Assessment and Improvement Report: 2013

Department: Mathematics

Assessment Coordinator: Hartenstine

Departmental Mission:
In accordance with the mission of Western Washington University and the College of Sciences and Technology, we aim to provide high quality education in mathematics meeting the needs of students and the state at both the undergraduate and graduate levels, providing a wide range of effective courses for math majors and students in other units; to equip our students with the conceptual understanding and computational skills to use quantitative reasoning and analysis effectively in their personal and professional lives; and to contribute to the mathematical profession through productive scholarship and active participation in the community and professional organizations.

Department Student Learning Outcomes: Upon graduation, (Department or Program) majors will be able to

1. demonstrate mastery of the essentials of two core lower-division mathematics courses: calculus and linear algebra (core math)
2. understand the importance of abstraction and rigor in mathematics, construct complete proofs, and critically examine the correctness of mathematical arguments (rigor)
3. demonstrate knowledge of a wide variety of mathematical areas by showing a solid grasp of the materials in upper-division courses in at least two of the following disciplines: abstract algebra, differential equations, geometry, linear algebra, mathematical analysis, number theory, optimization, numerical analysis, probability and statistics (breadth)
4. recognize major contributions of some prominent mathematicians of the past and present (history)
5. demonstrate in-depth understanding of at least two mathematical subjects at an advanced level by showing understanding of the materials in a second course of a sequence in these subjects (depth)
6. [For programs in mathematics education] complete the appropriate professional preparation program and certification (certification)

GUR Learning Outcomes:
3. Use quantitative and scientific reasoning to frame and solve problems.
5. Apply tools of technology, with an understanding of their uses and limitations.

Student Learning Outcomes Assessed: (based on data collected in 2011-12)

<table>
<thead>
<tr>
<th>Assessment Measures</th>
<th>SLOs Assessed</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades in Math 204 and Math 224 of graduating seniors.</td>
<td>1</td>
<td>The average grades (in numerical scale) of the two courses were 3.36 and 3.19, respectively. These numbers are highly satisfactory.</td>
</tr>
</tbody>
</table>
In-class performance in 3 sections of Math 331 as measured by student achievement on exam questions corresponding to two specific course objectives.

| Counted the number of students who take a differential equations course | 3 |
| Count of the number of different mathematical areas studied successfully (C or better) at the upper division. Our learning outcomes require at least two. | The data are tabulated as follows: |
| Count of the number of graduating seniors who took Math 419. | 4 |
| Count of the number of sequences at the advanced level successfully completed (C or better) by graduating seniors. Our learning outcomes require at least two. | 5 |

For the objective, “the ability to find the general solution of any 2x2 linear system with constant coefficients, solve initial value problems for such systems, classify the equilibrium solution of such a system, and describe the qualitative behavior of solutions by analyzing the phase portrait”, data was collected on 11 exam questions. The average student score on straightforward questions was about 80% (with similar results for all such questions) and was about 60% for more abstract or challenging questions. These results are satisfactory.

For the objective “the ability to find bifurcation values and construct and interpret bifurcation diagrams for autonomous first-order equations that depend on a parameter, and the understanding of how a small change in the parameter value can affect the qualitative behavior of solutions”, six exam questions were used. The average student score on such a question was about 67%, with results similar for all six questions. This result is satisfactory on this more challenging topic.

The overwhelming majority of students take such a course. A course in differential equations is not currently required for a BS degree. The question was raised in the Curriculum Committee whether completing a degree without a DE course was acceptable. Since nearly all students do study DE, it was decided that no further action is needed.

It is seen that most students complete more sequences than are required. Note that completing two such sequences is not required for all of our major options.
| Count of the number of students graduating with BAE (Bachelor of Arts in Education) who earn the appropriate professional certification. | 6 |
| All students graduating with a BAE earned credentials. In addition, many other students earned math credentials while completing other degrees. |
| Exit survey of graduating seniors. | A large majority of seniors reported that the math faculty were at least somewhat helpful in guiding them into courses related to their interests. Although satisfactory, this is an indication that there is still a lot of room for improvement among the math faculty in this area. |

**Example(s) of Changes Based on Assessment Findings:**

The proportion of students who take Math 419 will be compared to the data from academic year 2012-13 to see if the drop seen this year is an anomaly. The results will be discussed in the department’s Curriculum Committee.

New documents concerning the major declaration and evaluation processes were developed. The procedures outlined in these documents will increase efficiency. By being better prepared for meeting with an advisor, students will get more benefit from the time spent with faculty.

Based on the results of the senior exit survey, we will encourage our faculty advisors to take student interests into greater consideration when developing a plan of study.