

## MEMO

To: Kerry Fulcher  
From: Maria Zack  
Date: September 2012  
RE: Annual Update on Program Review MOU Progress

The following recommendations resulting from the MICS Program Review ((Phase I: <https://portal.pointloma.edu/web/mathematical-information-and-computer-sciences/programreviewi> and Phase II: <https://portal.pointloma.edu/web/mathematical-information-and-computer-sciences/programreviewii>):

1. Revise the curriculum in the Information Systems Major and transform it into a more efficient major in Computer Information Systems.
2. Update the Computer Science and Mathematics curricula to reflect the changes described in the body of the MICS Program Review Phase I and Phase II.
3. Develop in partnership with the other departments in Rohr Science (Biology, Chemistry, and Physics and Engineering) a minor in Computational Science
4. Develop and test hybrid components for existing classes in the department.
5. Phase in the additional assessments of program learning outcomes as describe in our updated assessment plan.

For reference the MOU is attached at the end of this report.

Here is the progress to date on each of the items:

1. Completed by Fall 2011
2. Completed by Fall 2011
3. The joint proposal for the Computational Science Minor was submitted to APC in November 2011 by all four of the departments in Rohr Science. The minor was approved and is being implemented in the fall of 2012. The fall enrollment in the introductory computer programming course has doubled. A significant part of this growth is due to students in bench science departments signing up for the course as part of their participation in the Computational Science Minor.

During the summer of 2012 we had one MICS student who was doing computational science research and was involved in an off-site project at Scripps. This enabled us to prototype an off-site computational science research project for a student and we learned a number of useful things. In addition, faculty in MICS and Biology are working jointly on some computational science projects that will involve students.

4. During the fall of 2011 and the spring of 2012 the technologically mediated material developed during the summer of 2011 for MTH121, MTH131 and MTH203 was tested. The conclusions of the tests are as follows:
  - MTH121 – Most of the modeling projects developed for this lab worked well. However one of them was too complex for students who were learning Calculus I and will need to be revised. (This revision was completed over the summer of 2012).
  - MTH131 – the new labs worked well and if we are successful in switching to Maxima, the university will be able to eliminate the cost of the license for the Maple software. (The department will make the determination about Maple this fall).
  - MTH203 – the material developed did not work well, it did not achieve the desired pedagogical aim, was frustrating for students and was too time consuming for faculty. In addition the MapleTA platform was difficult to work with.

During the summer of 2012, faculty continued work on developing hybrid material. The team began the summer with:

- Reviewing what had been learned from the 2011-12 experiments
- Reading recent publications on “flipping” the classroom (this is the focus of our hybrid work)
- Reviewing the results from small-scale experiments conducted in other classes during the academic year (e.g. using YouTube videos with students, having students process textual material in some different ways such as turning in outlines, working with other technology platforms).
- Looking at a number of models on the internet for presenting mathematical material.
- Playing with technology which included recording explanations written by hand on a pad, recording demonstrations giving on a black board, using an iPad to record explanations (written and vocal), making use of student generated videos, reviewing professionally generated videos and narrating Powerpoint presentations. We quickly learned that the styluses currently available for iPads are not sufficiently sensitive to produce clear results when writing complex mathematical equations.
- It is interesting to note that the experiments that we did with students during the spring of 2012, indicate that the students have a clear preference for things that appear to be “home grown” as opposed to commercially produced. Many enjoyed explanations that were recordings of a faculty member writing on a pad and explaining a computational technique (the camera was focused on the pad).

After this work it was determined to do the following:

- Focus on developing material for MTH203 the elementary statistics class working on last year, and MTH303 Problem Solving. Because of the high number of sections that we teach of these classes each year, they provide the opportunity to do matched tests and obtain data rapidly. Note that this is a schedule change from our original plan.
- Map out the material that needs to be turned into technologically mediated content in order to enable “flipping” to occur. This was completed during the summer of 2012.
- Spend the fall of 2012 finishing up the first pass at recording material for MTH203 and MTH303. All recordings will be “home grown” and use a combination of narrated powerpoint presentations, recordings of faculty writing on pads and recordings of faculty working in front of a chalk board (or the equivalent). The math faculty members are meeting weekly this semester to keep this project moving forward.
- Test the newly developed material in MTH203 and MTH303 in the spring of 2013. Calculus II to using the free software Maxima.

5. The new assessments for our MICS assessment program were developed and implemented at the end of the Fall 2011 and Spring 2012 semesters.

**Program Review Memorandum of Understanding  
Mathematical, Information and Computer Sciences Department  
November 2010**

Plan for Improvement: Recommendations from the Program Review:

The following recommendations emerged from the MICS Program Review:

6. Revise the curriculum in the Information Systems Major and transform it into a more efficient major in Computer Information Systems.
7. Update the Computer Science and Mathematics curricula to reflect the changes described in the body of the MICS Program Review Phase I and Phase II.
8. Develop in partnership with the other departments in Rohr Science (Biology, Chemistry, and Physics and Engineering) a minor in Computational Science
9. Develop and test hybrid components for existing classes in the department.
10. Phase in the additional assessments of program learning outcomes as describe in our updated assessment plan.

Action Steps for Implementing Improvements:

The timeline for implementing these changes can be seen in the timeline appendix. Details of the steps needed can be found in the program review (Phase I: <https://portal.pointloma.edu/web/mathematical-information-and-computer-sciences/programreviewi> and Phase II: <https://portal.pointloma.edu/web/mathematical-information-and-computer-sciences/programreviewii>) and in the attached detail for work on hybrid/flipped classes.

Assessment Measures:

- The changes in curriculum for Computer Information Systems, Computer Science and Mathematics will be assessed via the program assessment system for each major. Details can be found in the MICS assessment documents (<https://portal.pointloma.edu/web/institutional-effectiveness/assessment/mics>).

Financial Implications of the Action Steps:

The numbers below correspond to the number of the recommendation above.

1. The Computer Information Systems major makes use of several classes in the Computer Science major. This change has the effect of a net reduction of one half of a full-time equivalent (FTE) faculty member in the department. Because of recent departures and upcoming retirements, this change will be absorbed by not refilling a faculty position in the department.
2. The updates in the Computer Science and Mathematics curricula are cost neutral since the changes involved the elimination as well as the addition of courses and making some previously elective courses required.
3. The development of the Computational Science minor is also cost neutral. Many of the courses in the minor already exist in one of the four departments in the building. There are a limited number of MICS courses needed to be added to the curriculum (Matlab, Python Scripting, Databases for Computational Science) and in revising the curriculum for Math and CS (recommendation 2) the department was able to free up the units needed for this purpose.
4. Develop and test hybrid components for existing classes in the department. This recommendation has a cost associated with it. The main expense is funding for faculty during the summer to develop the hybrid components. There will be limited costs for software and other technical tools that will be paid out of department funds. It is anticipated that the process of creation, experimentation and testing will take 4-5 years. The details related to this process can be seen in the hybrid attachment.
5. Phasing in the additional assessments in the department is cost neutral.

The Provost and the MICS Department mutually agree to pursue these recommendations for the MICS Department. The Provost will provide material and administrative support for the actions taken as the result of the recommendations provided that the MICS Department makes satisfactory annual progress on the initiatives. MICS Department will carry out these actions and submit an annual report of progress.

Signed:

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Kerry Fulcher, Ph.D., Provost

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Maria Zack, Ph.D., Chair MICS

### Five-Year Timeline for Recommendations

	<b>Curriculum</b>	<b>Computational Science</b>	<b>Assessment</b>	<b>Hybrids</b>
<b>2010-11</b>	<ul style="list-style-type: none"> <li>• Complete Program Review</li> <li>• Turn in curriculum proposal to the Academic Policies Committee</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss details of a computational science minor with the other departments in the building</li> </ul>	<ul style="list-style-type: none"> <li>• CSC254 Signature Assignment and Rubric (develop)</li> <li>• MTH242 Signature Assignment and Rubric (develop)</li> <li>• ISS424 Signature Assignment and Rubric (develop)</li> <li>• Annual Assessment</li> </ul>	Summer 2011 <ul style="list-style-type: none"> <li>• Convert MTH131, MTH121, CSC133 and MTH203</li> </ul>
<b>2011-12</b>	<ul style="list-style-type: none"> <li>• Implement curriculum with needed transitional schedules for students</li> </ul>	<ul style="list-style-type: none"> <li>• Map out and submit needed curricular changes if the computational science minor is to proceed</li> </ul>	<ul style="list-style-type: none"> <li>• Senior Seminar Societal Role Assignment and Rubric (develop)</li> <li>• MTH382 Signature Assignment and Rubric (develop)</li> <li>• ISS414 Signature Assignment and Rubric (develop)</li> <li>• Annual Assessment</li> </ul>	Fall 2011 <ul style="list-style-type: none"> <li>• Trial run with MTH121 and CSC133</li> <li>• Trial run with randomized treatments in MTH203</li> </ul> Spring 2012 <ul style="list-style-type: none"> <li>• Trial run with MTH131</li> <li>• Trial run with randomized treatments in MTH203</li> </ul> Summer 2012 <ul style="list-style-type: none"> <li>• Evaluate what was learned from the 2011-12 trials</li> <li>• Convert CSC181 and MTH303</li> </ul>
<b>2012-13</b>	<ul style="list-style-type: none"> <li>• Finish implementing new curriculum</li> </ul>	<ul style="list-style-type: none"> <li>• Implement new computational science minor</li> </ul>	<ul style="list-style-type: none"> <li>• CSC494 Signature Assignment and Rubric (develop)</li> <li>• Annual Assessment</li> </ul>	Fall 2012 <ul style="list-style-type: none"> <li>• Second trial run with MTH121 and CSC133</li> <li>• Trial run with randomized treatments with CSC181 and MTH303</li> </ul> Spring 2013 <ul style="list-style-type: none"> <li>• Second trial run with MTH131</li> <li>• Trial run with randomized treatments with CSC181 and MTH303</li> </ul> Summer 2013 <ul style="list-style-type: none"> <li>• Evaluate what was learned from the 2012-13 trials</li> <li>• Adjust classes as needed</li> </ul>

	<b>Curriculum</b>	<b>Computational Science</b>	<b>Assessment</b>	<b>Hybrids</b>
<b>2013-14</b>	<ul style="list-style-type: none"> <li>Assess new curriculum</li> </ul>	<ul style="list-style-type: none"> <li>Implement new computational science minor</li> </ul>	<ul style="list-style-type: none"> <li>Annual Assessment</li> </ul>	Fall 2013 <ul style="list-style-type: none"> <li>Continue gathering data in CSC181, MTH121, MTH203 and MTH303</li> </ul> Spring 2014 <ul style="list-style-type: none"> <li>Continue gathering data in CSC181, MTH131, MTH203 and MTH303</li> <li>Make determination about continuing the use of hybrids</li> <li>Write journal articles on what we have learned about learning outcomes with these hybrid</li> </ul>
<b>2014-15</b>	<ul style="list-style-type: none"> <li>Assess new curriculum</li> </ul>	<ul style="list-style-type: none"> <li>Preliminary assessment of new computational science minor</li> </ul>	<ul style="list-style-type: none"> <li>Annual Assessment</li> </ul>	<ul style="list-style-type: none"> <li>Implement decisions about the continuing use of hybrids for these classes</li> </ul>

## Hybrid Scoping

### The Classes:

- CSC133 – Introduction to Computer Science and Information Systems (3 units taught once per year)
- CSC181 – Excel (1 unit taught 5 times per year)
- MTH121 – Modeling (1 unit taught once per year)
- MTH131 – Calculus Lab (1 unit taught once per year)
- MTH203 – Elementary Statistics (this is the “service” statistics class) (3 units taught 6-7 times per year)
- MTH303 – Problem Solving (our broad general education class) (3 units taught 12 times per year)

### Content Development Needed:

- Laboratory content moved to hybrid for: CSC133, CSC181 and MTH131
- Information reinforcement and mastery content to hybrid for MTH203 and MTH303

As a department we have outlined the content to be moved to computer format for each course. The basic assumption is that this content will aid in “flipping” the classes, allowing more course time to be focused on problem solving. For some classes there is a significant amount of public domain content available to assist with developing the hybrid modules (CSC181 and MTH203). For others, much of the content will need to be created from scratch (CSC133, MTH121, MTH131 and MTH303).

### Cost

Our scoping indicates that it will take roughly one unit of work to convert partial content for each unit of the class. The one exception to this is MTH131 which may require 2 units for conversion because of some of the complexities of creating content for that particular course.

- 15-20 units of conversion work (at the summer pay cost) spread over 4 summers: \$32,000 (max)
- Additional supplies or equipment for testing interfaces: \$1,000
- Cost of analyzing data, conducting research (students): \$1,500

Total cost is a maximum of \$34,500 (assuming that adjunct pay rate remain the same).

When laboratory fees were increased, the majority of that annual fee increase was “banked” by the Provost’s Office to support research and curricular development in the department. The money that accumulates each year will be sufficient to fund this work. Much of the money in fees has been collected from these particular classes and the conversion work will assist with the laboratory aspects of these classes.

### Timeline

Note that we anticipate the class conversions to be team projects. Multiple faculty members will be involved in the conversion of classes (many working on teams for a single class). We also need to work collaboratively as a team and with PLNU ITS to find the best technological solutions.

If we notice significant positive or negative experimental effects, we may change the time line for the randomized studies of learning outcomes.

### Summer 2011

- Convert MTH131, MTH121, CSC133 and MTH203

### Fall 2011

- Trial run with MTH121 and CSC133
- Trial run with randomized treatments in MTH203

Spring 2012

- Trail run with MTH131
- Trial run with randomized treatments in MTH203

Summer 2012

- Evaluate what was learned from the 2011-12 trials
- Convert CSC181 and MTH303

Fall 2012

- Second trial run with MTH121 and CSC133
- Trial run with randomized treatments with CSC181 and MTH303

Spring 2013

- Second trial run with MTH131
- Trial run with randomized treatments with CSC181 and MTH303

Summer 2013

- Evaluate what was learned from the 2012-13 trials
- Adjust classes as needed

Fall 2013

- Continue gathering data in CSC181, MTH121, MTH203 and MTH303

Spring 2014

- Continue gathering data in CSC181, MTH131, MTH203 and MTH303
- Make determination about continuing the use of hybrids

Summer 2014

- Finalize any changes that need to be made in the material.