Degree/Certificate: Bachelor of Arts in Education

Major/Option: Mathematics/Elementary Major and Mathematics/Elementary Major with Middle Level Mathematics Endorsement Option

Submitted by: Mathematics Education Committee

Date: November 1, 2013

Part I – Program SLO Assessment Report for 2012-13

1. **Student Learning Outcome**: The student performance or learning objective as published either in the catalog or elsewhere in your department literature.

   Apply numerical, analytical, and graphical techniques to explore algebraic concepts of functions and relations.

2. **Overall evaluation of progress on outcome**: Indicate whether or not the SLO has been met, and if met, to what level.

   _____ SLO is met after changes resulting from ongoing assessments, referencing assessment results from the previous year to highlight revisions;

   _____ SLO is met, but with changes forthcoming;

   ___ SLO met without change required.

   🍀 Please note that we are continuing to make adjustments to our program to improve our students’ meeting of this SLO.

3. **Strategies and methods**: Description of assessment method and choices, why they were used and how they were implemented.

Math 311 is a mathematics content course designed to provide prospective elementary mathematics majors with a solid foundation in the algebraic concepts of functions and relations. The topics include exponential, logarithmic, polynomial, and rational functions, as well as sequences and series. In the winter of 2013, eight elementary math majors took Math 311. The work of learning for this class consists of active class participation, homework, two quizzes, two tests, and one final exam. Two items were chosen from the final exam as the assessment of the SLO of 2012-13.
The first item was to check students' understanding of exponential decay and the second item to check students' understanding of transformations. Both items require students to use functional reasoning at a more advanced level than the previous courses such as Math 211 and Math 412. For example, the second item asks students to examine the transformations done to \( f(x) \) in a given order and coordinate those actions into a symbolic expression for \( g(x) \) in terms of \( f(x) \). Both items implicitly involve reconciling symbolic as well as graphical interpretations, and are facilitated by the use of technology. They were graded on a scale of 1-7 points.

4. **Observations gathered from data:** Include findings and analyses based on the strategies and methods identified in item #3.
   a. Findings:

   **Item 1**

<table>
<thead>
<tr>
<th>Score</th>
<th>4</th>
<th>5</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percents of students</td>
<td>37.5%</td>
<td>50.0%</td>
<td>12.5%</td>
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</tbody>
</table>

   **Item 2**

<table>
<thead>
<tr>
<th>Score</th>
<th>3</th>
<th>5</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
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<td>37.5%</td>
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</tr>
</tbody>
</table>
b. Analysis of findings:

On the first item, 62.5% of the students scored a 5 or higher (out of 7 possible points), by answering part a) which involved an input of the given time. But algebraic errors plagued part b), whereby some students could successfully set up the required equation but were unsuccessful in solving it. For 50% of the students, the algebra errors were minor in nature, suggesting a lack of fluency. For 37.5% of the students, there was evidence of thin underlying conceptual knowledge.

On the second item, 62.5% of the students scored a 5 or higher (out of 7 possible points), by answering part a) which involved following a given point as it underwent the specified transformations. For 50% of the students, there was some difficulty in matching the graphical motions with the accompanying symbolic representations. For 37.5% of the students, there was evidence of thin underlying knowledge of the overall concept.

5. What program changes will be made based on the assessment results?

a) Describe plans to improve student learning based on assessment findings (e.g., course content, course sequencing, curriculum revision, learning environment or student advising).

Though in general students were successful in analyzing exponential decay and functional transformations, we noticed that some students were partially hindered by their lack of fluency with fundamental algebraic notions at the outset of the course. In particular, algebraic difficulties related to symbolic fluency may have played a role in some students struggle to apply some of the concepts.

While using technological tools seemed to play a positive role in achieving an initial conceptual understanding of broad ideas, the practical aspects of problem-solving seemed to hinge in part on a student’s algebraic background prior to their taking of Math 311. Therefore, instructors should continue to do pre-assessments at the beginning of the course, encourage students to refresh their skills, and provide students with the means and resources to do so.

b) Provide a broad timeline of how and when identified changes will be addressed in the upcoming year.

Mathematics education faculty will discuss ways to increase math elementary majors’ attention to algebraic fluency in their mathematical activities. In particular, faculty will discuss ways that students can maintain the algebra skills they’ve developed in prior classes, and also the merits of different resources available for students to practice their skills.

6. Description of revisions to the assessment process the results suggest are needed and an evaluation of the assessment plan/process itself (e.g., what changed, what worked, what did not work, and why?).

The evaluation process was effective; no revisions are necessary.
PART II – CLOSING THE LOOP
FOLLOW-UP FROM THE 2011-12 PROGRAM ASSESSMENT REPORT

Working definition for closing the loop: Using assessment results to improve student learning as well as pedagogical practices. This is an essential step in the continuous cycle of assessing student learning. It is the collaborative process through which programs use evidence of student learning to gauge the efficacy of collective educational practices, and to identify and implement strategies for improving student learning.” Adapted 8.21.13 from http://www.hamline.edu/learning-outcomes/closing-loop.html.

1. Student Learning Outcome(s) assessed for 2011-12
Demonstrate computational proficiency using various strategies, including a conceptual understanding of numbers, relationships among number and number systems and meanings of operations with all real numbers.

2. Strategies implemented during 2012-13 to improve student learning, based on findings of the 2011-12 assessment activities.

3. Summary of results (may include comparative data or narrative; description of changes made to curriculum, pedagogy, mode of delivery, etc.): Describe the effect of the changes towards improving student learning and/or the learning environment.

4. What further changes to curriculum, pedagogy, mode of delivery, etc. are projected based on closing-the-loop data, findings and analysis?