

Assessment of Student Learning Plan (ASLP): Computer Science

2016-17 Academic Year

A. College, Department, Date

College Science Technology & Health
Department Computer Science
Date 6/6/2017

B. Contact Person for the Assessment Plan

Name and title Dr. David Briggs, Dept. Chair

C. Degree Program

Name of Degree Program Bachelor of Science in Computer Science

D. Assessment of Student Learning: Program Assessment

Step 1: Identify the Student Learning Outcomes (SLO's)

- a. Do you have your student learning outcomes published on your department's website? Yes

at <http://usm.maine.edu/cos/mission-statement-department-computer-science>

- b. Please identify **which of your student learning outcome(s) were assessed this past academic year.**

In Fall 2016, COS 360 and COS 450 were offered and their learning outcomes assessed. In Spring 2017 COS 398, COS 420, and COS 485 were offered and their learning outcomes assessed. At the end of the year, the department met to discuss the outcomes of the assessments. Here is a list of the courses and their associated outcomes:

COS 360 - outcomes (b), (h), and (j)

COS 398 - outcomes (e), (f), and (h)

COS 420 - outcomes (c), (d), (i), and (k)

COS 450 - outcomes (b), (e), (f), and (i)

COS 485 - outcomes (a) and (j)

The outcomes are:

(a) an ability to apply knowledge of computing and mathematics appropriate to the discipline

(b) an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

(c) an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs

(d) an ability to function effectively on teams to accomplish a common goal

(e) an understanding of professional, ethical, legal, security and social issues and responsibilities

(f) an ability to communicate effectively with a range of audiences

(g) an ability to analyze the local and global impact of computing on individuals, organizations, and society

(h) recognition of the need for and an ability to engage in continuing professional development

(i) an ability to use current techniques, skills, and tools necessary for computing practice.

(j) an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

(k) an ability to apply design and development principles in the construction of software systems of varying complexity.

- c. *Do you have a **matrix or curriculum map** showing when your student learning outcomes are assessed and in which courses?* Yes

Assessment map:

Spring 2016 (even spring)

COS 350 (a) (c) (k)

COS 420 (c) (d) (i) (k)

COS 457 (b) (e) (f) (i)

Fall 2016 (even fall)

COS 360 (b) (h) (j)

COS 450 (b) (e) (f) (i)

Spring 2017 (odd spring)
COS 398 (e) (f) (g) (h)
COS 485 (a) (j)

Step 2: Assessment Methods Selected and Implemented

- a. *Identify which direct measures (other than course grades), that were used to determine whether students achieved the stated learning outcomes for the degree.*

Our assessments are direct measures using rubrics for specific assignments or exam questions designed to evaluate achievement of a specific learning outcome. The details of the specific assessment instruments and their rubrics are documented in the submission to the ABET visiting team.

- b. *Briefly describe when you implemented the assessment activity, and if a scoring rubric was used to evaluate the expected level of student achievement. (This information may be shown on your curriculum map).*

The individual assessment instruments are, of course, implemented when the class is delivered, according to the matrix given above. All assessments use scoring rubrics and are normalized for the convenience of the ABET examiners to a scale of 1 to 5 for Poor, Fair, Good, Very Good, Excellent (or some comparable nomenclature). The courses which assessed outcomes during the 2016-2017 academic year are COS 360(fall), COS 398(spring), COS 420(spring), COS 450(fall), COS 485(spring).

Step 3: Using the Assessment results to Improve Student Learning

- a. *Briefly describe your unit's process of reviewing the program assessment results (i.e. annual process by faculty committee, etc).*

At the end of each year we have a department meeting where we share and discuss our assessment results and discuss plans for future changes. This meeting has been an important and useful meeting for sharing ideas and experiences. Individual faculty members share their assessment results and identify specific problems and their intended responses.

- b. *What changes have been or will be made to improve student learning, as a result of using the program assessment results?*

Our changes are generally about spending more course time on difficult subjects. In the past we have changed COS 161 and COS 285 from 3 to 4 credit to add labs and more course time to cover material better. These have both been valuable changes.

Final conclusions from this year's assessments:

COS 360

This course assessed outcome (b), (h), and (j).

For outcome (b)

An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

I used four assessments. In the first one, which was not a question on an exam, about 93% were in the very good or excellent categories. The results on the other assessments were disappointing, with 25%, 50%, and 39% of the students falling into the Very Good or Excellent categories, respectively for instruments #2 through #4.

Clearly more work is needed. I plan on doing several things.

1. present the techniques for accomplishing these tasks more directly as algorithms.
2. use active learning techniques to have students work on similar problems in class
3. if time permits and where the task lends itself to this treatment, develop an interactive tool that randomly generates problems and gives them feedback on their answers

Outcome (h) is students will have

Recognition of the need for and an ability to engage in continuing professional development

I assessed this by with a writing exercise that I graded on a binary scale. 82% of the class submitted the exercise, which was not worth very much towards their grade, and everyone who submitted did well enough to earn the point, so 82% were excellent. Our students understand that computer science is changing all the time and that they will need to learn new things.

Outcome (j) is

An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

I used three programming assignments to assess this outcome. I supplied them with test cases and the correct results, and they generally did well. The only one of the three that did not have 75% very good or excellent is the last one, which asked them to code some functions in a language that is new to them, ML. This is the last exercise of the semester, and 7 of the 28 students did not hand it in. If we excluded the ones who did not hand it in, the average score on the assessment instrument would go up by 35 points, which is 19% of the grade. The percentage of very good or excellent would go up to 59% instead of the 46% it is using all 28 students.

Still, the ML coding is where they are having the most difficulty. I believe if I spend give them some exercises to do in class as groups, this might get them to engage more with the material. I also intend to cut out some of the more advanced features, such as lazy evaluation and infinite structures, and focus more on the fundamentals of ML.

COS 398

This class assessed outcomes (e), (f), and (h)

Outcome (e) is

Students will show an understanding of professional, ethical, legal, security and social issues and responsibilities

This was assessed with questions 1, 3, 4, 5, 9 on the mid-term exam, which tested their knowledge of laws, responsibilities and security.

Over 87% were very good or excellent, and I have no plans to modify the course with respect to this outcome.

Outcome (f) is

Students will show an ability to communicate effectively with a range of audiences

N/A as of June 26

Outcome (h) is

Students will recognize the need for and an ability to engage in continuing professional development

N/A as of June 26

COS 420

This class assessed outcomes (c), (d), (i), and (k).

Outcome (c) is

an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs

It was assessed by evaluating a particular large development project at different phases of implementation.

Overall, I was pleased with the student progress in this course. Most came in with little understanding about how to approach and solve a large, complex, software development project and by the end of the course the majority of the students were able to demonstrate good skills in requirements definition, design, implementation and team work. Every group was able to bring their project to a very high quality level by the end of the course. This years results of 79% compares a bit less favorably to last year 88% of the students reached a level of Excellent or very good. One of the 3 students was not in our initial two year sequence, the other two did not seem motivated and simply did not do that much group work.

Outcome (d) is

an ability to function effectively on teams to accomplish a common goal

Students work as partners in paired teams as part of a larger group of five individuals. They change partners and roles every iteration. Assessment is based on four peer evaluations for technical and project management contributions. (scale 1-5). 42% were very good or excellent.

Well, obviously the course did not meet the target objective of 75% very good or excellent. Having said that, it is a very difficult measure to set boundaries. First, students are basing it on their own perspective and scaling system. Next, I am not convinced that the criteria boundaries I used (ie 3.25-3.49) are good. Students in the class mentioned that the course helped a lot in constructing collaboration mechanisms and providing the technical infrastructure to make it happen (Github). We read a paper on collaboration and it was often a subject of discussion in the class. Last year, 65% had excellent or very good.

I am not sure if this is something that needs to be addressed and, if so, how to address it. Changing the boundaries seems like the best approach. Here is the argument : 3 represents average contribution from a students perspective. The level of good is at 3.5-3.74 ... this range is "above average" from a peer evaluation perspective. The decrease from last year is dramatic and a bit concerning.

Outcome (i) is

an ability to use current techniques, skills, and tools necessary for computing practice.

For assessment, in the first assignment I had students adapt a software application that includes packages, serializable file storage, and implementations of numerous design patterns to solve a moderately complex problem. They need to use a source control system (Github) to maintain code. (Scale 1-5).

The first assignment requires students to build on baseline code to solve a basic data storage and retrieval problem. The above scores reflect the level of expertise of students who completed the course, not the students who started the course. If students cannot complete Assignment # 1, then I ask them to leave the course (I cannot put them on teams if they cannot work with the provided code). If I included the students who had to drop the class, then I would have 20% (6/20) having a poor score. The students who had problems with the first assignment found it difficult to understand the interactions of a number of classes and the organization of code into packages. This may be a topic that could be covered more thoroughly in earlier classes.

96% of students were deemed very good or excellent, meeting the 75% target..

Outcome (k) is

an ability to apply design and development principles in the construction of software systems of varying complexity.

It was assessed with a question on the second exam asking students to apply design patterns and analyze and design the key classes and behaviors to solve a problem that is described in a paragraph. Students were expected to construct a UML class diagram to represent the key classes and a sequence diagram to show how the class behaviors could be used to solve a key use-case. There were 100 points total for the exam (Scale 1-5).

While the 75% very good or excellent was just met for this outcome, I believe that it could be better. In particular, the exam question that asks students to develop a design a paragraph problem statement was not done to the level that I think it should be done. I plan on providing more examples of how to do this in future classes.

COS 450

This class assessed outcomes (b), (e), (f), and (i)

Outcome (b) is

students will show an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

To analyze this outcome, I used the number of passing test cases for a portion of two projects; one from project 1 (alarm clock) at the start of the semester and the second on project 3 (virtual memory) at the end. My hope was to see improvement over the course of the semester, with encouragement from me during the course. Unfortunately, the reverse happened. Scores dropped.

There was a decline in the assessment which I attribute to 'burning out' the students with the amount and complexity of programming work in the course. There were a number of students that dropped

after the first project, and several that can be seen in the assessment spreadsheet that failed to complete the project. This was unsettling.

While the development work is substantial, I believe for a suitably prepared student focused on their work it is accomplishable in the given time. A number of students who did fair and poor did not appear to commit the time and effort needed. Several were asking basic questions less than a week prior to the due date which should have been asked five weeks earlier when the assignment was posted.

Only 60% of the students were very good or excellent, so the 75% target was not met.

Outcome (e) is

Students will show an understanding of professional, ethical, legal, security and social issues and responsibilities

N/A as of June 26

Outcome (f) is

Students will demonstrate an ability to communicate effectively with a range of audiences

N/A as of June 26

Outcome (i) is

Students will show an ability to use current techniques, skills, and tools necessary for computing practice.

N/A as of June 26

COS 485

This class assessed outcomes (A) and (J). The department has set an aspirational goal of 75% of students achieving "Very Good" or "Excellent" on the assessment outcomes.

For the A outcome (An ability to apply knowledge of computing and mathematics appropriate to the discipline.), only 44% of my students achieved this level. This is typical for our students. Some of our students have strong mathematical abilities, but many of our students are not mathematically inclined. The analyses and proofs are generally student's least favorite aspect of this class. Despite my exhortations on the importance of mathematical analysis, many student never seem able to do the analyses themselves or truly understand the proofs. I try very hard to make the analyses and proofs understandable, but in the end many students do poorly. At this point in their education I cannot fix their lack of mathematical aptitude.

For the J outcome (An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.), 70% of my students achieved this level. Although it did not meet the goal, I am very pleased with this level of achievement. This is a very challenging class that I have worked very hard to make rigorous yet still understandable by the students. This was a strong cohort of students and the class worked well.

I am not planning any changes for next year.

c. Date of most recent program review/self-study?

ABET accreditation visit in spring semester of 2016.

E. Course Assessment Activities: *Is your program able to report any assessment-related activities at the Course-Level... (i.e. created grading rubrics to use in required courses, examined student progress in entry-level courses, developed a new course, etc)? Please briefly explain any assessment projects.*

We continue to be concerned about the attrition we experience in our early courses, which are not, however assessed for the ABET outcomes. Some individuals are planning to incorporate features of the flipped classroom model in courses with are very concerned about the high number D, F, I & W grades in our introductory classes. We are reworking the discrete mathematics sequence to make it more applied and integrated with the students' programming work.

F. Community Engagement Activities in your departmental curriculum:

a. Does your department have a student learning outcome that is related to any community engagement activities? If so, please state the outcome.

Although some of the learning outcomes, notably (e) and (g), refer to non-academic contexts, the assessments are not related to any community engagement activity.

b. Please indicate what community engagement activities are included in your program’s curriculum, and whether the activities are required or optional for students in your major.

<u>Community Engagement Activity</u>	<u>Included</u>	<u>Required/Optional</u>	
Student Research (related to a community-based problem)	___	R	O
Student-Faculty Community Research Project	___	R	O
Internship, or a Field Experience	___	R	O
Independent Study (community-related project)	___	R	O
Capstone Course (community-related project)	___	R	O
Service-Learning (course-based)	___	R	O
Study Abroad, or an International Program	___	R	O
Interdisciplinary Collaborative Project (community related)	___	R	O
Student Leadership Activities (related to a team project)	___	R	O
Students/Faculty Community Leadership (advisory boards, committees, conference presentations)	___	R	O
Other Activities (not mentioned above):			

c. Please list any courses (i.e. EDU 400) that have a community engagement activity in your program.

Many of our students do “internships”, which are more like fixed term part time employment that does not earn academic credit. We work with our advisory board to facilitate placement and believe the experiences are valuable, but they are not formally a part of the degree requirements. No courses in our program have community engagement activities.