



**ANNUAL PROGRAM REPORT**

College	Science
Department	Computer Science
Program	Master's in Computer Science
Reporting for Academic Year	2016-2017
Last 5-Year Review	2010-2011
Next 5-Year Review	2017-2018
Department Chair	Matt Johnson
Date Submitted	6/26/2017

I. **SUMMARY OF ASSESSMENT** *(suggested length of 1-2 pages)*

A. **Program Learning Outcomes (PLO)**

Students graduating with an M.S. in Computer Science from CSU East Bay will be able to:

1. Apply knowledge of mathematics and computational theory to analyze problems in computer science, and assess and determine the resources and requirements needed for their solution. (ILO 1,2)
2. Design, develop, and evaluate a computer-based system, process, component, or program to meet desired needs. (ILO 1,4)
3. Classify and explain the mechanisms, components and architecture of computing systems. (ILO 1)
4. Employ current techniques, skills, and tools necessary for computing practice, and justify the need for continuing professional development. (ILO 1)
5. Discuss professional, ethical, legal, and security issues and responsibilities and the impact of computing on individuals, organizations and society. (ILO 1,2)
6. Function successfully on teams to accomplish a common goal, and explain computer science concepts effectively in written and oral form. (ILO 1,5)

B. **Program Learning Outcome(s) Assessed**

Following our assessment plan, the Department is assessing one PLO per year. This is the fourth year that assessment has been done and so we are assessing PLO #4 this year. The department does collect assessment data for all targeted courses each year, however, so as to track trajectories for scores on all PLOs and allow for "closing the loop."

Post-assessment quizzes were administered for three courses this year (addressing PLO #4):

CS 6310 – Advanced Software Engineering, Elective, Developing PLOs 2 and 4

### C. Summary of Assessment Process

#### **Instrument(s) and Sampling Procedure:**

The Department created SLOs and PLOs for the Master in Computer Science program in the academic year 2012-2013. The Department made the decision to use Blackboard as a means to provide students with an assessment exam that addresses the SLOs of each course. The SLOs for each course have been mapped to the program PLOs and the ILOs of the university. The assessment exams were developed for the required courses in the program, as well as a representative set of elective courses. The assessment instruments were then made available to the department faculty via a BlackBoard repository. Instructors teaching courses which were to be assessed in a given year deployed the tests and reported the results back to the Graduate Coordinator.

#### **Sample Characteristics:**

The Department has been using this assessment mechanism for three years now and can evaluate its advantages and disadvantages. Unfortunately, evaluating the results of the assessment exams as they stand is challenging, as each assessment contains questions addressing multiple PLOs. Due to a BlackBoard limitation, the results for individual PLOs cannot be automatically aggregated and compared across multiple courses, and instead must be tabulated by hand. To solve this problem, for the semester-based program, the Department agreed to develop assessment instruments that address only one PLO at a time. This will allow assessment to be automated, providing the opportunity to assess more courses, and assess those courses more frequently. The Department has developed most of the new assessment instruments for the semester-based program and will complete the remaining ones in early 2017-2018.

An additional challenge in the current system is assessing PLOs for both the Master's in Computer Science program and the Master's in Computer Network program. Since the programs share the great majority of the courses, but have different PLOs, it has been necessary to provide separate mappings of course SLOs to the PLOs of the two different programs, or to include additional questions on the assessment instruments to address the different PLOs. Fortunately, this difficulty will be eliminated under the semester-based program as the Master's in Computer Science and the Master's in Computer Networks have been combined into a single program with common PLOs. In addition, the PLOs for the Bachelor's and Master's programs have been coordinated so that matching PLOs for the undergraduate and graduate programs will be evaluated on the same timetable.

#### **Data Collection:**

Assessment data for PLO 4 was collected in three courses, all in Fall quarter 2016. The data were collected by the instructors of the classes from the BlackBoard tests that they had deployed.

The courses were:

CS 6310 Advanced Software Engineering  
CS 6320 Software Engineering of Web-Based Systems  
CS 6525 Network Security

#### **Data Analysis:**

In evaluating the assessment scores for PLO #4, we find mediocre results in two of the courses assessed, CS 6310 and CS 6320, and much better results in the last course assessed, CS 6525. PLO #4 is one of the more challenging outcomes for students to achieve in that it requires students to develop and master their coding skills. Developing good coding skills often takes years of practice and should be begun early

in an undergraduate career. Again, most of the graduate students in the Master's in Computer Science program are international students, and many international Computer Science programs do not stress coding skills to the degree that is necessary to become proficient. As a result, many of our Master's students start at a disadvantage in regards to PLO #4. The Department addresses this disadvantage by requiring remediation of basic programming courses for many admitted students, and by emphasizing the need for programming projects in as many Master's degree courses as possible. Under the semester-based system, a new required graduate-level data structures and algorithm analysis has been added to help students get up to speed quickly.

Please also note that all of the courses used to assess PLO #4 are electives, which can lead to selection bias. It may be that students with poorer coding skills chose to take CS 6310 and CS 6320, where the assessment results are mediocre, and students with better skills chose to take CS 6525, where the results are good. It is not clear that the scores assess the program as a whole. That said, PLO #4 is to be developed in CS 6310 and CS 6320 while it is to be mastered in CS 6525, and the scores do actually reflect a better mastery of coding in CS 6525 than the earlier courses. The Department has again addressed the issue of consistency of assessment under semesters by assessing all PLOs in required classes rather than electives.

In regards to closing the loop and using the results of the assessment process to improve student learning for PLO #4, it would appear that the students in CS 6525 have successfully mastered the PLO and no further modifications are needed. In CS 6310 and 6320, we would like to see improvements in coding proficiency at the development level. As mentioned, the new required course in coding that will be instituted under semesters will be the Department's first attempt to address this issue.

**CS 6310:**

This elective course in Advanced Software Engineering addresses material which is relatively well-defined, including both theoretical elements as well as significant elements of coding and development practice. It requires advanced understanding of software development issues, practical use of software development tools, and testing and software lifetime management, which is why it particularly addresses PLO #4. There is reasonable latitude available for addressing different areas or additional material, so fine-tuning would be aimed towards identifying subject material which most successfully results in student acquisition of the necessary skills and theory. In addition, as with most classes, it would be beneficial to provide additional learning opportunities for students who were unsuccessfully served by the current class format. These opportunities might include high impact educational practices such as collaborative projects or swapped classrooms.

**CS 6320:**

This elective course in Software Engineering of Web-Based Systems addresses material which has a well-defined core of material but is constantly being enhanced by new developments and advances in the industry standards. It clearly maps to PLO #4, in critiquing, planning and producing complex software applications as web systems typically involve many elements, both front-end interfaces and back-end databases, across multiple machines simultaneously. There is again a fairly wide range of subject areas that could be covered, and actual implementation of systems using standard tools, cloud-based services, industry-standard libraries and frameworks is an essential part of the class. Similarly to CS 6310, closing the loop will entail identifying the theoretical subject areas and software projects that lead to the most successful student learning.

**CS 6525:**

This elective course in Network Security addresses material which has a relatively well-defined core, but which also includes a constantly changing array of attacks and corresponding applications of security functionality. Both theory and implementation are critical to this subject, with familiarity with industry

standard libraries and tools being necessary. After addressing subject material common to most security solutions, a wide range of subjects may be covered, providing the opportunity to adapt the class to the needs of the students. As in CS 6320, proficiency with current tools, services, and frameworks is essential. Based on the assessment data, students have been quite successful in mastering the material and gaining proficiency in security software development. Instructors should continue to use the current model, while incorporating high impact educational practices.

#### D. Summary of Assessment Results

**Main Findings:**

At the Development level, while students have attained a medium level of proficiency in PLO #4, the Department would like to work towards higher levels of proficiency for these classes. At the Mastery level though, students have attained a high level of mastery of PLO #4.

2016-2017	Assessment Results	1	2	3	4	5
	CS 6310 Advanced Software Engineering (Fall 2016)		70%		56%	
	CS 6320 Software Engineering of Web-Based Systems (Fall 2016)				53.8%	
	CS 6525 Network Security (Fall 2016)				97.8%	
	CS 6901 Capstone Exams (Fall 2016, Winter 2017, Spring 2017)	55%	86%	60%		

**Recommendations for Program Improvement:**

The Department has proposed a transformed curriculum for the semester-based system which includes a new required course in program development and analysis which will provide students with the opportunity to improve the coding skills essential to attaining proficiency in PLO #4. Also, as described above, the assessment tools that the Department is currently using are unwieldy, and there is the potential for selection bias in assessing certain PLOs since they are assessed in elective courses which not all students may take. Under the semester system, the Department plans to assess PLOs in required courses only and has created assessment tools which more clearly assess one PLO at a time.

**Next Step(s) for Closing the Loop:**

In the last year before the semester-based system begins, course instructors will be encouraged to include more program development, testing, and tool use in their courses. In addition, it would be beneficial to provide additional learning opportunities for students who were unsuccessfully served by the current class format. These opportunities might include high impact educational practices such as collaborative projects or swapped classrooms.

**Other Reflections:**

#### E. Assessment Plans for Next Year

The Department will continue using its current program assessment plan and will assess PLO #5 next year. Note that since Master’s program PLOs were adapted to match the Bachelor’s program PLOs

under the semester-based system, assessment data from the current PLOs will not provide a meaningful comparison under the new system. The department will begin gathering assessment data regarding the semester-based PLOs beginning in Fall 2018.