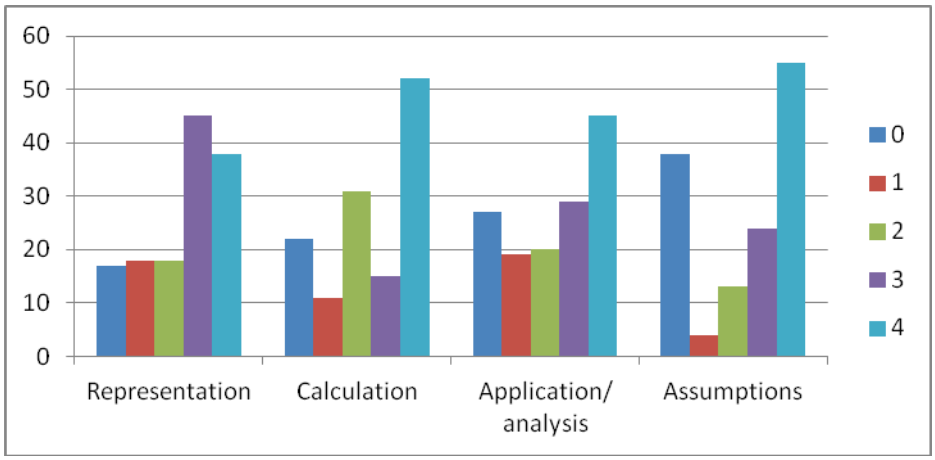
REPORT DATE: 1/9/2014

Quantitative Reasoning is assessed in Math 1054, based on embedded questions on the final exam, using the AAC&U Quantitative Literacy Value Rubric. This precalculus course has students at the Freshmen through Senior level. The topics covered include polynomial, rational, exponential and logarithmic functions. Topics also include trigonometric functions with emphasis on trigonometric identities and trigonometric analysis. Students are also exposed to problem solving methods. Math 1054 serves as a rigorous prerequisite to the study of calculus.

Number of students: 288
Number of sections: 14

Number of students reporting : 140
Number of sections reporting: 7

Distribution of Scores:



Mean scores overall:

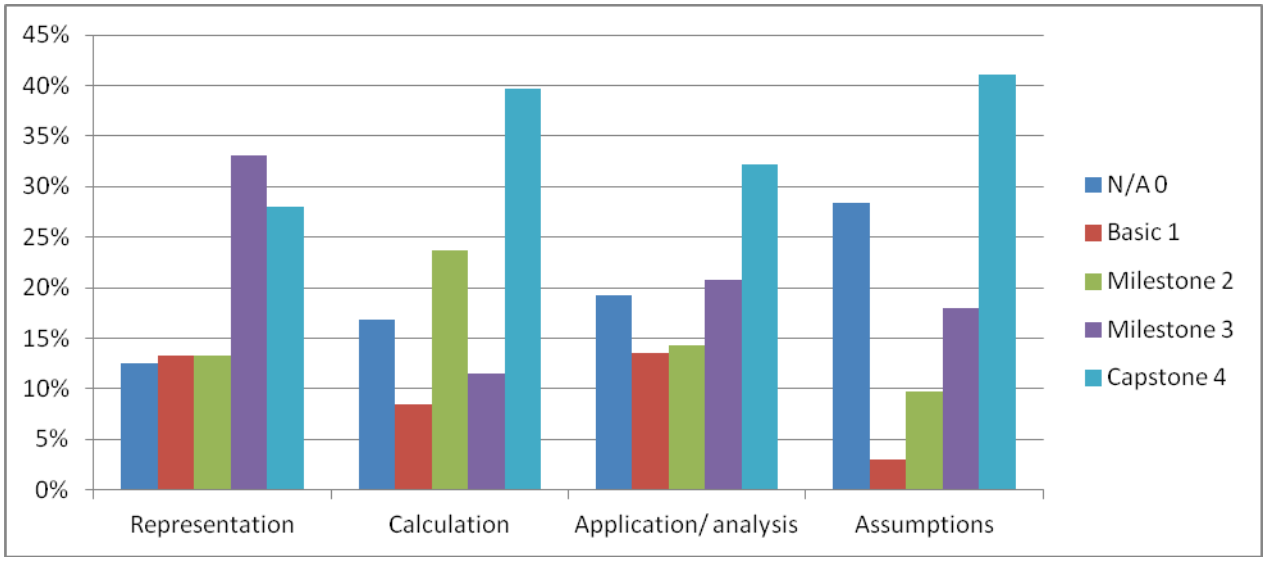
Criteria	Mean
Representation	2.51
Calculation	2.49
Application	2.33
Assumption	2.40

Distribution of Scores: Frequency by Score

Score	Representation	Calculation	Application/ analysis	Assumptions
N/A 0	17	22	27	38
Basic 1	18	11	19	4
Milestone 2	18	31	20	13
Milestone 3	45	15	29	24
Capstone 4	38	52	45	55
TOTAL	136	131	140	134

Percentage by Score:

Level	Representation	Calculation	Application/ analysis	Assumptions
N/A 0	13%	17%	19%	28%
Basic 1	13%	8%	14%	3%
Milestone 2	13%	24%	14%	10%
Milestone 3	33%	11%	21%	18%
Capstone 4	28%	40%	32%	41%
Level 3-4	61%	51%	53%	59%
Below level 2	26%	25%	33%	31%



Analysis

Across the different criteria, the data shows a bimodal distribution with many students at the extreme ends, and fewer with level of 1 and 2. In this case, mean is no longer a good indicator for performance comparison.

The weakest area for Math1054 students is assumptions, for which 28% of the students failed below basic level (level 1). However, there are also 41% of the students who reached level 4 on assumption assessment. The second weak area is application, for which 19% failed below basic level 1 and 14% just reach basic level.

Compared with assumptions and application, students seem more comfortable at representation and calculation. More than half (51%) reached level 3 or higher on calculations and 61% reached level 3-4 on representation. Meanwhile it should not be ignored that about one quarter of the students failed to meet basic level 2 on calculation (25%) and representation (26%).

Discussion/Action/Closing the Loop:

Precalculus is a standard mathematical course and the assessment items were embedded into the final exam across the sections. The problems selected covered the following:

- Representation of exponential functions using tables and graphs
- Calculation of a quantity by solving a logarithmic equation
- Analysis of a polynomial root finding problem
- Assumptions to be made when solving a problem using properties of triangles

All sections used the same questions and a common rubric. A grade of 0 to 4 was assigned for each item. A 4 indicated complete mastery, a 3 indicated conceptual mastery, but with some minor errors. A 2 indicated a "starting knowledge" of the problem, but no mastery. A "0" or "1" indicated little or no understanding.

The data indicates a wide variety of understanding among students. More time can be spent in the future teaching students conceptual connections to make proper use of mathematical assumptions, representations, and applications. Students seem to be comfortable with mathematical calculations. Going forward, conceptual underpinnings of precalculus can be used to drive the focus of the curriculum.

In the Spring 2014 semester, there will be more meetings with all faculty who are teaching the course to discuss issues arising in the teaching and learning of precalculus, as well as details regarding assessment. Specific content, such as the unit circle and graphs of trigonometric functions, will be targeted for greater emphasis, and other content, such as routine equation solving, will be targeted for de-emphasis. In so doing, our goal is to make the teaching and learning of precalculus to be an effective prerequisite for future work in mathematics.