QA Course
ELO
Assessment

Kelly MacArthur

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To meet the QA requirement, for students whose major does not require any further mathematics, most students take either

(a) Math1030 (Introduction to Quantitative Reasoning),
(b) Math1050 (College Algebra) or
(c) Math1090 (Business Algebra),

depending on their major.
QA ELOs:

1. Explain algebraic expressions and the relationship among algebraic quantities including quadratic, exponential, and logarithmic expressions, equations and functions.

2. Identify the role of a mathematical function and use linear, quadratic, logarithmic and exponential functions to model real world examples.

3. Demonstrate how to model and interpret "real world" situations using algebra, geometry, and conversions, including how this applies to financial decisions typically made by adult citizens.

4. Compare and illustrate the features of linear and exponential growth using practical examples and/or given sequences.

5. Develop critical thinking skills necessary to tackle any quantitative problem with at least some starting idea and the persistence to see it through to the end.
## Data Collected:

<table>
<thead>
<tr>
<th>Math1030</th>
<th>Math1050</th>
<th>Math1090</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre (from first week quiz)</td>
<td>Post data (from final exam) from Math1050 ELOs #3, 7, 11, and 12 (collected for all students)</td>
<td>Post data (from final exam) from ALL Math1090 ELOs (collected for all students)</td>
</tr>
<tr>
<td>and post data (from final exam) from Math1030 ELOs #2, 3, 5, and 7 (collected for all students)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results:

Math1030 Averages and Basic Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean Pre-Test score</th>
<th>Mean Post-Test score</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 2017</td>
<td>31.96%</td>
<td>67.75%</td>
<td>473</td>
</tr>
<tr>
<td>Spring, 2018</td>
<td>24.4%</td>
<td>61.14%</td>
<td>411</td>
</tr>
</tbody>
</table>

Math1030 ELO Means and Improvements
(The given means are from the post tests, i.e. final exams. Improvement is the percent change between pre and post tests.)

<table>
<thead>
<tr>
<th></th>
<th>ELO #2 Mean</th>
<th>ELO #2 Improvement</th>
<th>ELO #3 Mean</th>
<th>ELO #3 Improvement</th>
<th>ELO #5 Mean</th>
<th>ELO #5 Improvement</th>
<th>ELO #7 Mean</th>
<th>ELO #7 Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 2017</td>
<td>85.25%</td>
<td>48.05%</td>
<td>76.25%</td>
<td>187.74%</td>
<td>79.75%</td>
<td>314.29%</td>
<td>56%</td>
<td>578.79%</td>
</tr>
<tr>
<td>Spring, 2018</td>
<td>49.8%</td>
<td>249.12%</td>
<td>78.5%</td>
<td>60.3%</td>
<td>70%</td>
<td>1172.73%</td>
<td>39.25%</td>
<td>361.76%</td>
</tr>
</tbody>
</table>
### Math1050 Averages and Basic Statistics

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Low</th>
<th>Mean</th>
<th>Median</th>
<th>Total Enrollment</th>
<th>Total Final Exams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 2017</td>
<td>99.94%</td>
<td>18.03%</td>
<td>74.68%</td>
<td>78.78%</td>
<td>933</td>
<td>??</td>
</tr>
<tr>
<td>Spring, 2018</td>
<td>99.23%</td>
<td>14.24%</td>
<td>72.47%</td>
<td>75.94%</td>
<td>441</td>
<td>410</td>
</tr>
</tbody>
</table>

### Math1050 ELO Means

<table>
<thead>
<tr>
<th></th>
<th>ELO #3</th>
<th>ELO #7</th>
<th>ELO #11</th>
<th>ELO #12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 2017</td>
<td>75.41%</td>
<td>73.64%</td>
<td>76.02%</td>
<td>79.34%</td>
</tr>
<tr>
<td>Spring, 2018</td>
<td>74.39%</td>
<td>72.30%</td>
<td>74.01%</td>
<td>79.22%</td>
</tr>
</tbody>
</table>
# Math1090 Averages and Basic Statistics

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Low</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Total Enrollment</th>
<th>Total Final Exams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 2017</td>
<td>102.6%</td>
<td>36.9%</td>
<td>76.3%</td>
<td>81.2%</td>
<td>15.8%</td>
<td>378</td>
<td>338</td>
</tr>
<tr>
<td>Spring, 2018</td>
<td>101.2%</td>
<td>39.9%</td>
<td>77.3%</td>
<td>79.4%</td>
<td>15.2%</td>
<td>234</td>
<td>209</td>
</tr>
</tbody>
</table>

*Note: The final exam added to 105 points to build in a cushion of extra credit, since we took off points for arithmetic mistakes and math grammar. This is why the average high scores are over 100%.*

## Math1090 ELO Means

<table>
<thead>
<tr>
<th></th>
<th>ELO #1</th>
<th>ELO #2</th>
<th>ELO #3</th>
<th>ELO #4</th>
<th>ELO #5</th>
<th>ELO #6</th>
<th>ELO #7</th>
<th>ELO #8</th>
<th>ELO #9</th>
<th>ELO #10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 2017</td>
<td>68.7%</td>
<td>73.4%</td>
<td>85.2%</td>
<td>81.5%</td>
<td>86.1%</td>
<td>69.1%</td>
<td>84.2%</td>
<td>80.2%</td>
<td>62%</td>
<td>76.1%</td>
</tr>
<tr>
<td>Spring, 2018</td>
<td>65.3%</td>
<td>70.2%</td>
<td>91.1%</td>
<td>69.2%</td>
<td>84.2%</td>
<td>77.4%</td>
<td>76.9%</td>
<td>73.3%</td>
<td>74.8%</td>
<td>61.6%</td>
</tr>
</tbody>
</table>
Discussion of Results:

1. The scores for Math1030 were way down in the spring, compared to fall. Our speculation is that this is the effect of changing the prerequisite to be Math980 instead of Math1010.

**Action Item:** We should keep an eye on this and also keep track of the pass rate (D- or higher) to see if this change of prerequisite is still helping students be successful.

2. The averages for Math1030 also seem a little lower than for Math1050 and Math1090. This could also be due to the differences in prerequisites for the different courses.

**Action item:** It would be helpful to have the final exam stats for 1030. The post-test is only a subset of the final exam questions.
3. We notice that the QA ELOs don't seem to align exactly with the concepts we know we're assessing on our final exams.

**Action Item**: We need to change the QA ELOs to more accurately reflect what we're teaching in our courses.

4. **Questions**: For Math1090, how can we improve instruction to help students perform better/increase comprehension for ELOs 1, 4, 6, 9, and 10?
   Also, on ELO #4, there is a huge difference in averages from fall to spring. Why?
5. **Question**: What do the course coordinators, of these three courses, plan to do differently this year based on this data?

6. **Action Item**: For this upcoming year, we need to collect more data including:
   
   (a) Assessment data for all ELOs, meaning all course ELOs for each of the three courses.
   
   (b) Standard deviations for final exam questions to help paint a more accurate picture.
7. Future Questions to Consider:

(a) What is the DFW rate for Math1030, Math1050 and Math1090? How does that compare to the national average?

(b) For Math1050, how many students are persisting? How many of those students are then going on to Math1060?

(c) What is the pass rate for Math1030 (with a D- or better grade)?

(d) What is the average homework and/or quiz scores? And is there any correlation with the students' final grades in the course?
Thank you!

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Appendix:
Course ELOs for which we collected data in Fall 2017 and Spring 2018:

Math 1030 ELOs for which we collected data.

2. Use an appropriate sentence to describe both the absolute and percent change in a given quantity and interpret such statements about the change. *(corresponds to QA ELOs #3 and 4)*

3. Use simple and compound units, making conversions when necessary, and develop accurate comparisons between units. *(corresponds to QA ELOs #3 and 5)*

5. Use the savings plan and loan formulas to calculate the payment amount into the savings plan when a certain financial goal needs to be achieved, to calculate the mortgage payment or interest paid over the life of the loan and discuss whether those results are realistic (or not), compare several loans with different interest rates in order to financial decisions. *(corresponds to QA ELOs #1, 2, 3, 4 and 5)*

7. Determine simple areas, volumes, and explain the differential effect of scaling on perimeter, area, volume as well as some of the practical implications of scaling. *(corresponds to QA ELOs #1, 3 and 5)*
Math1050 ELOs for which we collected data.

3. For polynomial functions, identify all zeros (real and complex), factors, x and y intercepts, end behavior and where the function is positive or negative. Use information to sketch graphs.
*(corresponds to QA ELOs #1 and 2)*

7. Solve absolute value, linear, polynomial, rational, radical, exponential and logarithmic equations and inequalities.
*(corresponds to QA ELOs #1, 2, 4 and 5)*

11. Understand series notation and know how to compute sums of finite or infinite arithmetic or geometric series.
*(corresponds to QA ELOs #4 and 5)*

12. Solve systems of equations (3x3 linear) and non-linear equations in two variables.
*(corresponds to QA ELO #5)*
Math 1090 ELOs for which we collected data.

1. Graph and analyze quadratic, exponential and logarithmic functions; solve quadratic, exponential and logarithmic equations.  
   (corresponds to QA ELOs #1, 2 and 4)

2. Understand what a mathematical function is and know how to use linear, quadratic, logarithmic and exponential functions to model real world examples.  
   (corresponds to QA ELOs #1, 2, 3, 4 and 5)

3. Know how to solve a system of linear or quadratic equations that arise in business applications.  
   (corresponds to QA ELOs #2, 3 and 5)

4. Find solutions to linear programming problems, to maximize a function over a geometric region.  
   (corresponds to QA ELOs #1 and 5)

5. Perform simple matrix algebra computations.  
   (corresponds to QA ELOs #5)
6. Use matrices to solve systems of linear equations.  
(corresponds to QA ELOs #3 and 5)

7. Understand what an inverse function is and be able to find the inverse function, when it exists.  
(corresponds to QA ELOs #1 and 2)

8. Distinguish between simple and compound interest situations.  
(corresponds to QA ELOs #3, 4 and 5)

9. Calculate future and present value of annuities, and know when to use which formula for the life application.  
(corresponds to QA ELOs #3 and 5)

10. Compute an amortization schedule and loan payments, such as automobile or mortgage payments.  
(corresponds to QA ELOs #3 and 5)