Program Review
Phase I

Department of Mathematical, Information and Computer Sciences
May 6, 2010

The Department of Mathematical, Information and Computer Sciences at PLNU works on an annual cycle of evaluation and identification of potential lines of inquiry that can lead to department improvement. Over the years this has lead to reading books collectively as a department to discuss pedagogy, reshaping the content of our department chapel program to be more vocation focused, developing the Junior/Senior Career Dinner program in our department and remodeling space to build a sense of community between and among the faculty and the students. This Program Review proposal's "themes for review" reflect the most important issues currently being investigated in our department in the academic year 2009-10.

Alignment with University Mission

Point Loma Nazarene University has worked over the last ten years to update its mission, vision and values statements. The mission statement is:

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

This statement is often summarized by the phrase "teach – shape – send."

The University's Vision and Core Values flow from this mission statement. The vision statement is:

Point Loma Nazarene University will be a nationally prominent Christian university and a leading Wesleyan voice in higher education and the church – known for excellence in academic preparation, wholeness in personal development, and faithfulness to mission.

PLNU's Core Values are:

- Excellence in Teaching and Learning
- An Intentionally Christian Community

- Faithfulness to our Nazarene Heritage and Wesleyan Theological Perspective
- The Development of Students as Whole Persons
- A Global Perspective and Experience
- Ethnic and Cultural Diversity
- The Stewardship of Resources
- Service as an Expression of Faith

PLNU's Institutional Learning Outcomes are:

- *Learning: Informed by our Faith*: Members of the PLNU community will display openness to new knowledge and perspectives, to think critically, analytically, and creatively and to communicate effectively.
- *Growing: In a Faith Community*: Members of the PLNU community will demonstrate God-inspired development and understanding of others, living gracefully within complex environmental and social contexts.
- *Serving: In a Context of Faith*: Members of the PLNU community will engage in actions that reflect Christian discipleship in a context of communal service and collective responsibility, serving both locally and globally.

These four statements of institutional identity provide the basis for the development of the mission statement, goals, learning outcomes and assessment plan of the Department of Mathematical, Information and Computer Sciences. The department's mission statement is:

The Mathematical, Information and Computer Sciences Department at Point Loma Nazarene University is committed to maintaining a curriculum that provides its students with the tools to be productive, the passion to continue learning, and Christian perspectives to provide a basis for making sound value judgments.

The goals of the Department of Mathematical, Information and Computer Sciences are:

- To prepare students for:
    - careers that use mathematics, computer science and computer information systems in business, industry, government and the nonprofit sector;
    - graduate study in fields related to mathematics, computer science and computer information systems; and
    - teaching mathematics and computer science at the secondary level.
- To prepare students to apply their knowledge and utilize appropriate technology to solve problems.
- To educate students to speak and write about their work with precision, clarity and organization.
- To help students gain an understanding of, and appreciation for, the historical development, contemporary progress, and societal role of mathematics, information systems and computer science.

- To integrate the study of mathematics, computer information systems and computer science with the Christian liberal arts.
- To provide appropriate mathematical, information systems and computer educational support for any major area of study in the university.

The department lives out this mission and these goals in a number of curricular and co-curricular ways. The department has a rigorous curriculum that is consistent with the national standards provided by the Mathematical Association of America and the Association of Computing Machinery. This curriculum is reinforced by assignments that help students to develop their "soft skills" as writers, speakers and members of teams. All students who earn a degree from the department are required to have an "integrative experience." This is a year-long research or service learning project or an internship. The goal of the integrative experience is for students to synthesize knowledge from many courses (in their major as well as part of the GE) and apply it to real world problems. (See Appendix 1: Research, Internships, and Service Learning for further details.)

The department also works intentionally to help students grow as whole persons. This includes the intentional planning of chapel experiences and a multistep process to aid in the discernment of vocation, where vocation is understood as whole life calling and includes more than profession. (See Appendix 2: Vocation for further details.)

Finally, the department seeks to build intentional Christian community in the department. This is done through a number of social activities (parties and gatherings in faculty members' homes), through department chapel and through the way that we have arranged the space in our department. We have created a small lounge with a sofa and chairs in our entry as well as a small study room for the students that includes a computer and blackboard. These spaces are in the middle of faculty offices and used by both faculty and students. The close proximity allows for conversations about both technical and personal subjects, and the easy access students have to faculty members who all live with an "open door policy" builds a sense of trust and willingness to share in one another's lives.

Assessment Data and Reflection on the Data

Each fall the department reviews the previous year's assessment data, longitudinal assessment data and the department's assessment plan. This information is used to fine-tune existing curriculum and to make curricular changes. Note that outcomes and means of assessment are the same for all three of our majors and all degrees (BS and BA) in our department. The department's learning outcomes are directly linked to the PLNU Mission Statement and the PLNU Institutional Learning Outcomes are derived from the department goals listed above.

Outcome #1 (Teach): Graduates will have a coherent and broad-based knowledge of their discipline. (Department Goals #1 and #2)
Measure: ETS Major Field Tests

Outcome #2 (Shape): Students will be prepared to give an oral technical presentation and a written summary of a topic in their field. (Department Goal #3)
Measure: Oral and Written Presentations in Senior Seminar
Measure: Alumni Survey (conducted every five years in parallel with Program Review)

Outcome #3 (Send): Graduates will be adequately prepared for entry into graduate school, teaching or jobs in their discipline. (Department Goals #1 and #2)
Measure: Alumni Survey (conducted every five years in parallel with Program Review)
Measure: Fieldwork Reports on Prospective Teachers

In addition, the department does an attitudinal assessment of Problem Solving (GE course) (Goal #4 and Goal #5). We expect that this assessment will change as the institution completes the Institutional Learning Outcomes and as the work of the General Education Committee is considering changes to the university's requirements progresses.
Measure: Class Survey in Problem Solving

The details of the process and extended discussion about the data can be found in Appendix 3: MICS Annual Assessment Report 09.

To see a diagram linking these items go to the ILOs and Department Learning Outcomes.

ETS Major Field Exams (longitudinal data found in Appendix 4: ETS Longitudinal Scores 2009):

- The small sample size of our data (few students in each of the three majors) leads to some variability in the ETS data. We have, however, used the ETS results to make some modifications in curriculum (introducing a few new classes, changing some classes from elective to required status and making adjustments in the content of classes).
- We have made adjustments in our Computer Science curriculum in the area of computer architecture and operating systems, which seems to be having an impact on the subscores in those areas.
- The scores on non-routine problems in the area of mathematics have been wildly erratic. We are currently analyzing these types of problems (understanding more deeply what measures ETS is using) to see if any curriculum adjustments are needed.
- We have begun requiring an "integrative experience" of all majors, which seems to be having a positive impact on our "applied" subscores.
- We continue to use the ETS Major Field Exam for Computer Science to measure the skills of our information systems students. This is an imperfect measure; however, we expect that with the shift in 2009-10 from offering a major in information systems to a

major in computer information systems (greater emphasis on computer science) this will be a better tool.

Senior Seminar Oral and Written Presentations (longitudinal data found in Appendix 5: Senior Seminar Scores 2009):

- Looking at longitudinal data, the scores have been fairly consistent. They improved once we communicated more clearly with students about our expectations (2006-07). However we have further work to do to strengthen the students' writing ability.
- We have been pushing students to be more "professional" in their writing and it is reflected in the lower scores in the written reports in 2008-09. We have been holding them to higher standards and thus giving them lower scores than we have in past years.
- The department needs to work on more clearly defining the rubric for grading these presentations and sharing that updated rubric with the students. Creating more detailed speaking and writing rubrics is one of the themes for this current Program Review (see below).

Fieldwork for Prospective Teachers (longitudinal data found in Appendix 6: Fieldwork Scores):

Our students have done very well in their fieldwork and we have consistently received feedback that they are well prepared both academically and socially for the classroom.

Alumni Survey:

We received helpful feedback on the alumni survey when it was last conducted six years ago. Our assessment plan calls for us to conduct the survey in parallel with Program Review, which means that we will be surveying alumni again in May of 2010.

Problem Solving Data (longitudinal data found in Appendix 7: Problem Solving Data):

Longitudinal data indicates that our students believe that the class is meeting our objectives:

- To contribute to the student's ability to solve non-routine problems.
- To expand the student's methods of inquiry and exploration.
- To contribute to the student's ability to form conjectures and check implications.
- To expand the student's understanding of major concepts, methods and applications of quantitative reasoning.
- To help the student see the role of problem solving in modern society.
- To involve the student directly in various problem solving activities.

University Data

Appendix 8: MICS Program Review Data Analysis contains data provided by the Office of Institutional Research along with the computations done on the data for the purpose of analysis. Some key information from the data:

Efficiency: The department teaches approximately 5% of the credit hours taught by the university (6% of the undergraduate credit hours) with roughly 4.5% of the faculty FTE. The changes made in 2009-10 to restructure the curriculum (particularly the Computer Information Systems curriculum) yielded a faculty FTE reduction of 0.5 (half of one full time equivalent), which can be seen in the fact that in 2009-10 the department is teaching 5.1% of all credit hours with 3.7% of the faculty FTE.

	2005-06	2006-07	2007-08	2008-09	2009-10
Percentage of PLNU Credit Hours	5.7%	4.8%	5.0%	4.9%	5.1%
Percentage of PLNU Faculty FTE	5.5%	4.7%	4.8%	4.3%	3.7%

Student Trends: In reviewing student composition data, various facts about the students majoring in our department emerge:

- The percentage of male majors in our department is higher than in the PLNU population (roughly 60% of our majors are male). This is typical for the disciplines taught in our department but lower than the national averages.
- The ethnicity of the students in our department roughly mirrors the school.
- More of our majors entered PLNU as first-time freshmen than is true of the overall student body (roughly 90% vs. 80%).
- The academic profile of our incoming students (both GPA and SAT scores) is higher than for the overall population at PLNU.

Trends in the Majors:

- Most students do not know what Computer Information Systems is when they enter college, so most of our majors select Computer Science or Mathematics as their major. After an introduction to each of the disciplines, the students finalize on majors and at any given time our majors are divided as: 40% Computer Science, 40% Mathematics and 20% Computer Information Systems.
- We have seen a small drop in the number of students majoring in our department, but we have seen the number of students graduating from the department hold steady and increase slightly (there is a fair amount of variability in the numbers).

	2005-06	2006-07	2007-08	2008-09	2009-10
Number of MICS Students*	73	77	69	74	63
Number of MICS Graduates*	10	21	14	22	17**

*This is head count so double majors are counted only once.
**These are the students who have completed grad checks.

- We have also seen an increase in the number of students with minors in our department, there has been an increase in Mathematics minors particularly among Physics and Liberal Studies majors. Often these minors are not seen in the data until the time of graduation and are not fully evident in our data set.

Retention and Graduation: Review of the data on persistence and graduation provided in this report, as well as a collection of data from the PLNU Major Migration Report (Appendix 9: Major Migration Report Summary).

- Our retention rates (first-time freshmen who began in the department and remain in the department as sophomores) are consistent with or slightly higher than the overall rates of students who remain in the same department at PLNU.
- Similarly, our six year graduation rate for first-time freshmen (those who begin in our department and graduate with a degree from our department) are consistent with or slightly higher than the same rates for all of PLNU.
- Our average time to degree for first-time freshmen in the department is 4 years. This number is based on cohorts that have had at least 6 years to graduate, but recent experience indicates that this number will probably trend downward in the next few years due to an increasing number of (early) December graduates.
- The Major Migration Report data indicates that we are not seeing any significant net change in the number of majors between the freshman and sophomore years. That is that the number of student lost and the number of students gained is roughly equivalent. There was a single anomalous year (2003-04 which had a very large number of freshmen entering our department).

Enrollment Data: Detailed enrollment data will be discussed as part of Phase II, when we will be looking at curriculum. The examination of this data in 2008-09 led to the changes in the CIS major that provided increased departmental efficiencies mentioned above.

Themes for the Program Review

After considering department needs and the data that we have reviewed, the department proposes to focus on the following three themes in Phase II of the Program Review:

- Examine CS/IS curriculum to look for increased efficiencies. This work began in the spring of 2008 and lead to curricular adjustments that were implemented in 2009-10. This theme would document the work done in 2008-09 and look at preliminary results from the adjustment.
- Refine the assessment processes in our Senior Capstone course. WASC has a rubric for capstone classes that will be helpful in this process, and we will use that as a guide for making some changes in our capstone course. As part of that process, our department needs to develop more detailed scoring rubrics for students' speaking and writing that we can use in the capstone course, as well using it as a formative assessment of writing and speaking skills in other locations in the curriculum where students are required to do projects and make presentations.
- Investigate the possibility of moving a few of our classes (MTH303 – Problem Solving, MTH203 – Introduction to Statistics, CSC181 – Excel and MTH131 – Maple Lab) to hybrid format. This is purely exploratory and further research may indicate that this is not a good option for our department or for these classes.

In addition to these themes, the department will be following up on what is learned from some standard assessments:

- ETS test information (as noted above)
- Results from the alumni survey (to be conducted in the Spring of 2010)
- Review of most current curriculum standards from the Mathematical Association of America and the Association of Computing Machinery.

Response to Previous Program/Department Review

As the result of the 2002-03 Department Review, a number of changes were recommended (details can be found in Appendix 10: Recommendations from the 2002-03 Department Review). Summaries of the recommendations and an update on the progress made are below:

- Offer both Bachelor of Science and Bachelor of Arts degrees in Computer Science and Mathematics.
  Update: BS and BA degrees are now available for Mathematics, Computer Science and Computer Information Systems.

- Adjust the content of the Computer Science major to strengthen the algorithms and computational mathematics component.
  Update: Curricular changes implemented.
- Adjust the content of the Mathematics major to strengthen the applied mathematics component.
  Update: Curricular changes implemented.
- Require all Mathematics majors who are studying to be secondary teachers to take EDU 304 Legal, Ethical and Wesleyan Perspectives on Education.
  Update: This requirement has been implemented.
- Significantly alter our Management Information Systems major and rename it Information Systems.
  Update: Those changes were made starting in the fall of 2003. Analysis since then has lead to further changes in curriculum and a significant modification of the program to now be a major in Computer Information Systems (begun in the fall of 2009). Details of this most recent change will be in Phase II of the Program Review.
- Rename the department to be the Department of Mathematical, Information and Computer Sciences to more accurately reflect the three majors in the department.
  Update: Completed.
- Continue to emphasize written and oral presentations in the department's courses. There is a need to further evaluate this component of our coursework once the Senior Seminar is established.
  Update: The Senior Seminar has been successfully running since the spring of 2004. One of the themes for Phase II of the Program Review is to further refine our assessment tools in Senior Seminar.
- Continue our mathematical support role for other majors in the university by making the changes to better serve other departments.
  Update: We have made changes to Calculus with Applications (Biology and Biochemistry), Mathematics for Elementary Teachers (School of Education) and have created a statistics class for Biology and Chemistry majors in partnership with those departments.

At the end of the 2002-2003 Department Review, the department created a set of five year goals (for details see Appendix 11: Future Goals and Directions from the 2002-03 Department Review). We have accomplished virtually all of our five year goals as is described below.

- Student Learning: The department created a service learning program, expanded research and internship opportunities for our students, developed a program to help students with the "nuts and bolts" for finding a job and has worked intentionally with the School of Education to recruit more Liberal Studies majors to do concentrations in mathematics.
  Pending: We have made some attempt to start student chapters of professional organizations but our students have not been particularly engaged with the idea. We

need to do further research to see what other institutions are doing and if they are having more success.

- Facilities: We have upgraded department offices, remodeled the workroom/assistant's office and secured funding to create a second group classroom. We continue to be involved in efforts to raise money for the new science complex.
  Pending: Secure funding for the needed research computers in the department. Some of the emphasis in our department research has changed and so has our computing needs. At this time it is not necessary to buy a more powerful computer for research.
- Alumni: We have strengthened our connections with alumni, involving them in our Senior Seminar and Career Dinners. They have been very helpful in opening doors for additional internships for current students.
  Pending: Attempts to restart the alumni auxiliary have not been successful, but Sheryl Smee is working on it again. We have not yet built a formal advisory board of alumni but have been using alumni as informal advisors. This idea needs to be reconsidered.
- Assessment: We have made use of the ETS exams for assessment and curricular change and informally evaluated their efficacy. We are currently updating the Alumni Survey for use in May of 2010.
  Pending: Considering ways to do some formative assessment. The work on curriculum maps and other projects related to Phase II of the process should help us to think about this issue in some concrete ways. One of our themes is to develop a set of presentation and writing rubrics so that we can use them formatively with students before they take the Senior Seminar.