

Keeping Assessment Simple

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Abstract. This case study describes an assessment plan created as part of an accreditation and five year departmental review process. It describes a simple but functional system for assessing major programs in Mathematics, Information Systems and Computer Science.

What did we hope to accomplish?

Point Loma Nazarene University (PLNU) is accountable to the Western Association of Schools and Colleges (WASC) as its accrediting agency. In the mid-90's PLNU went through a three-year cycle of document preparation and an accreditation visit. After that visit, the WASC visiting team informed the university that on its next visit it would put greater emphasis on planning and assessment. As the result of this information, PLNU has been attempting to develop a variety of planning and assessment tools to use in the on-going activity of the institution. The Department of Mathematics and Computer Science made a first attempt at assessment in 1999 by conducting a five year department review. There were pluses and minuses to the process, but the main problem is that it did not develop a system of on-going assessment and strategic planning.

In 2003 the department once again undertook a department review.¹ The team of nine faculty members in the department does not contain any experts in the area of assessment, and there is no one in the department who desires to make assessment part of his or her on-going scholarly work. With this in mind, we needed to design a system that would meet the expectations of WASC and our needs for planning and reviewing departmental effectiveness without becoming too cumbersome or time consuming. The review involved more than 100 pages of writing and documentation, but it also provided a reasonable template for future reviews (we should be able to update data and modify the text without rewriting the entire document). We believe that our department has developed a workable assessment and planning system that can carry us into the future.

What did we do?

PLNU is a small, liberal arts institution of approximately 2500 undergraduates. The Mathematic and Computer Science Department has roughly 100 students spread across three majors (Computer Science, Information Systems and Mathematics). The students in the department share some classes, and the faculty intentionally works to create a sense of unity among the 100 majors. To begin the assessment process, the Mathematics and Computer Science Department faculty sat down as a team and, over a period of weeks, developed a department mission statement and goals that represented the full department. This statement is shown in Figure 1 and is posted on our department website.²

¹ A full copy of the department review document can be obtained by emailing Maria Zack.

² mics.ptloma.edu/Department%20Assessment/Mission%20Statement%20and%20Goals.htm

Department Mission Statement: The Mathematics and Computer Science 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.

Department Goals: The goals of the Department of Mathematics and Computer Science are:

1. To prepare students for:
 - careers that use mathematics, computer science and management information systems in business, industry or government.
 - graduate study in fields related to mathematics, computer science and management information systems.
 - teaching mathematics and computer science at the secondary level.
2. To prepare students to apply their knowledge and utilize appropriate technology to solve problems.
3. To educate students to speak and write about their work with precision, clarity and organization.
4. 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.
5. To integrate the study of mathematics, information systems and computer science with the Christian liberal arts.
6. To provide appropriate mathematical, information systems and computer educational support for any major area of study in this university.

Figure 1. Department Mission and Goals

Using these goals as a starting point, the department worked to develop an assessment plan. Our fundamental value was to develop an assessment program that was simple enough that it could be sustained over a number of years and was broad enough that the same assessment measures could be applied to all three majors. We looked at [1] to gather ideas about the success and failures of assessment programs and projects at other institutions. We found this resource invaluable in helping us find a place to begin.

The assessment plan that we developed for the department had to meet several criteria given to us by the university (including some externally verifiable measures). The institution required us to submit drafts of our plan in various stages of development. Having a deadline provided a good incentive for our team to wrap up discussion and make decisions. The assessment plan that we arrived at includes:

- An Alumni survey to be given once every five years. We used this tool in 1999 and modified it in 2003 to focus on some new initiatives in the department. This survey gathers information about the alumni and also asks attitudinal questions. Both the survey instrument³ and results⁴ are posted on our website.

- The creation of a Senior Seminar where all three majors gather together. In this seminar students hear talks by faculty and alumni and take the ETS Major Field Test in Mathematics (for Mathematics majors) or Computer Science (for Computer Science and Information Systems majors). The students also are required to give a 15 minute talk and write a short paper about a topic selected by the student in consultation with a faculty advisor. These talks and papers emphasize students' speaking and writing abilities and are graded by all department faculty members with the students being given the rubrics in advance.
- A comparison of our curriculum to national and state standards (these include MAA, ACM, ABET and AIS as well as the State of California standards for preparation of secondary school teachers).
- The use of external reviewers. We asked two faculty members in institutions similar to ours to take a look at our department review and all of the related data and to evaluate the curricular changes that we had made based on our assessment process. This was especially important in the area of Information Systems because we completely redesigned the curriculum. The two reviewers contributed valuable insights and suggestions that helped us to fine-tune our programs.

Details of the Assessment Plan are available in Appendix A and on our department web site,⁵ as are the results of the ETS exams.⁶

After the preliminary round of assessment, we determined that we needed to make some changes to our assessment program.

- The Alumni Survey needs to be modified before we use it again. We gained some useful information from the data, but our assessment plan called for us to evaluate how the students rated PLNU's preparation of them for their next professional step (either a job or graduate school). Because of the small sample size, the standard deviations were large. So though the alumni told us that they were pleased with their preparation, we do not want to give too much weight to this conclusion.
- We had to wait on the university to get permission to add the Senior Seminar. In the interim, we gave the students the ETS test in a setting where it did not count as part of any course grade. The Math and CS students were given

³ mics.ptloma.edu/Department%20Assessment/Alumni%20Survey.doc

⁴ mics.ptloma.edu/Department%20Assessment/Alumni%20Survey%20Data.xls

⁵ mics.ptloma.edu/Department%20Assessment/Assessment%20Plan.htm

⁶ mics.ptloma.edu/Department%20Assessment/ETS_Exams.htm

the test in a class and the IS students took the test during an individually scheduled time with the department. We feel that most of the IS students did not take the test seriously. Since the students raw score will now be worth 20% of the grade for the Senior Seminar, this problem should be resolved. The Senior Seminar is graded on a pass/no pass basis.

What did we learn?

First and foremost, we learned the lesson of “keep it simple” when it comes to assessment plans. Our colleagues in other departments have still not begun to collect data because they created very elaborate and complex assessment plans and are overwhelmed by the amount of work needed to execute their beautifully crafted process. We are in the second year of data gathering and have already begun to learn useful information from our data.

Second, it is important to get full department “buy in” for the assessment plan. No one in our department sees this as her primary area of scholarship, yet because we built universally applicable goals and a department wide plan, all are willing to do their share of the work to get the assessment tasks accomplished. Certainly, the group approach to building an assessment plan is initially more time consuming but the long term benefits far outweigh the initial costs.

Third, our initial findings from the first full round of implementation of this very simple assessment plan were instructive. The general feeling in the department was that the data that we gathered resonated with faculty intuition about the status of the curriculum. Having the data to back up our intuition was very helpful in seeking administration level support to make needed changes. The key findings are:

- The students who graduated in 2000 or beyond feel better prepared in the areas of speaking, writing and the use of technology than those who graduated before 2000. Improvement of these skills was one of the goals of our 1999 curriculum changes. Though the Alumni Survey had some flaws, this information was very clear cut.
- The ETS MFT exams pointed out that our Mathematics and Computer Science majors were somewhat weak in a few specific areas (we found the ETS area specific sub scores much more useful than the overall scores). The findings of the ETS MFT for our Information Systems majors were a bit harder to use because the major has been a mixture of Computer Science and Business. There currently is no ETS MFT for IS so we had to test them using the CS exam. Overall, the MFT showed that our majors are performing well as compared to national norms and that greatly pleased the department’s faculty.

- We needed to make only a few minor curricular changes to meet the current national standards for Mathematics and Computer Science (CUPM *Curriculum Guide 2004* and ACM, 2001). In 1999, during the department’s last major “review” our curriculum for Mathematics and Computer Science was completely redesigned. Fortunately, the changes that were made at that time are consistent with the bulk of the recommendations in the current professional standards. However, our CS curriculum needed a few minor additions related to web technology. The national standards provided by ACM and ABET were helpful in crafting a new and more technical Information Systems major. Because we are a liberal arts institution, our restrictions on the number of non-GE units a student can take will prevent us from ever being able to apply for ABET accreditation, however the standards were helpful guidelines.

These findings were used in a variety of ways as we modified our curriculum.

- The Alumni Survey confirmed the need to continue our work with students in the areas of speaking, writing and the use of technology. We emphasize this across the curriculum with a capstone experience in the senior seminar. As much as the students do not like it when we are pushing them to speak publicly in their freshmen and sophomore years, it is an important part of their preparation for the professional world.
- We made some minor curricular adjustments in Mathematics. As indicated by ETS scores, we now require the students to take more applied mathematics. In the old curriculum, students were required to take four units of applied mathematics by choosing between Applied Mathematics (four units) and Mathematical Statistics (four units). In the new curriculum, students are required to take a total of ten units of applied mathematics by choosing several courses from Advanced Linear Algebra (two units), Numerical and Symbolic Computation (two units), Complex Analysis (two units), Applied Mathematics (four units), Discrete Mathematics (four units) and Mathematical Statistics (four units). In addition, we require all mathematics majors to take History of Mathematics (a suggestion made by a reviewer to better align our curriculum with our goals).
- We made some minor curricular adjustments in Computer Science. We now require all students to take Computer Architecture and have increased the number of units of Discrete Mathematics from two to four. Both of these changes were indicated by the ETS scores. We have also increased the number of units in the database course from two to three and have added a class in web

applications programming (recommended by outside reviewers and national standards).

- Our Information Systems curriculum was completely redesigned. With the addition of our new hardware lab, the major has become more “hands-on” and technical. Our outside reviewers agreed that this is consistent with the trend in Information Systems education and we hope that this will revitalize our major.

Next steps and recommendations

We are now in the second year of this assessment cycle; however this is the first year for the Senior Seminar because we had to go through the institution’s academic course review process before we could add the course to our curriculum. We are currently fine-tuning the rubrics for the speaking and writing portion of the course and hope that we can craft an excellent course over the next few years. The initial response of the faculty and the students to the course has been positive.

Over the next couple of years, we need to modify the Alumni Survey and develop a more careful plan for follow up to increase the response rate. We will not be sending the survey again until 2008, so there is time for this work.

Our next significant assessment project is to develop a program for assessing our department’s portion of the university’s General Education program. Though our department has goals for our general education course, the university does not have clear goals for the overall general education program. This has made assessment difficult. PLNU

students may take either one semester of Calculus or a course called Problem Solving to satisfy their general education requirement. We are currently giving an attitudinal survey as part of our assessment but need to see if we can develop tools for assessing problem solving skills. A fairly high level of department energy is currently going into this project.

Our department has learned some very valuable lessons in developing our assessment plan, the most essential ones are:

- Build your assessment from a clear set of goals that everyone in your department accepts.
- Make the assessment as easy as possible. Pick things that can be done in a straightforward manner and with a minimum of labor. Assessment can not be sustained if your faculty finds it too invasive or time consuming.
- Pick assessment tools that will back up your intuition. The faculty has a reasonably good sense of what is happening with students, but data can be very helpful in obtaining institutional resources to make the necessary changes.

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References

1. Gold, Bonnie, et al. *Assessment Practices in Undergraduate Mathematics*. Washington, DC: Mathematical Association of America, 1999.

Appendix. Learning Outcomes Assessment

Computer Science Major

Outcome #1 (Teach): *Graduates will have a coherent and broad-based knowledge of the discipline of computing.*

Means of assessment: Require students to take the ETS Major Field Test in Computer Science as the mid-term exam for the capstone course, Computer Science 481, Senior Seminar in Computer Science.

Criteria of success: 50% of our students achieve above the 25th percentile on the exam.

Outcome #2 (Shape): *Students will be prepared to give an oral technical presentation and a written summary of a topic in their field.*

Means of Assessment: Each student will be required to give a 20-minute oral presentation and a four page written summary of a topic in their field as a part of their participation in the Senior Seminar in Computer Science. 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 1 (outstanding) to 3 (unsatisfactory) in the following areas:

- Overall Content:
 - Technical information
 - Depth of information
 - Command of background material
- Oral Presentation:
 - Organization
 - Use of presentation tools
 - Notation
 - Exposition
 - Ability to field questions from the audience
- Written Summary:
 - Organization
 - Grammar and spelling
 - Notation
 - Clarity of writing
 - Bibliography and other supporting documentation

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

Outcome #3 (Send): *Computer Science graduates will be adequately prepared for entry into graduate school or jobs in the computing profession.*

Means of assessment: Alumni will be surveyed every five years. They will be asked at least the following questions:

If you have a job in Computer Science: On a scale of 1 to 5, 1 being outstanding and 5 being poor, how well do you think that the undergraduate Computer Science curriculum at PLNU prepared you for your work in the field?

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 Computer Science curriculum at PLNU prepared you for graduate school?

Criteria of success: An average response of 2 for each question.

Mathematics Major

Outcome #1 (Teach): *Graduates will have a coherent and broad-based knowledge of the discipline of Mathematics.*

Means of assessment : 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.

Criteria of success: 50% of our students achieve above the 25th percentile on the exam.

Outcome #2 (Shape): *Students will be prepared to give an oral technical presentation and a written summary of a topic in their field.*

Means of assessment : Each student will be required to give a 20-minute oral presentation and a four page written summary of a topic in their field as a part of their participation in the Senior Seminar in Mathematics. 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 1 (outstanding) to 3 (unsatisfactory) in the following areas:

- Overall Content:
 - Technical information
 - Depth of information
 - Command of background material
- Oral Presentation:
 - Organization
 - Use of presentation tools
 - Notation
 - Exposition
 - Ability to field questions from the audience
- Written Summary:
 - Organization
 - Grammar and spelling
 - Notation
 - Clarity of writing
 - Bibliography and other supporting documentation

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

Outcome #3 (Send): *Mathematics graduates will be adequately prepared for graduate study, teaching and careers using Mathematics.*

Means of assessment : Alumni will be surveyed every five years. They will be asked at least the following questions:

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?

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?

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 of success: An average response of 2 for each question.

Information Systems Major

Outcome #1 (Teach): *Graduates will have a coherent and broad-based knowledge of the discipline of Information Systems.*

Means of assessment : Require students to take the ETS Major Field Test in Computer Science as the mid-term exam in IS 481, Senior Seminar in Information Systems.

Criteria of success: 50% of our students achieve above the 25th percentile on the exam.

Outcome #2 (Shape): *Students will be prepared to give a written summary of a topic in their field.*

Means of assessment : Each student will be required to give a 20-minute oral presentation and a four page written summary of a topic in their field as a part of their participation in the Senior Seminar in Information Systems. 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 1 (outstanding) to 3 (unsatisfactory) in the following areas:

- Overall Content:
 - Technical information
 - Depth of information
 - Command of background material
- Oral Presentation:
 - Organization
 - Use of presentation tools
 - Notation
 - Exposition
 - Ability to field questions from the audience
- Written Summary:
 - Organization
 - Grammar and spelling
 - Notation
 - Clarity of writing
 - Bibliography and other supporting documentation

Criteria of success: 80% of the students should have an average score of at least 2 in each of the two main areas.

Outcome #3 (Send): *Management Information Systems graduates will be adequately prepared for entry into the information systems profession.*

Means of assessment : Alumni will be surveyed every five years. They will be asked at least the following question:

1. If you have a job in computer science: On a scale of 1 to 5, 1 being outstanding and 5 being poor, how well do you think that the undergraduate Management Information Systems curriculum at PLNU prepared you for your work in the field?

Criteria of success: An average response of 2.