

Mathematics Program 2012 Annual Assessment Update

**I. Mission Statement, Program Goals, Student Learning Outcomes, Curriculum Map, AND Multi-Year Assessment Plan**

The documents can be found at:

<http://www.westmont.edu/academics/departments/mathematics/LearningStandards.html>

**II. Follow up on Action Items**

**The following action items were identified in our previous Annual Assessment Update.**

(1)

- A. At the conclusion of the 2011/12 academic year, mathematics faculty, led by Russ Howell, will evaluate the course and determine whether to make the Senior Capstone Course a permanent part of the major curriculum.
- B. Russ Howell taught a pilot version of a capstone course as MA 150. Three students enrolled. The course covered some topics in the philosophy of mathematics and reviewed undergraduate mathematics courses as preparation for the Major Field Test. The three students took the major field test at the end of the course. The following notes convey the comments and conclusions from our collective reflection at a program meeting on 5/11/12 (see minutes).

*Students in the pilot version of this course in spring 2013 appreciated the opportunity to review material for the MFT and enjoyed their study of the philosophy of mathematics.*

*Since only 3 students were enrolled, not much can be said about the course's impact on their performance on the MFT. Their scores were 158, 161, 178, averaging 165.667, which is slightly higher than our overall mean for the 22 students who have taken the test since 2008.*

*Next year, we plan to propose a change to our major: require a new 2-unit Senior Seminar, to be taken by seniors in the spring semester. We will eliminate the specific requirement of a capstone course and increase the breadth units to 12, allowing students to take any 3 courses in addition to 108, 110 and the Senior Seminar. **The department will submit a proposal for a Senior Seminar and a change to the configuration of unit requirements for the major to the Faculty Senate in Fall 2012.***

(2)

- A. We will administer the MFT to the graduates of 2012 as a required, graded component of the capstone course in order to see if the capstone course had an impact on scores. The department chair and the department administrative assistant will oversee this task in cooperation with Russ Howell who is teaching the pilot version of the Senior Capstone course.

B. See section III for discussion of this action item.

(3)

- A. During Fall 2011, we will discuss the enrollment issues in the MA 008 and MA 009 courses as a department and formulate plans for finding answers. The department chair will oversee this discussion among all the mathematics faculty.
- B. Discussions about enrollment and students' level of preparation were held throughout 2012-13, culminating in a summary discussion on 5/11.

**During summer 2012, we will create a placement test for use by incoming students to determine what course in the calculus sequence they should take. Dave Hunter is creating the exam with input from other department members. He and the department chair will work with the director of advising and the records office to administer the exam to incoming students. During the 2012-13 year, the department will discuss the results and impact. The department chair will oversee this discussion among all mathematics faculty.**

(4)

- A. During the 2011-12 year, we will meet with client departments to determine how well calculus is serving their needs.
- B. Department members held these meetings. See minutes of 5/11/12 for a summary. At this point, client departments have no suggestions for changes to our courses

(5)

- A. Early during Spring 2012, we will determine whether the calculus textbook by Rowgawski is serving the students' needs or whether we need to try a new textbook for 2012/13. The department chair will oversee this discussion among all the mathematics faculty.
- B. In discussion throughout Spring 2012, we decided that we are not satisfied with Rogawski. For 2012-13, faculty teaching MA 9 and MA 10 will select textbooks independently.

**During 2012-13, the department will continue to discuss the best choice of calculus textbooks. Department chair will oversee discussion.**

(6)

- A. During Fall 2011, we will finalize and prioritize the list of MAA-recommended books that we would like the library to acquire. We will then submit the list to the library acquisition staff. The department chair will oversee this task among all the mathematics faculty.
- B. After reviewing the MAA list, we decided not to request any of the books.

(7)

- A. During the 2011/12 academic year, the department will discuss the possibility of implementing an alumni survey in a future year. The department chair will oversee this discussion among all the mathematics faculty.
- B. We are in the process of acquiring an updated email list of alumni in preparation for conducting an Alumni Survey. We will discuss the details of such a survey during fall 2012.**

(8)

- A. Modify the rubric for assessing writing samples during summer and fall of 2011. The department chair will oversee this discussion among all the mathematics faculty.
- B. Modification was made. Current version of the rubric can be found at Mathematics\Assessment Data\2011-12\communication\program writing rubric2011.pdf.

(9)

- A. Make a change to the co-requisite for MA 180. Discrete Mathematics (MA-015) or Linear Algebra (MA-020) will be a co-requisite for students taking the course for the first time. Department chair will submit the necessary paperwork to the records office during fall 2011.
- B. This task was completed.

(10)

- A. Students will be strongly encouraged in academic advising to take their first writing intensive course in the major (either MA 108 or MA 110) before taking MA 180 for the second time. Department chair will remind mathematics faculty of this policy at the start of the advising period in fall 2011 and spring 2012.
- B. This task was completed.

(11)

- A. Beginning in the fall of 2011, the instructor of MA 180 will collect samples of student writing from all students taking the course for the second time. Collection will continue until the department revisits the communication SLO in 2014-15.
- B. Collection was done and continues.

(12)

- A. Make use of the rubric in writing instruction in lower division courses, specifically MA 019, MA 015, and MA 020. Department chair will remind mathematics faculty of this policy at the start of each semester.
- B. Use was made and will continue.

(13)

- A. By Fall 2011, upgrade our license for Scientific Workplace (typesetting software we have been using for student writing). The upgrade will allow more students to use the software simultaneously than the previous license. It will also give them access to the complete set of typesetting tools rather than the limited access provided by our previous license. Russ Howell will oversee this acquisition.
- B. Task was completed.

(14)

- A. Continue the discussion in the 2011/12 academic year about how to best use the typesetting software to promote student learning in the area of written communication. The department chair will facilitate this discussion.
- B. **This discussion was postponed to 2012-13.**

### III. 2011/12 Focus Core Knowledge Student Learning Outcome

#### A. Summary

1. In order to assess the Core Knowledge Student Learning Outcome, we required graduating students to take the Mathematics Major Field Test (MFT) at the end of their final semester in the program. The data consist of the scores on the MFT of the 22 students who earned degrees from our program between 2008 and 2012.
2. Our departmental benchmark is that 50% of students would have scores above the 75th percentile.
3. The files with the scores are stored on the archive at Mathematics\Assessment Data\2011-12\Core Knowledge.

#### B. Interpretation

1. The mathematics faculty discussed the data at a meeting on 5/11/12. Minutes of these meetings are stored on the archive at Mathematics\Records\minutes\2011\_12.
2. No external voices have been involved in analyzing the data.
3. We have the scores of the 22 students who took the MFT between 2008 and 2012. The mean score was 161, which puts Westmont in the 79<sup>th</sup> percentile of all institutions whose scores are collected by ETS.

Our median score was 165, so half our students scored at the 71<sup>st</sup> percentile or above. Our benchmark was 50% of students scoring above the 75<sup>th</sup> percentile, so we did not quite meet the benchmark.

Looking at the assessment indicators, our students performance on the algebra portion of the exam was the weakest overall. The content of this part of the course is described by ETS:

**Linear Algebra:** matrices, linear transformations, characteristic polynomials, eigenvalues and eigenvectors, vector spaces, systems of linear equations

**Abstract Algebra:** elementary theory of groups, rings and fields; elementary topics from number theory

We wonder whether the fact that students take the MFT two to three years after completing Linear Algebra may make this part of the exam difficult for them. Without more specific information about the questions asked, it will be difficult to answer that question with certainty.

### **C. Closing the Loop**

In response to what we have learned from assessing this data, our department has decided to explore ways of spiraling back to earlier topics in subsequent courses (e.g., do more linear algebra in geometry) in order to increase the likelihood that students retain relevant material. We will continue that discussion in 2012-13

## **IV. Next Steps**

A. **Action Items** The following is a collection of all the Action Items given above.

- 1) The department will submit a proposal for a Senior Seminar and a change to the configuration of unit requirements for the major to the Faculty Senate in Fall 2012.
- 2) During summer 2012, we will create a placement test for use by incoming students to determine what course in the calculus sequence they should take. Dave Hunter is creating the exam with input from other department members. He and the department chair will work with the director of advising and the records office to administer the exam to incoming students. During the 2012-13 year, the department will discuss the results and impact. The department chair will oversee this discussion among all mathematics faculty.
- 3) During 2012-13, the department will continue to discuss the best choice of calculus textbooks. Department chair will oversee discussion.
- 4) We are in the process of acquiring an updated email list of alumni in preparation for conducting an Alumni Survey. We will discuss the details of such a survey during fall 2012.
- 5) Continue the discussion in the 2011/12 academic year about how to best use the typesetting software to promote student learning in the area of written communication. The department chair will facilitate this discussion.

- 6) Explore ways of spiraling back to earlier topics in subsequent courses (e.g., do more linear algebra in geometry) in order to increase the likelihood that students retain relevant material.

B. The Multi-Year Assessment Plan is included in Appendix D.

**V. Appendices**

- A. 2011 response from PRC.
- B. The online MFT was used to collect the data.
- C. No rubrics were used to assess the data.
- D. Multi-year assessment plan.
- E. Assessment of Written communication outcome

Appendix A



# WESTMONT

## *Program Review Committee*

### MEMORANDUM

Date: November 14, 2011  
To: Patti Hunter, Chair, Department of Mathematics  
Re: Annual Assessment Update Report  
Prepared By: Program Review Committee/Edd Noell

Thank you for the timely submission of your 2011 Annual Assessment Update Report.

The Program Review Committee (PRC) commends your department for following up on the following action items either identified in the Mathematics 2010 annual report or named by the Program Review Committee:

1. Developing and Offering a Senior Capstone Course (Spring 2012)
2. Evaluating the Continued Use of the Mathematics Field Test
3. Reviewing Curricular Changes
4. Reviewing Library Holdings
5. Evaluating Writing Samples in Assessing the Writing Component of the Communication Student Learning Outcomes

The PRC affirms that the department has addressed the following major items as requested in the annual assessment report template:

**Mission Statement:**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> In place | <input checked="" type="checkbox"/> Aligned with college mission statement |
| <input checked="" type="checkbox"/> Clear    | <input checked="" type="checkbox"/> Posted on department website           |
| <input checked="" type="checkbox"/> Concise  | <input checked="" type="checkbox"/> Link provided in the report            |

**PLOs:**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Consistent with college/program mission                                | <input checked="" type="checkbox"/> Assessable                   |
| <input checked="" type="checkbox"/> Realistic  | <input checked="" type="checkbox"/> Posted on department website |
| <input checked="" type="checkbox"/> Few in number  | <input checked="" type="checkbox"/> Link provided in the report  |
| <input checked="" type="checkbox"/> Used by faculty/staff to set priorities and make data-guided decisions |  |

**Curriculum Map:**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> In place | <input checked="" type="checkbox"/> Required courses identified (for 2012) |
| <input checked="" type="checkbox"/> Clear    | <input checked="" type="checkbox"/> Posted on department website           |

- Curriculum is aligned with PLOs
- Link provided in the report
- Assessment conducted in or after courses in which the outcomes are mastered

**Multi-Year Assessment Plan:**

- In place
- Sufficiently specific about closing the loop
- Complete
- Posted on department website
- Realistic
- Link provided in the report
- Aligned with institutional schedule

**Current Year Focus:** For 2011-12, the department has decided to focus on student learning in the main concepts, skills, and facts of mathematics as expressed in the Core Knowledge Program Learning Outcome.

**Next Steps:** Modifying the communication rubric to confirm more to departmental desires is a wise step, as is making use of the rubric in writing instruction in lower division courses. It will also be helpful if the department chair follows up with faculty advisors to ensure that students are directed to take their first writing intensive course in Mathematics before taking MA 180 for the second time.

**Appendices:** The department is to be commended for including the 2010 PRC response, prompts used to collect writing samples, rubric used to assess writing samples, and multi-year assessment plan in the appendices.

**Feedback for use in 6-Year Report:** The department is encouraged to continue to make use of frequent departmental dialogue and collaboration as it enacts action items, including discussion of enrollment issues in the MA 008, 009, and 010 courses and processing of feedback from client departments regarding how well MA 009 is serving their student needs.

**Conclusion:**

The items that merit specific attention for next year are:

1. Collecting of writing samples from MA 180 and assessing the communication SLO using these samples for assessment in 2013-2014.
2. Further departmental discussion regarding the best use of typesetting software for student learning in written communication.
3. Developing a detailed alumni survey.



Appendix D Mathematics Program MULTI-YEAR PLAN 2011

Outcomes	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Means of Assessment, Benchmark	Who is in charge?	How the loop will be closed /has been closed?
1. Core Knowledge	X				X		Major Field Test in Mathematics, 50% above the 75 <sup>th</sup> percentile	Department chair coordinates discussion and work among all mathematics faculty	New senior capstone course is being developed in 2011-12 to provide more effective way of insuring students have mastered the material and of assessing the SLO.
2. Communication				X			Writing samples scored with rubric, 75% show improvement during term (will be changed in light of 2010/11 assessment)	Department chair coordinates discussion and work among all mathematics faculty	Corequisite to MA 180 has been changed for 2011-12 to insure that students are able to develop their skills more fully before having them assessed. Course in which SLO will be assessed beginning in 2011-12 has been changed to provide more informative student work. Software license will be upgraded to facilitate student learning and our assessment of their learning.
3. Creativity			X				Externally reviewed journal problems, 50% get correct solutions according to the journal	Instructor of MA 180.	If benchmark is not met, mathematics faculty will review the curriculum.
4. Christian Connection		X				X	Reflective paper scored with rubric, 50% score superior	Department chair coordinates discussion and work among all mathematics faculty	New senior capstone course is being developed in 2011-12 to provide more effective way of insuring students have mastered the material and of assessing the SLO.
<b>GE Projects</b>									
5.									

NOTE: Six-Year Program Review Report due 9/15/2014



	<p>April 2011</p> <p>The prompts and rubric is included in appendix B of our 2011 annual update. The writing samples and summary of evaluations are stored on the archive at Assessment Data\2010_11\writing samples.</p>		
2b	<p>Indirect assessment (surveys, interviews, focus groups, etc.)</p>	n*=  	Results:  
3	<p>What pertinent information did your assessment uncover? <i>Provide your answer in the box below</i></p> <p>In scoring and discussing the writing samples, we found that students in their last semester of the program are writing at or above an acceptable level for the type of writing elicited by the prompts, according the standards in the discipline of mathematics. They make appropriate choices in the layout, alignment, and formatting of their text. They choose appropriate variable names and make appropriate use of symbols. They generally apply definitions correctly, making only occasional logical errors. Their exposition is generally complete and economical and they make proper use of prose.</p> <p>In scoring and discussing the writing samples, we determined that our assessment methods are not giving us all the information we need about student learning and the effectiveness of our curriculum and teaching. In particular, we determined that our benchmark is more appropriate for an individual course than for the program as a whole. Moreover, the prompts, which consist of individual problems, do not give students sufficient opportunity to display the full range of their knowledge and skills in the area of written communication. We also found that some categories on the rubric need changing. This assessment work also resulted in the continuation of the departmental discussion about the most appropriate software for students to use in producing their written work. In particular, our assessment of student work has confirmed the value of software that allows students to typeset mathematics. We continue to discuss the relative merits of various software packages in light of their ease of use and their cost.</p>		
4	<p>What conclusions did you come to and what recommendations made? <i>Provide your answer in the box below.</i></p> <p>In response to what we have learned from assessing this data, our department has decided to do the following:</p> <ol style="list-style-type: none"> <li>1. Modify the rubric so that the categories conform more to the outcomes we desire.</li> <li>2. Make a change to the co-requisite for MA 180. Discrete Mathematics (MA-0115) or Linear Algebra (MA-020) will be a co-requisite for students taking the course for the first time. Students will be strongly encouraged in academic advising to take their first writing intensive course in the major (either MA 108 or MA 110) before taking MA 180 for the second time.</li> </ol>		

	<ol style="list-style-type: none"> <li>3. Collect samples of writing from MA 180 from students taking the course for the second time. These samples will be in response to a prompt that is already being used in the course. MA 180 writing is in response to challenge problems published in mathematics journals. Consequently the writing is more sustained and creative.</li> <li>4. Assess the communication SLO using these samples by collectively using the modified rubric.</li> <li>5. Make use of the rubric in writing instruction in lower division courses, specifically MA 019, MA 015, and MA 020.</li> <li>6. Upgrade our license for Scientific Workplace (typesetting software we have been using for student writing). The upgrade will allow more students to use the software simultaneously than the previous license. It will also give them access to the complete set of typesetting tools rather than the limited access provided by our previous license.</li> <li>7. Continue the discussion in the 2011/12 academic year about how to best use the typesetting software to promote student learning in the area of written communication.</li> </ol>			
5	<p>What changes will be incorporated as a result of the departmental data analysis? In response to what we have learned from assessing this data, our department has decided to do the following:</p> <ol style="list-style-type: none"> <li>1. Modify the rubric so that the categories conform more to the outcomes we desire.</li> <li>2. Make a change to the co-requisite for MA 180. Discrete Mathematics (MA-0115) or Linear Algebra (MA-020) will be a co-requisite for students taking the course for the first time. Students will be strongly encouraged in academic advising to take their first writing intensive course in the major (either MA 108 or MA 110) before taking MA 180 for the second time.</li> <li>3. Collect samples of writing from MA 180 from students taking the course for the second time. These samples will be in response to a prompt that is already being used in the course. MA 180 writing is in response to challenge problems published in mathematics journals. Consequently the writing is more sustained and creative.</li> <li>4. Assess the communication SLO using these samples by collectively using the modified rubric.</li> <li>5. Make use of the rubric in writing instruction in lower division courses, specifically MA 019, MA 015, and MA 020.</li> <li>6. Upgrade our license for Scientific Workplace (typesetting software we have been using for student writing). The upgrade will allow more students to use the software simultaneously than the previous license. It will also give them access to the complete set of typesetting tools rather than the limited access provided by our previous license.</li> <li>7. Continue the discussion in the 2011/12 academic year about how to best use the typesetting software to promote student learning in the area of written communication.</li> </ol>			
	<i>Closing the loop</i>	<i>When</i>	<i>Who is in charge</i>	<i>Resources required</i>
	Beginning in the fall of 2011, the instructor of MA 180 will collect samples of student writing from all	Completed	See first column	None

	<p>students taking the course for the second time. Collection will continue until the department revisits the communication SLO in 2014-15.</p> <p>Make use of the rubric in writing instruction in lower division courses, specifically MA 019, MA 015, and MA 020. Department chair will remind mathematics faculty of this policy at the start of each semester.</p> <p>By Fall 2011, upgrade our license for Scientific Workplace (typesetting software we have been using for student writing). The upgrade will allow more students to use the software simultaneously than the previous license. It will also give them access to the complete set of typesetting tools rather than the limited access provided by our previous license. Russ Howell will oversee this acquisition.</p> <p>Continue the discussion in the 2011/12 academic year about how to best use the typesetting software to promote student learning in the area of written communication. The department chair will facilitate this discussion.</p>	2011-12		
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		<b>A</b>	<b># rating improved</b>	<b>C</b>	<b># rating improved</b>	<b>E</b>	<b># rating improved</b>	<b>G</b>	<b># rating improved</b>
		<b>Change</b>		<b>Change</b>		<b>Change</b>		<b>Change</b>	
I	Formatting	1	3	5	5	1	3	-1	2
II	Variables/Symbols	5	5	5	5	3	4	1	3
III	Typesetting	1	3	3	4	-1	2	-1	2
IV	Logic	3	4	1	3	-3	1	5	5
V	Exposition	3	4	5	5	1	3	3	4

n = number of student samples or participants