Portland Community College
Computer Science Program review
2014 - 2015

Li Liang                      Walter Morales                     Gayathri Iyer
Sylvania                      Rock Creek                          Rock Creek
SAC Chair                      wmorales@pcc.edu                    gdiyer@pcc.edu

Nick Insalata                 Doug Jones
Sylvania                      Sylvania
nicholas.insalata@pcc.edu      cdjones@pcc.edu

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Crede quae habes, et habes
Computer Science Program Review

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1 Program Overview

1(a) Educational Goals

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.

Quick Facts About CS

1. Transfer program
2. 2,308 students and 501 FTE (2013-2014)
3. 22% of students are female
4. 100-level courses comprise 82% of FTE
5. 12% of intro CS students move to 200-level CS courses at PCC
6. 28% of 200-level students did not take a 100-level CS course at PCC

PCC’s primary transfer partner for Computer Science is Portland State University. The “core transfer” path for PSU includes 101 credit hours of required classes1 including 24 credit hours of CS classes2. An additional 12 credit hours of PCC CS classes are recommended3 in order to ensure 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

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1 Described in the PCC Transfer Guide
2 CS 162, CS 201, CS 250, CS 251, CS 260, and CS 261
3 CS 140U, CS 160, and CS 161
content, not the source sequence. There are fewer required transfer courses to PSU at this time, for example, that 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.

A statewide Associate of Science Oregon Transfer - Computer Science degree (ASOT-CS) has been created as this report is being prepared, and the impact of this degree on PCC’s CS program is uncertain. The ASOT-CS degree does not address the fundamental problem of dissimilar transfer requirements among Oregon universities, and we expect that students will continue to select their courses based on their transfer destination, rather than ASOT-CS degree requirements. The PCC CS program will provide support as needed to ensure our students are eligible to transfer to their university of choice.

1(b) Changes Since Last review

The significant changes since the last program review include

- Most on-campus courses are now in CLWEB format, with 2 or 3 hours per week online.

- All CS courses are offered as Distance Learning courses. PCC is the only area school that offers all required CS transfer courses online.

- All CS programming courses except CS 161 require students to use the Linux environment for program development.

- Second term C Programming (CS 234U) has been discontinued due to low enrollment.

- Second term Game Programming (CS 233G) has been discontinued by choice to allow resources to be deployed elsewhere.
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- Program development using Apple’s OS X technology has been discontinued by choice to allow resources to be deployed elsewhere.

- Measures to ensure academic integrity (particularly in online courses) have been expanded.

1(c) Change As A Result of Last review

The CS program constantly changes, and many of the changes were anticipated in the last review. While it can not be said 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 and results from the last review include:

1. Work with College leadership and the College community to expand the instructional technology resources available to Computer Science students. There are fewer seats available in computer-equipped classrooms now than were available in 2010, primarily due to the re-purposing of space to support the new GIS program. A hybrid Windows/OS X lab was created in TCB 309, but resource and technical issues resulted in its conversion to Windows-only last year. The CS program offered a mobile platform programming course for two terms, but this effort was later transferred to the CIS program due to resource constraints in CS.

2. Innovate class delivery and pedagogy to reduce student costs. It is unfortunate that student costs have not decreased since the 2010. Some innovations have occurred, such as online textbook rentals, and significant paper reductions have occurred through increased use of online homework submissions.

3. Increase faculty expertise. Membership and participation in technical societies such as the ACM and IEEE has increased among the CS faculty, as has conference attendance.
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4. Continue to implement innovative curriculum changes. A number of curriculum changes have been implemented since 2010. Changes in the core CS curriculum largely are driven by changes in University transfer requirements. Changes designed to promote PCC college-wide outcomes largely are driven by the annual Learning Assessment Council self-assessments.

5. Expand outreach efforts to K-12 and industry stakeholders. The CS program has increased its participation in statewide groups such as the OCCC and has active dual-credit arrangements.

2 Outcomes and Assessment

2(a) Course Outcomes and Assessment
The CS program has implemented a number of pedagogical changes as a result of our ongoing assessment of student learning, including:

1. Restructured lab sessions in all CS courses through the implementation of CLWEB format.
2. Increased frequency of in-class, closed book assessments to discourage academic dishonesty.
3. Increased used of proficiency testing “gateway” assignments.
4. Redevelopment of course outcomes (in CCOGs) to facilitate measurement.

2(b) College Core Outcomes and Assessment
The CS SAC has participated in the annual Learning Assessment Council self-assessments. Not all courses directly address core outcomes, but the program as a whole does address all core outcomes. Alignment is as follows:

Communication  CS students must communicate complex technical information about algorithms, programs, and software systems to instructors and fellow students. Students must write structured comments in program code, create informative and accurate discussion posts in Desire2Learn, and (in some classes) write expository essays on technical subjects.

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4 The May 9, 2015 meeting will be held at Rock Creek campus
5 e.g. Wilson HS in Portland
Community and Environmental Responsibility  This is not part of the core transfer requirements of our partners, and so is directly addressed in non-core courses, particularly CS 160. Topics such as green manufacture, electronic waste, and recycling are discussed. Other CS courses touch on this outcome indirectly, primarily on emphasizing resource conservation in system design.

Critical Thinking and Problem Solving  All CS students must identify and analyze problems, and devise solutions in the form of computer code. This outcome is central to the discipline of Computer Science, and the theory and practice of critical thinking is included in all courses.

Cultural Awareness  This is not part of the core transfer requirements of our partners, and is directly addressed in non-core courses, notably CS 133G, CS 140U, and CS 160. Students must understand the cultural differences involved in measures of software quality, cultural issues in technical communications, and in many cases have the opportunity to work in groups with international students.

Professional Competence  Students are required to attain levels of competency identified by our transfer partners. Students are assessed in ways similar to those used at the transfer universities to ensure required standards are met.

Self-Reflection  This is not part of the core transfer requirements of our partners, and is directly addressed in non-core courses, notably CS 133G and CS 160.

The CS program outcomes are not well aligned with College core outcomes. The mission of the CS program, simply put, is to teach students what our partners tell us students need to know in order to transfer. Alignment of course content and assessment with our transfer partners is important to the program’s success, and this presents challenges in incorporating College core outcomes. The CS program has met this obligation by incorporating core outcomes as central themes in our non-core courses, and as secondary themes in our core transfer courses.
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2(c) Core Outcomes Mapping Matrix

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course Name</th>
<th>C01</th>
<th>C02</th>
<th>C03</th>
<th>C04</th>
<th>C05</th>
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3 Other Curricular Issues

3(a) Distance Learning

All CS courses include Desire2Learn distance learning sections, with the exception of CS 233G (which is discontinued). All CS courses are offered as Distance Learning at least one time per year.

In the most recent full year (2013 - 2014) 37% of course sections were offered as Distance Learning (see Figure [1], page [32]). This proportion is slightly lower than the long-term average, and is expected to increase in future terms.

In the last five full years (2010 - 2014) Distance Learning courses comprise 43% of headcount (see Figure [2], page [33]). This suggests a greater fill rate for Distance Learning sections compared with on-campus sections.

Student success rates are approximately equivalent among delivery modes in the 2013 - 2014 year, as can be seen in Table [3] (page [34]), with roughly 65% of distance students earning passing grades, compared with 67% of on-campus students (based on 2013 - 2014 year data). The withdrawal rate for distance sections
is slightly higher than for on-campus sections (17% vs 15%).

Small differences emerge when comparing student success for the last five years (2010 - 2014), as can be seen in Table 1 on page 31. The district-wide success rate in Computer Science is about 66%, and the success rate of distance learning students is about 63%.

The decreased success rate and increased withdrawal rate for distance learning students suggests an un-met need for student support in online classes. Computer Science is working with Distance Learning and Disability Services to bring all of our online courses into compliance with the most recent Quality Matters and PCC design guidelines, and ensure all of our course material is as easily accessible as possible to students with disabilities.

Academic integrity is a significant concern in the online environment, and the percentage of students who adequately master the course material may be lower than the success rate for distance courses.

Success rates vary between 100-level and 200-level courses. Success rates for 100-level courses are quite close to the program average (since over 80% of FTE is enrolled in 100-level courses), while success rates in 200-level courses is somewhat higher (about 5% in the last year, about 3% over the last five years). The information we have (mostly informal, from students) indicates that this difference is due to two factors:

- Self-selection of the student population. Students enrolled in 200-level courses tend to be seeking a CS degree, and have a greater affinity for the subject matter than general education students.

- Greater experience with PCC’s Desire2Learn environment and online learn-
Of greater concern is the campus-based difference in success rates. Online sections of the same course may have different success rates when taught at different campuses. Online students in the CS 161 course, for example, have a success rate of 61% when the course is offered at Rock Creek, compared with a success rate of 49% when the course is offered at Sylvania (as shown in Figure 3 on page 34).

These differences may be due to different student populations, different instructional techniques, or other factors. The CS SAC is working to understand the root causes of this difference and develop appropriate strategies to increase online success rates.

The Computer Science program is working with the Distance Learning department to make the process of developing and deploying online courses easier and more effective for CS courses. This is an important effort for the program because the existing procedures present several challenges to offering online CS courses, including:

1. The online course review process prevents timely updates to our CS courses. Substantial changes are required at least every year, and often every term. The formal approval for new versions of courses is cumbersome, and many of our courses are offered without formal approval.

2. Course material that is highly technical in nature needs to be accessible to students with disabilities. Disability Services lacks sufficient resources to provide timely assistance to the CS course revision process, or provide timely review of updated courses to ensure standards are met.

3. CS courses use a variety of online environments, including Desire2Learn, WebWorks, and Linux servers. Integration of these environments in our
distance learning course material is difficult because the support infrastructure for these environments is fragmented and inconsistent. Common login is not supported across these environments, grade information is not easily shared, and Help Desk support does not include all of the needed environments.

3(b) Educational Initiatives

Computer Science is an international discipline, and the Computer Science program hosts a number of international students. We are fortunate to include within our program a large and diverse group of students with different backgrounds and perspectives. The table in Figure 3 indicates that we experienced an increase in the percentage of Asian and Hispanic students in our classes in the 2012-2013 year, followed by a small decline the following year. These students comprise 8.7% and 7.1% of our students population, respectively, and are the largest groups beyond “White, Non-Hispanic” at 71.4%. Approximately 22.4% of our students are female (Figure 7 page 38), but this is not broken by ethnicity.

One of the advantages of teaching Computer Science is that in most courses the “language of computers”, i.e. the programming language, is universal. A student who learns C++ in China will encounter the same language rules as their Computer Science colleagues in the US. Consequently we see the “reverse internationalization” of the curriculum, as most other countries have to learn and adopt US programming standards and procedures as they teach the topic of computer science.

The course material, beyond the programming language, can be a challenge, however. Computer Science textbooks can be quite dense, and they are filled with technical terms and formal notation that may not be familiar to international students. International students in Computer Science need a higher level of English literacy than is required in many other disciplines in order to comprehend the course material. Lack of English reading skills has been a barrier to success for several CS students, and instructors have on occasion re-written course material.
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to make it more accessible to students with inadequate English reading skills.

The CS program has made an effort to introduce an international perspective in the curriculum to increase the cultural awareness of local students. The CS 133U gaming course, for example, brings perspectives of other countries views regarding violence in video games, titles that are culturally acceptable, taboos and subject matters that should be avoided in different cultures. The presentation of these topics in this class prepare our students to be aware of cultural differences. If they become game developers, they will have a better understanding and be more cultural sensitive when working on large projects that would fail in other countries if there is no care concerning cultural differences.

The topic of outsourcing or “offshoring” arises in CS 160 and programming courses, and instructors have the opportunity to discuss with students different practices utilized in other cultures when dealing with project design, implementation and work ethic. Adjunct faculty who manage projects with overseas teams (and so have experience working with international groups) offer valuable “real world” insights to our students.

The sustainability initiative has had an impact on the CS Curriculum. To a great extent CS has eliminated paper testing and submission of paper assignments in favor of online submissions (e.g. email or Desire2Learn). We believe and hope that our graduates will carry this green approach to their workplace.

3(c) Existing Dual Credit

The CS program has an active dual-credit arrangement with Wilson High School for CS 160 and CS 161. An earlier arrangement with Benson High School was discontinued when the instructor left Benson. We have been approached by other

6 with Chris Bartlo, a Wilson teacher who meets our instructor requirements
7 with William Diss, a Benson teacher
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local high schools, but the instructor qualifications did not allow them to teach our courses, so no further discussions have been conducted.

A curriculum conflict often arises when a high school desires to engage in a dual-credit arrangement. High school CS programs usually tend to be more diverse in their teaching, choosing topics that do not transfer to PCC’s CS program, or to the programs of our transfer partners. There is a tendency to teach topics that a HS student might think are fun, instead of teaching topics that would transfer to a university or community college.

In a recent meeting, the OCCC (Oregon Council for Computer Chairs) addressed the issue of high school dual-credit arrangements. The OCCC would like to invite high school teachers to OCCC meetings to facilitate alignment of curriculum that would make dual-credit arrangements easier to implement.

In recent months there appears to have been a renewed emphasis by PCC to actively pursue dual-credit agreements, particularly in STEM fields such as Computer Science. This program actively supports such efforts, and will engage with high schools when possible. The Computer Science program has somewhat less flexibility than other programs, due to the requirements posed by our transfer agreements.

The sections offered for a transfer course must be fungible, which requires courses offered at high schools as part of a dual-credit arrangement conform to the same standards of practice as courses offered on PCC campuses. 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.

3(d) Additional Dual Credit

Dual-credit arrangements are evaluated as they are received. The barriers to further dual-credit arrangements are

1. Instructor qualifications. Most high school instructors do not have the advanced degrees needed to teach our transfer courses.

2. Curriculum conflict. Most advanced high school computer science courses are based on College Board or Project Lead The Way model courses, which are not compatible with PCC’s transfer courses.

3. Inadequate technology. Many of the high school programs do not have computer resources that will run the required desktop software\(^8\), and lack any sort of Linux environment.

4. Transfer inflexibility. PCC is not able to alter or change our courses to make it easier to implement dual-credit without jeopardizing our transfer agreements.

The CS program will continue to evaluate proposals for dual-credit arrangements, and additional dual-credit courses may be offered in future terms.

3(e) Course Evaluations

Course evaluations are used by the CS SAC for a variety of purposes. As with many other SACs, we use the online course evaluations in our classes, and the response rate is poor. Implementation of the “grade hook” incentive seems to have improved response rates, but this data is preliminary.

The response rate for in-class, paper surveys approached 100% in many sections, significantly better than the online course evaluation system. These surveys were developed by the SAC, and were discontinued when the College-wide course evaluation system was implemented. This decreased response rate may adversely

\(^8\) e.g. Microsoft’s Visual Studio 2013
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affect 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. Inferences are limited, based on response rate. When the data provides evidence to suggest changes in a course, or changes by 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. Instructional practices or course material that conflict with course CCOG or SAC policies are addressed by the Department Chair or Division Dean.

3(f) Other Curricular Changes

The charter of our program is to produce highly qualified transfer students to pursue their Bachelors degree at a four year institution of their choice. Our main partners are Portland State University and Oregon Institute of Technology. The SAC has ongoing relationships with these partners and actively monitor changes in their requirements. PCC courses are changed as soon as possible when transfer requirements change, and our goal is to ensure course-level compatibility with our partners.

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

- CS250 and CS251 are now also offered online. PCC is the only Oregon college or university to offer this sequence online.

- A student can now complete all of their transfer requirements using Distance Learning courses.

- All of our classes include designated lab hours. These lab sessions include extensive preparation for the proficiency testing that students endure when applying to Portland State University’s Computer Science program.

Although the Computer Science program is a transfer program, most students who take CS classes do not transfer and complete a CS degree. Informally, a “PCC CS major” is considered to be a student who enrolls in a 200-level CS course. The reason for this definition is to distinguish students who take CS courses to meet
general education or other program requirements from students who intend to pursue Computer Science.

In the last 5 full years (2010 - 2014), only 768 of the 6955 students enrolled in 100-level courses subsequently enrolled in a 200-level course (Table 4, page 38). Some students in 100-level courses may yet enroll in a 200-level course, but even so the large majority (more than 80%) of “CS students” are not “PCC CS major” students.

The needs of these non-transfer, “non-CS”, students has driven some curriculum development since the last review. The game programming (CS 133G) and introductory (CS 160) courses have large numbers of these students, and course development in these areas is largely driven by student feedback and instructor insights, rather than university transfer requirements.

The changing interests of "non-CS" students may change the focus of our non-core courses in the future. While computer games remain a popular interest, students also have expressed interest in related areas such as security, robotics, expert systems, and hardware integration. While some of these interests fall into other programs such as Computer Information Systems or Electronic Engineering Technology, a few may serve as inspiration for new CS courses in the future.

4 Needs of Students and the Community

4(a) Demographics

The majority of CS students are from the Portland metro area, typically areas surrounding Rock Creek and Sylvania campuses. Past efforts to offer CS courses at Cascade have failed due to low enrollment, and no CS classes have been offered at Southeast.

The maps shown in Figures 10 through 13 starting on page 41 show the geographic distribution of CS students. These images were produced by Microsoft’s Map Point 2013 software, and the darker the color, the greater the density of students.

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9 e.g. Arduino and Raspberry Pi
The first two maps (Figure 10 and Figure 11) compare 2010 and 2014 populations. A comparison of these maps shows a narrowing of geographic diversity among our students, with fewer students in areas more distant from a PCC campus.

The next two maps (Figure 12 and 13) identify the geographic profile of Asian and Hispanic students in our program. These images show that our Asian and Hispanic students are drawn from the area’s traditional ethnic communities. Together, these images indicate that efforts to increase diversity in our program may successfully focus on traditional ethnic communities in the metro area.

In addition to geographic considerations, the program has seen an increase in the average age of students, an increase in the number of international students, and an increase in the number of students who are military veterans or active duty military (Figure 6, page 37). These demographics changes have altered some instructional practices.

4(b) Changes In Instruction

CS efforts to accommodate changes in student demographics are constrained by the need to keep the course outcomes, course content, and the instructional environment consistent with our transfer partners. That being noted, the program makes use of appropriate PCC support facilities to ensure the learning environment in all classes is inclusive and responsive to the needs of all students, and makes changes to pedagogy and technology where possible to meet the changing needs of our student population. Changes that have been implemented since the last review include:

1. Increased use of active media in online course material. This is a technology change designed to make course material more widely available on non-PC devices such as tablets and smartphones. The program has seen an increase in the use of non-PC devices for accessing course material. These new devices are not, for the most part, supported by TSS or the Student Help Desk.

2. Increased use of guided self-assessments in courses. Guided self-assessments are ungraded exercises that allow the student to identify weaknesses in their
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preparation for graded assessments. Students with non-traditional back-
grounds or preparation can reassure themselves that they are prepared to
succeed in the graded assessments (or not, as the case may be).

4(c) Projected Enrollment Patterns

Enrollment in Computer Science classes has declined in the last few terms, but
remains relatively high. It appears a long-term Federal emphasis on science ed-
ucation will benefit CS programs in general, and the long-term outlook for the
program is favorable.

As with many PCC programs, enrollment in Computer Science is in-
versely correlated to the regional economy. Enrollment increases in times
of economic difficulty, and decreases as the economy improves. The im-
proving regional economy is expected to negatively affect Computer Sci-
ence enrollment in the near-term future.

Enrollment in Computer Science classes is capped by class capacity, which
in turn is determined by resource availability within PCC. The CS program is
reducing the number of sections offered each term in order to increase fill rates as
well as accommodate lower enrollments. An effect of this strategy is larger class
wait lists, with the consequence that some students are unable to register for a CS
class because space is not available. FTE and enrollment in the program could
be increased by reducing target fill rates for sections, and since the program has
decided this option, some demand for CS classes has been “left on the table” as
it were, and the enrollment decline is somewhat inflated as a consequence.

4(d) Access and Diversity

Diversity, especially gender equity, is a struggle for Computer Science and STEM
programs in general. Since the last Review the percentage of female students has
increased from 20% to 22%, which is less than PCC’s Physics (33%), College-
level Mathematics (47.5%), and Biology (65%) programs, but better than PCC’s
Computer Science Program Review

Engineering Transfer program (20%).

There is work to be done here, although PCC is not unique in its low percentage of female CS students. PCC CS faculty participate in outreach efforts targeted at high school and middle schools girls, along with other community colleges and area universities. Instructors have attempted to develop class activities that have a broader appeal to female students, and encourage a learning atmosphere less “geek”.

4(e) Disability Services Academic Accommodations

Disability Services provides interpreters and assistive technology for on-campus CS classes as needed, and all CS faculty have been trained and are aware of their responsibility to support students with disabilities. Faculty work with disability counselors when accommodation letters are received to implement all approved accommodations.

Access to course material is not uniformly satisfactory for students with disabilities in the CS program. Access to resources from Disability Services needed to prepare fully accessible course material is restricted by lack of resources - simply put, there simply isn’t enough Disability Services staff available to meet the demand for their services. Absent assistance from Disability Services, faculty are unable to make all course material and activities fully accessible in online courses.

The CS strategy in these situations is to prioritize requests to Disability Services so that the most important items are completed as soon as possible, and provide equivalent activities and course materials to students with disabilities if needed. Neither approach leads to a satisfactory resolution. Disability Services works on only the most important items, and other items are not done. The different activities and course materials strive to be equivalent in all cases, yet some students may not be as fully prepared for future classes as others. These are situations where the “letter of the law” might be met, but the “spirit” of PCC’s policies towards students with disabilities most certainly is not.

Quick Facts

Disability Services is hampered by lack of resources, and without their support CS courses are delayed, or unapproved course material is used.
The CS SAC feels that PCC’s Disability Services group is significantly understaffed and resource constraints in Disability Services negatively affect the SAC’s ability to meet the needs of students with disabilities in our online courses. This situation can be resolved only by increasing the capacity of Disability Services. The Disability Services staff is wonderful - there simply are not enough of them.

4(f) Feedback Issues

Feedback from transfer partners is the primary driver of curriculum change in the CS program, followed by feedback from our students. Community and business groups have indirect influence through our transfer partners.

All curricular change is driven by our transfer partners. The goal of the CS program is to maintain course-level compatibility with Portland State University, our primary partner. This means that any course change implemented at PSU must be implemented as soon as possible at PCC. Recent changes include:

1. Mandatory use of a Linux-based program development environment. PCC no longer permits students to use a Windows-based environment (e.g. Visual Studio) in core transfer courses[^10] as a result of similar changes at PSU.

2. Restricted use of programming language features. PCC no longer permits students to use certain features of the C++ programming language in some courses[^11] as a result of similar changes at PSU.

3. Increased use of proficiency exams. A “proficiency exam” in this context is a timed, proctored test where the student is not allowed any notes or class resources and must create a program. PSU implemented this requirement as a result of extensive academic dishonesty issues[^12]. PCC has implemented a similar requirement in order to prepare transfer students, with the additional effect that cheating in PCC courses also is more difficult.

[^10]: CS 162, CS 201, CS 250, CS 251, CS 260, and CS 261
[^11]: Specifically, the C++ STL cannot be used in CS 260
[^12]: For example, students passing 300-level courses while being unable complete 100-level tasks
5  Faculty

5(a)  Quantity and Quality

There are three full-time faculty at Sylvania, and two full-time faculty at Rock Creek. There are no open full-time positions in the CS program.

We have a diverse faculty to serve our diverse student body. The five full time faculty members come from four different ethnic backgrounds. Among them, three are male and two are female. With the gender imbalance in the high tech industry, we hope to inspire more girls going into STEM fields.

This year Sylvania replaced one retired full time instructor with a recently graduated young faculty member. With this newly added talent, we anticipate stronger relationships with our transfer partners, and stronger leadership in CS mathematics courses within the Oregon community college community.

The adjunct faculty pool contains approximately 12 instructors, some of whom teach a both Sylvania and Rock Creek. Some of them have been teaching at PCC for over 10 years. Many of them do work in the computer industry at firms such as Intel and Tektronix. Their experience provides students in our 200-level courses valuable advice about current trends in the industry.

5(b)  Instructor Qualifications

The minimum current instructor qualifications are:

Position  CS Instructor

Education  Masters Degree in Computer Science or Software Engineering is preferred. Minimum requirements shall be a Masters 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.

5(c) Professional Development

The Computer Science faculty have been engaged in the past years in a variety of
activities to support our program. Communication with members of the software
community and faculty from partners universities keep us informed of upcoming
events and curricular changes that most faculty are engage and participate in. Such
events consist of state wide department chair meetings, faculty visits to other insti-
tutions, participation in IT shows, speeches at local High Schools, visits to foreign
universities to support PCC’s Internationalization efforts, preview days, advising
days, among others. Other activities include:

- Attend game programming conferences to keep our gaming courses current.
- Attend annual CCSC conference.
- Collaborate with publishers on interactive course materials.
- Participate in workshops and seminars offered by Microsoft and other local
  software companies.
- Participate in Quality Matters peer review.
- Present gaming software at elementary schools
- Participate in Disability Service Subject Area Study. Subject Area Stud-
  ies are a collaborative term of engagement between subject matter experts,
online accessibility advocates and disability resource specialists on the ac-
  cessibility of those subject areas in online and classroom environments.
- Collaborate with faculty from Microelectronics department on summer camp
effort.
6 Facilities and Support

6(a) Classrooms and Technology

Many of the current approaches to computer science education adopt a hands on philosophy, which requires a computer-equipped classroom. Since the students can show their programs to anyone in such an environment, it is a wonderful way to motivate students when they are learning the difficult skill of complex programming, and allow them share their results with other students.

Some of our courses are taught in classrooms with only a podium computer. Student success is negatively impacted in these environments because marginal students do not receive the same degree of peer support, and often are unable to formulate a question for the instructor without the “let me show you” capability of a computer-equipped classroom.

Network access to resources such as Desire2Learn and the Linux servers is critical even in an on-campus course. Network failures or slow network performance make some class activities and lectures impossible, and any lack of wireless network capacity prevents students from accessing course materials during their free time on campus. Network issues have resulted in significant class disruptions that negatively affect student success.

Quick Facts

TSS, the Help Desk, and other support groups are unable to support the Linux environment used by CS. Linux support is done by faculty, which reduces the time available to help students.

6(b) Library

Our students are encouraged to use both books and electronic resources from the library. The SUMMIT system and inter-library loan are particularly helpful in providing a much broader range of access to books and other resources.

6(c) Clerical and Administrative Support

We are fortunate to have the strong administrative support. The Deans and their assistants make things happen fast and easy, may it be a book purchase or a con-
Computer Science Program Review

Technology and technology support is an ongoing challenge for the CS program. CS requires relatively robust technology, which means faculty, classroom, podium, and laboratory computers must be upgraded regularly - preferably at least every three years - in order to support curriculum activities.

Network access, as noted above, is critical, and network support has been inadequate. Connection failure, slow response time, and network outages are too common and very disruptive to class activities.

The recent shift to Linux-based programming has exposed significant shortcomings in our technology support infrastructure. The Linux environment has become critical to the CS program due to transfer requirements, but support for Linux from the TSS group and Help Desk is minimal. The Help Desk staff is not familiar with Linux technology, and refers all tickets to TSS or CS faculty for resolution. TSS staff are largely unable to provide timely support due to other duties (there simply are not enough staff in TSS to provide Linux support), and so tickets are referred to CS faculty for resolution.

The abysmal support for the Linux environment means that CS faculty largely are self-supporting. Instructors are the primary Linux support resource for their students (in an attempt to reduce calls to the Help Desk), and Department Chairs provide technical support to instructors.

The self-support model for Linux systems saps faculty resources that could be used support student success, and in some instances emergency support needs have caused faculty to delay or cancel student meetings.

The current support model is not sustainable, and several alternatives are being reviewed. The most appealing outcome, in the view of the CS SAC, is that additional resources are found that will allow TSS and the Help Desk to support the Linux environment with the same high degree of service they provide for other environments. Other alternatives include hiring a casual employee (at the Division level) to provide Linux support, and outsourcing the Linux environment.
Computer Science Program Review

6(d) Advising, Counseling, and Disability Services

The advisor and career specialists are our heroine and hero who present our students with the big picture and the pathway to success. They gently guide our students in and out of the program. We thank them for bringing ready students to us and enhancing students learning with internships and potential jobs.

6(e) Scheduling

CS class sections are scheduled at Sylvania, Rock Creek, and through Distance Learning. All CS class sections have an enrollment limit of twenty-five. CS classes at Sylvania are conducted in a dedicated computer-equipped classroom and classes at Rock Creek are scheduled as space allows.

All CS classes are 4 credit hours, with 6 contact hours per week. Due to room availability constraints, many classes are CLWEB format, meeting on-campus for 3 or 4 hours per week, and meeting online (using Desire2Learn) for the remainder. Class meetings are either once per week for 3 hours, or twice per week for 2 hours each.

Rock Creek and Sylvania use collaborative scheduling to minimize schedule conflict and meet a variety of student scheduling needs. Inter-campus agreements identify the courses offered at each campus during a term, and these agreements are updated as needed in response to enrollment or curriculum changes.

7 Recommendations

7(a) Plans for Improvement

The CS program meets contact hour requirements by using PCCs hybrid course format known as CLWEB. This increases contact hours with students beyond the required minimum by increasing instructor availability to the entire class. The online sessions typically are structured applied learning activities, and are different from the homework that students are required to complete.

13 Most computer-equipped classrooms have 24 workstations
14 TCB 310 or TCB 309
At the Rock Creek campus, we have been working actively with the Womens Resource center to entice more girls/women to the STEM area. We have participated in two events in the year 2013-2014, namely

- Womens Self Care Retreat
- Hermanas

The participants were middle school girls who were exposed to 1-hour workshops of Alice, the animation software, and programming techniques from code.org.

Young adults today are realizing how computer science knowledge can help them succeed at not just being a software developer, but with nearly any job. There is still a dearth of women in Computer Science, however, in spite of all the opportunities. Our goal is to create an environment that is safe and reassuring to the girls in middle schools and high schools. Research has shown that if they are encouraged to pursue STEM related work and computer science in particular at an early age, they have a better chance of being successful when they start taking college level classes.

This year, we will be offering 1-day STEM workshops that will target high school students through our PCC outreach program. These 1-day workshops will be held at the Rock Creek campus, and students will explore the topic of electronics and programming. It is aimed at beginners with no experience in these topics. There will be three 1-day workshops followed by a weeklong camp in summer. Our goal is to include all students so they can be prepared for advanced degrees and technical careers in STEM fields.

There have also been several collaborative efforts between the CS department and the Music department and the Biology department in the RC campus. In CS133G (Introduction to Computer Games class), students collaborated with the Music department and used some creative music with their game programs. In a different project, in the same course, CS 133G Biology students acted as biologist consultants, to help guide the CS students create a game using science. The Biology students used their Cell Basics document to create one ideal document, and the game team was then required to develop a game using this document. The teams communicated by email and in person to make sure that the game worked the way it was intended. The goal was to make learning Cell Basics fun and to do
it through gaming.

7(b) Support Required

1. Additional classroom and lab space is needed. CS courses meet for 6 hours per week (3 lecture, 3 lab), and the lab time should be scheduled in a computer-equipped classroom. The CLWEB format is not optimal for CS courses, and we would like all required contact hours in the classroom, and use online tools for optional supplemental instruction.

2. Online support for students with disabilities needs to be improved, and this requires expanded support from Disability Service. The Disability Services group needs additional trained staff and resources to meet the demand for their services.

3. The procedures for scheduling and implementing Distance Learning classes needs to be streamlined. The dynamic environment of computer science requires the ability to add new Distance Learning sections, change instructors for existing sections, and add new Distance Learning instructors in a timely manner. The current process to approve new sections and instructors is slow and cumbersome.

4. Improved district-wide tutoring services should be available for CS students. Student Learning Center staff at Rock Creek are not able to support CS courses.

5. Improved Linux system support and infrastructure. Neither TSS nor the Student Help Desk provide adequate support for Linux systems, and CS faculty address many support and system administration issues.

6. Expanded student access to computer labs. Students need access to computer labs outside of class time in order to manage their course work.

7. Improved ability to video record classroom sessions will full audio to support online learning. Distance Learning students, and online students in CLWEB courses, benefit from recorded sessions. Rock Creek and Sylvania have few rooms equipped with this capability, and making the recordings accessible to students with disabilities presents additional challenges.
8. Increased schedule flexibility. CS needs to split lecture and lab sessions into separate CRNs to allow students greater flexibility in their schedule. This will require changes in faculty workload calculations and compensation.

9. Improved student access to textbooks. Textbook shortages prevent some students from having access to textbooks. A more responsive purchase process or expanded use of electronic textbooks (purchase or rental) is needed.

10. Improved CS advising. Transfer requirements vary by institution, and many PCC advisors are not able to provide CS students with accurate advising information.

11. Greater flexibility in software licensing. CS students often have capable personal computers, but lack some licensed software that is available on PCC lab and classroom computers. Negotiating software licenses that allow CS faculty to pre-configure virtual machines for student home use would increase student success and increase student access to course software.

12. Improved support for mobile devices in PCC’s online environment. CS has observed an increase in the use of mobile devices. Online courses in the Desire2Learn environment are optimized for desktops (large monitor, mouse, keyboard, password security) rather than a mobile device (small display, touch interface, biometric or location based security).

8 Appendices

8(a) Where The Data Came From, And How They Were Crunched

The data sources used in this report are:

IE Data published by Institutional Effectiveness as part of the Program Profile. Data from this source is aggregated for the 2013 - 2014 academic year.

ARGOS Data reported by PCC’s Argos system. This system accesses BANNER data. Data from this source is term data. The OLAP feature of Argos was used for some analysis.

15 e.g. tablets and smartphones
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SWRSLST  Data reported by the SWRSLST report in PCC’s BANNER system. This report is post-processed by the R system. Data from this source is aggregated for the five-year period from 201004 (Fall 2010) through 201404 (Fall 2014).

The data source for each table and graph is identified in the caption for the graph.

8(b)  Graphs and Tables

Table 1: Student Success by Campus 2010 - 2014 (Source: SWRSLST)

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<tr>
<th>Campus</th>
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<th>Pass %</th>
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<td>Rock Creek</td>
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</tr>
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<td>District Wide</td>
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Table 2: Student Success by Course 2010 - 2014 (Source: SWRSLST)

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<th>Course</th>
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<th>Pass %</th>
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</thead>
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</tr>
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<td>CS 133U</td>
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</table>
## Computer Science 2014 - 2015

### Figure 1: Delivery Mode 2013 - 2014 (Source: IE)

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Figure 2: Delivery Mode 2010 - 2014 (Source: SWRSLST)
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Figure 3: Student Success By Delivery Mode 2013-2014 (Source: IE)
Figure 4: Student Success by Course 2013 - 2014 (Source: IE)
### Figure 5: Student Race and Ethnicity (Source: IE)

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<td>1672</td>
<td>2032</td>
<td>2143</td>
</tr>
<tr>
<td>White Non-Hispanic</td>
<td>76.7</td>
<td>72.5</td>
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<tr>
<td>Black</td>
<td>2.6</td>
<td>3.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Hispanic</td>
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<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Asian</td>
<td>0.2</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Native American/American Indian/Alaskan</td>
<td>3.7</td>
<td>3.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Multi-Racial</td>
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<td>3.4</td>
<td>3.8</td>
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<td>1.0</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
### Figure 6: Student Age (Source: IE)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>COLLEGEWIDE (Excl Campus 6)</th>
<th>N</th>
<th>Excl</th>
<th>Age Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-17</td>
<td>2134</td>
<td>2.7</td>
<td>21.0</td>
<td>19.4</td>
</tr>
<tr>
<td>18-20</td>
<td>2249</td>
<td>2.2</td>
<td>21.2</td>
<td>19.8</td>
</tr>
<tr>
<td>21-25</td>
<td>279</td>
<td>2.2</td>
<td>21.0</td>
<td>19.8</td>
</tr>
<tr>
<td>26-30</td>
<td>215</td>
<td>1.9</td>
<td>20.4</td>
<td>19.5</td>
</tr>
<tr>
<td>31-40</td>
<td>193</td>
<td>1.7</td>
<td>19.2</td>
<td>19.2</td>
</tr>
<tr>
<td>41-50</td>
<td>58</td>
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<td>0.6</td>
<td>0.6</td>
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<tr>
<td>51-60</td>
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<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>61+</td>
<td>0.3</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
<th>Excl</th>
<th>Age Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2134</td>
<td>21.0</td>
<td>19.4</td>
</tr>
<tr>
<td>2249</td>
<td>21.2</td>
<td>19.8</td>
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<tr>
<td>279</td>
<td>21.0</td>
<td>19.8</td>
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<td>215</td>
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<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>0.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Computer Science Program Review

Table 3: Student Success By Course Level 2010 - 2014 (Source: SWRSLST)

<table>
<thead>
<tr>
<th>Level of Course</th>
<th>Fail %</th>
<th>Pass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 level courses</td>
<td>34.3</td>
<td>65.7</td>
</tr>
<tr>
<td>200 level course</td>
<td>31.3</td>
<td>68.7</td>
</tr>
</tbody>
</table>

Table 4: Enrollment in 100 and 200 Level Classes 2010 - 2014 (Source: SWRSLST)

<table>
<thead>
<tr>
<th>Class Level</th>
<th>Headcount</th>
<th>No. In Other Level</th>
<th>% in Other Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Level</td>
<td>6955</td>
<td>768</td>
<td>12.5</td>
</tr>
<tr>
<td>200 Level</td>
<td>1068</td>
<td>768</td>
<td>71.9</td>
</tr>
</tbody>
</table>

Figure 7: Student Gender (Source: IE)
## Computer Science Program Enrollment (Source: IE)

<table>
<thead>
<tr>
<th>COLLEGEWIDE TABLES (Excl Campus 6): Full Time Equivalent (Student FTE) Enrollment and % Change</th>
<th>2009-10</th>
<th>Percent Change: 08-09 to 09-10</th>
<th>2010-11</th>
<th>Percent Change: 09-10 to 10-11</th>
<th>2011-12</th>
<th>Percent Change: 10-11 to 11-12</th>
<th>2012-13</th>
<th>Percent Change: 11-12 to 12-13</th>
<th>2013-14</th>
<th>Percent Change: 12-13 to 13-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>Collegewide, Excl Campus 6</td>
<td>306.1</td>
<td>24.1</td>
<td>301.1</td>
<td>24.8</td>
<td>362.1</td>
<td>18.3</td>
<td>439.5</td>
<td>24.4</td>
<td>467.1</td>
<td>6.3</td>
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</table>

## Computer Science Program Enrollment (Source: IE)

<table>
<thead>
<tr>
<th>COLLEGEWIDE TABLES (Excl Campus 6): Unduplicated Headcount Enrollment and % Change</th>
<th>2009-10</th>
<th>Percent Change: 08-09 to 09-10</th>
<th>2010-11</th>
<th>Percent Change: 09-10 to 10-11</th>
<th>2011-12</th>
<th>Percent Change: 10-11 to 11-12</th>
<th>2012-13</th>
<th>Percent Change: 11-12 to 12-13</th>
<th>2013-14</th>
<th>Percent Change: 12-13 to 13-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>Collegewide, Excl Campus 6</td>
<td>1,552</td>
<td>24.1</td>
<td>1,832</td>
<td>18.0</td>
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<td>16.6</td>
<td>2,250</td>
<td>5.3</td>
<td>2,308</td>
<td>2.6</td>
</tr>
</tbody>
</table>
### Computer Science Program Review

#### Figure 9: Student Courseload (Source: IE)

<table>
<thead>
<tr>
<th></th>
<th>Full Time Credit Course Load</th>
<th>Half Time Credit Course Load</th>
<th>Part Time Credit Course Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td><strong>Collegewide, Excl Campus 6</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall 2011-2012</td>
<td>60.6</td>
<td>24.9</td>
<td>14.5</td>
</tr>
<tr>
<td>Fall 2012-2013</td>
<td>59.1</td>
<td>28.5</td>
<td>12.4</td>
</tr>
<tr>
<td>Fall 2013-2014</td>
<td>61.5</td>
<td>26.9</td>
<td>11.5</td>
</tr>
</tbody>
</table>
Figure 10: CS Student Residence 2010 (Source: IE)
Figure 11: CS Student Residence 2014 (Source: IE)
Figure 12: CS Asian / Pacific Islander Student Residence 2014 (Source: IE)
Figure 13: CS Hispanic Student Residence 2010 (Source: IE)