

# **Mathematics**

## **Evidence and Use of Evidence of Assessment**

### **2014-2015**

**Department Learning Outcome (Teach):** *Graduates will have a coherent and broad-based knowledge of the discipline of Mathematics.*

**Program Learning Outcomes (Teach):**

1. Students will be able to demonstrate facility with analytical concepts.
2. Students will be able to write proofs.
3. Students will be able to demonstrate facility with algebraic structures.

**Department Learning Outcome (Shape):** *Students will develop characteristics necessary to be effective members of the communities where they work and live.*

**Program Learning Outcomes (Shape):**

4. Students will be able to apply their mathematical knowledge to solve problems.
5. Students will be comfortable using technology to solve problems.
6. Students will be able to speak about their work with precision, clarity and organization (Oral Communication).
7. Students will be able to write about their work with precision, clarity and organization (Written Communication).
8. Students will collaborate effectively in teams.
9. Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand (Information Literacy).
10. Students will be able to gather relevant information, examine information and form a conclusion based on that information (Critical Thinking).
11. Students will be able to understand and create arguments supported by quantitative evidence, and they can clearly communicate those arguments in a variety of formats (Quantitative Reasoning).

**Department Learning Outcome (Send):** *We believe that work is an act of service. Graduates will be prepared to serve a complex world through their technical and professional abilities.*

**Program Learning Outcome (Send):**

12. Mathematics graduates will be adequately prepared for graduate study, teaching and careers using Mathematics.

**Assessment Data Mathematical, Information and Computer Sciences  
Spring 2015**

**Learning Outcome:** Students will be able to demonstrate facility with analytical concepts.

**Outcome Measure:** Annual - ETS Major Field Test in Mathematics: Calculus subscore

**Criteria for Success:** The department subscore will be at the 65<sup>th</sup> percentile or higher

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

This is the most recent 10 years of data.

Year	Percentile
2005-06	75
2006-07	90
2007-08	80
2008-09	90
2009-10	90
2010-11	70
2011-12	99
2012-13	38
2013-14	72
2014-15	*

\* Insufficient students for score to be calculated

Note the ETS changed the Mathematics test in 2004-05

Note the ETS changed the Mathematics test in 2012-13.

**Conclusions Drawn from Data:**

The students have been meeting our expectations. Our sample size is relatively small, so we expect some variation from year to year because of the size of the standard deviation on small samples. We are concerned about the drop in the scores with the exam change in 2012-13, but they seem to have recovered in 2013-14. We need to look at the questions that make up this subscore to see if we need to make curricular adjustments or if the questions being asked mean that this tool is no longer measuring what we want to measure.

**Changes to be Made Based on Data:**

We made curricular adjustments in about 2008-09 to reduce the amount of Real Analysis (two semesters to one) in order to create space for additional course work. It does not appear that these changes had a negative impact on student scores. However, it appears that the questions in this section are mostly focused on calculus-related concepts.

**Rubric Used**

None. The scores are computed by ETS.

## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Students will be able to write proofs.

**Outcome Measure:**

Annual - MTH242 Signature Assignment

Alternating Years - MTH424 and MTH444 Signature Assignment

**Criteria for Success:** 80% of the students to score a 2.5 or higher (on a scale of 1-4) in each of the four areas:

- Statement of the problem
- Logic
- Symbolism
- Justification

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

	MTH242				
	Percentage of Class at 2.5 or Higher				
	2011	2012	2013	2014	2015
Statement of Problem	100%	100%	100%	100%	100%
Logic	100%	88%	100%	100%	100%
Symbolism	100%	100%	100%	100%	100%
Justification	86%	75%	100%	83%	88%

	MTH424
	Percentage at 2.5 or higher
	Fall 2013
Statement of Problem	92%
Logic	92%
Symbolism	100%
Justification	77%

<b>MTH444</b>		
<b>Percentage at 2.5 or higher</b>		
	<b>Fall 2012</b>	<b>Fall 2014</b>
Statement of Problem	92%	100%
Logic	92%	100%
Symbolism	100%	100%
Justification	77%	100%

**Conclusions Drawn from Data:**

The place where the students continue to struggle the most is in the area of justification in their proofs.

**Changes to be Made Based on Data:**

We continue to emphasize the need for strong justification of every step in a proof and to more clearly reinforce that in early assignments in the class.

**Proof Writing Rubric (MTH242, MTH424, MTH444)**

	Unsatisfactory	Low Satisfactory	High Satisfactory	Outstanding
Statement of the Problem	Can not determine what is given and what needs to be proved	Misses one part of the hypothesis or the conclusion	Makes one minor error in identifying hypothesis or conclusion	Understands what is given and what is to be proved
Logic	Proof has major flaws that make it invalid.	Proof misses more than one major element.	Proof has the main flow of the logic correct but misses one major element	Statements flow logically from one another
Symbolism	There are many errors in the use of symbolic notation	There are more than two errors in symbolic notation	There are two or fewer minor errors in symbolic notation (e.g. missing parentheses)	All symbols are used correctly
Justification	There are several errors in the justification	There is one major mistake in justification or more than two minor errors.	There are two or fewer minor errors in justification for the steps.	Every logical step has the appropriate reason (theorem, definition, lemma, etc.)

**Assessment Data Mathematical, Information and Computer Sciences  
Spring 2015**

**Learning Outcome:** Students will be able to demonstrate facility with algebraic structures.

**Outcome Measure:** Annual: ETS Major Field Test in Mathematics: Algebra subscore

**Criteria for Success:** The department subscore will be at the 65<sup>th</sup> percentile or higher.

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

This is the most recent 10 years of data:

Year	Percentile
2005-06	95
2006-07	80
2007-08	80
2008-09	80
2009-10	65
2010-11	90
2011-12	85
2012-13	72
2013-14	49
2014-15	*

\* Insufficient students for score to be calculated

Note the ETS changed the Mathematics test in 2004-05

Note the ETS changed the Mathematics test in 2012-13.

**Conclusions Drawn from Data:**

The students have been meeting our expectations. Our sample size is relatively small, so we expect some variation from year to year because of the size of the standard deviation on small samples. Because we teach Abstract Algebra on alternating years, we are investigating what appears to be a cyclical pattern when students perform better in the years when we teach Abstract Algebra (even year fall semesters). We are concerned about the drop in the scores with the exam change in 2012-13. We need to look at the questions that make up this subscore to see if we need to make curricular adjustments or if the questions being asked mean that this tool is no longer measuring what we want to measure. However, because we did not have

sufficient students to generate a subscore this year, we need to wait at least a year to make a judgement.

**Changes to be Made Based on Data:**

We made curricular adjustments in about 2008-09 to reduce the amount of abstract algebra (two semesters to one) in order to create space for additional course work. It does not appear that these changes had a negative impact on student scores. We did increase the amount of linear algebra that we are requiring each student to take, so that may have balanced the reduction in abstract algebra.

**Rubric Used**

None. The scores are computed by ETS.



## Assessment Data Mathematical, Information and Computer Sciences Spring 2015

**Learning Outcome:** Students will be able to apply their mathematical knowledge to solve problems.

**Outcome Measure: Annual** - ETS Major Field Test in Mathematics: Applied subscore

**Criteria for Success:** The department subscore will be at the 65<sup>th</sup> percentile or higher

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

This is the data from the most recent 10 years.

Year	Percentile
2005-06	75
2006-07	75
2007-08	60
2008-09	95
2009-10	85
2010-11	70
2011-12	96
2012-13	60
2013-14	39
2014-15	*

\* Insufficient students for score to be calculated

Note the ETS changed the Mathematics test in 2004-05

Note the ETS changed the Mathematics test in 2012-13.

**Conclusions Drawn from Data:**

The students have been meeting our expectations. Our sample size is relatively small, so we expect some variation from year to year because of the size of the standard deviation on small samples. We are concerned about the drop in the scores with the exam change in 2012-13.

We need to look at the questions that make up this subscore to see if we need to make curricular adjustments or if the questions being asked mean that this tool is no longer measuring what we want to measure.

**Changes to be Made Based on Data:**

Over the last several years we have increased the amount of applied mathematics problems in our coursework.

**Rubric Used**

None. The scores are computed by ETS.

**Assessment Data Mathematical, Information and Computer Sciences  
Spring 2015**

**Learning Outcome:** Students will be comfortable using technology to solve problems.

**Outcome Measure:** Annual: MTH382 Signature Assignment and CSC254 Signature Assignment

**Criteria for Success:**

MTH382: 80% of the students should have an average score of at least 2.5 in each of the major areas.

CSC254: 80% of the students should have an average score of at least 2 in each of the major areas.

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

	<b>MTH382</b>			
	<b>Percentage of students at 2.5 or higher</b>			
	2011-12	2012-13	2013-14	2014-15
Students will be able to use technology to solve problems	100%	100%	skipped	100%

	<b>CSC254</b>			
	<b>Percentage of Class at 2 or Higher</b>			
	2011	2012	2013	2014
Compilation	100%	100%	92%	100%
Runtime Correctness	86%	58%	85%	75%
Problem Solving	100%	100%	100%	100%

**Conclusions Drawn from Data:**

MTH382: Students have been able to satisfactorily analyze data using technology.

CSC254: The students find the run-time correctness the most challenging. This is because this is the area of programming that is the most detailed oriented.

**Changes to be Made Based on Data:**

MTH382: Continue to use a hands on data analysis project.

CSC254: Continue to emphasize the need to carefully de-bug computer code during development.

### MTH382 Signature Assignment Rubric

	Outstanding (4)	High Satisfactory (3)	Low Satisfactory (2)	Unsatisfactory (1)
Use of technology to solve problems	<p>Other than checking results, uses only the relevant operations <math>\{+, -, \times, \div, \sqrt{\square}, \text{and Sum()}\}</math> in formulas in a manner that is typical of Excel usage in industry.</p> <p>and</p> <p>Uses cell addresses instead of typing in numerical results (other than typing <math>n</math> or <math>n-1</math>).</p>	<p>Other than checking results, uses only the relevant operations <math>\{+, -, \times, \div, \sqrt{\square}, \text{and Sum()}\}</math> in formulas.</p> <p>and</p> <p>Uses one or fewer instances of typing a numerical result (other than <math>n</math> or <math>n-1</math>) instead of a cell address in a formula.</p>	<p>Other than checking results, uses one of the built in functions (Average, StDev) instead of <math>\{+, -, \times, \div, \sqrt{\square}, \text{and Sum()}\}</math>.</p> <p>or</p> <p>Occasionally types numerical results (other than <math>n</math> or <math>n-1</math>) instead of cell addresses in formulas.</p>	<p>Other than checking results, uses both of the built in functions (Average, StDev) instead of <math>\{+, -, \times, \div, \sqrt{\square}, \text{and Sum()}\}</math>.</p> <p>or</p> <p>Often types in numerical results instead of cell addresses in formulas.</p>

Criterion: 80% of students will score at or above 2.5.

### CSC 254 Signature Assignment Rubric

	Unsatisfactory (1)	Satisfactory (2)	Good (3)	Excellent (4)
<b>Compilation</b>	<ul style="list-style-type: none"> <li>Compiles with errors</li> </ul>	<ul style="list-style-type: none"> <li>Compiles with no errors, but has linking errors</li> </ul>	<ul style="list-style-type: none"> <li>Compiles with no syntax errors or linking errors, but has warnings.</li> </ul>	<ul style="list-style-type: none"> <li>Compiles and links with no errors</li> </ul>
<b>Runtime correctness</b>	<ul style="list-style-type: none"> <li>No correct response to any test case from the sample data provided.</li> </ul>	<ul style="list-style-type: none"> <li>Executes correctly on at least one test case from the sample data provided.</li> </ul>	<ul style="list-style-type: none"> <li>Executes correctly on the given sample data, but not accepted by the online judge (no need to look at source code in this case)</li> </ul>	<ul style="list-style-type: none"> <li>Accepted by the online judge, indicating that it has passed numerous independent test cases unknown to the student.</li> </ul>
<b>Problem solving</b>	<ul style="list-style-type: none"> <li>Analysis of program source code indicates that program is NOT close to working, and could NOT easily be modified to work given additional time.</li> </ul>	<ul style="list-style-type: none"> <li>Analysis of program source code indicates that the student partially understands the problem solution.</li> </ul>	<ul style="list-style-type: none"> <li>Analysis of program source code indicates that program is close to working, and could be modified to work given additional time.</li> </ul>	<ul style="list-style-type: none"> <li>Accepted by judge</li> </ul>

**Criterion: 80% of students will average 2 in Runtime correctness and Problem solving.**

## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Students will be able to speak about their work with precision, clarity and organization (Oral Communication).

**Outcome Measure:** Annual: Each student will be required to give a 20-minute oral presentation on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance of their presentation and will be rated by the faculty using a rubric with a scale of 4 (outstanding) to 1 (unsatisfactory) in the following areas:

- Command of background material
- Organization
- Oral presentation skills (added as part of the new rubric in the spring of 2010)
- Use of presentation tools
- Ability to field questions from the audience

Note that the department has a mapping between its rubric and the AAC&U Oral Communication Value Rubric.

**Criteria for Success:** 80% of the students should have an average score of at least 2.5 in each of the major areas in the department rubric. This translates to 80% of the students being above a 3.5 in the AAC&U rubric.

Our translation from our data to the AAC&U is included. Our department continues to provide the students with our departmental rubric because it has been developed over many years and works effectively with our majors.

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Background	92%	80%	94%	94%	88%	100%	95%	100%	100%	92%	100%
Organization	92%	80%	94%	94%	94%	100%	85%	100%	100%	100%	100%
Oral presentation skills (2010)						100%	90%	100%	100%	92%	100%
Presentation Tools	83%	80%	94%	88%	94%	100%	100%	100%	100%	100%	100%
Ability to field questions	92%	80%	94%	81%	100%	100%	100%	83%	100%	100%	89%

AAC&U “translation” (we have only done this for the years that PLNU has been making use of the DQP)

	2012-13	2013-14	2014-15
Organization	100%	100%	100%
Language	100%	92%	100%
Delivery	100%	92%	100%
Supporting Material	100%	100%	100%
Central Message	100%	100%	89%

**Conclusions Drawn from Data:**

In general, the students have been performing reasonably well in the area of giving oral presentations. We attribute this to the fact that we intentionally have students presenting technical material in front of others starting in their freshman year.

**Changes to be Made Based on Data:**

Over time we have increased our standards and expanded the rubric to increase clarity for students and to push them to speak at a professional level. Looking at the scores, it is possible to see the times when alterations have been made:

- 2008-09 Standards tightened
- 2009-10 Rubric expanded to include more detailed instructions



**MICS Oral Presentation Rubric**

<b>Criteria</b>	<b>Outstanding</b>	<b>High Satisfactory</b>	<b>Low Satisfactory</b>	<b>Unsatisfactory</b>
<b>Command of background material</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Clearly knows material and key facts by memory</li> <li><input type="checkbox"/> Expands on PPT slides</li> <li><input type="checkbox"/> Content appropriate for audience</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Clearly knows key facts with a few memory slips</li> <li><input type="checkbox"/> Some expansion on PPT slides</li> <li><input type="checkbox"/> Partial audience adaptation of content</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Reads some information; knows some facts from memory</li> <li><input type="checkbox"/> No expansion of PPT slide content</li> <li><input type="checkbox"/> Little audience adaptation of content</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Reads sentences from slides</li> <li><input type="checkbox"/> Dependent on notes</li> <li><input type="checkbox"/> Lacks audience adaptation of content</li> </ul>
<b>Organization</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Clear and concise outline</li> <li><input type="checkbox"/> Relevant graphics and key text items on slides</li> <li><input type="checkbox"/> Presentation length is +/- 30 seconds of time limit</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Clear outline</li> <li><input type="checkbox"/> Too much information on slides (not concise)</li> <li><input type="checkbox"/> +/- 1 minute of time limit</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Some sense of outline</li> <li><input type="checkbox"/> Too much detailed information on slides</li> <li><input type="checkbox"/> +/- 1:30 of time limit</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> No clear outline</li> <li><input type="checkbox"/> Slides are in paragraphed; too much detailed information on one slide</li> <li><input type="checkbox"/> +/- 2 minutes of time limit</li> </ul>
<b>Oral Presentation skills</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Clearly has practiced several times; smooth transitions</li> <li><input type="checkbox"/> Engages audience in content at least twice and engagement is well connected to talk (questions, examples, etc)</li> <li><input type="checkbox"/> Free of disfluencies (ah, umh)</li> <li><input type="checkbox"/> Is clearly heard in the room and uses inflection for emphasis</li> <li><input type="checkbox"/> Engaged audience through eye contact</li> <li><input type="checkbox"/> Engaged audience through gestures</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Has practiced but transitions are not smooth</li> <li><input type="checkbox"/> Engages audience at least once in content (questions, examples, etc.) and engagement is well connected to the talk.</li> <li><input type="checkbox"/> A few disfluencies (ah, umh, er)</li> <li><input type="checkbox"/> Can be understood most of the time and uses some inflection</li> <li><input type="checkbox"/> Some engagement of audience through eye contact</li> <li><input type="checkbox"/> Some engagement of audience through gestures</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Has practiced presentation but cannot verbally make transitions between slides</li> <li><input type="checkbox"/> Audience engagement at least once with content (questions, examples, etc.) but it is not well connected to the talk.</li> <li><input type="checkbox"/> Many disfluencies (ah, umh, er)</li> <li><input type="checkbox"/> Can sometimes be understood and uses little inflection</li> <li><input type="checkbox"/> Infrequent eye contact</li> <li><input type="checkbox"/> Distracting gestures or mannerisms</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Clearly did not practice presentation; Does not anticipate content of next slide</li> <li><input type="checkbox"/> No audience involvement</li> <li><input type="checkbox"/> Disfluencies (ah, umh, er) detract from presentation</li> <li><input type="checkbox"/> Can not be heard and/or speaks in a monotone</li> <li><input type="checkbox"/> Little audience awareness or eye contact</li> <li><input type="checkbox"/> Frequent distracting gestures or mannerisms</li> </ul>
<b>Use of Presentation Tools</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> PPT background is matched to content, legible font, seamless transitions</li> <li><input type="checkbox"/> Graphics imbedded and matched to topic, necessary hyperlinks work</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Appropriate PPT slide backgrounds, transitions &amp; font</li> <li><input type="checkbox"/> Most graphics imbedded and matched to topic, most necessary hyperlinks work</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Distracting PPT slide backgrounds and transitions, font hard to read</li> <li><input type="checkbox"/> Some inappropriate graphics or use of PPT embellishments, necessary hyperlinks don't work</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> No attention given to PPT slide backgrounds and transitions, font illegible</li> <li><input type="checkbox"/> Distracting use of embellishments, graphics not connected to topic</li> </ul>
<b>Ability to field questions</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Able to answer questions clearly and without hesitation and prepared material to answer anticipated questions</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Can answer all questions with some hesitation</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Able to answer half of the questions with hesitation</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Unable to answer any questions</li> </ul>

Translation between MICS and AAC&U Rubric

MICS Category	MICS Item Position in Rubric	AAC&U Category
Clear and concise outline	4	Organization
Relevant graphics and key text items on slides	5	Organization
Presentation length is +/- 30 seconds of time limit	6	Organization
Expands on PPT slides	2	Language
Content appropriate for audience	3	Language
Engages audience	8	Language
Transitions	7	Delivery
Free of disfluencies (ah, uhm)	9	Delivery
Is clearly heard in the room and uses inflection for emphasis	10	Delivery
Engaged audience through eye contact	11	Delivery
Engaged audience through gestures	12	Delivery
PPT background is matched to content, legible font, seamless transitions	13	Delivery
Relevant graphics and key text items on slides	5	Supporting
Graphics imbedded and matched to topic, necessary hyperlinks work	14	Supporting
Clearly knows material and key facts by memory	1	Central Message
Able to answer questions clearly and without hesitation	15	Central Message

**AAC&U Value Rubric**

	<b>Capstone 4</b>	<b>Milestones 3</b>	<b>Milestones 2</b>	<b>Benchmark 1</b>
<b>Organization</b>	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
<b>Language</b>	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
<b>Delivery</b>	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
<b>Supporting Material</b>	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/authority on the topic.
<b>Central Message</b>	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced, but is not explicitly stated in the presentation.

## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Students will be able to write about their work with precision, clarity and organization (Written Communication).

**Outcome Measure:**

Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance of their presentation and will be rated by the faculty using a rubric with a scale of 4 (outstanding) to 1 (unsatisfactory) in the following areas:

- Bibliography and other supporting documentation
- Organization
- Grammar and spelling
- Depth of information
- Clarity of writing

Note that the department has a mapping between its rubric and the AAC&U Written Communication Value Rubric.

**Criteria for Success:** 80% of the students should have an average score of at least 2.5 in each of the major areas in the department rubric. This translates to 80% of the students being above a 3.5 in the AAC&U rubric.

Our translation from our data to the AAC&U is included. Our department continues to provide the students with our departmental rubric because it has been developed over many years and works effectively with our majors

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

## Longitudinal Data:

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Bibliography and support	82%	60%	88%	69%	75%	88%	55%	93%	100%	100%	100%
Organization	91%	87%	94%	100%	88%	63%	65%	93%	100%	100%	100%
Grammar and Spelling	91%	73%	88%	94%	75%	81%	60%	79%	100%	92%	89%
Depth of Information	82%	60%	88%	81%	88%	88%	50%	93%	91%	77%	78%
Clarity of Writing	82%	80%	94%	94%	69%	81%	70%	79%	91%	77%	78%

AAC&U “translation” (we have only done this for the years that PLNU has been making use of the DQP)

<b>Written Report</b>	2012-13	2013-14	2014-15
Context and Purpose for Writing	100%	77%	100%
Content Development	91%	77%	78%
Genre and Disciplinary Conventions	100%	100%	100%
Sources and Evidence	100%	100%	100%
Control of Syntax and Mechanics	100%	92%	89%

## Conclusions Drawn from Data:

In general, the students have been performing reasonably well in writing technical reports. We still some weaknesses in the quality of their writing and the use of their source material.

## Changes to be Made Based on Data:

Over time we have increased our standards and expanded the rubric to increase clarity for students and to push them to speak at a professional level. Looking at the scores, it is possible to see the times when alterations have been made:

- 2008-09 Standards tightened
- 2009-10 Rubric expanded to include more detailed instructions
- In 2014-15 we instituted a literature review assignment to strengthen the students' capacity for using resources and identifying why the resources are relevant. This assignment needs to be adjusted, but seems to have helped students to understand their work.

In addition, the university has just changed general education requirements so that students will take an upper division literature class. We hope that this further exposure to formal writing later in their academic career will help to strengthen our students' writing.

**MICS Written Presentation Rubric**

<b>Criteria</b>	<b>Outstanding</b>	<b>High Satisfactory</b>	<b>Low Satisfactory</b>	<b>Unsatisfactory</b>
Bibliography and supporting documents	<input type="checkbox"/> Multiple references from distinct reputable sources  <input type="checkbox"/> References cited in the body of the document	<input type="checkbox"/> Most references from distinct reputable sources  <input type="checkbox"/> Some citation of references in the body of the document	<input type="checkbox"/> Some references from reputable sources  <input type="checkbox"/> Limited citation of references in the body of the document	<input type="checkbox"/> No bibliography or all references from untrusted sites on the internet  <input type="checkbox"/> No citation of references in the body of the document
Organization	<input type="checkbox"/> Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic  <input type="checkbox"/> Clear introduction, body (with sections), and conclusion includes summary and closure  <input type="checkbox"/> Includes both an abstract and table of contents	<input type="checkbox"/> Conveys a central idea or topic with some ideas connected to the topic  <input type="checkbox"/> Includes introduction, body and conclusion  <input type="checkbox"/> Includes abstract and table of contents (one partial and one complete)	<input type="checkbox"/> Attempts to focus on an idea or topic with many ideas not connected to the topic  <input type="checkbox"/> Introduction, body, conclusion detectable but not clear  <input type="checkbox"/> Includes partial abstract and partial table of contents	<input type="checkbox"/> Has little or no focus on central idea or topic  <input type="checkbox"/> Introduction, body or conclusion absent  <input type="checkbox"/> No abstract or table of contents
Grammar and spelling	<input type="checkbox"/> No use of first- person tense  <input type="checkbox"/> No grammatical or spelling errors	<input type="checkbox"/> Few uses of the first-person tense  <input type="checkbox"/> Few grammatical and spelling errors	<input type="checkbox"/> Several uses of the first- person tense  <input type="checkbox"/> Some grammatical and spelling errors	<input type="checkbox"/> Written in first-person tense  <input type="checkbox"/> Many grammatical and spelling errors
Depth of information	<input type="checkbox"/> Appropriately synthesizes information from multiple distinct sources  <input type="checkbox"/> Draws conclusions and personal insights from synthesis  <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is excellent	<input type="checkbox"/> Synthesis of information from at least three distinct sources  <input type="checkbox"/> At least two personal insights or conclusions stated  <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is good	<input type="checkbox"/> Synthesis of information from at least two distinct sources  <input type="checkbox"/> At least one personal insight or conclusion stated  <input type="checkbox"/> Has the minimum number of pages including penalty pages; subject coverage is adequate	<input type="checkbox"/> Summary reporting of information without synthesis  <input type="checkbox"/> No personal insights  <input type="checkbox"/> Does not have the minimum number of pages including penalty pages
Clarity of writing	<input type="checkbox"/> Sentences flow  <input type="checkbox"/> Smooth transitions between paragraphs  <input type="checkbox"/> Any and all terms and acronyms are defined  <input type="checkbox"/> Provides evidence to support points	<input type="checkbox"/> Good sentence structure  <input type="checkbox"/> Adequate transitions between paragraphs  <input type="checkbox"/> Most terms and acronyms are defined  <input type="checkbox"/> Lacks support for some points	<input type="checkbox"/> Occasional poor sentence structure  <input type="checkbox"/> Transitions between paragraphs unclear  <input type="checkbox"/> Some terms and acronyms are defined  <input type="checkbox"/> Provides minimal support for points	<input type="checkbox"/> Frequent poor sentence structure  <input type="checkbox"/> Lacked transitions between paragraphs  <input type="checkbox"/> Many terms and acronyms are undefined  <input type="checkbox"/> Ideas not supported

Translation between MICS and AAC&U Rubric

MICS Category	MICS Item Position in Rubric	AAC&U Category
Conveys a central theme with all ideas connected, arrangement of ideas clearly related to topic	3	Purpose
Appropriately synthesizes information from multiple distinct sources	8	Development
Draws conclusions and personal insights from synthesis	9	Development
Has the minimum number of pages including penalty pages; subject coverage is excellent	10	Development
Provides evidence to support points	14	Development
Clear introduction, body (with sections), and conclusion includes summary and closure	4	Genre
Includes both an abstract and table of contents	5	Genre
Multiple references from distinct reputable sources	1	Source
References cited in the body of the document	2	Source
No use of first- person tense	6	Syntax
No grammatical or spelling errors	7	Syntax
Sentences flow	11	Syntax
Smooth transitions between paragraphs	12	Syntax
Any and all terms and acronyms are defined	13	Syntax

**AAC&U Written Communication Value Rubric**

	<b>Capstone 4</b>	<b>Milestones 3</b>	<b>Milestones 2</b>	<b>Benchmark 1</b>
<b>Context of and Purpose for Writing</b> <i>Includes considerations of audience, purpose, and the circumstances surrounding the writing task(s).</i>	Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context).	Demonstrates awareness of context, audience, purpose, and to the assigned tasks(s) (e.g., begins to show awareness of audience's perceptions and assumptions).	Demonstrates minimal attention to context, audience, purpose, and to the assigned tasks(s) (e.g., expectation of instructor or self as audience).
<b>Content Development</b>	Uses appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work.	Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work.	Uses appropriate and relevant content to develop and explore ideas through most of the work.	Uses appropriate and relevant content to develop simple ideas in some parts of the work.
<b>Genre and Disciplinary Conventions</b> <i>Formal and informal rules inherent in the expectations for writing in particular forms and/or academic fields (please see glossary).</i>	Demonstrates detailed attention to and successful execution of a wide range of conventions particular to a specific discipline and/or writing task (s) including organization, content, presentation, formatting, and stylistic choices	Demonstrates consistent use of important conventions particular to a specific discipline and/or writing task(s), including organization, content, presentation, and stylistic choices	Follows expectations appropriate to a specific discipline and/or writing task(s) for basic organization, content, and presentation	Attempts to use a consistent system for basic organization and presentation.
<b>Sources and Evidence</b>	Demonstrates skillful use of high-quality, credible, relevant sources to develop ideas that are appropriate for the discipline and genre of the writing	Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that are appropriate for the discipline and genre of the writing.	Demonstrates an attempt to use sources to support ideas in the writing.
<b>Control of Syntax and Mechanics</b>	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	Uses language that sometimes impedes meaning because of errors in usage.



## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Students will collaborate effectively in teams.

**Outcome Measure:**

Annual: CSC324 Signature Assignment – evaluation of group while working on a project

Annual: MTH352 Signature Assignment – evaluation of group while working on a project

**Criteria for Success:** 80% of the students should have an average score of at least 2.5 in each of the major areas.

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

	CSC324 Percent of students with average at least 3.0	
	Fall 2012	Fall 2014
Contributes to team meetings	86%	80%
Encourages team members	93%	84%
Contributes individually outside of team meetings	93%	88%
Attitude	100%	96%
Fosters constructive team climate	100%	92%
Responds to conflict	100%	100%

	MTH352 Percent of students with average at least 3.0	
	Spring 2013	Spring 2015
Contributes to team meetings	91%	86%
Encourages team members	91%	93%
Contributes individually outside of team meetings	82%	93%
Attitude	100%	100%
Fosters constructive team climate	91%	100%
Responds to conflict	91%	100%

**Conclusions Drawn from Data:**

The students are performing well as member of teams.

**Changes to be Made Based on Data:**

Continue to make use of group activities throughout the curriculum.

## MICS Teamwork Rubric

### Definition

Teamwork is behaviors under the control of individual team members (effort they put into team tasks, their manner of interacting with others on team, and the quantity and quality of contributions they make to team discussions.)

*Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet unsatisfactory (cell one) level performance.*

**The purpose of this is to evaluate individual team members. Although no team member will ever see your evaluation of them, please take it seriously.**

### Directions:

- **Do not put your own name anywhere on this form, the evaluations are to be anonymous.**
- **Please write the name of the person you are evaluating here .....**\_\_\_\_\_
- **Please fill out one copy of this form for every person who was on your team, including one for yourself.**
- **For each row, place a checkmark in the box that best describes your teammate's performance.**

	Outstanding	High Satisfactory	Low Satisfactory	Unsatisfactory
<b>Contributes to team meetings</b>	<input type="checkbox"/> Helps the team move forward by articulating the merits of alternative ideas or proposals.	<input type="checkbox"/> Offers new suggestions to advance the work of the group.	<input type="checkbox"/> Shares ideas but does not advance the work of the group.	<input type="checkbox"/> Sits quietly in team meetings and does not contribute
<b>Encourages members of the team</b>	<input type="checkbox"/> Actively seeks to find opportunities to encourage all members of the team.	<input type="checkbox"/> Offers encouragement to all members of the team	<input type="checkbox"/> Offers words of encouragement to friends	<input type="checkbox"/> Does not offer word of encouragement to anyone
<b>Individual contributions outside of team meetings</b>	<input type="checkbox"/> Completes all assigned tasks by deadline; work accomplished is thorough. Proactively helps other team members complete their assigned tasks.	<input type="checkbox"/> Completes all assigned tasks by deadline; work accomplished is thorough.	<input type="checkbox"/> Completes all assigned tasks by deadline.	<input type="checkbox"/> Does not complete all assigned tasks by deadline.
<b>Attitude</b>	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude <b>rarely</b> and helps others to become more positive.	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude <b>rarely</b> .	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude <b>less</b> often than a positive attitude.	<input type="checkbox"/> Demonstrates (comments, facial expressions, etc.) a negative attitude <b>more</b> often than a positive attitude.

<p><b>Fosters constructive team climate</b></p>	<p><input type="checkbox"/> Supports a constructive team climate by doing <b><u>all of the following</u></b>:</p> <ul style="list-style-type: none"> <li>• Treats team members respectfully by being polite and constructive in communication.</li> <li>• Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work.</li> <li>• Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.</li> </ul>	<p><input type="checkbox"/> Supports a constructive team climate by doing <b><u>any two of the following</u></b>:</p> <ul style="list-style-type: none"> <li>• Treats team members respectfully by being polite and constructive in communication.</li> <li>• Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work.</li> <li>• Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.</li> </ul>	<p><input type="checkbox"/> Supports a constructive team climate by doing <b><u>any one of the following</u></b>:</p> <ul style="list-style-type: none"> <li>• Treats team members respectfully by being polite and constructive in communication.</li> <li>• Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work.</li> <li>• Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.</li> </ul>	<p><input type="checkbox"/> Supports a constructive team climate by doing <b><u>none of the following</u></b>:</p> <ul style="list-style-type: none"> <li>• Treats team members respectfully by being polite and constructive in communication.</li> <li>• Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work.</li> <li>• Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.</li> </ul>
<p><b>Responds to conflict</b></p>	<p><input type="checkbox"/> Identifies and acknowledges conflict and acknowledges that relationships can be damaged. Seeks to restore relationships.</p>	<p><input type="checkbox"/> Identifies and acknowledges conflict and acknowledges that relationships can be damaged.</p>	<p><input type="checkbox"/> Identifies and acknowledges conflict but will not acknowledge that relationships can be damaged.</p>	<p><input type="checkbox"/> Will not acknowledge that conflict has occurred or that relationships can be damaged.</p>

## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand (Information Literacy).

**Outcome Measure:** Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria in advance and their paper will be rated by the faculty using a rubric with a scale of 4 (capstone) to 1 (benchmark) in the following areas:

- Determine the Extent of Information Needed
- Access the Needed Information
- Evaluate Information and its Sources Critically (carefully explains the reason for the choice of sources).
- Use Information Effectively to Accomplish a Specific Purpose
- Access and Use Information Ethically and Legally

**Criteria for Success:** 80% of the students should have an average score of at least 3 in each of the major areas.

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

Information Literacy	Percentage of Students at 2.5 or Higher		
	2012-13	2013-14	2014-15
Determine the Extent of Information Needed	100%	62%	78%
Access the Needed Information	91%	69%	100%
Evaluate Information and its Sources Critically (carefully explains the reasons for the choice of source) (added 2014-15)			33%
Use Information Effectively to Accomplish a Specific Purpose	91%	85%	89%
Access and Use Information Ethically and Legally	91%	77%	100%

**Conclusions Drawn from Data:**

For the first two years we applied the rubric to the student's final senior paper to measure their use of information. The quality of the use of information was uneven and we had not made our expectations clear.

The students are still having trouble articulating the reasons that they have selected a specific reference for use in their final paper. They are also not cite sources with the consistency that we would desire.

**Changes to be Made Based on Data:**

In 2014-15 we changed the assignment so that seniors submit a literature review in advance of submitting their final senior paper. The literature review is evaluated using the first three criteria in the rubric and students are asked to self-assess as well. The final paper is evaluated using all elements 1,2,4 and 5 of the information literacy and students also do a self-assessment with the rubric before turning in their final paper.

The first year of the literature review process was disappointing. We need to work with students so that they can articulate the reasons for their reference selections. The assignment needs to be redesigned to focus more clearly on this issue.

In addition, the change in general education requirements means that all students will be required to take an upper division literature course and that should help reinforce some of these skills closer to the time that our students are writing their final paper in senior seminar.

**MICS Information Literacy Rubric**  
Adapted from the AAC&U Value Rubric

	<b>Capstone - 4</b>	<b>Milestone - 3</b>	<b>Milestone - 2</b>	<b>Benchmark - 1</b>
<b>Determine the Extent of Information Needed</b>	Effectively defines the scope of the research question or thesis. Effectively determines key concepts. Types of information (sources) selected directly relate to concepts or answer research question.	Defines the scope of the research question or thesis completely. Can determine key concepts. Types of information (sources) selected relate to concepts or answer research question.	Defines the scope of the research question or thesis incompletely (parts are missing, remains too broad or too narrow, etc.). Can determine key concepts. Types of information (sources) selected partially relate to concepts or answer research question.	Has difficulty defining the scope of the research question or thesis. Has difficulty determining key concepts. Types of information (sources) selected do not relate to concepts or answer research question.
<b>Access the Needed Information</b>	Accesses information using effective search strategies and most appropriate information sources.	Accesses information using variety of search strategies and some relevant information sources.	Accesses information using simple search strategies, retrieves information from limited and similar sources.	Accesses information randomly, retrieves information that lacks relevance and quality.
<b>Evaluate Information and its Sources Critically</b>	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
<b>Use Information Effectively to Accomplish a Specific Purpose</b>	Communicates, organizes and synthesizes information from sources. Supports all points in the paper.	Communicates, organizes and synthesizes information from sources. Supports most points in the paper.	Communicates and organizes information from sources. The information is not yet synthesized and/or supports only a few points.	Communicates information from sources. The information is fragmented and/or used inappropriately (misquoted, taken out of context, or incorrectly paraphrased, etc.).
<b>Access and Use Information Ethically and Legally</b>	Students use correctly all of the following information use strategies: <ul style="list-style-type: none"> <li>• use of citations and references;</li> <li>• use of paraphrasing, summary, or quoting;</li> <li>• use of information in ways that are true to original context;</li> <li>• distinguishes between common knowledge and ideas requiring attribution and (where appropriate) demonstrates a full understanding of the ethical and legal restrictions on the use of published, confidential, and/or proprietary information.</li> </ul>	Students use correctly three of the following information use strategies: <ul style="list-style-type: none"> <li>• use of citations and references;</li> <li>• use of paraphrasing, summary, or quoting;</li> <li>• use of information in ways that are true to original context;</li> <li>• distinguishes between common knowledge and ideas requiring attribution and (where appropriate) demonstrates a full understanding of the ethical and legal restrictions on the use of published, confidential, and/or proprietary information.</li> </ul>	Students use correctly two of the following information use strategies: <ul style="list-style-type: none"> <li>• use of citations and references;</li> <li>• use of paraphrasing, summary, or quoting;</li> <li>• use of information in ways that are true to original context;</li> <li>• distinguishes between common knowledge and ideas requiring attribution and (where appropriate) demonstrates a full understanding of the ethical and legal restrictions on the use of published, confidential, and/or proprietary information.</li> </ul>	Students use correctly one of the following information use strategies: <ul style="list-style-type: none"> <li>• use of citations and references;</li> <li>• use of paraphrasing, summary, or quoting;</li> <li>• use of information in ways that are true to original context;</li> <li>• distinguishes between common knowledge and ideas requiring attribution and (where appropriate) demonstrates a full understanding of the ethical and legal restrictions on the use of published, confidential, and/or proprietary information.</li> </ul>

## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Students will be able to gather relevant information, examine information and form a conclusion based on that information (Critical Thinking).

**Outcome Measure:** Annual: Each student will be required to write a paper on a topic in their field as a part of their participation in the Senior Seminar. The audience for this talk will include department faculty, fellow students and possibly some alumni. The students will be given the evaluation criteria which will be applied to their paper and will be rated by the faculty using a rubric with a scale of 4 (capstone) to 1 (benchmark) in the following areas:

- Explanation of issues
- Evidence: Selecting and using information to investigate a point of view or conclusion
- Conclusion and related outcomes (implications and consequences)

**Criteria for Success:** 80% of the students should have an average score of at least 2.5 in each of the major areas. This is based on the AAC&U 1-4 point scoring system.

### Aligned with DQP Learning Areas (circle one or more):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

### Longitudinal Data:

	Percentage of Students at 2.5 or Higher		
	2012-13	2013-14	2014-15
Explanation of issues	100%	77%	100%
Evidence	100%	77%	89%
Conclusions and related outcomes (implications and consequences)	100%	85%	89%

### Conclusions Drawn from Data:

The AAC&U rubrics are written in a language that is rooted in the humanities. We have had to work with students to translate/clarify the meaning of some aspects of the rubric, assignment and our expectations. However, they are generally meeting our expectations. We however still have work to do.

### Changes to be Made Based on Data:

We are providing the students with the critical thinking rubric as part of the instructions for the assignment and starting in 2014-15 we began having them self-assess their work with the rubric before submission. We expect to need to further modify the rubric to use language that is better understood by our students.



**Rubric:**

**MICS Critical Thinking Rubric (2/6/13)**  
Adapted from the AAC&U Value Rubric

	<b>Capstone – 4</b>	<b>Milestone -3</b>	<b>Milestone - 2</b>	<b>Benchmark -1</b>
<b>Explanation of issues</b>	Issue/problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/or backgrounds unknown.	Issue/problem to be considered critically is stated without clarification or description.
<b>Evidence</b> <i>Selecting and using information to investigate a point of view or conclusion</i>	Information is taken from source(s) with enough interpretation/evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/evaluation. Viewpoints of experts are taken as fact, without question.
<b>Conclusions and related outcomes (implications and consequences)</b>	Conclusions and related outcomes (consequences and implications) are logical and reflect student’s informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Students will be able to understand and create arguments supported by quantitative evidence, and they can clearly communicate those arguments in a variety of formats (Quantitative Reasoning).

**Outcome Measure:** Annual: Each student will be required to complete a quantitative reasoning assignment as part of Senior Seminar. The students will be given the evaluation criteria with their assignment and will be rated by the faculty using a rubric with a scale of 4 (completely correct) to 0 (completely incorrect) in the following areas:

- The ability to formulate a mathematical model from a verbal description of a problem.
- The ability to solve non-routine problems using logic and quantitative techniques.
- The ability to construct solutions to problems using computational techniques.

**Criteria for Success:** 80% of the students should have an average score of at least 3 in each of the major areas.

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

### Longitudinal Data:

2014-15 is the first year that we are formally assessing QL in a manner connected with the DQP.

	Percent 2.5 or Higher
	2014-15
Students will be able to formulate a mathematical model from a verbal description of a problem.	44%
Students will be able to solve non-routine problems using logic and quantitative techniques.	100%
Students will be able to construct solutions to problems using computational techniques.	89%

**Conclusions Drawn from Data:**

We scoring the problems, we realized that some of the students had mis-interpreted the question related to “formulate a mathematical model from a verbal description.” This made the problem difficult to score. We will need to revise that problem.

**Changes to be Made Based on Data:**

Revise one of the questions on the assignment. The majors in our department are heavily quantitative and thus our students’ quantitative skill is regularly assessed because it underlies many of the tasks that they do in their classes.

**Quantitative Reasoning Rubric (this is the same rubric we use for general education)**

	Unsatisfactory	Low Satisfactory	Satisfactory	High Satisfactory	Outstanding
Students will be able to formulate a mathematical model from a verbal description of a problem (#1 up to filling in formula).	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able to solve non-routine problems using logic and quantitative techniques (#2).	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct
Students will be able to construct solutions to problems using computational techniques (#1 computation of payment).	Completely incorrect	Missed more than one key step or concept	Missed one key step or concept	Made a minor error	Completely correct

Translation between AAC&U Value Rubric and MICS Quantitative Literacy Rubric

Note that the main reason that our department has chosen to not use the AAC&U rubric is that the underlying assumption of the rubric is that students are working with statistical information and are writing text about that statistical information. There is a great deal more to quantitative literacy than statistics and writing about data.

MICS Category	AAC&U Category
	<b>Interpretation</b> <i>Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>
Students will be able to formulate a mathematical model from a verbal description of a problem	<b>Representation</b> <i>Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>
Students will be able to construct solutions to problems using computational techniques	<b>Calculation</b>
	<b>Application / Analysis</b> <i>Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis</i>
	<b>Assumptions</b> <i>Ability to make and evaluate important assumptions in estimation, modeling, and data analysis</i>
	<b>Communication</b> <i>Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)</i>
Students will be able to solve non-routine problems using logic and quantitative techniques	

## AAC&U Value Rubric

	<b>Capstone 4</b>	<b>Milestones 3</b>	<b>Milestones 2</b>	<b>Benchmark 1</b>
<b>Interpretation</b> <i>Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. <i>For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.</i>	Provides accurate explanations of information presented in mathematical forms. <i>For instance, accurately explains the trend data shown in a graph.</i>	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. <i>For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.</i>	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. <i>For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.</i>
<b>Representation</b> <i>Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.
<b>Calculation</b>	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.
<b>Application / Analysis</b> <i>Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis</i>	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work.	Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.
<b>Assumptions</b> <i>Ability to make and evaluate important assumptions in estimation, modeling, and data analysis</i>	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
<b>Communication</b> <i>Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)</i>	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

## Assessment Data Mathematical, Information and Computer Sciences

**Learning Outcome:** Mathematics graduates will be adequately prepared for graduate study, teaching and careers using Mathematics.

**Outcome Measure:**

Annual: Require students to take the ETS Major Field Test in Mathematics as the mid-term exam for the capstone course, Mathematics 481, Senior Seminar in Mathematics.

Annual: Fieldwork evaluations of prospective teachers in EDU304. The students are rated in several areas of competence using a three point rubric (weak =1, acceptable =2 and strong =3). From these scores an overall rating is computed by taking the mean.

Every 5 Years: Alumni will be surveyed every five years. They will be asked at least the following questions:

1. If you have a job in industry: On a scale of 1 to 5, 1 being outstanding and 5 being poor, how well do you think that the undergraduate Mathematics curriculum at PLNU prepared you for your work in the field?
2. If you are going to graduate school or went to graduate school: On a scale of 1 to 5, 1 being outstanding and 5 being poor, how well do you think that the undergraduate Mathematics curriculum at PLNU prepared you for graduate school?
3. If you are in a teaching credential program or working as a teacher: On a scale of 1 to 5, 1 being outstanding and 5 being poor, how well do you think that the undergraduate Mathematics curriculum at PLNU prepared you for teaching?

**Criteria for Success:** 1) 50% of our students achieve above the 50<sup>th</sup> percentile on the exam.  
2) 80% of the students will have an average score of 2.5 or higher.  
3) An average response of 2 for each question.

**Aligned with DQP Learning Areas (circle one or more):**

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

**Longitudinal Data:**

ETS Major Field Test:

Most recent 10 years of data.

	Overall Benchmark Met	Calculus	Algebra	Routine	Non-Routine	Applied
Year		Percentile	Percentile	Percentile	Percentile	Percentile
2005-06	Y	75	95	90	95	75
2006-07	Y	90	80	90	70	75
2007-08	Y	80	80	70	75	60
2008-09	Y	90	80	75	25	95
2009-10	Y	90	65	75	20	85
2010-11	Y	70	90	85	35	70
2011-12	Y	99	85	98	99	96
2012-13	Y	38	72	69	72	60
2013-14	Y	72	49	57	51	39
2014-15	Y	*	*	*	*	*

\* Insufficient students for score to be calculated

Note the ETS changed the Mathematics test in 2004-05

Note the ETS changed the Mathematics test in 2012-13

School of Education Fieldwork:

This data is based on assessment conducted by the supervising teachers for students engaging in classroom fieldwork.

	Percentage of Students Scoring 2.5 or Higher							
	2007-08	2008-19	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Overall Score	100%	71%	N/A	N/A	N/A	100%	N/A	100%

Alumni Data:

In the spring of 2010, the department surveyed alumni who had graduated in the last 15 years. The response rate on the survey was 31.7% with the majority (80.9%) of the respondents having graduated in the last decade. A detailed summary analysis of the data can be found in Appendix: 2010 Alumni Survey Results Summary of our department's Program Review. Below are the components of the survey relevant to our assessment plan.

**How well did the undergraduate curriculum prepare you for:**

	Well or higher	OK	Poorly
Work in the field (if went into the field)	85.2%	14.8%	0.0%
Graduate school	76.5%	5.9%	17.6%
Teaching	80.0%	20.0%	0.0%



## **Conclusions Drawn from Data:**

### ETS Results:

Our scores show that our benchmark is being met for overall performance on the test. We are continuing to evaluate the changes made by ETS in 2012-13 to determine if we are concerned about any the changes in student results. It may be that they are now including questions on some material that we do not teach. We have noticed a cyclical patten in some subscore results and are investigating to if this correlates with our two year rotation of upper division courses.

### Alumni Survey:

Overall, our alumni believe that they were well prepared. Further investigation indicates that the students (3) who said that they were "poorly" prepared for graduate school are all mathematics majors who are employed as teachers and appear to be getting education-related masters degrees while working full-time. The hypothesis is that the "lack of preparation" may be in education coursework and not mathematics.

## **Changes to be Made Based on Data:**

### ETS Results:

We have used ETS data to small modifications (changes in pedagogy or assignments) as well as larger curricular modifications (addition or alteration of classes). In our recent Program Review we investigated the variability of the scores on the "non-routine" problems and learned that this category is a rotating collection of problems, some of them from topics not taught in our curriculum. We did however determine that we needed to do some work to strengthen our curriculum in the area of applied mathematics. This has resulted in increasing the number of required units of linear algebra and reconfiguring our applied mathematics class to become a class in differential equations and a class in modeling both of them using a modeling paradigm. It is too early to tell if these changes have achieved our intended outcomes, but the students have been positive about the curricular rearrangement. See our APC proposals for the specific descriptions of curricular changes made.

### School of Education Fieldwork:

None in MICS, but the School of Education uses this as a tool to adjust their education classes that our students take while doing fieldwork. The teachers have been satisfied with the performance in of our students.

### Alumni Survey:

Work to better prepare students who plan on being teachers for graduate school in education. In particular encourage them to take more education classes while an undergraduate.

In 2005 our department has instituted three changes in the last five years that seem to have had an impact on developing critical skills in our graduates:

- Increasing the expectations for written and oral presentations in senior seminar (this is in addition to the writing and oral presentations that are threaded throughout our curriculum)
- Requiring all seniors in our department to take the senior seminar class
- Requiring an "integrative experience" (internship, year-long service learning project or year-long honor research project) of all of our majors.

This has a direct impact on five skills listed in the table below. The question on the survey is listed above the table.

**Please tell us if your departmental course work enhanced your abilities in the listed areas:**

		Very much enhanced	Much enhanced	Enhanced	Not enhanced and N/A
Think analytically and logically	2000-2004	53.8%	26.9%	15.4%	3.8%
	2005-2009	64.0%	36.0%	0.0%	0.0%
Write effectively in the discipline	2000-2004	11.5%	23.1%	42.3%	23.1%
	2005-2009	16.0%	36.0%	36.0%	12.0%
Effective oral communication	2000-2004	3.8%	23.1%	46.2%	26.9%
	2005-2009	12.0%	12.0%	60.0%	16.0%
Solve problems using technology	2000-2004	19.2%	46.2%	26.9%	7.7%
	2005-2009	32.0%	56.0%	8.0%	4.0%
Integrate knowledge from different sources	2000-2004	15.4%	34.6%	38.5%	11.5%
	2005-2009	8.0%	52.0%	32.0%	8.0%

Data from the Alumni Survey says that our graduates believe that their coursework in our department has also enhanced:

- Their ability to write effectively (88% for those who graduated in 2005-09, 77% for those who graduated in 2000-04)
- Their ability to communicate orally in the discipline (84% for those who graduated in 2005-09, 73% for those who graduated in 2000-04)
- Their ability to solve problems using technology (96% for those who graduated in 2005-09, 92% for those who graduated in 2000-04)

**Rubric:**

**ETS:**

The ETS provides the data.

**Field Work:**

School of Education uses the rubric shown below.

**Alumni Survey:**

This is not rubric scored, but the data is tabulated.

**School of Education Fieldwork Rubric**

	Weak Candidate	Acceptable Candidate	Strong Candidate
Cultural Sensitivity: Demonstrates respect and cultural sensitivity toward ethnically and culturally diverse students.			
Basic Skills: Models appropriate literacies.			
Attendance: Punctuality and dependability.			
Cooperation: Fulfills assignments/follows instructions.			
Initiative: Anticipates needs/assumes responsibilities.			
Attitude: Maintains poise and positive interaction with students.			
Interest: Shows enthusiasm/communicates with supervisors.			
Appearance: Dresses appropriately.			