MEMO

To: Kerry Fulcher
From: Maria Zack
Date: September 2014
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 has been implemented. As a result we are seeing a doubling in our introductory programming class. The majority of the interest in the program is coming from Biology majors and we have now had several service learning projects and joint honors projects related to computational science. In a new development, the Psychology Department is interested in becoming part of the computational science minor. We will be investigating this possibility in the 2015-16 academic year.

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).

In the 2012-13 Academic year:

- A complete redesign of MTH203 as a hybrid using Carnegie Mellon (now Acrobatiq) material with a successful pilot test in the summer of 2013.
- Background work to construct MTH303 as a hybrid. The department encountered several obstacles with the Pearson material that was selected. While a great deal of development was done in the summer of 2013, the integration between Pearson and Canvas was not working effectively. This led to a decision to run MTH303 in the Fall of 2013 as "electronically mediated" and not to reduce the seat time. Pearson promises that the integration problems will be solved by January of 2014.
- Our experiments with free software have gone well. This has allowed us to move to using Maxima as a replacement for Maple. ITS was able to give up the Maple license and thus save PLNU money. We have also begun investigating using R, a statistical package, as a replacement for some costly software packages such as SPSS and MatLab.

In the 2013-14 Academic Year:

- MTH203 Statistics was piloted as a hybrid/blended class in Spring of 2014. This pilot informed course redesign over the summer.
- MTH303 Problem Solving as hybrid/blended was piloted in the Spring of 2014. This pilot informed course redesign over the summer.
- In the Summer of 2014 MTH203 and MTH303 were refined as blended/hybrid classes. MTH213 Fundamentals of Elementary Mathematics I and CSC143 Introduction to Computer Programming were also constructed.

Future Work:

- Teach MTH203 and MTH303 as blended/hybrid in the 2014-15 year and gather data.
- Pilot test MTH213, MTH223 and CSC as hybrids in 2014-15 school year (development will happen over the summer and fall of 2014).
- Gather learning outcome data on hybrid courses and refine the courses. Some preliminary data is attached.

5. The new assessments for our MICS assessment program were developed and implemented at the end of the Fall 2011 and Spring 2012 semesters. We have added new learning outcomes and means of assessment to address PLNU's need to assess core competancies for WASC.

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 and annual report of progress.

Signed:

Kerry Fulcher, Ph.D., Provost	Maria Zack, Ph.D., Chair MICS

Five-Year Timeline for Recommendations

	Curriculum	Computational Science	Assessment	Hybrids
2010-11	• Complete Program Review • Turn in curriculum proposal to the Academic Policies Committee	• Discuss details of a computational science minor with the other departments in the building	• CSC254 Signature Assignment and Rubric (develop) • MTH242 Signature Assignment and Rubric (develop) • ISS424 Signature Assignment and Rubric (develop) • Annual Assessment	Summer 2011 • Convert MTH131, MTH121, CSC133 and MTH203
2011-12	• Implement curriculum with needed transitional schedules for students	• Map out and submit needed curricular changes if the computational science minor is to proceed	• Senior Seminar Societal Role Assignment and Rubric (develop) • MTH382 Signature Assignment and Rubric (develop) • ISS414 Signature Assignment and Rubric (develop) • Annual Assessment	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
2012-13	• Finish implementing new curriculum	• Implement new computational science minor	• CSC494 Signature Assignment and Rubric (develop) • Annual Assessment	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

	Curriculum	Computational Science	Assessment	Hybrids
2013-14	• Assess new curriculum	• Implement new computational science minor	• Annual Assessment	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 • Write journal articles on what we have learned about learning outcomes with these hybrid
2014-15	• Assess new curriculum	• Preliminary assessment of new computational science minor	• Annual Assessment	• Implement decisions about the continuing use of hybrids for these classes

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.

Analysis of Face to Face vs. Hybrid Problem Solving (MTH303) Spring 2014

	Face to Face - Average	Hybrid - Average
Approximately how many hours per week did you spend **reading material in the textbook**?	1.41	
Approximately how many hours per week did you spend outside of class doing the **online reading**?		1.34
Approximately how many hours per week did you spend outside of class doing the **online quizzes**?		1.49
Approximately how many hours per week did you spend working on the **online practice problems**?		2.26
Approximately how many hours per week did you spend on the **written homework**?	1.95	1.44

	Face to Face - Agree or Strongly Agree	Hybrid - Agree or Strongly Agree
I found the **reading** helpful in learning course material.	66%	
I found the online **reading** helpful in learning course material.		58%
I found the online **quizzes** helpful in learning course material.		58%
I found the **online practice problems** helpful in learning course material.		78%
I found the **written homework problems** helpful in learning course material.	91%	69%
I found the **in-class activities** helpful in learning course material.	94%	81%
How did you typically work on course material? One long session	69%	78%
How did you typically work on course material? Several short sessions.	31%	22%
The course technology was easy to use.		73%
Prior to taking this course, I wanted to take a hybrid/blended course.		32%
After taking this course, I would like to take another hybrid/blended course.		56%
The blended/hybrid format contributed to my ability to learn.		48%
For this course, the blended/hybrid format is preferable to traditional lecture.		54%

	Face to Face - Agree or Strongly Agree	Hybrid - Agree or Strongly Agree
In this class, we have been directly involved in problem solving activities.	92%	83%
This class has contributed to my ability to solve different types of problems.	71%	63%
This class has expanded my methods of exploration in problem solving.	71%	62%
This class has contributed to my ability to make educated guesses and check their correctness by analyzing their implications.	60%	59%
This class has helped me to understand major concepts, methods and applications of critical thinking.	71%	59%
This class has helped me to see the importance of problem solving in our modern society.	69%	63%

MTH303	Face to Face Average	Hybrid Average
Students will be able to formulate a mathematical model from a verbal description of a problem.	2.81	2.90
Students will be able it solve non-routine problems using logic and quantitative techniques.	2.59	2.73
Students will be able to construct solutions to problems using computational techniques.	2.78	2.90

MTH303	Face to Face Median	Hybrid Median
Students will be able to formulate a mathematical model from a verbal description of a problem.	4.00	4.00
Students will be able it solve non-routine problems using logic and quantitative techniques.	2.50	3.00
Students will be able to construct solutions to problems using computational techniques.	3.00	3.00

MTH303	Face to Face 2.5 or >	Hybrid 2.5 or >
Students will be able to formulate a mathematical model from a verbal description of a problem.	67%	65%
Students will be able it solve non-routine problems using logic and quantitative techniques.	60%	70%
Students will be able to construct solutions to problems using computational techniques.	70%	70%

MTH303	Face to Face 3 or >	Hybrid 3or >
Students will be able to formulate a mathematical model from a verbal description of a problem.	63%	60%
Students will be able it solve non-routine problems using logic and quantitative techniques.	50%	55%
Students will be able to construct solutions to problems using computational techniques.	67%	55%