

**Central Washington University
Assessment of Student Learning
Department and Program Report**

Please enter the appropriate information concerning your student learning assessment activities for this year.

Academic Year of Report: 2007 – 2008
Department: Computer Science

College: COTS
Program: Bachelor of Science

1. What student learning outcomes were assessed this year, and why?

In answering this question, please identify the specific student learning outcomes you assessed this year, reasons for assessing these outcomes, with the outcomes written in clear, measurable terms, and note how the outcomes are linked to department, college and university mission and goals.

Comment On Which Student Learning Outcomes Were Assessed and Why.

The Computer Science Department has established a regular review process for assessment of student learning. As noted in our Student Learning Assessment Plan our assessment measures generally are reviewed either annually or on a three year basis. This year all the measures reviewed fell into the category of annually collected measures.

Student Learning Outcomes and Links to Departmental, College and University Goals.

Student Learning Outcomes (performance, knowledge, attitudes)	Related Program/ Departmental Goals	Related College Goals	Related University Goals
1. Basic Knowledge: Graduates will demonstrate an understanding of each of the subject areas that define the discipline as well as the interrelationships that exist among them.	Goals 1 & 2. Promote the role of computer science and computer literacy in undergraduate education at Central Washington University. Offer undergraduate programs that train students as computer specialists with a fundamental understanding of technology.	Goal I: Provide for an outstanding academic and student experience in the College of the Sciences.	Goal I: Maintain and strengthen an outstanding academic and student life on the Ellensburg campus.
2. Critical Thinking Skills: Graduates will demonstrate the ability to utilize appropriate theoretical constructs for problem solving: definitions, and axioms, theorems, proofs, and interpretation of results.	Goal 2. Offer undergraduate programs that train students as computer specialists with a fundamental understanding of technology.	Goal I: Provide for an outstanding academic and student experience in the College of the Sciences.	Goal I: Maintain and strengthen an outstanding academic and student life on the Ellensburg campus.

<p>3. Research Skills: Graduates will have the ability to apply basic research methods in computer science.</p>	<p>Goals 3, 5 & 6. Maintain an intellectually stimulating learning environment where diverse perspectives are valued and encouraged.</p> <p>Play a leadership role in scholarship by making basic and relevant scientific contributions to our respective sub-disciplines.</p> <p>Build an interdisciplinary program and an associated Masters Degree program.</p>	<p>Goal VII & III: Create and sustain productive, civil, and pleasant learning environment.</p> <p>Provide for outstanding graduate programs that meet focused regional needs and achieve academic excellence.</p>	<p>Goal VI & V: Build inclusive and diverse campus communities that promote intellectual inquiry and encourage civility, mutual respect, and cooperation.</p> <p>Achieve regional and national prominence for the university.</p>
<p>4. Applied Design Skills: Graduates will have the ability to apply appropriate design constructs: requirements analysis and specification, design, implementation, and testing.</p>	<p>Goal 2. Offer undergraduate programs that train students as computer specialists with a fundamental understanding of technology.</p>	<p>Goal I: Provide for an outstanding academic and student experience in the College of the Sciences.</p>	<p>Goal I: Maintain and strengthen an outstanding academic and student life on the Ellensburg campus.</p>
<p>5. Ethics and Society: Graduates will demonstrate knowledge of ethical codes and societal issues associated with the computing field.</p>	<p>Goal 1. Promote the role of computer science and computer literacy in undergraduate education at Central Washington University.</p>	<p>Goal I: Provide for an outstanding academic and student experience in the College of the Sciences.</p>	<p>Goal I: Maintain and strengthen an outstanding academic and student life on the Ellensburg campus.</p>
<p>6. Technical and Theoretical Background: Graduates will demonstrate knowledge of recent technological and theoretical developments, general professional standards, and have an awareness of their own strengths and limitations as well as those of the discipline itself.</p>	<p>Goals 3 & 5. Maintain an intellectually stimulating learning environment where diverse perspectives are valued and encouraged.</p> <p>Play a leadership role in scholarship by making basic and relevant scientific contributions to our respective sub-disciplines.</p>	<p>Goal VII & III: Create and sustain productive, civil, and pleasant learning environment.</p> <p>Provide for outstanding graduate programs that meet focused regional needs and achieve academic excellence.</p>	<p>Goal VI & V: Build inclusive and diverse campus communities that promote intellectual inquiry and encourage civility, mutual respect, and cooperation.</p> <p>Achieve regional and national prominence for the university.</p>

<p>7. History of Computing: Graduates will be aware of the history of computing, including those major developments and trends - economic, scientific, legal, political, and cultural - that have combined to shape the discipline.</p>	<p>Goal 1. Promote the role of computer science and computer literacy in undergraduate education at Central Washington University.</p>	<p>Goal I: Provide for an outstanding academic and student experience in the College of the Sciences.</p>	<p>Goal I: Maintain and strengthen an outstanding academic and student life on the Ellensburg campus.</p>
<p>8. Graduate Preparation: Graduates will have the necessary background for entry into graduate study.</p>	<p>Goal 2, 4 & 6. Offer undergraduate programs that train students as computer specialists with a fundamental understanding of technology.</p> <p>Sustain a productive team of faculty and staff.</p>	<p>Goal I, IV & III: Provide for an outstanding academic and student experience in the College of the Sciences. Develop a diversified funding base to support curriculum and academic facilities, student and faculty research and scholarships, as well as faculty development, service and applied research in college disciplines.</p> <p>Provide for outstanding graduate programs that meet focused regional needs and achieve academic excellence.</p>	<p>Goal I: Maintain and strengthen an outstanding academic and student life on the Ellensburg campus.</p>
<p>9. Communication Skills: Graduates will have the ability to communicate effectively.</p>	<p>Goal 2. Offer undergraduate programs that train students as computer specialists with a fundamental understanding of technology.</p>	<p>Goal I: Provide for an outstanding academic and student experience in the College of the Sciences.</p>	<p>Goal I: Maintain and strengthen an outstanding academic and student life on the Ellensburg campus.</p>

2. How were they assessed?

In answering these questions, please concisely describe the specific methods used in assessing student learning. Please also specify the population assessed, when the assessment took place, and the standard of mastery (criterion) against which you will compare your assessment results. If appropriate, please list survey or questionnaire response rate from total population.

A) What methods were used?

B) Who was assessed?

C) When was it assessed?

Overview

As several of the measures the department uses helps us assess correspond to more than one of the student learning outcomes, we have divide the answers here into two sections. We will begin by listing the methods of assessment and answer parts A), B), and C). After that we will correlate the methods of assessment with the student learning outcomes.

Method Used	Who was Assessed	When the Assessment Occurred
Major Field Test	Senior CS Majors	June 2008
Senior Capstone Courses, CS 480 / 481	Senior CS Majors	Fall 2007 and Winter 2008 when the courses were offered
Senior Colloquium, CS 489	Senior CS Majors	June 2008
Participation in SOURCE	Majors at all levels	June 2008
Participation in research projects and groups	Majors at all levels	June 2008
Survey of students in Fundamentals of Computer Science, CS 112	Entering majors, minors and some non-majors	June 2008
Exit Interviews	Senior CS Majors	June 2008
Employers and Internship Employers Surveys	Majors at all levels	June 2008
Graduate School Acceptance	Senior CS Majors	June 2008

Student Learning Outcome	Method Used
1. Basic Knowledge	Major Field Test Exit Interviews
2. Critical Thinking Skills	Major Field Test
3. Research Skills	Senior Colloquium, CS 489 Participation in SOURCE Participation in research projects and groups
4. Applied Design Skills	Senior Capstone Courses, CS 480 / 481
5. Ethics and Society	Senior Colloquium, CS 489
6. Technical and Theoretical Background	Senior Capstone Courses, CS 480 / 481 Employers and Internship Employers Exit Interviews
7. History of Computing	Fundamentals of Computer Science, CS 112
8. Graduate Preparation	Participation in SOURCE Participation in research projects and groups Graduate School Acceptance
9. Communication Skills	Senior Capstone Courses, CS 480 / 481 Senior Colloquium, CS 489

3. What was learned?

In answering this question, please report results in specific qualitative or quantitative terms, with the results linked to the outcomes you assessed, and compared to the standard of mastery (criterion) you noted above. Please also include a concise interpretation or analysis of the results.

Overview

As in the prior section, we will first give the results of each student learning outcome measurement and follow this with how these results compare to the standard of mastery for each of the student learning outcomes as found in our Assessment Plan.

Assessment Measures

Major Field Test

Currently, approximately 150 computer science departments across the country use this test as part of their assessment process. The faculty have reviewed the list of institutions participating in the computer science MFT and feel it provides a fair cross section of computer science programs, many from what are considered peer-institutions. Listed below are the results from the most recent five years.

	03-04		04-05		05-06		06-07		07-08	
	Score	Percentile	Score	Percentile	Score	Percentile	Score	Percentile	Score	Percentile
Num. Stu.	28		22		27		24		17	
Overall	151.6	71	145.3	45	153.1	75	148.2	54	149.1	58
Programming	54.2	63	51.1	48	60.0	82	55.0	65	60.7	82
Systems	38.2	91	31.3	71	40.2	92	39.9	92	37.0	87
Theory	43.7	63	37.4	33	44.3	63	33.3	23	34.8	28
GPA – avg.	3.18		3.19		3.66		3.25		3.19	

Senior Capstone Courses, CS 480 / 481

This year the department had five senior project teams. Two teams used the traditional waterfall model of software development, two teams used the extreme programming model of software development, and one team used a research project model of development. In each model students were required to develop six documents and make three presentations. Four teams met the major requirements specified in their original design. One team did not meet all the specified major requirements due to factors beyond their control.

Model of Project	Met All Requirements	Met Major Requirements	Major Requirements Lacking
Waterfall		1	1
Extreme Programming	1	1	
Research		1	

All documents and presentations were evaluated relative to both content and style rubrics. In the content evaluation, one team was evaluated as excellent, three teams were evaluated as exceeding expectations and one team was evaluated as meeting expectations. In the style evaluations, two teams were evaluated as exceeding expectations and three teams were evaluated as meeting expectations.

	Excellent	Exceeds Expectations	Meets Expectations	Fails Some Expectations	Missing Major Requirements
Content	1	3	1		
Style		2	3		

Senior Colloquium, CS 489

All graduating seniors are required to participate in the Senior Colloquium. This year 17 students took this class. In addition to taking the Major Field Test, students complete an ethics unit, write a research paper and make a presentation on that research paper.

	Excellent	Exceeds Expectations	Meets Expectations	Fails Some Expectations	Missing Major Requirements
Ethics Unit	11	4	2		
Research Paper	9	4	2	2	
Presentation	10	3	3	1	

Participation in SOURCE and in research projects and groups

The faculty believes that it is the students in their last two years of study in computer science who generally have the background to be eligible to participate in SOURCE or research projects. This year there were 35 students in last two years of study in computer science. Thirteen students participated in some form of undergraduate research this year. With one regular faculty member on sabbatical, there were four active regular faculty members in the department this year.

	Number of Students
SOURCE	6
Individual Research	4
Group Research	10
Conference Presentations	5
Publications	3

Survey of Students in Fundamentals of Computer Science, CS 112

This course underwent a significant change this year as a result of one of last year's recommendations. We will discuss the changes and our perceptions about them in section 5 below. Here we will present the result of our survey of students taking CS 112 this year. The class had four basic sections: Alice – a programming language used to introduce animation, careers in computer science, hands-on computers – a look at basic data representation and the development of computer hardware, and Scribbler robots – programming low level interaction with robotic sensors.

Alice: Students enjoyed the introduction to animation. Students valued the introduction to “pairs” programming. Students had an appreciation for the impact of this technique in the development of software.

Careers in computer science: The results here were an improved perception about the opportunities and requirements of a career in computer science. Most of the students reported already leaning towards becoming computer science majors.

Hands-on computers: Students reported a better appreciation for the development of hardware and in how computers are put together. Generally students reported an improved comprehension of data representation, though a minority of students reported still being confused on this topic.

Scribbler robots: Though generally well received a number of students reported frustration with the somewhat uneven performance of the Scribbler sensors.

Exit Interviews

All graduating seniors participate in an exit interview. Topics covered include the efficacy of the core curriculum, the impact, breadth, and depth of the focus area electives, the perceived state-of-the-art of our labs (including research and instructional labs – both hardware and software), the faculty, the staff and any other concerns. The following represents the highlights of senior exit interviews conducted in AY 07-08.

Core courses are effective and generally meet the perceived needs of the students. Students would like to see more emphasis on multiple database engines in the database class. Students feel that the software engineering class still does not provide sufficient background in testing.

Focus area elective courses provide sufficient breadth and depth for the interests of the students.

Labs continue to house state of the art equipment and software. Students are aware that the department with the help of the university replaces one lab each year allowing students to have access to the latest in computing technology.

Faculty were perceived as knowledgeable and helpful.

Staff were perceived as friendly and helpful. The descriptor “awesome” came up frequently.

Employers and Internship Employers

Internship employers are surveyed at the end of any term that they employ a computer science intern. Employers of computer science graduates are surveyed more informally. The results of this feedback has been uniformly positive. Students are considered prepared for the work place with an understanding of basic professional interactions.

Graduate School Acceptance

	Number of Students
Number Applied	2
Number Accepted	1
Number Pending	1
Number Rejected	

Assessment of Student Learning Outcomes for AY 07-08

Standards of mastery are described in the Computer Science Student Learning Outcomes Assessment Plan.

Student Learning Outcome	Standard of Mastery	AY 07-08 Results
1. Basic Knowledge	Major Field Test > 50 th percentile overall and in content areas Exit Interviews – student self-reported strengths and weaknesses of the program	Overall, Programming and Systems > 50 th percentile Theory < 50 th percentile Focus area electives, labs, faculty, and staff were all listed as strengths. Two concerns were raised in core courses: database breadth and understanding of testing.
2. Critical Thinking Skills	Major Field Test > 50 th percentile overall and in content areas	Overall, Programming and Systems > 50 th percentile Theory < 50 th percentile
3. Research Skills	Senior Colloquium, CS 489 All graduates will produce a successful research paper Participation in SOURCE Participation in research projects and groups > 25% student participation > 2 students per faculty	15 of 17 students produced acceptable papers, 2 student papers were minimally acceptable. 13 of 39 eligible students participated in some form of undergraduate research 2.75 students per active full-time faculty member
4. Applied Design Skills	Senior Capstone Courses, CS 480 / 481 > 75% successful projects All teams produce minimally acceptable documents based on content	4 of 5 teams met the major requirements of their project. All teams produced acceptable documents based on content.
5. Ethics and Society	Senior Colloquium, CS 489 All students successfully complete the ethics unit.	All students successfully completed the ethics unit.
6. Technical and Theoretical Background	Senior Capstone Courses, CS 480 / 481 All teams produce professionally acceptable documents based on style. Employers and Internship Employers Surveys – no negative responses from surveys Exit Interviews – student self-reported strengths and weaknesses of the program	All teams produced acceptable documents based on style. Students perceived as prepared and professional. Focus area electives, labs, faculty, and staff were all listed as strengths. Two concerns were raised in core courses: database breadth and understanding of testing.

7. History of Computing	Fundamentals of Computer Science, CS 112 – student self-reported strengths and weaknesses of the class	The history component woven into Alice, Hands-on computing and the Scribbler robots was effective.
8. Graduate Preparation	Participation in SOURCE Participation in research projects and groups > 25% student participation > 2 students per faculty	13 of 39 eligible students participated in some form of undergraduate research 2.75 students per active full-time faculty member
	Graduate School Acceptance	2 students applied for graduate school. At this time one has been accepted and one has applications pending.
9. Communication Skills	Senior Capstone Courses, CS 480 / 481 All teams produce professionally acceptable documents based on style. All teams make three professionally acceptable presentations.	All teams produced acceptable documents based on style. All teams made acceptable presentations based on style.
	Senior Colloquium, CS 489 All graduates will write an acceptable research paper and make an acceptable presentation.	15 of 17 students produced acceptable papers, 2 student papers were minimally acceptable. 16 of 17 students made an acceptable presentation, 1 student presentation was minimally acceptable.

4. What will the department or program do as a result of that information?

In answering this question, please note specific changes to your program as they affect student learning, and as they are related to results from the assessment process. If no changes are planned, please describe why no changes are needed. In addition, how will the department report the results and changes to internal and external constituents (e.g., advisory groups, newsletters, forums, etc.).

Student Learning Outcome	Assessment and Curricular Changes
1. Basic Knowledge	<p>Generally this student learning outcome has been met, there are however three concerns.</p> <p>a) Though the Theory category results of the MFT showed some improvement this year, they results are still not to the level of mastery indicated in our plan. We believe that two components continue to affect these results. First preparation in prerequisite Mathematics courses continues to be uneven. Second objectives in the CS 427 Analysis of Algorithms course are not being met successfully. Last year, the faculty met with colleagues from the Mathematics Dept. We discussed potential changes for Math 260 and 330, the prerequisite courses for CS 427. These changes have not yet been implemented. A new book was selected for CS 427 and a new plan adopted for the course. Dr. Kovalerchuk will continue to develop changes for CS 427 next year.</p> <p>b) Students noted a concern in the Exit Interviews that they are currently being exposed to just one database management system. The faculty believes that although this single system has all the components of general database systems, exposing students to new database engines is important. With that in mind the database course will incorporate additional database engines next year.</p> <p>c) Students noted a concern in the Exit Interviews that they believe they do not have sufficient background in testing. This is also a concern that arose in the faculty evaluation of CS 480/481 projects. While we will continue to provide more information on testing and testing software in CS 480, the faculty believes that we need to restructure our curriculum so that testing becomes an important component prior to the CS 480 class. The faculty will conduct a full curriculum review will take place next year so that these and other concerns can be addressed.</p>
2. Critical Thinking Skills	<p>Generally this student learning outcome has been met, there is however one concern. Performance in the MFT in the area of Theory, while improving, is not to the mastery level. We believe that this is a critical component in critical thinking for a computer scientist. Curricular changes here will correspond to the changes listed in 1a) above.</p>
3. Research Skills	<p>Based on the results of the current assessment the faculty believe that this concern has been met. No curricular changes are planed here.</p>
4. Applied Design Skills	<p>Based on the results of the current assessment the faculty believe that this concern has been met. No curricular changes are planed here.</p>
5. Ethics and Society	<p>Based on the results of the current assessment the faculty believe that this concern has been met. No curricular changes are planed here.</p>

6. Technical and Theoretical Background	Generally this student learning outcome has been met, there are however two concerns. Concerns were raised in exit interviews about database breadth of experience. Concerns were raised in both exit interview and faculty review of performance in CS 480/481 about student knowledge of testing. Curricular changes here correspond to the changes listed in 1b) and 1c) above.
7. History of Computing	Based on the results of the current assessment the faculty believe that this concern has been met. No curricular changes are planed here.
8. Graduate Preparation	Based on the results of the current assessment the faculty believe that this concern has been met. No curricular changes are planed here.
9. Communication Skills	Based on the results of the current assessment the faculty believe that this concern has been met. No curricular changes are planed here.

The faculty are also recommending three other curricular actions for next year that affect our program and thus indirectly student learning outcomes.

- Full curriculum review – this is called for in curriculum change 1c) above, the faculty also continue to believe that a regular curricular review is important to the health of the program.
- The results of the survey of students in CS 112 shows that although the changes in the course were effective and well received by the students, most of the students were already intended computer science majors. One reason for the changes to this class was an attempt to attract more students to the major. We believe that this class needs wider exposure. We intend to propose this class as a general education class in an effort to attract more students.
- It is the intent of the faculty to as part of the curriculum review to consider changes to our program that might attract more students to the major. As part of the discussion among the faculty, it was decided that it would be important to make business and industry feedback about our program design a major contribution to this effort. Thus we will be creating an Employer Advisory Board.

Results of our changes will be reported in four ways:

- through this report to the university administration,
- through the annual COTS assessment meeting in the fall,
- incorporate results into our five year program review, and
- incorporate the results of these evaluations into the Computer Engineering Technology ABET accreditation (many of our courses are used as core and elective courses in this track of Electrical Engineering Technology).

5. What did the department or program do in response to last year's assessment information?

In answering this question, please describe any changes that have been made to improve student learning based on previous assessment results. Please also discuss any changes you have made to your assessment plan or assessment methods.

The department adopted the following curricular change recommendations last year AY 06-07.

1. Senior project courses – CS 480 and 481 – as noted in the AY 05-06 recommendations, we will continue to emphasize testing as an important component of the courses.

Action: Ed Gellenbeck added testing lectures and interaction with testing frameworks to the CS 480 class this year.

Analysis: This continues to be a concern. The faculty felt in their evaluation of the content component in CS 480 /481 that though improved, the testing methodology used by the students does not demonstrate the mastery required. Thus we have a continuing recommendation in this area (recommendation 1c and curriculum review described in section 4).

2. Redesign CS 101 the computer literacy course to reflect the fact that the Office 2007 suite of applications will be installed on university systems this fall – a major change in the interface and capabilities of the Office programs.

Action: Jim Schwing and Bob Ota designed a new curriculum for CS 101 and Bob taught the course throughout the year and integrated the new material.

Analysis: These changes were successfully completed.

3. Redesign CS 112, Foundations of Computer Science, with the major purpose of attracting more majors to the discipline while still covering the basic material. Further as noted in the AY 05-06 report in Recommendation 4, the department will attempt to address some of the mathematical shortcomings in this redesign. Further, if this course is successful in connecting with new majors, it is our intent to use this as the starting point for designing a new computer science track.

Action: Ed Gellenbeck and Diana Springerlund redesigned the course. Ed Gellenbeck, Diana Springerlund and Jim Schwing taught the redesigned course throughout the year.

Analysis: Strong interest and positive response in the course along with course evaluations showed that the new course learning outcomes were being met. However based on the result of the student survey, we were not successful in attracting a significant number of new students to the major. Thus we have a continuing recommendation in this area (the second bullet described in section 4).

4. Pay particular attention to the material conveyed in CS 427, Analysis of Algorithms, the major computational theory course taught as part of the curriculum.

Action: Razvan Andonie choose a new book and redesigned the course for this year. Razvan Andonie also taught the course this year.

Analysis: Though result on the MFT improved somewhat, this continues to be a concern. Thus we have a continuing recommendation in this area (recommendation 1a described in section 4).

6. Questions or suggestions concerning Assessment of Student Learning at Central Washington University: