Computer Science

Program Review
2020

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1. Program Overview

A. Educational Goals

What are the educational goals or objectives of this program/discipline? How do these compare with national or professional program/discipline trends or guidelines? Have they changed since the last review, or are they expected to change in the next five years?

The Computer Science program is a lower division collegiate (LDC) transfer program for students seeking a Bachelor's degree in Computer Science. The goal of the program is to enable PCC students to complete the first two years of their four-year degree, and then enroll as a third-year student at their transfer university. National guidelines, such as those published by the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE)organizations, are of less importance to the program than the specific transfer requirements of our partner universities.

PCC's primary transfer partner for Computer Science students is Portland State University. The "core transfer" path for PSU includes 101 credit hours of required classes (described in the PCC Transfer Guide) including 24 credit hours of CS classes (CS 162, CS 201, CS 250, CS 251, CS 260, and CS 261). An additional 12 credit hours of PCC CS classes are recommended (CS 140U, CS 160, CS 161, CS 299) in order to ensure that transfer students are properly prepared. This sequence is unique among Oregon universities, and does not align with collegiate curriculum guidelines published by the ACM or IEEE, nor with the advanced High School curriculum guidelines offered by Project Lead the Way or the College Board.

University transfer requirements have changed every year since the last program review, and the pace of change is unlikely to slow. Changed requirements generally appear in the course content, not the course sequence. There are fewer required transfer courses to PSU at this time, for example, then there were at the last review, but the content of the courses has been substantially revised. In most cases, the revisions do not affect course outcomes but rather content and technology. For example, the change in programming environment from Windows to Linux in multiple CS courses affected course content.

A statewide Associate of Science Oregon Transfer - Computer Science degree (ASOT-CS) has been created, and although its adoption at PCC was not recommended by the CS SAC.

B. Changes in This Review Period

Briefly describe curricular, instructional, or other changes that were made as a result of your SAC's recommendations in the last program review and/or the administrative response.

The significant changes since the last program review include:

- PSU introduced the new Proficiency Demonstration to test the proficiency of students entering their CS department, so we adapted many of our current courses to include practice versions of this exam as our midterms and finals.
- PCC introduced the new bridge course CS299 as additional practice for the Proficiency Demo.
- CS 160 discontinued the Brookshear textbook and started using, "An Invitation to Computer Science", by Schneider and Gersting. Additional curricular changes included introducing Python

programming content to get students to be better prepared for CS 161 and removing Ceebot to better serve accessibility issues.

- The CS SAC is currently working with the new general education requirements and moving content around to satisfy the Quantitative reasoning requirement in CS 160.
- To better prepare transfer students, CS140U was made a prerequisite to CS 162.
- Academic Integrity has been a problem with online classes for the CS department. Since Fall 2016, online sections of CS 140U, CS 161, CS 162, CS 201, CS 250, CS251, CS 260, and CS 261 have been modified to incorporate two on-campus proctored exams, the aforementioned practice proficiency demos, which collectively comprise 40% of the final course grade.
- The CS SAC introduced online tutoring for CS students to improve their success rate.
- CS 233U (Advanced C Programming) was deactivated in 2017.
- CS 162 was made a prerequisite to CS 201 to ensure student success in CS 201.
- CS 140U was made a prerequisite to CS 162 to ensure student success in CS 162.
- Master shells were established for all CS courses.

The CS program constantly changes, and many of the changes were anticipated in the last review. While it cannot be said that any given change is the result of the last review, the recommendations presented in the last review contributed to the evolution of the program. The recommendations from the last review included:

Assessment of Student Learning Outcomes (Section 2) – The CS Program Review did not adequately address assessment of student learning. Section 2(a) Course Outcomes and Assessment – indicates that pedagogical changes were a result of ongoing assessment of student learning, but this is not suggested by the types of changes cited, except for the last example, which speaks only to the need to identify measurable outcomes.

More importantly, however, Section 2(c), which asked for a description of assessment design, a summary of results and examples of changes planned based on those results, was entirely omitted.

2. Outcomes and Assessment

A. Course-Level Outcomes

The college has an expectation that course outcomes, as listed in the CCOG, are both assessable and assessed, with the intent that SACs will collaborate to develop a shared vision for course-level learning outcomes.

The CS SAC has been engaged in a data-driven effort to improve student success in CS, including altering outcomes, assessments, and pedagogy. The effort is ongoing, and results have been mixed.

i. Assessable Course Outcomes

What is the SAC process for review of course outcomes in your CCOGs to ensure that they are assessable?

Course-level outcomes are reviewed when CCOG revisions are developed, even if the revisions affect only SAC-controlled fields. Outcome changes are not forwarded for approval if the changes are solely related to assessment; instead these types of changes are queued and will be included in the next major CCOG revision. No CCOG will be forwarded for approval without appropriate language for the course outcomes.

At present the following CS courses contain at least one outcome that is not accessible:

CS 140U: Collaborate in teams on system tasks.

CS 251: Be successful in subsequent coursework in the mathematical foundation of Computer Science.

The CCOGs for these courses will be revised after the General Education Redesign project is completed for the CS courses (early 2021).

ii. Changes Made as A Result of Assessment of Student Learning

Identify and give examples of changes made in instruction, to improve students' attainment of course outcomes or outcomes of requisite course sequences (such as are found in in MTH, WR, ESOL, BI, etc.), that were made based on the results of assessment of student learning.

The CS SAC's efforts to improve student attainment in the past 5 years have involved the following two areas: improving student success in the CS 160 -> CS 161 -> CS 162 sequence, which accounts for approximately 53% of total CS enrollment, and improving student access to on-campus classes

CS 160 -> CS 161 -> CS 162 Sequence

The first set of changes to these courses was driven by the LAC annual assessment project.

In 2015 – 2016, the CS SAC reviewed the Communications core outcome. Our assessment methodology in 2015 was not satisfactory, and no changes to course content or pedagogy was made as a result of this

effort. Instead, it was viewed as a "training exercise" for the SAC to improve our internal assessment process.

In 2016 - 2017 the CS SAC did not review a College core outcome, and instead assessed the program outcome of Computational Thinking. The assessment consisted of voluntary, anonymous exercises at the start of the term and the end of the term in each CS course, with the goal of determining if student achievement in Computational Thinking increased as a result of taking the course. While the SAC believes the exercises were valid and reliable instruments, we did not achieve an adequate response rate, and no changes to course content or pedagogy were made as a result of this effort. As with the previous year, this was more of a learning experience, and was the last time we used voluntary exercises.

In 2017 - 2018 the CS SAC participated in the College-wide "All In" project to assess the *Quantitative Reasoning* outcome. The Quantitative Reasoning assessment data focused on introductory course sections. The college-wide scoring did not include every student artifact in CS, but the SAC did a separate scoring for CS that included all artifacts so that we could assess program-level results. Course content changes were made in CS 133G, CS 160, and CS 161, primarily with exercises and assessments (no outcome changes). These changes have largely remained intact, but we did not "close the loop" by re-assessing the outcome.

In addition to the "All-In" effort, the SAC looked at student success in CS 162, and hypothesized that insufficient mastery or retention of prerequisite course knowledge was a factor in relatively low success rates in CS 162. We assessed CS 162 students' prerequisite knowledge level in the first week of the term. The data indicated that a significant proportion of students who passed CS 161 could not demonstrate CS 161-level skills in CS 162. This resulted in changing assessment procedures in CS 161 (on-campus proficiency tests for Online Learning sections, closed-book proficiency testing for all sections), and changing pedagogy to emphasize more lab-type activities in the classroom (instead of relegating these to homework).

In 2018 - 2019 we continued to evaluate the effects of earlier changes in CS 161. We repeated the first-week assessment in CS 162, and found that significantly fewer students entered CS 162 with a "knowledge deficit", i.e. more students were able to demonstrate CS 161-level skills in the first week of CS 162. The data did **not** support our hypothesis, however, because there was **no** significant change in student success rates in CS 162. Students were better prepared than before when starting CS 162, but were still struggling to finish the course.

In 2019 - 2020 we started pilot projects to test pedagogy changes to try to improve the student success rate in CS 162. As of this writing we have no data on the effectiveness of the changes.

The first effort is testing greater use of collaborative, multi-section software tools to build a "super-community" that includes all CS 162 students. Peer learning is important in CS, and having more peers with which to interact may help students feel more comfortable about acknowledging struggles and seeking help.

The second effort is testing online interactive textbooks. Traditional hardcopy (or electronic copies of traditional hardcopy) CS textbooks can be a struggle to read. Online interactive textbooks provide a mixture of presentation, practice, and formative self-assessment that (according to studies provided by

the publisher) result in both increased student engagement and increased student success due to more active learning.

The second set of changes to these courses was driven by the General Education Redesign project, supported by internal data on CS student success derived from BANNER reports.

The General Education Redesign project requires that Science/Math/Computer Science Gen Ed courses support the new Quantitative Reasoning outcome developed as part of the project. The SAC's review of student success data from BANNER, "All In" data from 2017 - 2018, and prerequisite assessment data in CS 162 from 2018 and later has resulted in a curriculum redesign in the CS 160 -> CS 161 -> CS 162 sequence. The revisions are still being finalized, and have not been approved, but will be submitted for GEARS approval on the "CS Meeting Day" in 2021. The changes include:

- CS 160 will remain a Gen Ed course, and will be focused at "non-Majors" who do not intend to continue with further CS courses. Students who wish to pursue CS transfer may take CS 160, depending on their background.
- CS 161 will be divided into two 4-cr courses (working numbers 161A and 161B). CS 161A will be a Gen Ed course, and will include greater emphasis on computational thinking and programming logic concepts than the current CS 161 course. CS 161 is intended for transfer students, although it may also be used to satisfy programming requirements for some PCC degrees.
- CS 161B will include greater emphasis on programming practice and Linux than the current CS 161 course.

In order to avoid increasing the number of required courses for CS transfer the CS 140U course will no longer be required. The necessary Linux skills will be taught in CS 161, following the practice of Portland State University.

Improving Student Access to On-Campus Classes

Data provided by online learning, data from BANNER reports, and data from learning assessments strongly suggests that delivery mode affects student success and student learning. Simply put, success rates in online classes are lower than on-campus classes, and one way to improve overall student learning and success is to have more face-to-face classes.

A cooperative effort among Deans and staff at every campus resulted in on-campus sections at Rock Creek, Sylvania, Cascade, and Southeast. Every PCC campus now offers face-to-face sections of 100-level CS courses, and this has resulted in a noticeable increase in the success rate among Cascade and Southeast populations who previously used online learning.

iii. Core Outcomes Mapping Matrix

For each course, choose the appropriate Mapping Level Indicator (0-4) to match faculty expectations for the Core Outcome for passing students.

There have been no changes to the core outcomes mapping matrix since 2015. See below:

Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
CS 133U	Introduction to C	2	1	3	0	2	0
CIS 133G	Introduction to Computer Games	2	1	3	2	2	2
CS 140U	Introduction to Unix	2	1	3	3	3	0
CS 160	Exploring Computer Science	2	2	2	2	2	2
CS 161	Computer Science I	2	1	3	0	3	1
CS 162	Computer Science II	2	1	3	0	3	1
CS 201	Computer Systems	2	1	4	0	3	0
CS 233G	Game Programming	2	2	4	0	4	0
CS 233U	Advanced C Programming	2	2	4	0	4	0
CS 250	Discrete Structures I	2	1	4	0	4	0
CS 251	Discrete Structures II	2	1	4	0	4	0
CS 260	Data Structures	2	0	4	0	4	0
CS 261	Programming Systems	2	0	4	0	4	0

B. Assessment of Core Outcomes

CS is a transfer program, with the key goal of preparing students to succeed in their upper-division studies in pursuit of a Computer Science degree. The CS program is designed to facilitate transfer to Portland State University. The SAC feels that it is important to note that as an LDC program with no degrees, certificates, or uniform course requirements, and with course content and outcomes largely determined by the requirements of our transfer partners, Computer Science does not prioritize student attainment of core outcomes in our curriculum. We're happy if students master core outcomes, but we are simply unable to modify our curriculum to support all of the core outcomes.

Some of the core outcomes are emphasized in Computer Science, including *critical thinking and problem solving*, and *professional competence*. These are the essential themes of Computer Science as a research discipline, in common with other STEM disciplines. Every CS course includes an emphasis on these outcomes.

In the last five years the CS SAC has gotten better at assessment. Not only is assessment of program effectiveness now viewed as a worthwhile activity (as opposed to busywork required by administrators), we have improved our assessment methodologies to the degree that meaningful data has been gathered, and actually used. The CS SAC is not as data-driven as some SACs (e.g. Math), and we do include qualitative data in our decision process.

i. Assessment Successes

Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects, highlighting efforts made to improve students' attainment of the Core Outcomes (LDC-DE disciplines) or Degree and Certificate Outcomes (CTE programs).

The core outcome of *critical thinking and problem solving* most closely aligns with what we do in Computer Science, and most of our assessment activities link back to that outcome. The "best" assessment is the one that provides the most useful and actionable information, so the assessment efforts in CS 161 and CS 162 can be highlighted. In these assessments the SAC was focused on improving student success rates in CS 162. In CS 162 virtually all of the course content aligns with critical thinking and problem solving, and a passing grade in CS 162 is evidence of achievement for this core outcome.

The SAC hypothesized that a factor in (the lack of) student success in CS 162 was preparation, i.e. some students lacked skills that should have been mastered in earlier courses. As a result, some students started falling behind in the first week of the term, and never caught up.

The SAC tested this hypothesis by assessing CS 161 outcomes in the first week of CS 162, in all CS 162 sections. If a student attained a "passing" grade (70% or better) on the assessment they would be considered "prepared" for CS 162. Since CS 161 is a prerequisite for CS 162, the supposition is that failure to attain a passing grade on the prerequisite assessment reflects a retention issue.

Since the assessment was required in CS 162 response rate was not an issue. Approximately half of the CS 162 students did not attain a passing grade on the prerequisite assessment, and as a result changes were made to CS 161.

ii. Reassessment

Do you have evidence that the changes made were effective by having reassessed the same outcome? If so, please describe briefly.

Subsequent assessment in CS 162 showed that the changes to CS 161 were effective – significantly more students attained a passing grade on the prerequisite assessment after the changes were made in CS 161.

iii. Assessment Improvements

Do you have evidence that the changes made were effective by having reassessed the same outcome? If so, please describe briefly.

This assessment occurred after some years of SAC "training" using the LAC assessment. Methodology problems encountered during LAC efforts were avoided in this assessment. Over the years we learned to avoid sampling errors, improve response rates, and test the validity and reliability of our instruments. As a result, for this assessment the data was clean, and the conclusions were valid. In a way, the effort could be called "best" simply because the SAC demonstrated a higher degree of assessment skill than in earlier efforts.

A more appropriate reason for labeling this assessment "best" is because the data showed that the SAC's assumption about the significance of preparation was not valid. Improvements in the prerequisite assessment scores did *not* result in improved student success. Prepared or not, students were (are) failing CS 162 at about the same rate, and the changes made in CS 161 did not affect student success in CS 162. That's counter-intuitive, and that is what makes this a valuable assessment effort.

Part of the motivation behind the present restructuring of CS 161 is another effort to address this issue. Currently, the beginning weeks of CS 162 include a review of the material of CS 161. When CS 161 has been extended to two courses, that review will not be necessary and more time can be spent on the core content of CS 162, which we hypothesize will increase pass rates. We will continue to assess this situation as it progresses.

iv. Challenging Core Outcomes

Are there any Core Outcomes that are particularly challenging for your (LDC-DE) SAC to assess, or difficult to align and assess within your (CTE) program? If yes, please identify which ones and the challenges that exist.

The remaining Core Outcomes are problematic for Computer Science.

Communication is, in some sense, important in every course, but is not specifically emphasized in any CS course. CS students do not write essays, make presentations, or focus on targeting a specific audience when communicating. No communications techniques beyond "put some comments in your code" are discussed in CS courses.

Cultural awareness is not an explicit aspect of our course content. Cultural awareness is absolutely critical in Computer Science, but like many such topics is not included in the lower-division curriculum of Oregon universities.

Self-reflection in not practiced in CS courses beyond grade feedback. As with cultural awareness, this is a critical component of Computer Science education - the ability to analyze (and manage) one's own skillset is a common professional requirement - but this is not a lower-division topic in Oregon.

3. Other Instructional Issues

A. Course Enrollment Trends

Please review the data for course enrollments in your subject area. Are enrollments similar to college FTE trends in general, or are they increasing or decreasing at a faster rate? What (if any) factors within control of your SAC may be influencing enrollments in your courses? What (if any) factors within control of the college may be influencing enrollments in your courses?

PCC

FTE Totals by Subject Area and Percent Difference from Previous Year

	Year									
	2013-14		2014-15		2015-16		2016-17		2017-18	
Campus	FTE	Percent Ch..	FTE	Percent Ch..	FTE	Percent Ch..	FTE	Percent Ch..	FTE	Percent Ch..
Collegewide	27,734	-5.4%	25,886	-6.7%	23,896	-7.7%	23,384	-2.1%	22,737	-2.8%
Cascade	6,369	-7.3%	5,701	-10.5%	4,937	-13.4%	4,841	-1.9%	4,729	-2.3%
RockCreek	7,541	-5.8%	7,200	-4.5%	6,796	-5.6%	6,797	0.0%	6,767	-0.4%
Southeast	2,861	5.4%	3,015	5.4%	2,745	-9.0%	2,722	-0.8%	2,530	-7.0%
Sylvania	10,963	-6.5%	9,969	-9.1%	9,224	-7.5%	8,871	-3.8%	8,580	-3.3%

CS

FTE Totals by Subject Area and Percent Difference from Previous Year

	Year									
	2013-14		2014-15		2015-16		2016-17		2017-18	
Campus	FTE	Percent Change	FTE	Percent Change	FTE	Percent Change	FTE	Percent Change	FTE	Percent Change
Collegewide	501.5	7.4%	449.6	-10.4%	414.5	-7.8%	458.1	10.5%	451.7	-1.4%
RockCreek	210.9	5.9%	206.0	-2.4%	200.1	-2.8%	208.6	4.2%	223.1	6.9%
Sylvania	290.6	8.5%	243.7	-16.2%	214.4	-12.0%	249.5	16.4%	228.6	-8.4%

Looking at the college-wide full-time enrollment data from 2013 to 2018, it is observed that there is continuous decrease in students' enrollment from the previous years. On the contrary, the Computer Science department did not face continuous decreases in enrollment. In the year 2013-2014, student enrollment increased 7.4 % from the previous year. In 2014-2015, the percent decrease for CS was 3.4% lower than the college. In 2015-2016, the decrease exactly reflected the college-wide trend. In 2016-2017, CS experienced a 10.6% increase in students' enrollment. Again, in 2017-2018, there was a small decline, but it was slightly less than the college as a whole. Therefore, we can conclude our enrollment trend is marginally better than the college FTE trends.

The periodic dip in the enrollment can be explained. As with many PCC programs, enrollment in Computer Science is inversely correlated to the regional economy. Enrollment increases in times of economic difficulty and decreases as the economy improves.

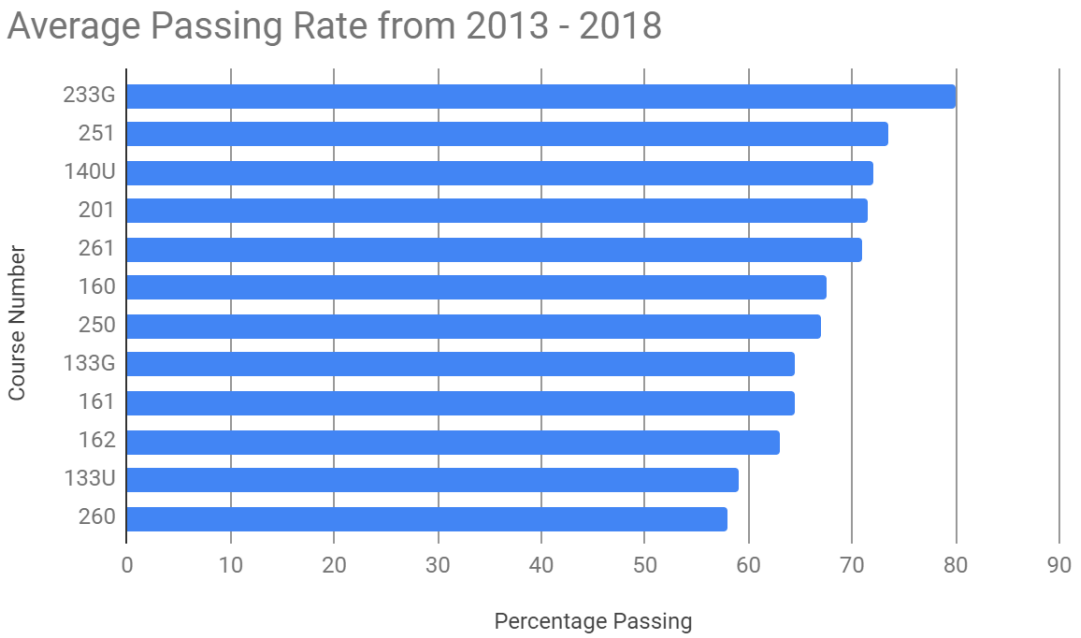
It appears a long-term national emphasis on STEM education will benefit CS programs, and the long-term outlook for the program is favorable. Next, PCC's implementation of Guided Pathways will increase enrollment, streamline the assessment of completion outcomes and enhance the transfer experience.

Additionally, any publicity or advertisement for the college and CS courses will increase enrollment. The CS SAC is also developing new courses as well as continuously updating existing courses to attract and retain students with the following goals:

- pursuing a Bachelors of Computer Science
- seeking introductory Computer Science knowledge to be used in other fields
- making a career transition to a technical field

B. Grades Awarded

Please review the grades awarded for the courses in your program. What patterns or trends do you see? Are there any courses with consistently lower pass rates than others? Why do you think this is the case, and how is your SAC addressing this?



CS 133U and CS 260 are the two courses with the lowest passing rates. The pass rates for these two courses are below 50%. In general, most of the CS courses have an average passing rate between 63% and 73%. CS 233G has the highest passing rate with 80%.

The course CS 133U, C Programming, has a steep learning curve. It is not easy for students without any prior programming experience and students sometimes mistake it as an introductory programming course, since the course does not have any prerequisites. The CS department has begun working with academic advising to make this clearer to students. Further, in the first week of class, CS 133U instructors advise students without any prior programming experience to take CS 160 instead.

Students taking CS 260, Data Structures, find the programming assignments and timed proficiency tests challenging. Instructors are working on the course, and with student input, hope to make the transition from CS 162 to CS 260 smoother. Note, CS 162 Computer Science II is the prerequisite of CS 260.

From the data above, it is observed that courses at the 200 level have higher passing rate than the 100 level courses, the two exceptions being CS 260 and CS 140U. In general, this does support the theory that students taking these higher-level courses usually major with a focus in CS, CIS or engineering. They are more serious and interested in the subject and therefore perform better overall.

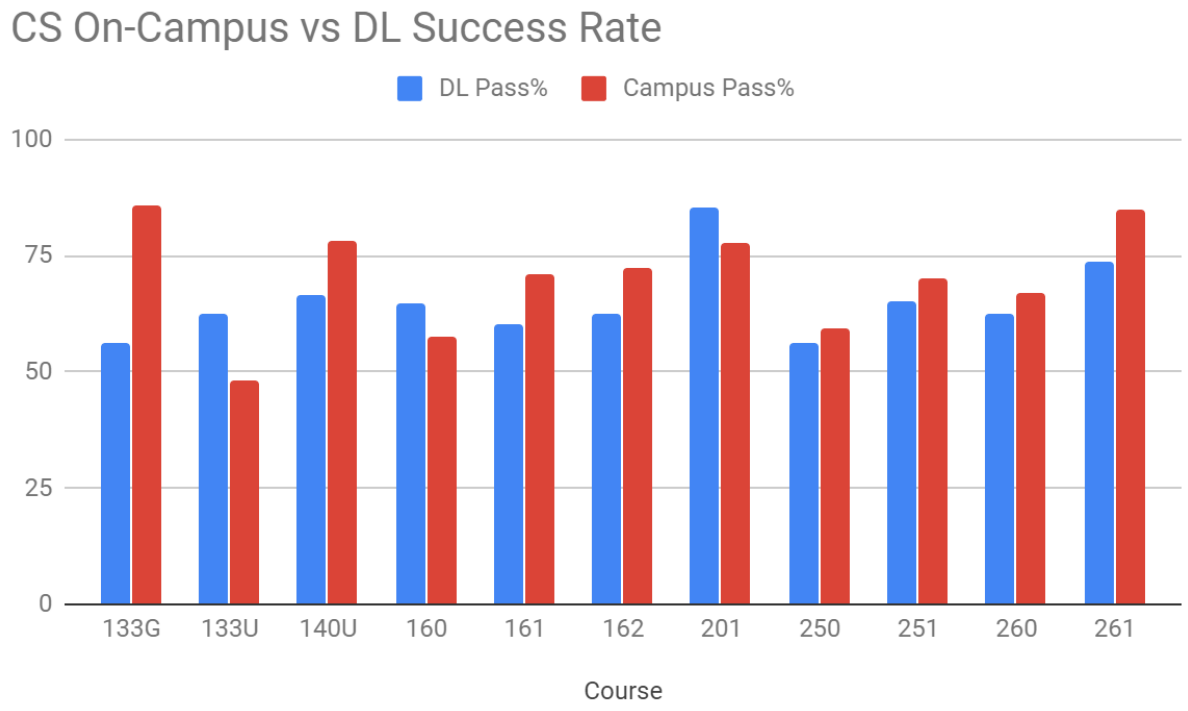
C. Distance Learning

Which of your courses are offered online and what is the proportion of on-campus and online? For courses offered both via online and on campus, are there differences in student success? If yes, describe the differences and how your SAC is addressing them. When referencing classes taught online, it is acceptable to refer to those offerings as 'OL.' In the PCC vernacular, 'Online Learning' has replaced 'Distance Learning (DL)' in the PCC vernacular due to the recent name change of the Online Learning Division.

All CS courses include Desire2Learn OL sections, with the exception of CS 233G. All CS courses are offered online at least one time per year.

Student success rates are not equivalent among delivery modes in the year 2015 (Winter, Spring, Summer, Fall), as can be seen in the Table below, with roughly 65% of distance students earning passing grades, compared with 70% of on-campus students (based on the year 2015 data).

Subject	Course	DL Pass%	Campus Pass%
CS	133G	56.4	85.7
CS	133U	62.6	48.3
CS	140U	66.6	78
CS	160	64.8	57.5
CS	161	60.3	71
CS	162	62.3	72.5
CS	201	85.3	77.7
CS	250	56	59.5
CS	251	65.3	70
CS	260	62.7	67
CS	261	73.8	84.7



The decreased success rate and increased withdrawal rate for distance learning students suggest an unmet need for student support in online classes. Computer Science has worked with OL and Disability Services to bring all of our online courses into compliance with the most recent Quality Matters and PCC design guidelines. This guarantees a high and consistent standard of online course materials and design. Furthermore, it ensures that all of our course material is as accessible as possible to students with disabilities.

However, it is important to note that despite these efforts, the online mode of delivery is measurably less successful than on-campus courses. Of course, OL is vital for equal access to courses, since many students are unable to come to campus due to work, family and other commitments. However, as professionals with a keen eye toward software and interface design, the CS department notes that the wholesale removal of human interaction from the process of learning must have an adverse effect on some student's success. We hope that in the interest of equitable student success, this problem will be addressed by the PCC administration in an appropriate manner.

Academic integrity in online courses has been an ongoing issue for our program as well as for our transfer partners. Cheating in online CS courses has been detected at PCC, PSU, OSU, and other schools. To prevent online students from cheating on exams, the CS department has implemented in-person proctored exams for CS 161, CS 162 and all 200-level courses.

D. Curricular Changes

Has the SAC made any curricular changes as a result of exploring/adopting educational initiatives (e.g., Community-Based Learning, Internationalization of the Curriculum, Inquiry-Based Learning, etc.)? If so, please describe.

Some of the changes we have implemented since the last review include:

- All Computer Science classes on-campus, hybrid and online have designated lab hours.
- CS 161, CS 162 and all 200-level classes have proctored exams. Students have the option to take the exam on-campus or online using a virtual proctoring service such as Examity.
- Made the CS 160 course accessible to all students by changing programming assignments from Ceebot to Python.
- Redesigning the CS 160 and CS 161 courses to increase student retention as well as meet changing general education requirements.

The CS SAC took the initiative to revive CS 233G. This gave students the opportunity to continue explorations in game design. There is a game development certificate at PCC and the SAC tried to collaborate, but the programs were not compatible due to the higher math requirements of the CS courses.

The Testing Proficiency Lab is a new one credit hour course. It bridges the gap for students transferring to 4-year universities by providing extra support to students taking proficiency exams.

E. Dual Credit Courses

Are there any courses in the program that are offered as Dual Credit at area high schools? If so, describe how the SAC develops and maintains relationships with the HS faculty in support of quality instruction.

The Computer Science department offers dual credit courses for eligible high school students.

Dual credit courses are offered in five high schools across the Portland Metro Area. The courses include CS 160 Exploring Computer Science, CS 161 Computer Science I, and CS 162 Computer Science II.

The CS program has an active dual-credit arrangement with Wilson High School for CS 160 and CS 161. The instructor at Wilson High School is Christopher Bartlo. Tigard High School offers CS 161, taught by Adam Cornachione, who is also an adjunct instructor at Rock Creek. Lake Oswego High School offers CS 160, CS 161 and CS 162. Gayathri Iyer, a full-time instructor at SY, teaches all three courses. Hillsboro High School and Benson High School both offer CS 160 and CS 161, taught by Theresa Alexander and David Beckler respectively. All dual credit instructors from high schools meet with PCC faculty annually at the dual credit symposium.

The Computer Science program has somewhat less flexibility in offering dual credit courses than other programs, due to the requirements posed by our transfer agreements. The sections offered for a transfer course must be fungible, which requires dual-credit courses to conform to the same standards of practice as PCC courses as well as those of our transfer partners. Department Chairs review syllabi, assessments, and course materials used in dual credit classes, which must be approved by a PCC Dean. Course outcomes, course content, instructional technology (e.g. program development environment), course credit hours, contact hours, and student assessments must be coordinated. A student who completes a transfer course offered as dual-credit should be able to pass the final examination offered in a "traditional" section of the same course. These requirements present constraints for the high school instructor that can be difficult to accommodate in a traditional high school environment. The inability of high schools to offer "exact clones" of PCC courses has been the primary reason for the paucity of CS dual-credit offerings.

F. Course Evaluations

Please describe the use of Course Evaluations by your SAC. Have you created SAC-specific questions? Do you have a mechanism for sharing results of the SAC-specific questions among the members of your SAC? Has the information you have received been of use at the course/program/discipline level?

The SAC uses the online college-wide course evaluation system for a variety of purposes. It has been observed that the response rate for online evaluations is significantly lower than the response rate for paper-based evaluations used in the past. This decreased response rate adversely affects the breadth of student feedback to the program. In all cases, the information collected for a specific course has been useful for the individual instructor, but general inferences are limited, based on response rate. When the data provide evidence that suggest changes in a course, or changes for the instructor teaching the course (which is more common), the matter is addressed by the instructor and Department Chair. Inconsistencies in course offerings uncovered during surveys are discussed at the SAC level whereas instructional practices or course material that conflict with course CCOG or SAC policies are addressed by the Department Chair or Division Dean.

Other than the District-wide questions, the CS SAC has also added specific questions in the evaluation:

- I would have benefited from online tutoring for this course.
- My previous CS classes adequately prepared me for this class.

Discuss the issues surrounding online tutoring here.

The second question helps the SAC to understand whether there is a seamless transfer from one course to another. If transition from one course to another is not smooth, the CS SAC addresses the issue and fills the gap.

4. Students and Community

A. Demographics

Have there been any changes in the demographics of the student populations you serve? If there have been changes, how have they impacted curriculum, instruction, or professional development, and, if so, in what way?

i. Age and Racial Demographics

As shown in the following table, the CS department is on par with the CIS department and other science and engineering departments in terms of racial diversity in the period from 2015-2020. The CS department also has quite similar age demographics to a variety of SCI/ENG departments. The departments included in the SCI/ENG category were BI, BIT, CET, CH, CIS, GE, MET, MT, and PHY.

Subject:	CS		CIS		SCI/ENG	
Headcount:	7,392		6,296		39,241	
Female:	1,761	24.50%	2,202	36.00%	21,279	55.80%
Male:	5,437	75.50%	3,922	64.00%	16,866	44.20%
Not spec:	194	125	172		1,096	
White:	4,390	59.40%	3,890	61.80%	23,202	59.10%
Asian:	711	9.60%	552	8.80%	3,442	8.80%
Hispanic:	653	8.80%	560	8.90%	4,484	11.40%
Black:	297	4.00%	317	5.00%	1,651	4.20%
Native Am:	44	0.60%	45	0.70%	279	0.70%
Pacific Is:	35	0.50%	33	0.50%	245	0.60%
Multiracial:	492	6.70%	391	6.20%	2,670	6.80%
International:	222	3.00%	143	2.30%	767	2.00%
Not spec:	548	7.40%	365	5.80%	2,501	6.40%
to 19:	2,851	38.60%	1,240	19.70%	14,452	36.80%
20-24:	1,875	25.40%	1,394	22.10%	10,187	26.00%
25-29:	1,285	17.40%	1,257	20.00%	6,395	16.30%
30-39:	1,024	13.90%	1,391	22.10%	5,654	14.40%
40-49:	262	3.50%	662	10.50%	1,856	4.70%
50+:	95	1.30%	352	5.60%	695	1.80%
Average:		24		29		24

As the following table demonstrates, the CS department has experienced modest college-wide increases in racial diversity in the period from 2013-2018.

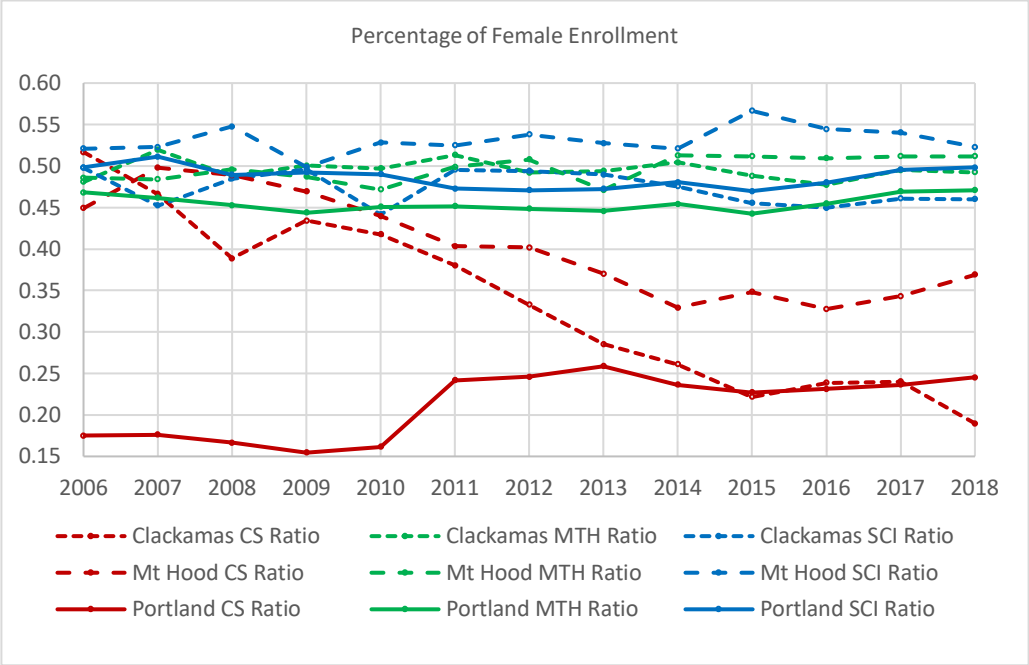
	Year									
	2013-14		2014-15		2015-16		2016-17		2017-18	
Race/Ethnicity	Headcounts	% of Total	Headcounts	% of Total	Headcounts	% of Total	Headcounts	% of Total	Headcounts	% of Total
Asian	218	9.4%	213	10.2%	220	11.5%	239	11.6%	232	11.6%
Black	84	3.6%	68	3.2%	72	3.8%	88	4.3%	82	4.1%
Hispanic	151	6.5%	153	7.3%	141	7.4%	162	7.8%	151	7.6%
Multi	102	4.4%	115	5.5%	104	5.5%	137	6.6%	135	6.8%
Native	11	0.5%	10	0.5%	10	0.5%	10	0.5%	9	0.5%
Pacific	12	0.5%	12	0.6%	10	0.5%	10	0.5%	12	0.6%
Unreported	198	8.6%	159	7.6%	150	7.9%	158	7.6%	176	8.8%
White	1,532	66.4%	1,368	65.2%	1,199	62.9%	1,262	61.1%	1,203	60.2%
Grand Total	2,308	100.0%	2,098	100.0%	1,906	100.0%	2,066	100.0%	2,000	100.0%

In the following table, which again considers the CS department in the period 2015-2020, the racial and age demographics at the SY and RC campuses are quite comparable to each other, and to the sciences college-wide, whereas the CA and SE have more racially diverse student populations. Given that the CA and SE campuses are located in more diverse neighborhoods, it is encouraging that our student populations at these new locations reflect the diversity of their surrounding communities.

CS 2015-20	ALL		SY		CA		RC		SE	
Headcount:	7,392		4,742		119		4,389		29	
Female:	1,761	25%	1,066	23%	31	26%	1,026	24%	1	4%
Male:	5,437	76%	3,551	77%	88	74%	3,250	76%	25	96%
Not spec:	194		125		-		113		3	
White:	4,390	59%	2,846	60%	53	45%	2,603	59%	14	48%
Asian:	711	10%	457	10%	9	8%	441	10%	8	28%
Hispanic:	653	9%	384	8%	13	11%	381	9%	2	7%
Black:	297	4%	192	4%	16	13%	169	4%	0	0%
Native Am:	44	1%	27	1%	-	0%	27	1%	0	0%
Pacific Is:	35	1%	25	1%	-	0%	23	1%	1	3%
Multiracial:	492	7%	312	7%	12	10%	282	6%	1	3%
International:	222	3%	159	3%	1	1%	125	3%	3	10%
Not spec:	548	7%	340	7%	15	13%	338	8%	0	0%
to 19:	2,851	39%	1,707	36%	75	63%	1,688	39%	13	45%
20-24:	1,875	25%	1,262	27%	22	19%	1,089	25%	8	28%
25-29:	1,285	17%	885	19%	11	9%	772	18%	2	7%
30-39:	1,024	14%	673	14%	11	9%	619	14%	5	17%
40-49:	262	4%	153	3%	-	0%	170	4%	1	3%
50+:	95	1%	62	1%	-	0%	51	1%	0	0%
Average:	24		24		19		24		22	

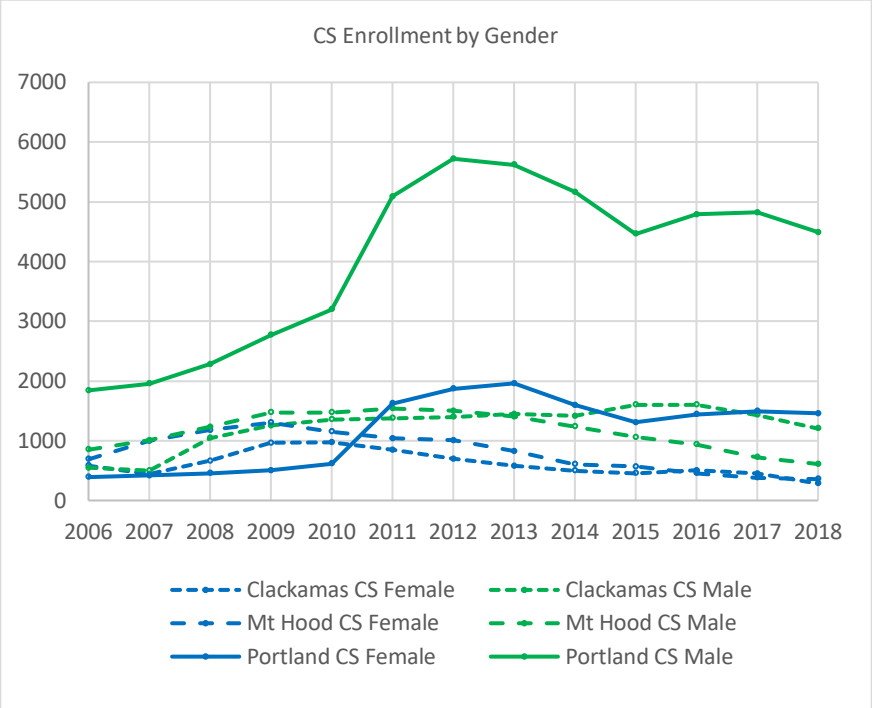
ii. Gender Demographics

The following three graphs explore the gender divide in CS. The table from which these graphs were generated was furnished by the HECC and is listed in the appendix.

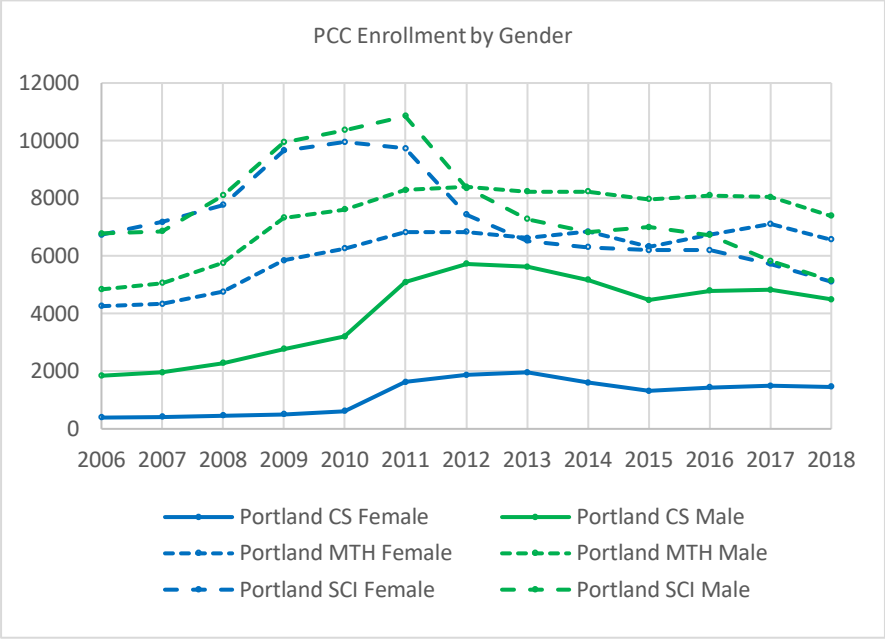


The above graph has a couple of interesting properties that are worth highlighting. First, CS is the only department with any significant variability in the ratio of male to female students. The percentage of women enrolled in math and science courses stays roughly around 50%, probably because math and science are required while CS is not. Second, the CS gender gap has changed very differently at the three schools over the last 15 years. CCC and Mt. Hood both began with almost no gender gap, but while CCC and has had a serious ongoing decline in female enrollment, Mt. Hood had a decline and seems to be rebounding. PCC, on the other hand, began with the worst gender gap and has stayed quite consistent but for one significant increase in 2010.

In the next graph, it becomes clear why this happened. While CS enrollment grew for everyone in 2005-2010, it then levelled off for CCC and Mt. Hood. For PCC however, 2010 was a tremendous year. The reason why the gender gap decreased in that year was that there were huge gains in enrollment, but proportionally more for women than men. After that year, enrollment rose and fell, but roughly equally for men and women, so the gender gap again remained consistent. It is worth noting that the only improvements in the gender gap resulted from a general decrease where men's enrollment decreased more, or a general increase where women's enrollment increased more. At no time did any institution decrease the gender gap by significantly increasing the enrollment of women while men's enrollment stayed constant or decreased. One way of interpreting this is that no institution successfully addressed the gender gap in a proactive matter since any improvement seemed accidental.



The graph below shows the evolving gender gap at PCC for CS compared to math and science. Here, in 2015-2017, the PCC math department shows the only example of closing the gender gap by increasing female enrollment while male enrollment remains constant.



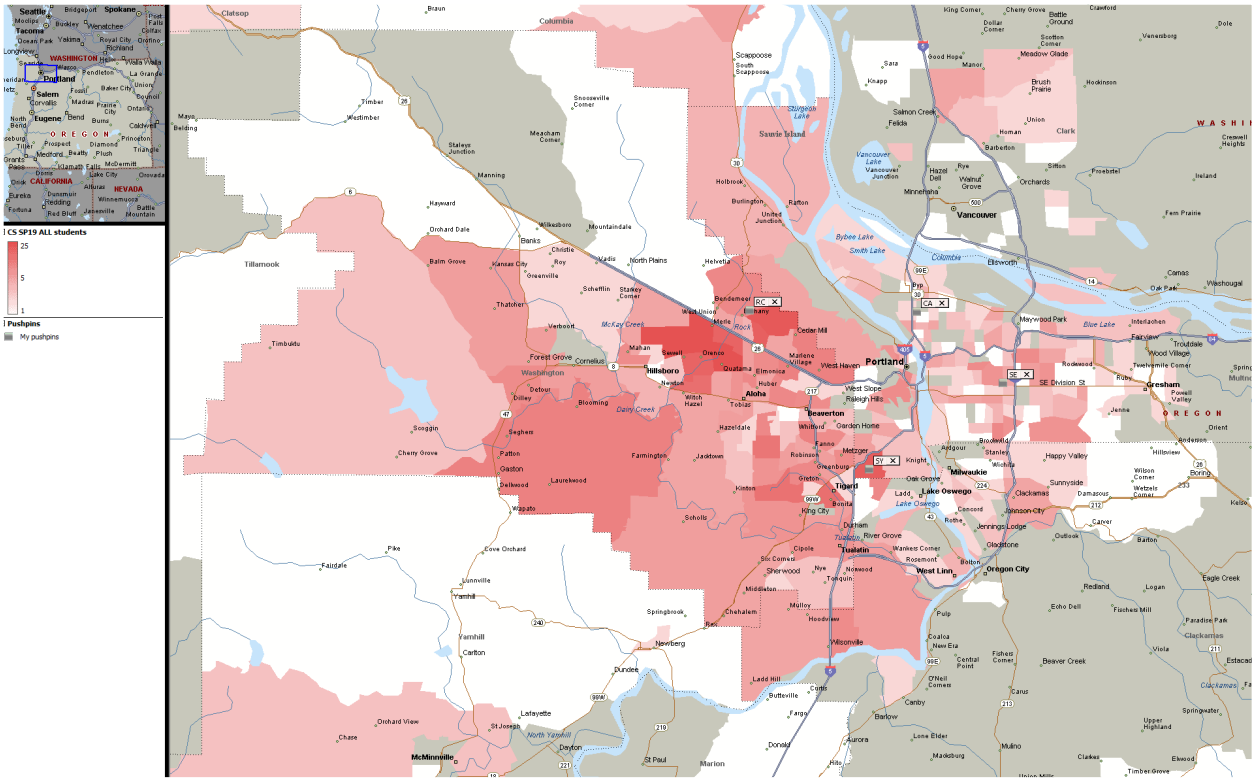
iii. Geographic Demographics

Our students come from different geographical regions but mostly from the areas surrounding the RC and SY campuses. In the past year, classes have been added to the SE and CA campuses that have been showing moderate success. These courses are currently been scheduled by SY. The additional classes at new campuses have been filled by adjuncts and FT instructors from SY. One effect of these new offerings is that it seems some of our online classes have lost enrollment. This was expected since the students from the SE area that were online CS students may now go to campus classes. We alternate DL and campus offerings, giving students several options during the school year.

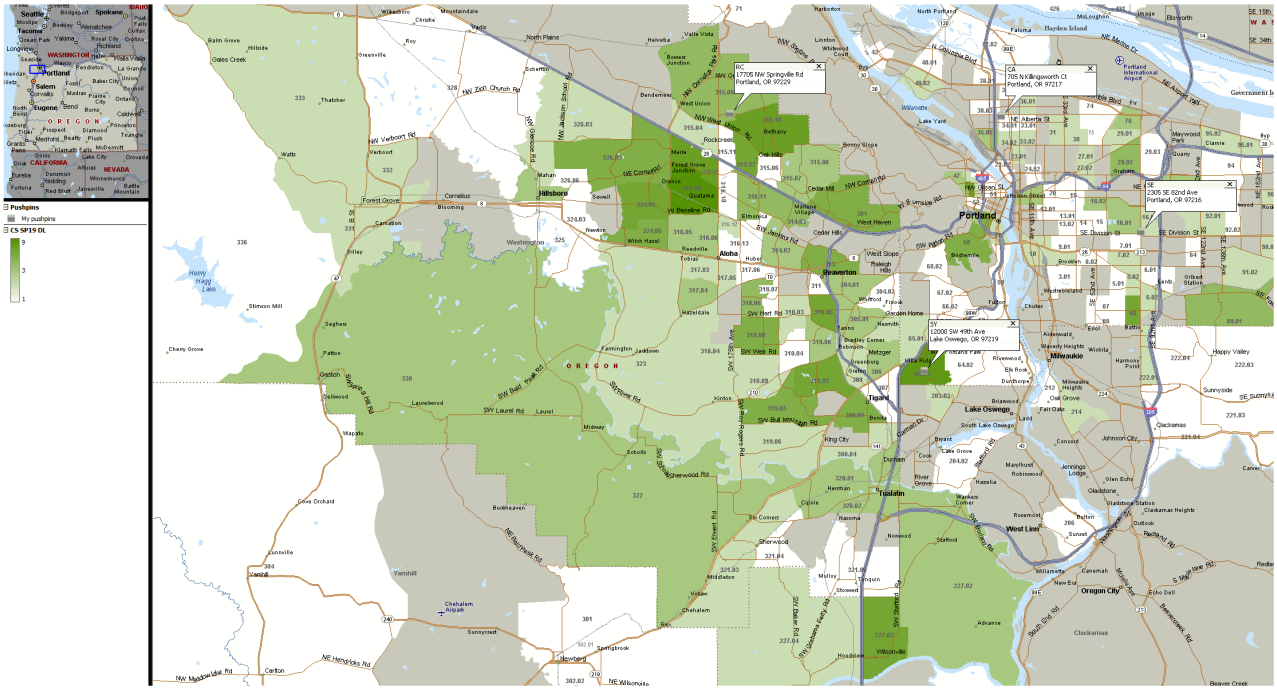
Another location that worked well in the past was the CLIMB center, but we ceased offerings at that location since the facility needed the space for other programs at that location. Some future plans include arrangements with the Hillsboro HS dual credit program to offer CS classes at PCC Hillsboro. Conversations have been initiated to start a model where the CS instructor from HHS would teach their CS classes at PCC and credits would count for HS and PCC. Since we are in early stages of conversation, we have not formally begun this program yet.

The maps below show that there are a good number of students that live in the RC/SY area. These two maps show where our students resided in Spring 2019 with references to the campus locations. These are based on Census tract information that is more reliable and precise than zip codes, created with Microsoft's Map Point 2013. The district map includes all of our CS DL and Campus students. The darker red areas could have 10+ students in a particular area. The white areas have 1 student and 2 in the lighter shaded areas.

All CS students, Spring 2019:



ALL CS DL students, Spring 2019:



B. Strategies

What strategies are used within the program/discipline to facilitate success for students with disabilities? If known, to what extent are your students utilizing the resources offered by Disability Services? What does the SAC see as particularly challenging in serving these students?

We comply with the accommodations requested by the office of students with disabilities. They have been helpful in guiding us on how to proceed in situations that are unique. We are always in the process of redesigning assignments and DL lectures, making sure to comply with federal laws and PCC policy. We still have some courses that need to pass the final review, but most of them are accessible. Additionally, our syllabi include statements urging students to consult DS if they need academic accommodations. Instructors go over the syllabus on the first day and point out this section. Of course, CS instructors are fully supportive of any accommodations recommended by Disability Services. We also offer a variety of courses fully online which is often preferred by students with mobility issues. Also, some students prefer to take online classes because their personal computers are equipped with assistive technologies.

The DS office has been supportive, but most likely overwhelmed, in assisting with closed captioning. They were awesome with adding captions to lecture videos for numerous professors. However, in another case, a professor's lecture materials contained screen shots of code to prevent students' cheating by copy and pasting the answer. This has been an issue for a visually impaired student this term. DS was informed of the situation but did not respond. So far he's figuring it out, but it would have been nice if he could participate more during lecture. We do a lot of pair programming (collaborating with other students) and that is helping to fill the gap where DS support staff should have stepped in.

Some challenges in accommodating DS students reported by our SAC include late accommodation reporting, when students provide DS notices in week 4 or 5. This makes it very difficult to serve them, as even the extended deadline is past for some of the deadlines. Additionally, all CS courses use software tools that have been verified to be accessible with the exception of gaming courses. These gaming classes provide a practically insurmountable challenge to visually impaired students since they require the creation and use of computer graphics. These objects and the tools used to create them are both absolutely required for course content and simultaneously totally inaccessible to students with a visual disability.

Another important challenge regarding DS is the actual PCC policies themselves. For example, a change to the CS 160 assignments made use of the text-based Python programming language rather than the more fun and engaging graphical program called Ceebot. This allows students with disabilities to have identical access to this particular class at the expense of all other students. Additionally, publishers often offer tools that would be of great benefit to students, but after review, they can't be used due to accessibility issues.

C. Online Strategies

What strategies are used within the program/discipline to facilitate success for online students? What does the SAC see as particularly challenging in serving online students?

Our programs consists of approximately 50% OL students. Since our last program review we have had constant improvements in our online labs. Thanks to the new improved technologies in D2L, students have the able to meet with their professors online for weekly labs.

One of the main issues that has affected our program is the introduction of proctored exams. Our main partner, PSU, has incorporated this method of assessing their students to alleviate the concerns with cheating. We copied their model by also requiring that our online students show up in person for their exams and some performance tests. The online system has had many types of software to address this concern but the SACC still feels that the best way to avoid cheating is to bring our students to campus. This practice could exclude some students who live too far from a PCC campus, but online testing software like Examity, and simply allowing to take exams at other schools' testing centers has ameliorated this issue.

D. Feedback

Has feedback from students, community groups, transfer institutions, business, industry or government been used to make curriculum or instructional changes (if this has not been addressed elsewhere in this document)? If so, describe.

We are constantly making changes to comply with state guidelines and changes made to our partner institutions so our students have a smooth transfer. As a transfer program, the vast majority of the work of our SAC centers on this issue. Some examples of this are listed in this document in section 1B.

5. Faculty

A. Diversity

Provide information on how the faculty instructional practices reflect the strategic intentions for diversity, equity and inclusion in PCC's Strategic Plan, Theme 5. What has the SAC done to further your faculty's inter-cultural competence and creation of a shared understanding about diversity, equity, and inclusion?

The Computer Science department faculty consists of:

- Four full-time faculty members at Sylvania
- Two full-time faculty members at Rock Creek
- 3 multi-year contract (MYC) part-time faculty
- 20 additional part-time faculty

There are no open full-time positions in the CS program.

We have a diverse faculty to serve our diverse student body. The six full time faculty members come from four different ethnic backgrounds. Among them, three are male and three are female. With the gender imbalance in the high-tech industry, we hope to inspire more girls going into STEM fields. Our faculty range from recently graduated young members to instructors with 30+ years of industry/teaching experiences.

The adjunct faculty pool contains approximately 23 instructors, some of whom teach at multiple campuses. Many of them have been teaching at PCC for over 10 years. Many others do work in the computer industry at firms such as Intel and Tektronix. Their experience provides valuable advice about current trends in the industry to students in our 200-level courses.

The CS SAC has been working to further our faculty's intercultural competence and create a shared understanding of diversity, equity, and inclusion (DEI). Specific examples include:

- Multiple faculty members have attended Cultural Responsive Teaching events.
- One instructor completed a 10-week Equity and Cultural Responsive Teaching online course.
- Various faculty attended YESS and Equity in STEM events.
- A few faculty members are part of the internationalization group. They reach out to international students during welcome week and provide guidance throughout the school year.
- As a result of YESS training, faculty practice and share experiences around creating an authentic culture of equity-minded teaching and learning environments. From creating an equity-minded teaching philosophy and course syllabus to developing equity-minded engagement, faculty members participate in community building both online and in on-campus environments.
- Gayathri has shared her practice of creating an equity-minded syllabus. She changed the language about late policy, avoiding the word "penalty." Instead, she encourages students to communicate with the instructor. She started to hold her office hours in more accessible areas such as the cafeteria. A short introduction video is included instead of a picture of the instructor for the online course.

B. Qualifications

Report any changes the SAC has made to instructor qualifications since the last review and the reason for the changes.

There have been no changes to the minimum current instructor qualifications, which are:

Master's Degree in Computer Science or Software Engineering is preferred. Minimum requirements shall be a Master's degree in a related field such as Electrical Engineering, Math, Computer Engineering, Information Systems or Systems Science.

Preference will be given to candidates with relevant recent industry or education/teaching experience. Computer science is such a quickly evolving field that no one of us can be current in all aspects of it in its entirety. Instead, it is important that all of us work to stay current in part of the field and important that we share our expertise with each other. All the members of the computer science discipline at PCC feel that it enhances our teaching and overall understanding when we work with the other faculty in our discipline. We learn from each other about ways of teaching methods to best help our students, and what is occurring in our rapidly changing field.

C. Professional Development

How have professional development activities of the faculty contributed to the strength of the program/discipline? If such activities have resulted in instructional or curricular changes, please describe.

The Computer Science faculty has been engaged in a variety of activities to support our program during the last review period. In the fast-changing software community, it's crucial for faculty to stay current and keep up with the technologies that industry is using. These professional development activities include:

- Attending technical conferences on various new technologies
- Attending game programming conferences to keep our gaming courses current.
- Participating in workshops and seminars offered by Microsoft, Nike and other local software companies.
- Attending OSCON

Communication with faculty from partner universities keep us informed of upcoming events and curricular changes that most faculty members are engaged and participate in. These events include:

- State-wide department chair meetings
- Annual CCSC conference
- Faculty visits to other institutions
- Participation in IT shows
- Visits to foreign universities to support PCC's Internationalization efforts
- Preview days
- Advising days

CS faculty also stays active and contributes to the PCC community in various areas. The activities include:

- Participating in Instruction Leadership Team
- Involvement in drone curriculum at PCC
- Participating in TLC workshops
- Attending critical thinking workshop
- Participating in online STEM Equity and Inclusion training
- Attending the Anderson Conference
- Attend QM workshops

CS faculty also reaches out to secondary school to spark interest in STEM fields. The activities include

- Teaching AP and dual credit classes at local high schools
- Coaching middle school, high school math, coding, cyber security competition teams
- Attending dual credit symposia
- Presenting gaming software at elementary schools

Other activities include:

- Collaborating with publishers on interactive course materials
- Collaborating with faculty from Microelectronics department on summer camp effort

6. Facilities

A. On Campus Facilities

Describe how classroom space, classroom technology, laboratory space, and equipment impact student success.

Since the Computer Science curriculum is mainly devoted to computer programming, which must be done on a computer, regular access to a computer both during and outside of class is absolutely essential to student success. The CS department makes use of computer equipped classrooms and labs at each of the four major campuses: SY, RC, CA and SE. At present, lab facilities are adequate for the volume of student need outside of class time, and there have not been any difficulties scheduling CS classes at the RC, CA or SE campuses. However, at the SY campus, where the bulk of our on-campus courses are offered, there has been a shortage of classroom availability. This has adversely affected the department's ability to schedule CS classes at appropriate times. With more construction at SY on the way, it is more important than ever that the administration ensure our department's access to classroom space. In an effort to be accommodating, it would be possible in some cases for CS faculty at SY to conduct lecture in a non-computer equipped classroom, then transfer over to a computer equipped classroom for lab sessions. We hope to continue to work with administration to resolve this issue.

B. Outside and Online Resources

Describe how students are using the library or other outside-the-classroom information resources (e.g., computer labs, tutoring, Student Learning Center). If courses are offered online, do students have online access to the same resources?

The CS department has an extensive network of student tutors dedicated specifically to the CS curriculum. On average, CS tutoring is offered for about 5 hours per day at the SY campus and about 3 hours per day at the RC campus. The CS department also offers online tutoring, but because the service is only offered for approximately 1 hour per week, it cannot be very helpful to students. This is an obvious equity issue that needs to be addressed. Furthermore, although the department began offering CS classes at the CA and SE campuses over two years ago, there is still no CS tutoring available at either of these campuses. Given the socioeconomic disparity between student populations at the SY and RC campuses vs. the SE and CA campuses and the college's putative commitment to equitable student success, this situation is especially disheartening. The CS department hopes to see this situation corrected as soon as possible.

Unlike math or writing, domain specific knowledge in Computer Science is not widespread. At the present time, students are unable to obtain homework help or tutoring at the library, SLC, TLC, nor at the Women's Center, Multicultural Center or Veterans' Center. It would be an excellent idea to host CS homework help and tutoring at these centers, especially in the interest of supporting a more diverse student population in CS. However, the people who would give this help would probably have to be hired solely for that purpose since CS knowledge is so specific - one couldn't expect a math or writing tutor to be able to help with CS curriculum. This is why the SY and RC tutors are mainly PCC CS students who are just further along in the program. Our recommendation is to use this proven approach at the

CA and SE campuses, and to host these tutors in the centers such as the SLC, Women's Center, or Maker Spaces, in order to address important YESS goals such as bridging the gender gap.

Another means that we might leverage student tutors is during actual class-time. The Multimedia and Mathematics departments have used flipped classrooms to great effect and the CS department is exploring this possibility as well. If successful, additional staff that could assist CS professors in managing classroom activities could be quite helpful for student engagement and retention.

C. Advising and Centers

Does the SAC have any insights on how students are using Academic Advising, Counseling, Student Leadership, and Student Resource Centers (e.g., the Veterans, Women's, Multicultural, and Queer Centers)? What opportunities do you see to promote student success by collaborating with these services?

Our dedicated computing advisor and career specialist are our heroines who present our students with the big picture and the pathways to success. Our academic advisor, Michelle Maxwell, guides our students through the tangled maze of CS transfer requirements for Oregon universities and beyond with grace and precision. Ava Stephens, our career specialist, maintains a huge network of connections to the tech industry, obtaining internships that ultimately lead to great careers. With a significant reorganization in the works at PCC, the CS department would like to take this opportunity to remind administrators of the absolutely VITAL role of these two counselors. The loss of either position to a general advisor without this specialized knowledge would be disastrous to student success, whereas lending them more support will undoubtedly have a profound positive impact on student life after PCC.

7. Recommendations

With another remodel coming at the SY campus and demand for classroom space increasing, it is more important than ever to allocate sufficient space for our program at times that students can attend. While not ideal, more temporary classroom space could be created at SY so long as it is equipped with the proper technology. Or, classes could to be moved to other campuses and related scheduling and budget issues addressed by administration. It is simply not acceptable to transform on-campus courses into DL courses due to the equity issues noted above.

In the upcoming reorg, it will be crucial to address student advising. A sane approach would be to have discipline specific advisors available at each campus district-wide. In the same vein, counselors are essential to student success. A system must be put in place so that CPN's trigger an email from an academic counselor followed by mandatory visit to said counselor – currently, they do neither. How can we help students that are struggling if there is no efficacious communication between faculty and support staff?

Another topic to be addressed in the reorg is class scheduling. Currently, this is done in an impromptu fashion by department chairs, but this is tough on students since classes in different departments often conflict. A district-wide scheduling department for related disciplines should be established. Or, a system created so that department chairs can confer with chairs of related disciplines to take on this arduous task, and are compensated for their time.

Tutoring for CS needs to be made available at the SE and CA campuses. Every quarter, multiple students request this basic support system. This should have happened years ago when the programs first began.

Currently, the CS Linux server is supported by CS faculty rather than IT. This is confusing for students and places undue strain on faculty. The correct approach would be to incorporate Linux access into PCC's existing IT infrastructure like D2L. This would likely be an extended project, but will be necessary for the CS department to continue to host student work on Linux.

A project should be undertaken to bring the CS and CIS departments closer together since students often take classes in both of these departments. Faculty should attend both departments' SAC meetings and receive compensation for doing so. A pathway for faculty from one department to easily teach a course in the other should be established. Finally, a project should be undertaken so that the departments could establish a system of cross-credit for degrees and certificates.

Lastly, as has been mentioned multiple times above, these changes to support our students need to be undertaken in a principled way, district-wide, in the coming reorg. This is the whole spirit of YESS. In that spirit, redistributing the full-time faculty among the four campuses should be seriously considered. The current impromptu situation of SY lending out faculty needs to stop, and a permanent solution put in place. The most important part of PCC is the instruction, and for true equity among students, the quality of instruction must be the same for all campuses.

Appendix

College	Sub	Gender	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
		Female	582	437	663	964	973	845	697	579	499	456	502	451	283
		Male	544	500	1043	1256	1356	1377	1397	1449	1412	1600	1601	1428	1208
	CS	Ratio	0.52	0.47	0.39	0.43	0.42	0.38	0.33	0.29	0.26	0.22	0.24	0.24	0.19
		Female	1264	1412	1545	1706	1864	2035	2087	1867	2002	2106	2196	2148	2039
		Male	1364	1306	1624	1701	1887	1931	2154	1913	1966	2207	2404	2189	2101
	MTH	Ratio	0.48	0.52	0.49	0.50	0.50	0.51	0.49	0.49	0.50	0.49	0.48	0.50	0.49
		Female	1411	1242	1583	1948	1762	2059	2105	1979	2162	1945	2019	1954	1888
		Male	1424	1504	1683	1980	2229	2095	2156	2062	2386	2327	2472	2287	2216
Clackamas	SCI	Ratio	0.50	0.45	0.48	0.50	0.44	0.50	0.49	0.49	0.48	0.46	0.45	0.46	0.46
		Female	693	999	1181	1302	1154	1040	1009	825	608	567	458	378	357
		Male	850	1007	1234	1473	1472	1539	1501	1404	1238	1062	940	724	610
	CS	Ratio	0.45	0.50	0.49	0.47	0.44	0.40	0.40	0.37	0.33	0.35	0.33	0.34	0.37
		Female	1343	1374	1466	1652	1648	1866	1867	1598	1983	1781	2107	2085	1935
		Male	1422	1466	1490	1741	1845	1874	1808	1795	1883	1699	2030	1990	1845
	MTH	Ratio	0.49	0.48	0.50	0.49	0.47	0.50	0.51	0.47	0.51	0.51	0.51	0.51	0.51
		Female	1068	1124	1256	1428	1446	1544	1471	1391	1286	1298	1119	1101	935
		Male	982	1025	1038	1435	1290	1397	1263	1246	1182	993	936	937	853
Mt Hood	SCI	Ratio	0.52	0.52	0.55	0.50	0.53	0.52	0.54	0.53	0.52	0.57	0.54	0.54	0.52
		Female	391	419	457	506	616	1622	1868	1961	1599	1310	1441	1494	1457
		Male	1843	1958	2285	2769	3199	5091	5721	5622	5164	4460	4790	4824	4489
	CS	Ratio	0.18	0.18	0.17	0.15	0.16	0.24	0.25	0.26	0.24	0.23	0.23	0.24	0.25
		Female	4257	4336	4757	5845	6253	6819	6834	6622	6847	6324	6747	7109	6570
		Male	4839	5060	5752	7326	7613	8287	8398	8236	8227	7966	8097	8040	7386
	MTH	Ratio	0.47	0.46	0.45	0.44	0.45	0.45	0.45	0.45	0.45	0.44	0.45	0.47	0.47
		Female	6728	7173	7766	9650	9954	9732	7433	6522	6304	6200	6204	5719	5106
		Male	6774	6855	8102	9944	10358	10847	8350	7280	6819	6998	6722	5826	5146
Portland	SCI	Ratio	0.50	0.51	0.49	0.49	0.49	0.47	0.47	0.47	0.48	0.47	0.48	0.50	0.50